# FINAL REPORT

## Quantifying *In Situ* Contaminant Mobility in Marine Sediments

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Environmental Security Technology Certification Program

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# Quantifying *In Situ* Metal and Organic Contaminant Mobility in Marine Sediments

# Space and Naval Warfare Systems Center San Diego, CA

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## 1. Introduction

### 1.1 Background Information

Contaminants enter shallow coastal waters from many sources, including ships, shoreside facilities, municipal outfalls, spills, and non point-source runoff. Sediments are typically considered a primary sink for these contaminants. Sediments in many bays, harbors and coastal waters used by DoD are contaminated with potentially harmful metal and organic compounds. The DoD is required by the Comprehensive Environmental Resource Conservation and Liability Act, as amended by the Superfund Amendment and Reauthorization Act of 1986 (CERCLA/SARA), to assess and if necessary remove and remediate these sites and discharges in order to protect the public health or welfare of the environment. To determine whether contaminants are moving into, out of, or remaining immobilized within the sediments, a determination of contaminant flux must be made. Variations in sediment chemical and physical properties make it impossible to rely on bulk sediment contaminant concentrations alone to predict contaminant flux, bioavailability, and therefore toxicity. Diagenetic reactions in surface sediments control contaminant pore water gradients, and the direction and magnitude of these gradients control the diffusive flux across the sediment-water interface. These fluxes can be calculated from measurements of contaminant pore water gradients and sediment physical properties. However, in some coastal areas pore water gradients are very steep and therefore difficult to measure. In addition, flux calculations based on pore water gradients only provide the diffusive component of a contaminant flux. An additional concern in coastal areas is that biological irrigation by infauna and wave or current induced flushing may provide a larger component of flux through advection of water through the sediments. To avoid these problems, a direct measurement of contaminant flux in coastal areas is often the best method to assess contaminant mobility across the sediment-water interface. This direct measurement can be made with a flux chamber that isolates a volume of seawater over the sediments to quantify contaminant flux across the sediment-water interface.

An instrument for measurement of contaminant fluxes from marine sediments called the Benthic Flux Sampling Device 2(BFSD2). The instrument is a commercialized version of the original prototype BFSD used during development and is adapted from benthic flux chamber technology developed in oceanography for studying the cycles of major elements and nutrients on the seafloor.

The BFSD2 is an autonomous instrument for *in-situ* measurement of toxicant flux rates from sediments. A flux out of or into the sediment is measured by isolating a volume of water above the sediment, drawing off samples from this volume over time, and analyzing these samples for increase or decrease in toxicant concentration. Increasing concentrations indicate that the toxicant is fluxing out of the sediment. Decreasing concentrations indicate that the toxicant is fluxing into the sediment.

Figure 1 shows the BFSD2, including its pyramid-shaped tubular frame, open-bottomed chamber, and associated sampling and control equipment. At the top of the frame is an acoustically released buoy for BFSD2 recovery. At the bottom of the frame is an open-bottomed chamber and associated sampling gear, flow-through sensors, a data acquisition and control unit, video camera system, power supply, and oxygen supply system.

**Figure 1. Benthic Flux Sampling Device 2.**

The BFSD2 provides a unique means of evaluating the significance of in-place sediment contamination. Knowledge of the degree to which contaminants remobilize is essential in defining the most cost effective remedial action at impacted sites. At present, there is no other viable method for direct quantification of sediments as sources. At sites where it can be demonstrated that remobilization of contaminants is limited, significant cost savings may be achieved through reduction of cleanup costs. This may often be the case because many contaminants are strongly sequestered within the sediment and not likely to leach out. Estimated disposal costs for contaminated sediments

range from $100-$1000/cubic yard. A recent survey of Navy shoreside facilities (NRaD, 1995) indicated that of the 31 facilities that responded, 29 reported the presence of contaminated sediment sites. The actual volume of contaminated sediment at these sites is not well-documented however even conservative estimates suggest that millions of cubic yards of material may exceed typical sediment quality guidelines.

## 1.2 Official DoD Requirement

This project addresses the DoD/Navy requirement for compliance, cleanup assessment, and remediation decisions using innovative technology to directly quantify the mobility and bioavailability of contaminants in marine sediments. Marine sediments serve as a repository for contamination from a wide variety of sources. The environmental risks posed by these contaminants are determined largely by the degree to which they remobilize into the environment.

### 1.2.1 How Requirements were Addressed

The technology demonstrated in this project provides a means of quantifying risks and supports the overall goal of cost-effective, risk-based environmental cleanup. This technology provides a basis for risk-based decision making and potential cost savings by

1. Improving methods for measuring bioavailability for contaminated sediment
2. Minimizing cleanup requirements at sites where contaminants are not remobilizing
3. Evaluating the integrity of natural and remedial sediment caps
4. Providing a direct measure of the time scale of natural attenuation
5. Documenting the actual contaminant contribution of sediments relative to other sources.

## 1.3 Objectives of the Demonstrations

The primary objective of the demonstrations of the BFSD2 was to perform deployments at contaminated sites in San Diego Bay, California and Pearl Harbor, Hawaii under the observation of California EPA certification evaluators. Other observers, including local, state and federal regulators, Remediation Program Managers, academic, industry and other DoD also attended. Each site offered different validation opportunities: San Diego Bay was used to show instrument repeatability and comparison with historical trends and Pearl Harbor was used to show site differences and geochemical trend analysis. Organics demonstrations were performed at the same sites. The specific planned objectives of the demonstrations were to:

(1) evaluate the quality of water samples collected using the BFSD2; specifically for use in determining if a statistically significant flux was occurring at the test locations in comparison to the blank flux results for the BFSD2.

(2) evaluate the BFSD2 for repeatability.

(3) evaluate the logistical and economic resources necessary to operate the BFSD2.

(4) evaluate the range of conditions in which the BFSD2 can be operated.

Other objectives included exposure of various user communities to the technology to encourage continued interest and applications.

### 1.4 Regulatory Issues

There were no regulatory permitting issues associated with deployment of the BFSD2. Collecting sediment samples in a marine environment is considered a nonhazardous activity (although personnel handling samples must follow all safety precautions and limit their exposure to potentially hazardous samples). No hazardous waste was generated during the demonstrations.

The BFSD2 is a sample collection instrument and its prototype was the first of its kind to collect sediment-water interface samples for contaminant flux analysis. Because this technology has no current equivalent, the BFSD2 is evaluated based on the internal quality assurance/quality control (QA/QC) for the laboratory analysis performed and on an analysis and interpretation of the data. Although some clean water standards have been set for seawater, only guidelines currently exist for sediments. And, whereas sample handling, preserving, analyzing and reporting is covered by a number of established methods and regulations, the primary regulatory issue for the BFSD2 involves the integrity of the collected samples to represent ambient conditions. Further, the heterogeneous nature of sediments combined with the complex chemistry of marine aquatic environments requires thoughtful evaluation of all data before arriving at conclusions. The BFSD2 system can routinely produce accurate, precise and repeatable results, however the application of these results to site specific conditions does not lend itself readily to standardized processes. In many cases, BFSD2 results may be used as an additional factor in a "weight of evidence" approach for risk-based decisions involving regulator concurrence.

### 1.5 Previous Testing of the Technology

Initial development program tests included *ex situ* (laboratory) and *in situ* (field) trials of critical components, subsystems, and systems. A number of system development tests were conducted at various locations within San Diego Bay during 1989-91.

Full-scale system trials of the prototype BFSD were conducted in Sinclair Inlet, offshore from Puget Sound Naval Shipyard, Bremerton WA, during June 1991 in support of an ongoing assessment. Ten deployments of the prototype BFSD were conducted to characterize flux rates of contaminants from seven shipyard sites and three reference sites (no blank test was conducted). Collected samples were analyzed for the trace metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). The tests were successful and results generally showed low release rates (or fluxes) compared to other contaminant sources. See general reference 12 for the complete report. Following review of the data, an active oxygen control subsystem with sensor feedback was developed and implemented along with several other changes to improve operation reliability.

During 1993 four systems tests of the upgraded prototype BFSD were conducted at sites within in San Diego Bay: one at Paleta Creek (at its entrance to the bay within Naval Station San Diego); two at a commercial yacht harbor (Shelter Island); and one at a industrial shipping terminal (PACO Industries). The deployments were preceded by a system blank test to determine the lower limits of flux that could be resolved with the prototype BFSD. Several experimental subsystems including a sensor for laser-induced fluorescence (LIF) investigation of polycyclic aromatic hydrocarbon (PAH) contaminants and an electrode for potentiometric stripping analysis (PSA) of trace metal (Cu and Zn) contaminants were also tested. Results from these deployments showed significant flux rates when compared to blank test results and clear differences between the sites as related to potential trace

metal sources. Paleta Creek results showed the highest flux levels for Cd, Cu, Ni and Zn. See reference 5 for the complete report.

Seven more prototype BFSD deployments in San Diego Bay in support of a sediment quality assessment at Naval Station San Diego were conducted during 1995. Paleta Creek was again included along with five other sites near piers and quay walls and one site outside the study area used as a reference. The work, preceded by a blank test, yielded results that were consistent with the previous study and showed Cd, Ni, Zn and Mn all to have positive fluxes. Paleta Creek again showed the highest trace metal fluxes with levels which were generally consistent with those measured two years prior. Correlations between measured trace metal flux levels and complex marine chemistry processes were studied and informative trends were identified. For example in the complex oxidation-reduction (redox) marine environment, it was found that trace metal fluxes are consistent with oxidation of solid metal sulfides as a sediment source. See key reference 7 for the complete report; an extract is included below to illustrate an initial interpretation of the Naval Station San Diego results:

> Some of these trace metal flux relationships may be better illustrated with bar charts showing the trends along a series of transects across the study area. Figures2 and 3 show the trace metal fluxes for the 1995 deployments along with data from the earlier 1993 deployments. The Zn fluxes in Figure 2 are so large that the other trace metal fluxes are barely visible, so the other metal fluxes are replotted in Figure 3 without Zn. This demonstrates that Zn is, by far, the trace metal with the largest flux out of the sediments. The first site displayed in both figures is the blank run, followed by the east-west transects near Pier 4 (Sites 3, 3r, 1r, and 2) and Paleta Creek (Sites 5, 4, and 6), and finally the 1993 data. Zn, Ni, and Cd fluxes in the 1995 data are high in the east (Sites 3 and 5) and decrease toward the west, and in the 1993 data higher in the central bay sites compared to north bay sites. The trends for Cu and Pb fluxes are less clear, with some sites showing fluxes into the sediments. Cu does, however, show the highest fluxes out of the sediments at Sites 3 and 5 where the sediment concentrations of most metals are high.

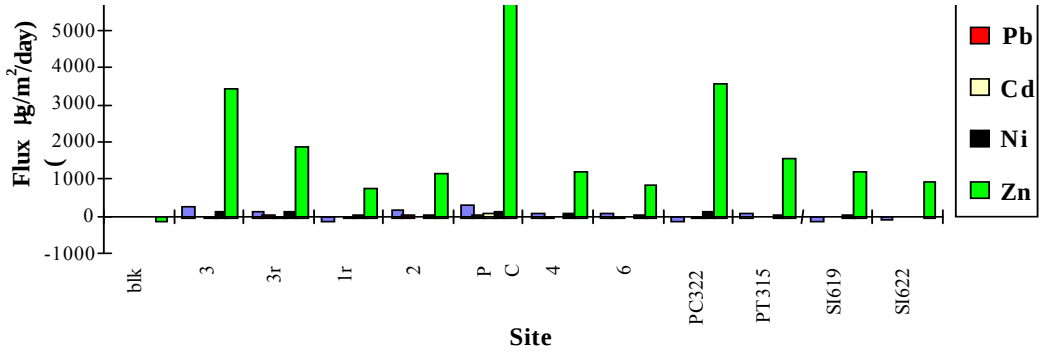



**Figure 2. Plot of Metal Fluxes Along East-west Transects**.

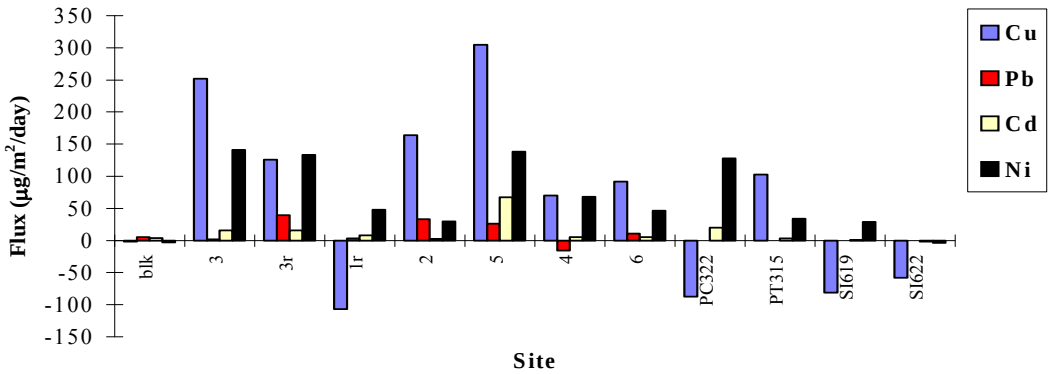



**Figure 3. Plot of Metal Fluxes Along East-west Transects, Excluding Zn.**

Looking at the NAVSTA area sediments out to the west side of the navigation channel, a surface area of approximately 3 million square meters (m2) is present. From the contour map of Zn concentrations in the sediment chemistry chapter, only approximately 500,000 m2 are above the ERM value of 410 ppm. The four Zn flux measurements from sediments with these high Zn levels (Sites 1R, 3, 3R, and 5) average 3100 + 2500 ug/ m2 / day. Sediments in the NAVSTA area with Zn levels below ERM values cover approximately 2.5 million m2 and three flux measurements from sediments with lower Zn levels average 1100 + 200 ug/ m2 / day. The overall flux of zinc directly from the sediments in the NAVSTA area is therefore 1500 + 600 kg Zn/ yr.

Finally, as mentioned above, blank tests of the prototype BFSD were conducted to determine the lowest levels of contaminants which could be resolved with the system. With the prototype BFSD prepared as it would be for a normal deployment, the test was conducted in seawater with the chamber sealed. A time-sequence for sample collection comparable to the planned deployments was used and the samples were analyzed identical to later site-collected samples. For the San Diego Bay tests discussed above the results were:

| Coumpound | flux ± S.E. (µg/m2/day) | |
|---|---|---|
| | 1993 | 1995 |
| Cadmium | 6 ± 7 | 5 ± 3 |
| Copper | -71 ± 62 | -2 ± 47 |
| Iron | -- | 160 ± 235 |
| Lead | -4 ± 8 | 7 ± 67 |
| Manganese | -- | -52 ± 26 |
| Nickle | 65 ± 69 | -4 ± 27 |
| Zinc | -227 ± 65 | -149 ± 267 |

Whereas the prototype BFSD performed successfully and was considered mature enough to begin technology transfer, the process of data analysis and interpretation revealed complexities requiring careful consideration prior to reaching conclusions. Technology transfer, to be fully discussed in section 8, began with a competitively awarded firm-fixed-priced contract for Benthic Flux Sampling Device 2 (BFSD2), which incorporated a number of changes from the prototype BFSD. A series of

*ex situ* and *in situ* tests and tests and checkouts assured that the instrument retained critical prototype BFSD performance attributes as well as establishing functionality of the changed features. A complete series of laboratory (e*x situ*) tests and checkouts were conducted. *Ex situ* tests included: the new rotary valve sampling system to assure reliable performance; the pump and diffuser system with dye-dispersion to assure adequate mixing; the flow-through sensor system to assure responsive and accurate readings; the vacuum-filled, *in situ*-filtered sample bottles to assure clog-free operation and adequate fill volume; and the data acquisition and control system to assure required performance.

# 2. Technology Description

## 2.1 Description

Contaminants enter shallow coastal waters from many sources, including ships, shoreside facilities, municipal outfalls, spills, and non point-source runoff. Sediments are typically considered a primary sink for these contaminants. Where previous shoreside practices have resulted in high concentrations of contaminants in the sediments, contaminants may flux out of the sediments. Also, in areas where pollution prevention and remediation practices have removed other contaminant sources, remaining contaminated sediments may serve as a primary contaminant source to the water column.

To determine whether contaminants are moving into, out of, or remaining immobilized within the sediments, a determination of contaminant flux must be made. Diagenetic reactions in surface sediments control contaminant pore water gradients, and the direction and magnitude of these gradients control the diffusive flux across the sediment-water interface. These fluxes can be calculated from measurements of contaminant pore water gradients and sediment physical properties. However, in some coastal areas pore water gradients are very steep and therefore difficult to measure. In addition, flux calculations based on pore water gradients provide only the diffusive component of a contaminant flux. An additional concern in coastal areas is that biological irrigation by infauna and wave or current induced flushing may provide a larger component of flux through advection of water through the sediments. To avoid these problems, a direct measurement of contaminant flux in coastal areas is required to assess contaminant mobility across the sediment-water interface. This direct measurement can be made with a flux chamber that isolates a volume of seawater over the sediments to quantify contaminant flux across the sediment-water interface.

The Navy-designed and developed, contractor-fabricated Benthic Flux Sampling Device 2 (BFSD2) is a flux chamber designed specifically for *in situ* measurement of contaminant fluxes in coastal areas. A chamber of known volume encloses a known surface area of sediment. Seawater samples are collected periodically at timed intervals. After a laboratory has analyzed the samples, and with knowledge of the time intervals between samples, a flux rate between the sediment and water in mass per surface area per unit time (micrograms per square meter per day [$\mu g/m^2/day$]) can be calculated.

The BFSD2, shown in Figure 4 with key components labeled, consists of an open-bottomed chamber mounted in a modified pyramid-shaped tubular framework with associated sampling gear, sensors, control system, power supply, and deployment and retrieval equipment. The entire device is approximately 1.2 by 1.2 meters from leg to leg and weighs approximately 175 pounds. The lower part of the framework contains the chamber, sampling valves, sampling bottles, and batteries. The upper frame includes a release that is acoustically burn-wire triggered. The BFSD2 is designed for use in coastal and inland waters to maximum depths of 50 meters. Maximum deployment time is approximately 4 days based on available battery capacity. Figures 5 and 6 illustrate the two basic configurations for landing and sampling events, respectively.

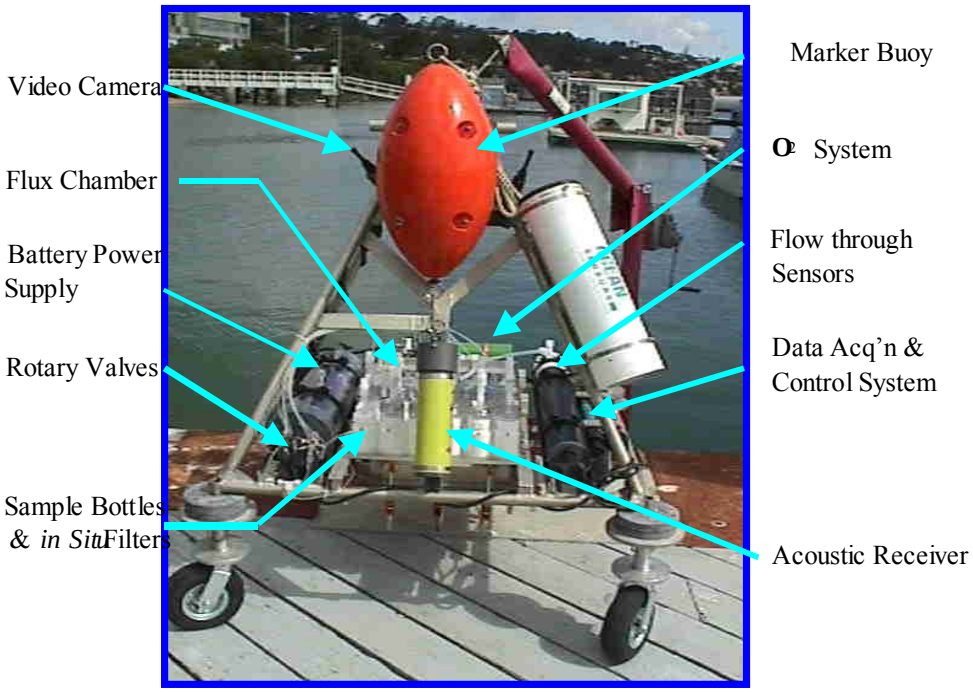
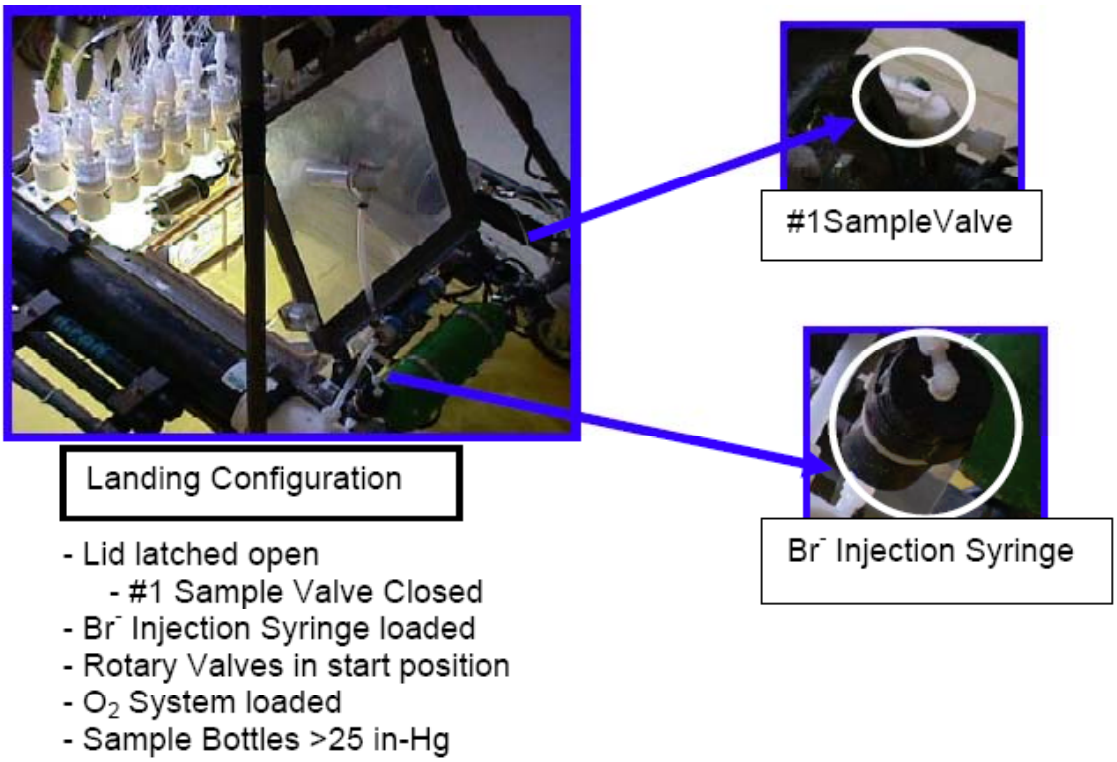



**Figure 4. Benthic Flux Sampling Device 2.**

**Figure 5. BFSD2 Sampling Events.**



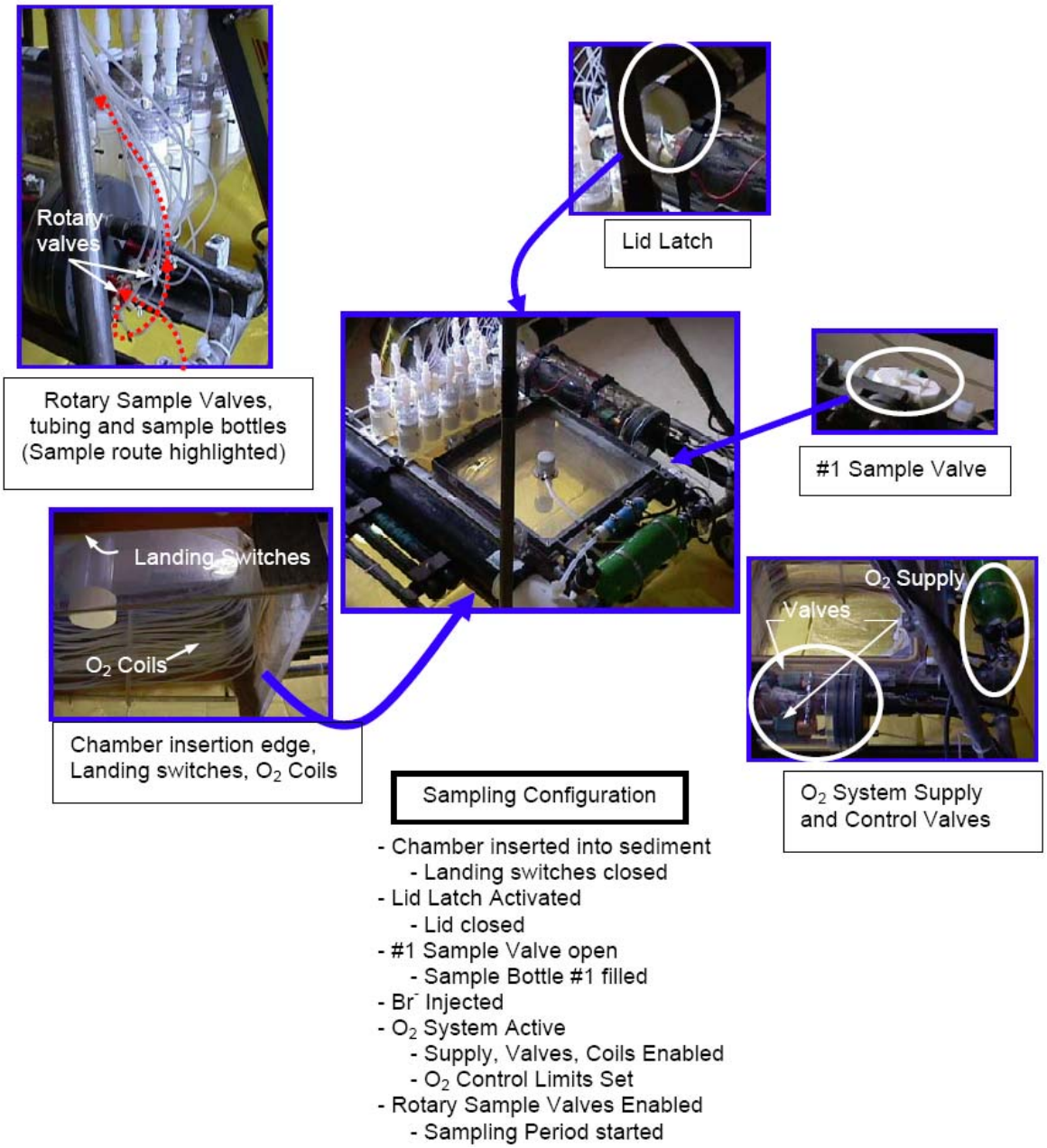



**Figure 6. BFSD2 Sampling Events.**

### 2.1.1 Sampling Chamber

The chamber is a bottomless box, approximately 40 centimeters (cm) square by 18 cm tall, with a volume of approximately 30.0 liters (Figure 7). The volume was chosen to allow for a maximum overall dilution of less than 10 percent due to sampling withdrawal into 11 samples of 250 milliliters (ml) each. For the combined demo, 11 combined samples were collected from within the chamber (100 mls for metals and 250 mls for PAH's) increasing the sample volume to 350 mls per sampling

event. This increased the dilution to about 13% for the combined sampling. The chamber is constructed of clear polycarbonate to avoid disrupting any exchanges that may be biologically driven and, thus, light sensitive. To prevent stagnation in the corners of the chamber, triangular blocks of polycarbonate occupy the 90-degree angles. The top of the chamber is hinged at one edge so that it may be left open during deployment to minimize sediment disturbance. Once the chamber is in place, the computer control system closes the lid. A gasket around the perimeter of the chamber ensures a positive seal between the chamber and the lid. Exact alignment is not required, because the lid is slightly larger than the sealing perimeter of the gasket and pivots on two sets of hinges. The lid is held closed by four permanent magnets situated along the chamber perimeter. The bottom of the chamber forms a knife-edge. Pressure-compensated switches mounted on the bottom surface of three sides of a flange circling the chamber at 7.6 cm above the base activate a series of three lights visible with a video camera mounted on the upper frame. Illumination of the lights indicate a uniform minimum sediment penetration depth has been achieved and a good probability that a positive seal between the chamber and the sediment has been achieved.

**Figure 7. Chamber Enclosure.**

Samples are drawn off through a 4-mm Teflon tube via synchronized parallel rotary valves and into evacuated 250 ml Teflon sampling bottles. For organics applications, standard precleaned 250 ml amber glass sample bottles with pre-combusted glass-fiber filter assemblies are used (Figure 8). For the combined demo, 100 ml Teflon bottles were used for metals and 250 ml amber glass bottles were used for PAH's.

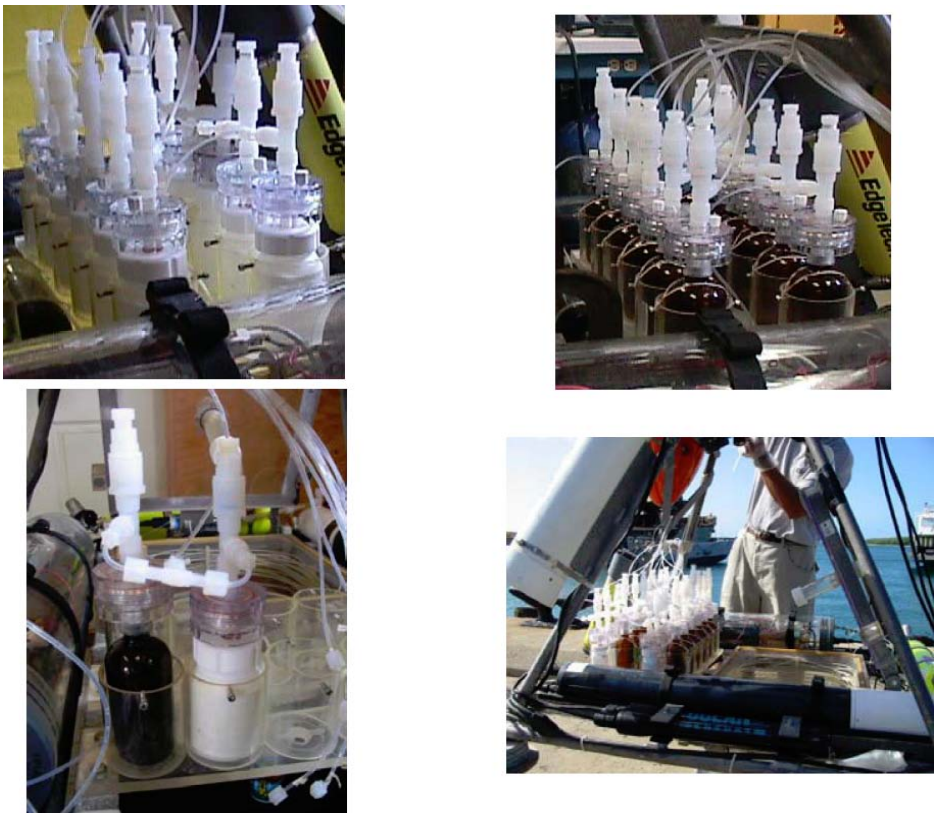


**Figure 8. Sample Bottles. Clockwise from Upper Left, metals Bottles; Organics Bottles; Combined Metals and Organics Configuration; and Paired Bottles for Combined Deployment.**

The first sample is drawn through a 0.45 micron-filter into the sample bottle upon closure of the lid at the start of the autonomous operation of the BFSD2; the remaining 11 samples are similarly collected as the synchronized parallel rotary valves are activated at preprogrammed intervals throughout the deployment. The bottles are evacuated to a minimum of 25 inches of mercury before deployment.

### 2.1.2 Acquisition and Control Subsystem

The acquisition and control unit is an Ocean Sensors Model OS200 conductivity temperature depth (CTD) instrument, modified to allow control of the BFSD2. It consists of a data logger that acquires and stores data from sensors, and a control unit that regulates sampling and other functions of the BFSD2. The data logger collects data from a suite of sensors housed in the CTD and connected to the chamber through a flow-through loop. A small constant-volume pump maintains circulation in the flow-through system to the sensors and is also used to maintain homogeneity of the contents of the chamber utilizing a helical diffuser mounted vertically on the central axis of the box. The control unit closes the lid, activates the flow-through/mixing pump, activates dissolved oxygen control valves, and controls activation the synchronized parallel rotary sampling valves. Commercial sensors, installed by Ocean Sensors, Inc., are mounted in the CTD instrument housing, and are connected to the chamber by means of a flow-through pump and circulation plumbing. Sensors are used for monitoring conditions within the chamber, including conductivity, temperature, pressure, salinity, pH, and dissolved oxygen, Figure 9. Circulation in the flow-through sensor system is maintained using a constant flow rate pump adjusted to approximately 15 milliliters per second (ml/sec).

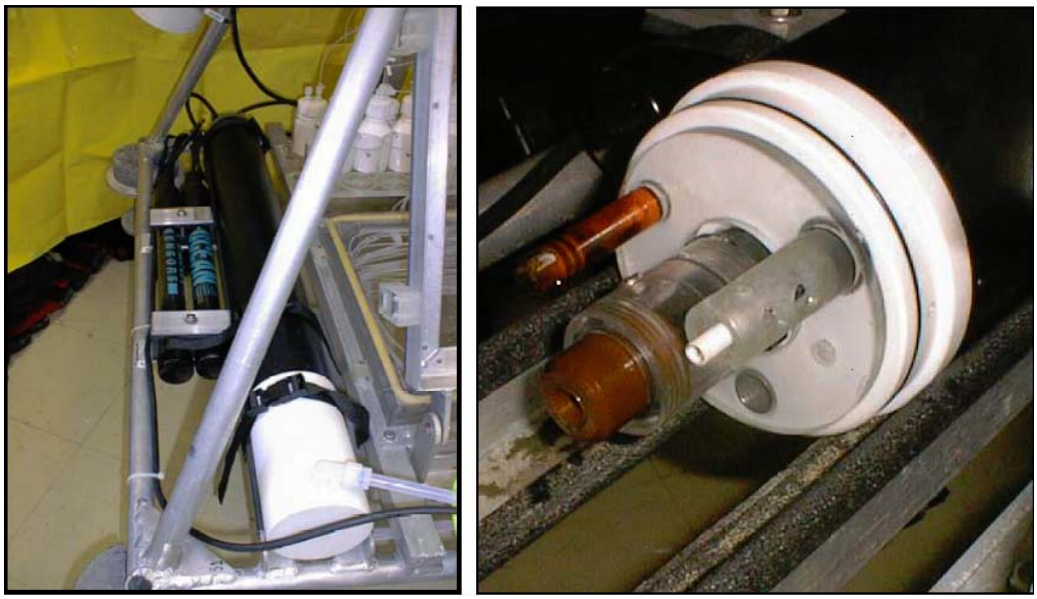


**Figure 9. Flow-Through Sensor System.**

### 2.1.3 Sampling Subsystem

Discrete samples are obtained using a vacuum collection approach consisting of sample containers, fill lines, in-line filters (with 0.45 micron membrane filters for metals or with 1.0 micron pre-combusted glass-fiber filters for organics), check valves, and synchronized parallel rotary valves connected to the chamber fill line. Off-the-shelf 250ml Teflon (metals) or amber-glass (organics) collection bottles are modified to allow filling through the cap. Sampling containers of any volume, material, or shape may be used, provided the cap can be modified to accept the fill line connection, the bottle wa lls are strong enough to withstand the pressure at the sampling depth, and the cap sea l is airtight and watertight at the sampling depth pressure. Glass, Teflon, and polycarbonate bottles have been tested and used successfully with the prototype BFSD. All valves, fittings, and tubes are made of Teflon or other nonmetallic materials to minimize potential metal contamination of samples and to facilitate cleaning. Samples are drawn from the chamber through a 4-mm Teflon tube connected to the rotary valves and into the sampling bottles. Sampling is initiated by the control system when it activates the valves at preprogrammed intervals. Seawater samples are drawn through the sampling system by a vacuum of 25 inches of mercury (minimum) which is applied to all sample bottles through check valves mounted in the bottle lids. The check valves are then sealed, and water enters each sample bottle when the rotary valves are activated (number 2 through 12) or when the lid closes and opens a valve attached to its hinge (number 1). Filtered seawater flows into each bottle until pressure is equalized, normally yielding at least 240ml.

### 2.1.4 Circulation Subsystem

The BFSD2 has a mixing area called the collection chamber and the process of interest is the exchange of chemical contaminants at the sediment-water interface sequestered within the chamber. The hydrodynamics inside the chamber must adequately simulate movement of water from near-bottom currents outside the chamber. For this purpose, a helical diffuser mounted vertically on the central axis of the chamber is used to mix the enclosed volume. Tests recorded on video verified that the helical diffuser provided a uniform, gentle mixing action that effectively dispersed dye injected into the chamber without disturbing the sediment layer on the chamber bottom.

The diffuser system includes a standard constant-volume submersible pump. The pump circulates water from an outlet in the chamber wall, into the sensor chamber and over the flow-through sensors, and back into the chamber via a rigid polycarbonate tube. The vertically mounted tube is capped at the discharge end and has 5mm holes drilled in a helix pattern along its length. The tests verified that this method visually dispersed a dye injection of Rhodamine in less than 120 seconds.

The acquisition and control unit, the oxygen supply bottle, a video camera and lighting system, circulation pumps, and the retrieval line canister are mounted on the frame members. The oxygen system is used to maintain aerobic conditions within the chamber by diffusing oxygen at a rate sufficient to maintain the initial dissolved oxygen levels through a coil of thin-walled, oxygen-permeable Teflon tubing.

### 2.1.5 Oxygen Control Subsystem

Over the course of an experiment, conditions in the isolated volume of seawater within the flux chamber begin to change from the initial conditions observed in the bottom water. Oxygen content is one factor that changes rapidly because isolated volumes of seawater in contact with the sediment surface will become anoxic without any resupply of oxygen. Since the fluxes of many contaminants, especially metals, are sensitive to redox conditions, the oxygen content is one of the most important factors that must b e monitored and regulated within the flux chamber. Most contaminant fluxes are not large enough to be measured in chambers without oxygen regulation because the isolated volume of seawater will become anoxic before significant contaminant fluxes have occurred. Because of this, an oxygen control system has been built into the BFSD2. This system maintains the oxygen levels in the chamber within a user-selected window about the measured bottom water oxygen level.

The oxygen regulating system consists of a supply tank, pressure regulator, control valves, diffusion coil, oxygen sensor, and control hardware and software. The supply tank is a 13-cubic foot aluminum diving tank equipped with a first-stage regulator that allows adjustment of output pressure to the system. The control valves are housed within a watertight pressure case with connections through bulkhead fittings on the end cap. The diffusion coil is thin-walled, 4-mm, oxygen-permeable, Teflon tubing approximately 15 meters (m) long. Oxygen is monitored using the oxygen sensor in the flow-through system described previously. The oxygen control valves (pressurize or vent) activation is incorporated into the control system of the BFSD2.

During a typical deployment, when the flux chamber is initially submerged, the ambient oxygen level in the water is measured with a control program which activates the circulation subsystem and sensors until a stable value of ambient oxygen concentration is obtained. This is performed with the BFSD2 either on the bottom or suspended less than 1 meter above the sediment (with the lid open). When oxygen stability is obtained, the user then establishes a maximum and a minimum oxygen control level, based on a userspecified range around the stable ambient level. Figure 10 is a typical set of data obtained from 15 minutes of operation. The control limits are entered into the operational control program and downloaded to the BFSD2 acquisition and control subsystem. When autonomous operations are started and the chamber is closed and sealed, the oxygen level inside the chamber is monitored by the control program. If the level drops below the allowable minimum, a control valve is momentarily opened, the diffusion coil is pressurized, and the oxygen level in the chamber begins to increase. When the oxygen level reaches the maximum allowable level, another control valve is activated and the pressurized tubing is vented. This sequence is repeated continuously during deployment, maintaining the oxygen level in the chamber near the ambient level. Figure 11 is a typical set of data obtained from a 72-hour deployment. Note that dissolved oxygen concentrations are reported in ml/l in this report. Dissolved oxygen concentrations in seawater can

be expressed in millimolar, uMoles/kg, mg-atoms/liter, mg/liter, ml/liter or percent saturation. Conversion from mg/l to ml/l is a linear computation (mg/l x 1.4276 = ml/l). It is true Standard Methods suggests re porting in mg/l, however different reporting units are found in the literature. We have historically used oxygen sensors obtained through Seabird Electronics, and their calibration procedures and software all use ml/l for dissolved oxygen concentrations.

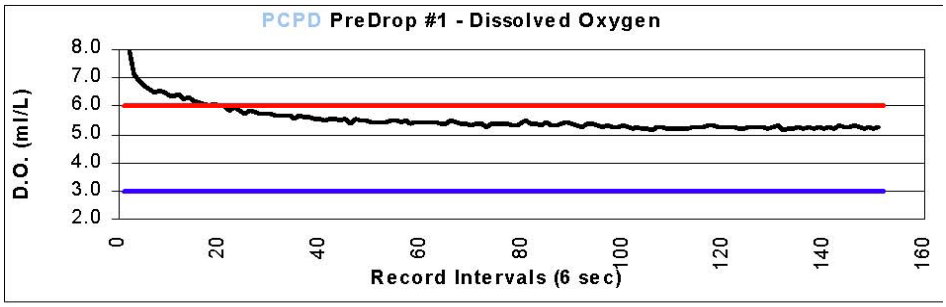



**Figure 10. Ambient Oxygen Data.**

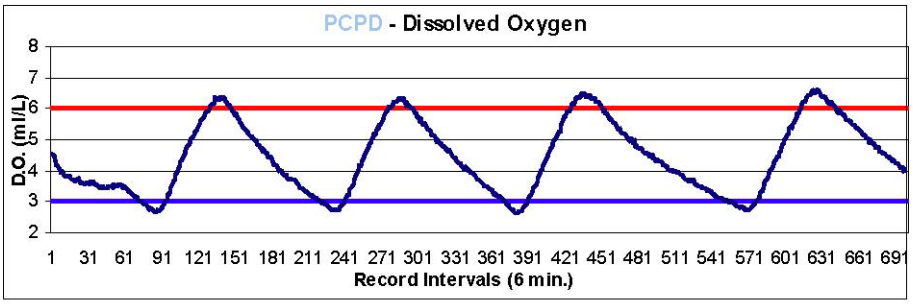



**Figure 11. Operational Oxygen Control Data.**

### 2.1.6 Deployment and Retrieval Subsystems

During deployment the test site is surveyed for obstacles with a light-aided video camera mounted on the upper frame of the BFSD2 using a on deck television monitor. As shown in Figure 12, a deployment cable and release line are used to lower the BFSD to its intended depth for the video inspection. Following either rapid or slow descent to the bottom, the minimum depth of collection chamber insertion is sensed by pressure-compensated switches, which activate lights mounted on the chamber frame. These lights are TV-monitored on deck.

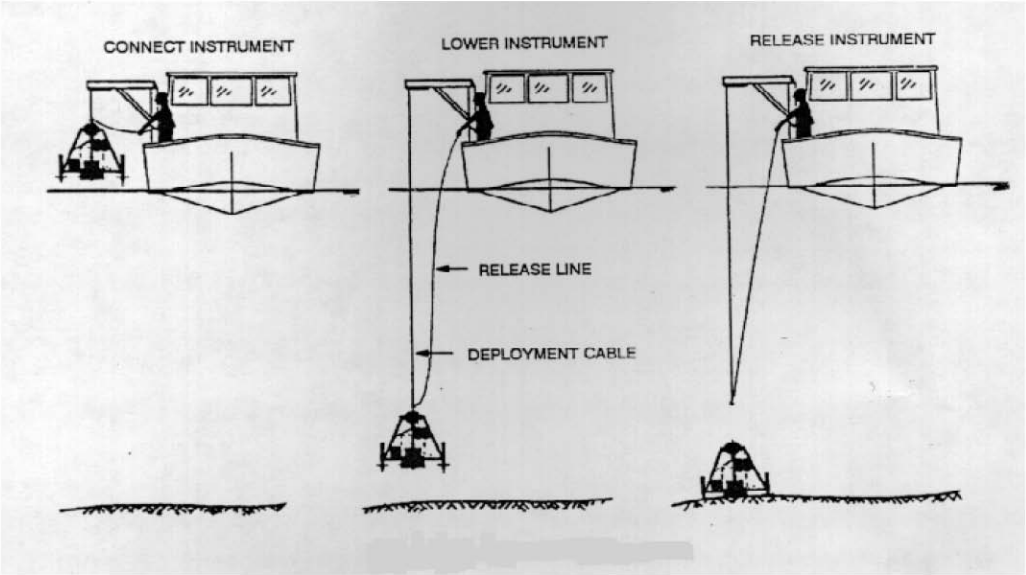



**Figure 12. BFSD Deployment.**

Recovery is accomplished by transmitting a coded acoustic signal to the frame-mounted receiver which in turn releases the marker buoy, Figure 13. As shown in Figure 14, the line attached to the buoy is used to lift the BFSD2 aboard the vessel. Stored sensor data is uploaded before the detaching cables.

**Figure 13. Acoustic Release and Retrieval Buoy.**

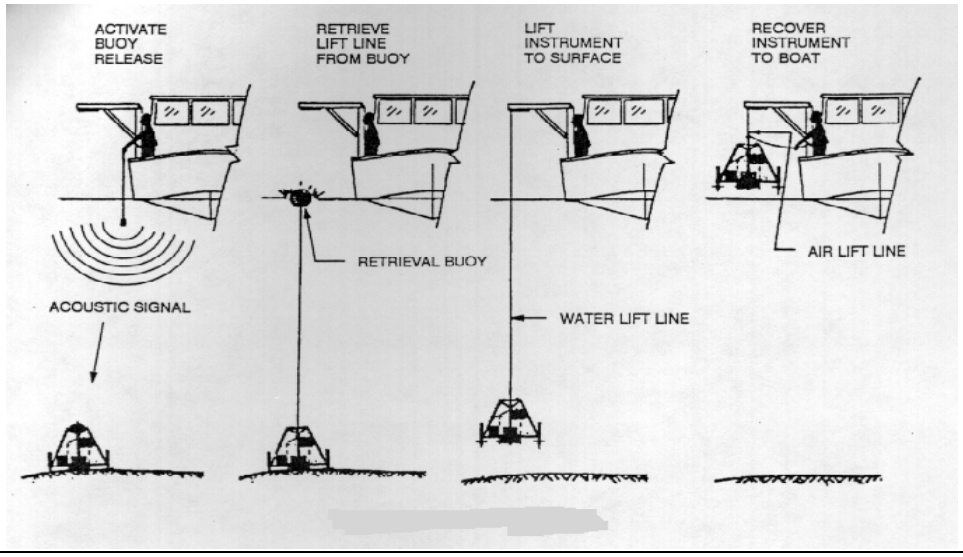



**Figure 14. BFSD Retrieval.**

### 2.1.7 Analytical Methods

#### 2.1.7.1 Cleaning

Prior to each deployment, the BFSD2 sample collection system is cleaned and decontaminated. A sequential process of flowing cleaning fluids through the sampling subsystem using vacuum; of soaking disassembled parts (collection bottles and other parts) in prepared solutions; of physically brushing and rinsing the collection and sensor chambers and the circulation subsystem with prepared solutions is followed. For metals, a nitric acid soak/rinse is used before a final rinse with 18 meg-ohm de-ionized water and for organics a methanol rinse with air dry is used prior to sealing/closing off all paths of contamination until deployment.

#### 2.1.7.2 Performance Indicators

A series of performance indicators are used to evaluate the data obtained during operational deployments. One performance indicator is the chemistry time-series data for silica. Silica, a common nutrient used in constructing the hard parts of some planktonic organisms, typically shows a continuous flux out of the sediments due to degradation processes. The linear increase in silica concentration with time in the collected sample bottles is therefore used as an internal check for problems such as a poor chamber seal at the lid or sediment surface. A field analytical test set (Hach Model DR2010) is used to assess the silica concentrations immediately following retrieval and before sending collected samples to the analytical laboratory. Figure 15 is an example of silica flux indicating an adequate chamber seal with the sediment. Also, with a good chamber seal the ongoing bacterial degradation of organic material in the sediment consumes oxygen (which must be regulated by the BFSD2) and also generates carbon dioxide. This gradually lowers the chamber pH and Figure 16 is an example of this data for a good chamber seal with the sediment.

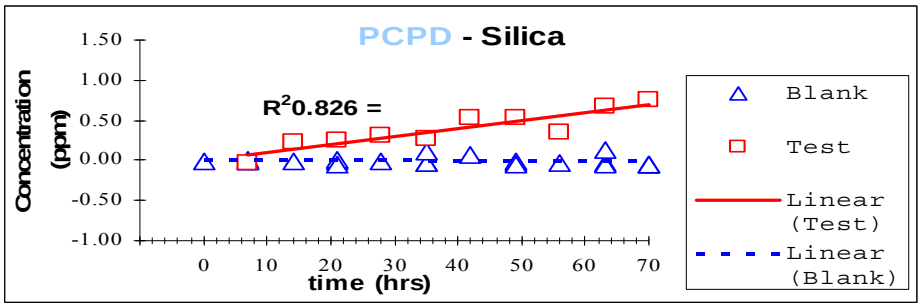



**Figure 15. Silica Flux for Good Chamber Seal.**

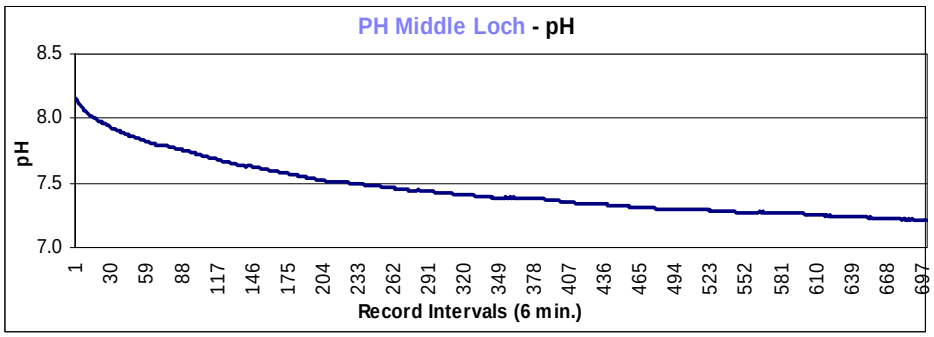



**Figure 16. pH Data for Good Chamber Seal.**

Although the expected relationships of these performance indictors aid in determining normal or successful deployments, natural variability is always present to cloud these relationships. Variations in the pore water reactions at the various sites lead to differences in the observed fluxes of oxygen, silica, and also the other contaminants. One major factor contributing to the large variations in fluxes may be burrowing activity. Enhanced biological irrigation (pumping of the overlying seawater through sediment burrows by infaunal organisms) increases the surface area of the sediment-water interface and flow rates across the interface, and may also increase the observed fluxes. The organisms responsible for this biological pumping will also affect oxygen uptake rates and may add to the complex interpretation of the analytical results.

#### 2.1.7.3 Blank Tests

Prior to the BFSD2 demonstrations, a triplicate blank test was performed to determine the lower limit of resolution for flux determinations of various metals. A polycarbonate panel was sealed across the bottom of the chamber and the BFSD2 was lowered to within several meters of the sediment surface. A standard operational program identical to the demonstration deployments was run for 70 hours. The results will be presented later in this report.

#### 2.1.7.4 Computations

Fluxes are computed from the trace metal concentrations in each sample bottle using a linear regression of concentration versus time after the concentrations are corrected for dilution effects. These dilution effects result from intake of bottom water from outside the chamber to replace the water removed for each collected sample. The corrected concentrations are obtained from the following equation:

$$[C_n] = [s_n] + \frac{v}{V}\left(\left(\sum_{i=1}^{n-1}[s_i]\right) - (n-1)[s_0]\right)$$

Where **[*C*]** is the corrected concentration, **[*s*]** is the measured sample concentration, ***n*** is the sample number (1 through 6), ***v*** is the sample volume, and ***V*** is the chamber volume. Fluxes are then calculated as follows:

$$Flux = \frac{mV}{A}$$

Where ***m*** is the slope of the regression of concentration versus time, ***V*** is the chamber volume, and ***A*** is the chamber area.

An interactive computational spreadsheet processes most data. Analytical laboratory results, sensor and other measured data, performance indicator results and blank test results are entered into the spreadsheet template and processed. A series of tables, charts and graphs are computed and displayed, including statistical confidence and other figures of merit. Appendix C provides a set of spreadsheet products for each demonstration.

## 2.2 Strengths, Advantages and Weaknesses

### 2.2.1 Strengths

The BFSD2 is an *in situ* technology. Benthic contaminant fluxes can provide a unique *in situ* measure of contaminated sediments as well as an indication of bioavailability. Many of the disadvantages cited for various approaches towards assessing sediment contamination relate to removal of the contaminated material to the laboratory for chemical and biological assays. In concert with traditional monitoring and assessment techniques, these flux measurements can lead to a better understanding of marine sediment contamination and transport mechanisms.

### 2.2.2 Advantages

The BFSD2 is an easily implemented technology, as it is readily deployed from a small boat, and all sampling, data logging, and control functions are carried out automatically based on preprogrammed parameters. The BFSD2 can be used to collect samples without diver assistance to minimize costs, time necessary for sampling, and safety issues associated with sampling activities. Furthermore, the system is able to collect a wide range of contaminants, nutrients, and dissolved gases and it is operational under a wide range of environmental conditions. All materials used in the system are suitable for use and prolonged exposure in the marine environment.

Results obtained using the BFSD2 can be used for the following purposes:

- Source quantification for comparison to other sources and input to models
- Indication of bioavailability since many studies indicate that resolubilized contaminants are more readily available for uptake
- Determination of the cleansing rate of a contaminated sediment site due to natural biogeochemical cycling of the in-place contaminants
- Provision of a nonintrusive monitoring tool for sites that have been capped or sealed to minimize biological exposure

- Testing and validation of hypotheses and models for predicting the response of marine sediments to various contaminants.

### 2.2.3 Weaknesses

One limitation is a lower limit on the flux rates that can be calculated from data collected using the BFSD2 system. Also, the BFSD2 may be deployed to a maximum depth of 50 meters and the maximum deployment is approximately 4 days, based on available battery capacity. The BFSD is stable in bottom currents up to 3 knots.

## 2.3 Factors Influencing Cost and Performance

### 2.3.1 Cost influences

The factors influencing cost include, in order:

1. Analytical laboratory costs: laboratory analysis of samples by highly specialized analytical laboratories accounts for approximately 50% of total BFSD2 project costs.

2. Blank tests: the larger the number of sites within a common bay, harbor or other defined location the smaller the proportional cost per site for blank tests. It may be possible to eliminate blank testing in some cases, but a cost approaching 50% could occur for only one deployment.

3. Remote location: Acquisition of local resources such as a surface vessel configured with a davit or A-frame and equipment shipping costs most influence total project costs. Transportation, per diem, materials and supplies are equivalent for all sites other than local. Labor costs are the same.

4. Work schedule: Limited site access or availability can influence cost. Without such restraints a work schedule taking advantage of *in situ* BFSD2 deployment periods over weekends and/or to accomplish cleaning, sample handling, and other turnaround preparations can be instituted. Extended work hours can be compensated with offsetting periods of inactivity.

### 2.3.2 Performance Influences

The factors influencing performance include:

1. Sediment physical conditions: The BFSD2 requires a collection chamber seal with the sediment to function properly. The primary cause for lack, or loss of seal is porosity of the sediment due to large grain size and distribution. An entire deployment can be lost under extreme conditions, however the use of performance indicators can avoid analytical laboratory costs by identifying such cases immediately after retrieval.

2. Sediment contamination levels: The lower limit for resolving significant flux levels is based on blank test results. Sites having contaminated sediment levels lower than blank test results cannot be resolved with a high degree of confidence. Such results are reported as statistical probabilities with confidence limits and are typically well below water quality limits and do not lead to cleanup issues.

3. Site marine conditions: As with 1. above (sediment-chamber seal), the BFSD2 also must also maintain a good chamber-lid seal. Surface vessel turbulence and/or prop wash, tidal and/or local currents, or even large fish disturbances can jar the magnetically held lid. A momentary loss of the lid seal can allow ambient seawater to enter the chamber and refresh sequestered sample water. Although such an event will be detected by the previously discussed performance indicators, some or all of the deployment can be negated by loss of lid seal.

# 3. Site/Facility Description

## 3.1 Background

Two locations were selected for BFSD2 demonstrations. The first was San Diego Bay, California (Paleta Creek area); and the second was Pearl Harbor, Hawaii (Middle Loch and Bishop Point). The locations/sites were selected based on the following criteria:

1. (metals) The sites were known to have metal-contaminated marine sediments, and had been at least partially characterized. The sediment contaminant levels were anticipated to be high enough to demonstrate statistically significant fluxes at the sediment-water interface.

2. (metals) Two deployments at the same San Diego Bay, Paleta Creek site would demonstrate repeatability; two deployments at geographically different Pearl Harbor sites would demonstrate characteristically different data and showcase analysis/interpretation results.

3. (metals) The contaminated sediments were located in shallow areas (less than 50 meters deep) and readily accessible.

4. (metals) Demonstration logistical support requirements would be demonstrated by deployments in Pearl Harbor.

5. (metals) Data from prototype BFSD deployments conducted at the Paleta Creek site were available for use as reference data and for comparison with demonstration results (See section 1.5).

6. (organics) Both sites were known to also have organics-contaminated sediments and other demonstration factors were already achieved.

## 3.2 Site/Facility Characteristics

### 3.2.1 San Diego Bay, California

With no major inputs of fresh water, the currents and residence time of water in San Diego Bay are tidally driven. The average depth of the bay is about 5 meters. The tidal range from mean lower-low water to mean higher-high water is about 1.7 meters. The maximum tidal velocity is about 0.05 to 0.1 meters per second. Sediment pore waters in San Diego Bay typically become anoxic several millimeters below the sediment surface. Dissolved oxygen concentrations range from 4 to 8 milliliters per liter; sea water pH varies from 7.9 to 8.1; and temperatures range from 14 to 25°C.

The sediments of San Diego Bay consist primarily of gray, brown, or black mud, silt, gravel, and sand. The sources of contamination in San Diego Bay have varied over time and include sewage, industrial wastes (commercial and military), ship discharges, urban runoff, and accidental spills. Current sources of pollution to San Diego Bay include underground dewatering, industries in the bay area, marinas and anchorages, Navy installations, underwater hull cleaning and vessel antifouling paints, and urban runoff. Known contaminants in the bay include arsenic, copper, chromium, lead,

cadmium, selenium, mercury, tin, manganese, silver, zinc, tributyltin, polynuclear aromatic hydrocarbons (PAH), petroleum hydrocarbons, polychlorinated biphenyls (PCB), chlordane, dieldrin, and DDT.

The Paleta Creek site, Figure 17, is located in San Diego Bay in San Diego County, California, adjacent to Naval Station San Diego. The Paleta Creek site is located on the western shore near Naval Station San Diego where Paleta Creek empties into the bay, slightly inland from the Navy Pier 8 and Mole Pier and north of Seventh Street. Naval Station San Diego began operations in 1919 as a docking/fleet repair base for the U.S. Shipping Board. In 1921, the Navy acquired the land for use as the San Diego Repair Base. From 1921 to the early 1940s, the station expanded as a result of land acquisitions and facilities development programs.

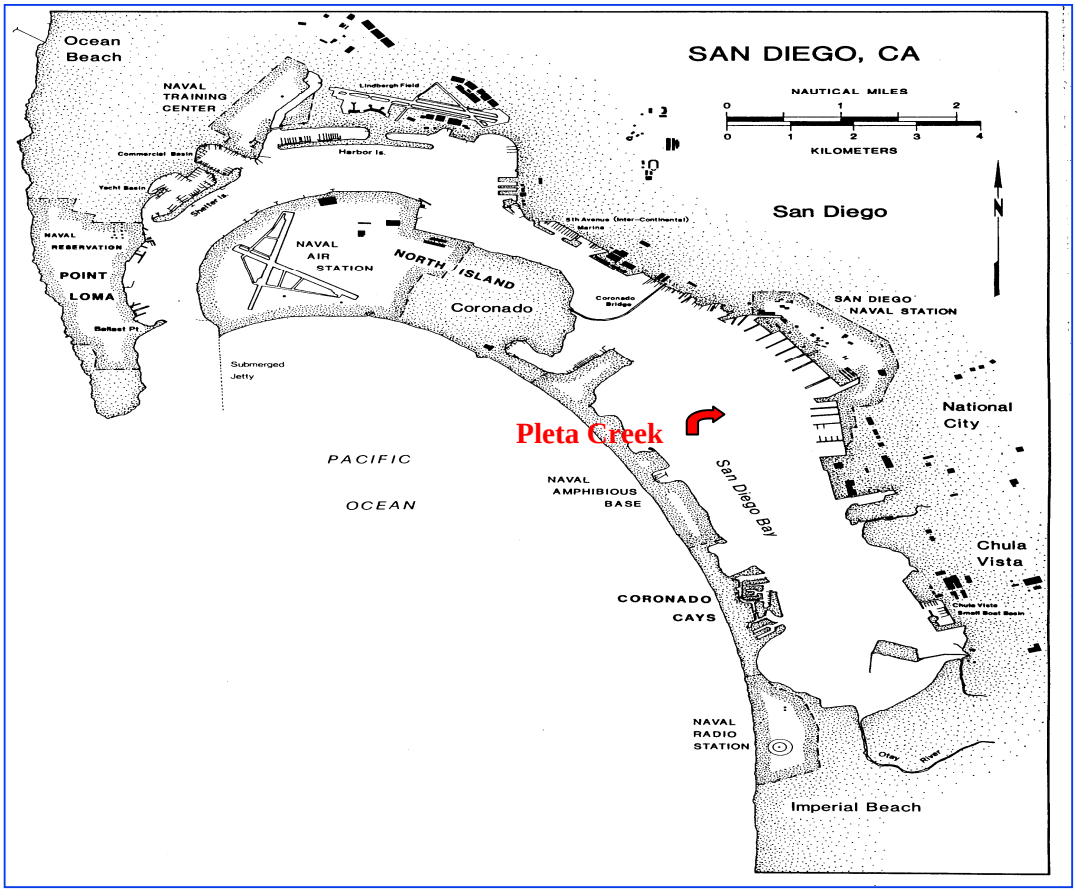



**Figure 17. San Diego Bay, Paleta Creek Site.**

### 3.2.2 Pearl Harbor, Hawaii

Pearl Harbor contains 21 square kilometers of surface water area; the mean depth is 9.1 meters. Tidal flow and circulation are weak and variable, with a mean tidal current velocity of 0.15 meter per second and a maximum ebb flow of 0.3 meters per second in the entrance channel. Salinity in Pearl Harbor ranges from 10 to 37.5 parts per thousand, with a yearly average of 32.8 parts per thousand. Harbor water temperatures annually range from 22.9 to 29.4°C, and dissolved oxygen values range from 2.8 to 11.0 milligrams per liter. Pearl Harbor is most appropriately described as a high-nutrient estuary.

Middle Loch is located in the northwestern end of Pearl Harbor, north and west of Ford Island, within the Pearl Harbor Naval Base, see Figure 18 below.

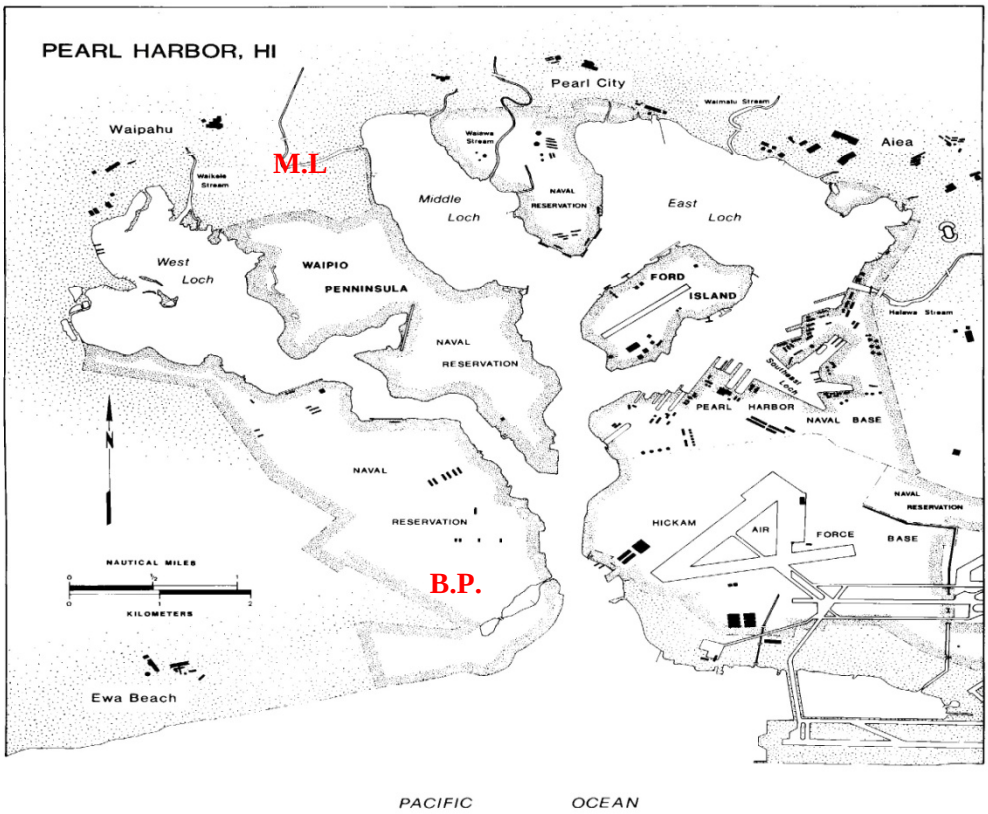



**Figure 18. Pearl Harbor, Hawaii Middle Loch Bishop and Point Sites.**

In 1901, the U.S. Navy acquired 800 acres of land to establish a naval station at Pearl Harbor. The Pearl Harbor Naval Base has existed since 1919. During World War I, about 12 warships were repaired and overhauled at the Navy Yard. In 1917, a temporary submarine base was relocated to the eastern shoreline of Southeast Loch. Industrial development in the vicinity of Pearl Harbor was greatly accelerated during the late 1930s and early 1940s. During the 1941 Japanese attack on Pearl Harbor during World War II, 21 of the U.S. ships in Pearl Harbor were sunk or severely damaged, and debris resulting from this attack remains buried in harbor sediments (despite initial cleanup efforts). Currently, Pearl Harbor is a major fleet homeport for nearly 40 warships, service-force vessels, submarines, and their associated support, training and repair facilities.

Middle Loch is moderately contaminated with heavy metals as well as with toxic organic compounds and hydrocarbons. Sediments contain various concentrations of metals such as silver, arsenic, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, and zinc. Toxic organic compounds include pollutants such as solvents, paints, pesticides, and PCBs. Hydrocarbon contaminants include all petroleum-based fuel products such as diesel, JP-5, JP-4, bunker fuel, gasoline, oils, sludges, and lubricants. Bishop Point is an active industrial area with ongoing salvage operations and related ship movements. Sediments contain similar contaminants as mentioned above but at higher levels.

# 4. Demonstration Approach

## 4.1 Performance Objectives

The demonstrations were intended to verify the performance of the BFSD2 by assessing whether chemicals are adsorbing to or desorbing from sediments at the sediment-water interface. Specifically, the objectives of the BFSD2 technology demonstrations were to:

(1) Evaluate the data quality of the water samples collected for use in determining if a statistically significant flux was occurring at the test locations.

(2) Evaluate the BFSD2 for repeatability.

(3) Evaluate the logistical and economic resources necessary to operate the BFSD2.

(4) Evaluate the range of conditions in which the BFSD2 can be operated.

In order to determine whether statistically significant fluxes were occurring at the test locations (Objective 1), 12 seawater samples were collected at 7-hour intervals using the BFSD2. For metals, the water samples were analyzed for cadmium, copper, manganese, nickel, lead, zinc and silica. For organics, the samples were analyzed for EPA priority PAHs, PCBs and pesticides. For metals, sediment samples, when collected, were analyzed for grain size, total solids, total organic carbon (TOC), acid volatile sulfide (AVS), simultaneously extracted metals (SEM), and total metals. Although the sediments may have been contaminated with other constituents, only the flux of the listed metals was evaluated during the demonstrations. For organics, sediment samples were analyzed for the same analytes as the associated water samples.

In addition, other metals including antimony, arsenic, selenium, silver, thallium, and iron were analyzed in the seawater samples collected during the three blank chamber tests. This data will be used at future dates when establishing baseline performance for these metals.

Sample concentrations were corrected for dilution introduced by the sampling process, and a regression curve was generated for each analyte based on the concentration data. Flux rates, with regression coefficients, were compared to the composite flux rate and standard deviation determined for each metal or organic during triplicate blank chamber tests. The measured flux rate for each metal or organic was then evaluated to assess if a statistically significant flux had been measured when compared to the blank chamber (background) test. The BFSD2 was evaluated for repeatability (Objective 2) by analyzing the metals results of repeat deployments, two weeks apart, at the same Paleta Creek site. Demonstration data was also compared to data from the site during previous prototype BFSD tests in the same approximate location. Finally, repeatability was evaluated by comparing the results from three blank chamber deployments for both metals and organics. The logistical and economic resources necessary (Objective 3) were evaluated by documenting costs associated with planning, scheduling and executing the demonstration deployments, laboratory analysis, data management, and report preparation. Lastly, the range of conditions for operating the BFSD2 were evaluated

(Objective 4) by describing the conditions under which the BFSD2 operated and the projected range of contaminants applicable to the technology.

The demonstration approach was to collect time series of water samples using the BFSD2 at two geographically different locations. For metals at the San Diego Bay location (Paleta Creek) two deployments at the same site were made; at the Pearl Harbor location, one deployment at each of two geologically different sites were made (Middle Loch and Bishop Point). Comparison of the results of the two Paleta Creek demonstrations to one another was intended to evaluate repeatability of the technology. Comparison of the results from the two geographically different sites in Pearl Harbor was intended to demonstrate data differences and analysis/interpretation approaches. Comparison of the Pearl Harbor data as a whole with that from San Diego also demonstrated geological differences between continental shelf and mid-Pacific riff measurements. For organics, one Paleta Creek deployment and one Bishop Point, Pearl Harbor deployment were performed to demonstrate the extended performance. For both metals and organics three "blank test" deployments were conducted, during which the BFSD2 was deployed in seawater with a sealed sampling chamber. Three time series of samples were collected and a baseline was established for each analyte, which provided a statistical estimate of the lower limit of flux detection measurable with the BFSD2. The data also served as another measure of precision and repeatability. Previous metals results obtained at the same location using the prototype BFSD also provided a general measure of trend repeatability. A rate of flux between the sediment and the water for each analyte for each deployment was calculated. The flux rate was calculated using knowledge of the volume of water enclosed within the BFSD2, the surface area of sediment isolated, the time the samples were collected, and the concentrations of the contaminants of interest in the individual sample. Because this technology has no current equivalent, the BFSD was evaluated based on the internal QA/QC of the laboratory analysis and an analysis of the data.

## 4.2 Physical Setup and Operation

### 4.2.1 Physical Setup

Deployment preparations included BFSD2 maintenance, decontamination and setup. Maintenance included inspection and repair due to leakage or corrosion, inspection of sealing surfaces, seals and o-rings, inspection and replacement of sacrificial zinc anodes, downloading and/or deleting unnecessary files in the memory-limited control and data acquisition subsystem, and inspection of any worn or other potentially failure prone areas.

Decontamination involves soaking and/or rinsing all surfaces contacting seawater samples in a series of fluids beginning with tap water, then de-ionized water, then a special detergent ("RBS"), then de-ionized water, then nitric acid for metals or Methanol for organics, then 18 meg-ohm de-ionized water (metals) and finally filtered air. For metals, the collection bottles are disassembled and all component parts are soaked, four-hours minimum, in each fluid. A 25% concentration of ultra-pure nitric acid is used to soak Teflon™ parts (bottles, lids, and sensor chamber) and a 10% concentration is used for all other parts (including acid-sensitive polycarbonate filter bodies). For organics, components are rinsed with Methanol and air-dried and precleaned amber-glass sample bottles are used. The synchronized rotary valves, tubes and fittings remain assembled to the BFSD2 and are cleaned in place by flowing the series of decontamination fluids through them. The acquisition and control subsystem is used to execute a special program which activates each valve position for specified time during which the decontamination fluids are forced through by positive pressure using a Teflon-coated pump. And finally, the collection chamber, lid, diffuser, circulation pump, tubes and fittings are physically scrubbed and rinsed in place with non-metallic brushes. All decontaminated surfaces are dried, reassembled or otherwise sealed to isolate them from ambient, air-borne contaminants.

BFSD2 setup includes various tasks to be performed prior to deployment using checklists. These include: charging the gel-cell 24Vdc battery; replacing the 14 circulation subsystem C-cell batteries; replacing the 6 acoustic release 9Vdc batteries; installing a new acoustic release subsystem burn wire, cleaning the plating anode and rigging the recovery float; checking and refilling (if required) the compressed-oxygen supply tank; checking the insertion light subsystem function and replacing its one battery (if required); installing the 12 sample collection bottles and evacuating them to less than 25 in-Hg; setting up laptop computer files for post-deployment data uploading; reviewing and modifying, as required, the deployment operational control programs and downloading the predrop program into the acquisition and control subsystem.

### 4.2.2 Deployment

Each BFSD deployment requires at least three personnel. One person is responsible for maneuvering, positioning and securing the surface vessel. Two additional persons are required to deploy and retrieve the BFSD. The checklists included in appendix D are the step-by-step procedures followed on deck to avoid oversights and mistakes. Ancillary tasks to be performed include collection of a sediment sample with a spring-loaded grab sampler and logging site GPS coordinates. Figures 19 through 22 illustrate typical deployment and recovery scenes.

### 4.2.3 Recovery

Recovery is initiated following an elapse time after the planned deployment greater than the operational program by at least two hours. This allows for accumulated processing delays which lengthen the overall autonomous time period. Once within approximately 100 yards of the deployment position a coded acoustic signal is transmitted to the BFSD2 acoustic receiver from the deck unit. A 15-minute function time begins during which the burn-wire is consumed and the recovery buoy is released. The line attached to the buoy is used to wench the BFSD2 and the attached coiled cables to the surface and aboard the vessel. Heavy sediment and other debris are washed off the BFSD2 before bringing it onboard. On deck an inspection of collection bottle status is made as an immediate indicator of deployment performance. Turning the compressed-oxygen cylinder valve off and installing storage caps on the pH and oxygen sensors is also done without delay. Other assessments that may be accomplished onboard include upload of logged data from the acquisition and control subsystem and processing of pH and oxygen sensor data as performance indicators. Spreadsheet templates are used to quickly generate graphs and charts of converted and processed data which display results for the entire operational deployment. Aboard a properly configured surface vessel such as SSC SD's R/V ECOS during the San Diego Bay demonstration sample handling such as acid preservation, labeling and sealing of 100 ml laboratory samples and 25 ml splits for measurement of silica concentration was accomplished. Once off loaded to shore, the BFSD2 must be thoroughly washed down with fresh water to remove all remaining debris, sediment and seawater and to minimize corrosion. As soon as practicable, a freshwater purge and forced-air dry of the synchronous rotary valves and associated tubes and fitting is accomplished.

**Figure 19. Deployment Equipment** (SSC SD Dock).

**Figure 20. Crane Loading Aboard Workboat** (Bishop Point, Pearl Harbor).

**Figure 21 Deployment** (Middle Loch, Pearl Harbor).

**Figure 22. Recovery** (Middle Loch, Pearl Harbor).

### 4.3 Sampling Procedures

The sampling procedures followed for the BFSD2 demonstrations provided assurance that the overall project goals and objectives were met. Careful adherence to the procedures ensured that data collected was useful in evaluating the effectiveness of the BFSD2 for benthic flux measurements.

#### 4.3.1 Overview of Sampling Operations

Sampling operations at each demonstration location consisted of site deployments during which the BFSD2 collected seawater samples at timed intervals and a sediment confirmation sample collected following each site deployment. Three additional identical blank (background) deployments with the BFSD2 collection chamber sealed using a polycarbonate bottom plate were used to statistically establish system blank performance as a baseline for comparison to the sediment flux data.

##### 4.3.1.1 BFSD2 Sampling

Samples were collected *in situ* in twelve 250-ml precleaned sampling bottles at preprogrammed time intervals. A description of the sampling technology can be found in Section 2.1. Sampling was initiated by starting the acquisition and control subsystem program, which activated synchronous rotary valves connected to the sample bottles. In-line filters passed only seawater with dissolved-phase contaminants at the time of collection. After each deployment, the samples for metals analysis

were transferred to appropriate sample containers and acidified, if necessary. Samples for organics analysis were collected in non-reusable bottles and shipped to the analytical lab without further disturbance. A baseline ambient water sample was collected as the number one BFSD2 sample during deployment. The sample was analyzed and used to establish the ambient concentration at time zero for each analyte. The total time required for the 12 sampling events including the time zero sample using 7-hour intervals was approximately 72 hours with consideration for accumulated data processing delays.

#### 4.3.1.2 Sediment Sampling

A sediment sample was collected at the end of each different site deployment using a spring-loaded grab sampler. The sediment was containerized, capped, labeled, and sealed. The sediment samples were used in various analyses, including digestion and extraction processes to measure trace metal and organic levels. Other measurements related to seawater data analysis and interpretation were conducted and are reported in a later section.

#### 4.3.1.3 System Blank Samples

With the BFSD2 configured as described in Section 2.1, three deployments using identical procedures were accomplished for both metals and for organics. The samples were collected and handled as in the demonstrations (see 4.3.1.1 above) and shipped to the analytical laboratory for the analyses discussed below.

#### 4.3.1.4 Quality Control

Demonstration samples and blank samples included equipment blanks, trip blanks and laboratory blanks to assess the performance of the equipment in the field.

#### 4.3.1.5 Communications and Documentation

The SSC SD program manager communicated regularly with demonstration participants to coordinate all field activities associated with the demonstrations and to resolve any logistical, technical, or QA issues that arose as the demonstrations progressed. Successful implementation of the demonstrations required detailed coordination and constant communication among all participants. Field documentation was included in field logbooks, field data sheets, chain-of-custody forms, and kept in a bound logbook. Each page was sequentially numbered and labeled with the project name and number. All photographs were logged by the digital camera and transferred to the computer file system. Those entries included the time, date, orientation, and subject of the photograph. Specific notes about each sample collected were written on sample field sheets and in the field logbook. Any deviations from the approved final demonstration plan were thoroughly documented in the field logbook and communicated to parties affected by the change. Original field sheets and chain-of-custody forms accompanied all samples shipped to the laboratory.

#### 4.3.1.6 Field Sample Collection

Sampling personnel collected and prepared samples using the procedures described below. All field activities conformed with the requirements of the Demonstration Plan and its attached Health and Safety Plan. Sampling operations at each site consisted of a deployment of the BFSD to collect seawater samples at timed intervals, and collection of a sediment grab sample after deployments. The series of samples collected during three blank test deployments with the chamber sealed with a polycarbonate bottom were used to assess the background level from which statistically significant fluxes can be derived.

#### 4.3.1.6.1 Field Blanks

One field blank for the San Diego Bay metals demonstration consisted of an additional 250-mL bottle filled with de-ionized water strapped to the flux chamber. This sample was to be used to assess the integrity of the sample bottle seals if anomalous data are obtained.

#### 4.3.1.6.2 Equipment Blanks

These samples consist of running 250 ml of de-ionized water through the BFSD2 sampling subsystem prior to deployment. One equipment blank was collected for each site demonstration. The equipment blank was used as a quality control measure to ensure that the BFSD2 was properly decontaminated between deployments.

#### 4.3.1.6.3 Trip Blank

**.** One trip blank for the San Diego Bay metals demonstration was collected by placing a closed 250-ml sample of de-ionized water in a sample cooler at the beginning of the demonstration. The trip blank was used as a quality control measure, if necessary, to ensure that samples are not contaminated during sample storage and shipment to the laboratory.

#### 4.3.1.6.4 Silica

Confirmatory silica analysis was used for metals tests to ensure that the BFSD2 is functioning properly, without any significant loss of collection chamber seal. Silica is a common component in constructing the hard parts of some planktonic organisms, and it typically fluxes out of sediments at a constant rate due to dissolution processes. By analyzing each of the samples collected using the BFSD for silica and plotting the concentration versus time data, a linear increase in silica concentration over time strongly suggests that there was a good seal of the chamber with the sediment. The first sample at time zero provides a value for silica in bottom waters at the start of the experiment. The silica analysis was performed using 25 ml of seawater removed from each sample collected prior to acid preservation. To maximize sample volume for organics analysis, measured pH data was used to ensure chamber seal integrity.

#### 4.3.1.6.5 BFSD2 System Blanks

Finally, for metals, a triple-duplicate deployment with the collection chamber sealed with a polycarbonate bottom ("blank test") was conducted as an experiment blank at the SSC SD dock in San Diego Bay. The data collected during those deployments provided a baseline with which to compare the site-specific flux rates, in order to document a statistically significant flux rate from both analytical and system variability in a seawater environment. For organics, a triplicate set of blank tests were conducted "*ex-situ*" using a single supply of ambient seawater. The data collected provided less variability due to the constant seawater supply, including sample makeup volumes.

### 4.3.1.7 Laboratory Blanks

Laboratory Blanks and Laboratory QC checks are designed to assess the precision and accuracy of the analysis, to demonstrate the absence of interferences and contamination from glassware and reagents, and to ensure the comparability of data. Laboratory QC checks consist of laboratory duplicates, surrogates, MS/MSDs, and method blanks. For organics, a Method Detection Limit study was performed to establish modified EPA standard procedures and controls for targeting specific PAHs, PCBs and pesticides with small sample volume. No comparable MDL study was performed for metals because adequate volumes were collected from the chamber for EPA standard procedures in which detection limits were adequate to measure anticipated metals concentrations.

#### 4.3.1.7.1 Method Blanks

Method blanks were used to verify that preparation of samples was contamination-free. Each batch of extracted and digested samples was accompanied by a blank that was analyzed in parallel with the rest of the samples, and carried through the entire preparation and analysis procedure. Method blanks may also be called calibration blanks. Calibration blanks are analyzed for seawater samples analyzed for metals, for seawater samples analyzed for silica, for sediment samples analyzed for metals, and for sediment samples analyzed for SEM.

#### 4.3.1.7.2 Precision

Analytical precision and method detection limits are determined by replicate storage, preparation, and analysis of standard seawater. Further verification of precision is achieved by splitting 1 in 20 field samples. Laboratory duplicates are analyzed during analysis of water samples analyzed for metals, water samples analyzed for alkalinity (if performed), sediment samples analyzed for metals, and sediment samples analyzed for SEM.

#### 4.3.1.7.3 Accuracy

Spiked replicates of field samples were processed with each analytical batch to validate method accuracy within the context of varying matrices. With water and extracted water samples that are analyzed by the method of standard additions, spiked samples are not used. MS and MSD samples were used for analysis of water samples analyzed for metals, sediment samples analyzed for metals, sediment samples for AVS, and sediment samples for SEM.

#### 4.3.1.8 Sample Storage, Packaging, and Shipping

The field team followed chain-of-custody procedures for each sample as it was collected following BFSD2 retrieval. An example chain-of-custody form can be found in Appendix E. The following information was completed on the chain-of-custody form: project number, project name, sampler's name, station number, date, time, station location, number of containers, and analysis parameters.

Following retrieval and removal of the samples from the BFSD at the end of each single deployment, and until shipment to Battelle (metals) or Aurther D. Little (organics), all samples were stored in refrigerators or coolers and maintained with ice at a temperature of approximately 4 $^{\circ}$C. The custody of samples was maintained in accordance with standard operation procedures (SOP). Samples to be shipped to the confirmatory laboratory were packaged and shipped according to the sample packaging and shipment requirements SOP. Copies of these SOPs are available upon request.

## 4.4 Analytical Procedures

### 4.4.1 Selection of metals Analytical Laboratory

The analytical laboratory selected to provide analytical services is Battelle Marine Sciences Laboratory (Battelle). Battelle was selected because of its experience with QA procedures, analytical result reporting requirements, and data quality parameters. Battelle is not affiliated with SSC SD or any of the demonstration team members.

### 4.4.2 Metals Analytical Methods

Sample and data analysis are key elements in the use of samples collected by the BFSD. Samples were analyzed for metals including cadmium, copper, lead, manganese, nickel, and zinc; and silica. The seawater samples collected by the BFSD2 and marine sediment samples were sent to Battelle for analysis. The analytical methods that were used are listed in Table 1. In addition, other metals

including antimony, arsenic, selenium, silver, thallium, and iron, were analyzed in the seawater samples collected during the three blank chamber tests. This data will be used in future projects to establish baseline data for the metals.

**Table 1. Analytical Methods.**

| ANALYTE | SEAWATER SAMPLE | SEDIMENT SAMPLE |
|---|---|---|
| | **Analytical Method** | **Analytical Method** |
| Cadmium | ICP-MS (Nakashima et al. 1988) | GFAA (Crecelius et al. 1993) |
| Copper | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Iron | GFAA (Crecelius et al. 1993) | XRF (Crecelius et al. 1993) |
| Manganese | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Nickel | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Lead | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Zinc | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Miscellaneous Metals - Antimony, Arsenic, Selenium, Silver, and Thallium | ICP-MS (Nakashima et al. 1988) GFAA or XRF (Crecelius et al. 1993) | N/A |
| Silica(1) | Strickland and Parsons 1968 | N/A |
| Alkalinity | Strickland and Parsons 1968 | N/A |
| Grain Size | N/A | (Plumb 1981) |

| | | |
|---|---|---|
| Total Solids | N/A | (Plumb 1981) |
| Total Organic Carbon | N/A | (Plumb 1981) |
| Acid Volatile Sulfide | N/A | (Lasorsa and Casas 1996) |
| Simultaneously Extracted Metals | N/A | ICP-MS (EPA Method 1638) |

N/A – Not Applicable
ICP-MS – Inductively coupled plasma mass spectroscopy
XRF – X-ray florescence
GFAA – Graphite furnace atomic absorbtion\
(1) Silica was analyzed in the field using a HACH DR 2010 instrument to assure sample integrity and to determine whether samples will be sent to the laboratory for full analysis.

#### 4.4.2.1 Preconcentration

The preconcentration method used for this project (Nakashima et al. 1988) was a tetrahydroborate reductive precipitation as a preconcentration technique. Samples were first acidified with nitric acid to pH 1.8 for storage. Samples were then adjusted to pH 8 to 9 with high-purity ammonia solution and iron and palladium were added. A sodium tetrahydroborate solution was added before the solution was filtered through a 25-millimeter (mm) -diameter acid-washed, acid-resistant cellulose nitrate 0.45-micrometer membrane filter. Concentrated nitric and hydrochloric acids are added to the empty bottle to dissolve any precipitate adhering to the walls; the acid mixture was subsequently transferred to the filter assembly. The filter is washed with water, and the solution was diluted to 25 ml. The filter and its holder were rinsed with 3-ml aliquots of the nitric and hydrochloric acids and water between samples, and were used repeatedly. The combination of iron and palladium brought about the rapid formation of a precipitate after the addition of sodium tetrahydroborate.

#### 4.4.2.2 Inductively Coupled Plasma Mass Spectrometry (Nakashima et al. 1988)

ICP-MS analysis allows the simultaneous, multi-elemental determination of metals by measuring the element-emitted light by optical spectrometry. Element-specific atomic-line emission spectra are dispersed by a grating spectrometer, and the intensities of the lines are monitored by photomultiplier tubes.

#### 4.4.2.3 Graphite Furnace Atomic Absorption (Nakashima et al. 1988)

GFAA allows the individual analysis of iron, arsenic, lead, selenium, and thallium to provide lower detection limits. In the furnace, the sample is evaporated to dryness, charred, and atomized. A light beam from a hollow cathode lamp or an electrode-less discharge lamp is directed through the tube into a monochromator and onto a detector that measures the amount of light. Because the wavelength of a light beam is characteristic of a single metal, the light energy absorbed is a measure of that metal's concentration.

#### 4.4.2.4 Silica (Strickland and Parsons 1968)

The sea water sample was allowed to react with molybdate under conditions which result in the formation of the silicomolybdate, phosphomolybdate, and arsenomolybdate complexes. A reducing solution, containing oxalic acid, is then added which reduces the silicomolybdate complex to give a blue reduction compound and simultaneously decomposes any phosphomolybdate or

arsenomolybdate, so that interference from phosphate and arsenate are eliminated. The extinction of the resulting solution was measured using 25centimeter (cm) cells. This method was performed using a Hach Model DR2010 Field Kit prior to sending samples to the laboratory.

#### 4.4.2.5 Sediment Samples

Sediment sample analysis included methods to determine grain size, TOC, AVS and total metals. The collected sediment samples were homogenized and split into subsamples before analysis. Sediment samples for total metals analysis were freeze-dried and ground prior to analysis. Total metals were then determined using X-ray fluorescence (XRF) or GFAA (Crecelius et al. 1993).

##### 4.4.2.5.1 Grain Size (Plumb 1981)

Grain size was measured by a combination of sieving, particle counters, and pipette analysis, as described in the above reference.

##### 4.4.2.5.2 TOC (Plumb 1981)

TOC was measured on an automated carbon analyzer by measuring total carbon and inorganic carbon contents, with the difference providing the TOC values. Inorganic carbon from carbonates and bicarbonates were removed by acid treatment. The organic compounds were decomposed by pyrolysis in the presence of oxygen or air.

##### 4.4.2.5.3 X-ray Fluorescence (Crecelius et al. 1993)

This procedure uses energy dispersive x-ray fluorescence spectroscopy to quantify elemental concentrations in sediment and tissue samples.

##### 4.4.2.5.4 AVS (Lasorsa and Casas 1996)

AVS is operationally defined as the fraction of sulfide present in the sediment that is extracted with cold hydrochloric acid. Analysis of AVS is an indicator of potential metal toxicity in sediments. AVS was determined by photoionization detection (PID) following a step that converted the sulfide in the sample to hydrogen sulfide. During the first step, the sample was allowed to react with 1 N hydrochloric acid, the system was purged with purified inert gas, and produced hydrogen sulfide was trapped using a column immersed in liquid nitrogen. The PID method used gas chromatographic separation and photoionization detection; the area under the curve of the chromatograph was used to calculate sulfide concentration from the linear regression of the standard curve.

### 4.4.3 Selection of Organics Analytical Laboratory

Arthur D. Little Analytical Laboratory, Cambridge, MA was selected for organics analysis as a result of a successful Method Detection Limit study to optimize detection limits for selected PAHs, PCBs and pesticides form 250 ml seawater samples. The resulting EPA-based procedures and controls were documented and used for all subsequent analyses.

### 4.4.4 Organics Analytical Methods

See Appendix C for a complete description of the Method Detection Limit study and organic sample analysis procedures and controls.

### 4.4.5 Data Reduction and Analysis

Correction of concentration for dilution, regression analysis, and flux rate concentrations were calculated using a custom spreadsheet template. See Appendix D for a complete set of spreadsheets for both metals and organics. Results from these complex computations require careful analysis and interpretation to reach valid conclusions. Various other sitespecific data and information must be used in combination with computed flux results to fully interpret the data. The approach taken and the conclusions reached for the demonstrations of this report are presented in the next section.

# 5. Performance Assessment

## 5.1 Performance Data

### 5.1.1 Metals Blank Tests

The primary purpose for performing system blank tests was to establish BFSD2 minimum performance levels, or detection limits, for assessment of flux data obtained during subsequent demonstration tests. Three replicate 70-hour blank tests were conducted using BFSD2 between May 14 and 31, 1998. The tests were conducted from the end of SSC, San Diego Pier 159 at approximately two feet off the bottom in seawater ranging from about 14 to 20 feet deep, depending on tidal flow.

As discussed earlier, the BFSD 2 collection chamber bottom was sealed with a polycarbonate plate and filled with ambient seawater at the start of each 70-hour test. Prior to each test routine procedures for decontamination of the sampling system were performed. Equipment and source blanks were taken. After each test the samples were handled in accordance with EPA Methods 1638 and 1669 and routine chain of custody procedures were used in preparation and shipment to Battelle Marine Sciences Laboratory for analysis. The Silica samples were sent to and analyzed by Scripps Institute of Oceanography.

Each test produced twelve 250ml sample bottles of seawater filtered *in situ* to 0.45 micron. Sample bottle one in each test was filled with ambient seawater taken from the water column as the BFSD 2 was lowered to its test depth at about 15 feet below the surface. Sample bottle two in each test was filled with seawater from the sealed chamber at 6 minutes after start of the 70-hour test. The remaining 10 sample bottles were filled from the chamber at 7-hour intervals. The data, analysis and graphs for each test were processed and compiled in Microsoft Excel spreadsheet, "BFSD2 Blank Tests.xls", provided with the electronic submission of this report. Appendix C provides copies of the spreadsheet results and includes data and graphs for the BFSD2 flow-through sensors. Table 2 below is a summary of the results of the blank tests

**Table 2. Metals Blank Test Results Summary.**

| Metal | Blank Flux ($\mu g/m^2/day$) | | | Repeatability ($\mu g/m^2/day$) | | |
|---|---|---|---|---|---|---|
| | Test 1(12) | Test 2 (6) | Test 3 (6) | Average Flux | +/- 95% C.L. | Std. Deviation |
| Copper (Cu) | 25 | -13 | 15 | 2.82 | 8.73 | 19.7 |
| Cadmium (Cd) | -5.3 | -0.8 | -0.09 | -0.52 | 0.75 | 2.8 |
| Lead (Pb) | 2.8 | 5 | 1 | 3.16 | 1.59 | 2.0 |
| Nickel (Ni) | 23 | 20 | -6.7 | 10.28 | 7.34 | 16.4 |
| Manganese (Mn) | -289 | -249 | -250 | -264.85 | 7.49 | 22.8 |
| Zinc (Zn) | -194 | -13 | 200 | -3.38 | -68.61 | 197 |
| Silica (SiO2)* (*mg/m2/day) | -4 | -3.3 | 1.4 | -1.97 | 2.88 | 2.9 |

#### 5.1.1.1 Discussion of Metals Blank Results

As expected, the blank results for most metals showed little or no time trend, indicating minimal source or loss of target analytes during the blank experiments. Figures 23 through 29 provide graphs of concentration versus time for each analyte for each blank test. With the exception of lead and manganese, replicate analysis indicates that none of the metal fluxes were significantly different from a zero flux condition at the 95% confidence level. Copper results for the three replicates showed both small positive and small negative flux rates. Replicate blanks for cadmium were all small and negative, however the variability was sufficient that the mean was still not significantly different than zero. Results for lead indicated small positive flux rates with a mean value of 2.9 □g/m$^2$/day which was different from the zero flux condition, suggesting a potential small source of lead in the experimental procedure. Nickel results indicated small positive and negative fluxes with no obvious uptake or sources of nickel from the system. Replicates for manganese all showed substantial negative flux rates indicating a significant loss of manganese due to some aspect of the experimental procedure. Results for zinc showed both positive and negative fluxes with no clear pattern of source or uptake.

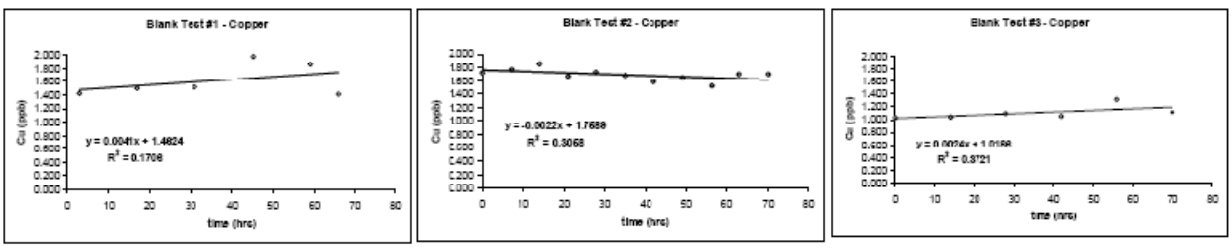



**Figure 23. Blank Performance for Copper (**Cu**).**

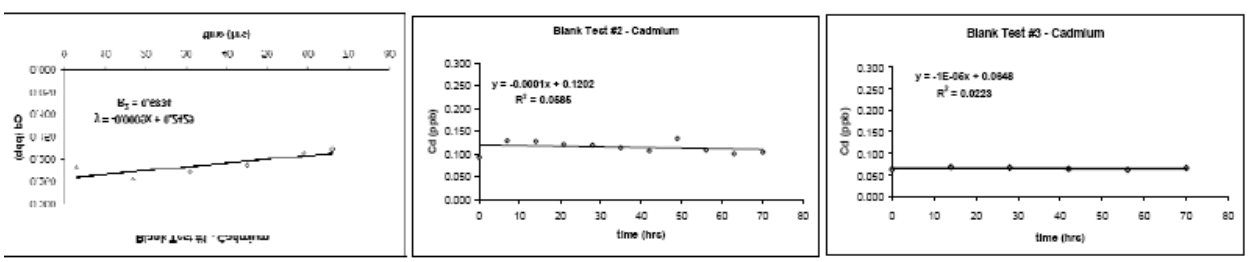



**Figure 24. Blank Performance for Cadmium (**Cd**).**

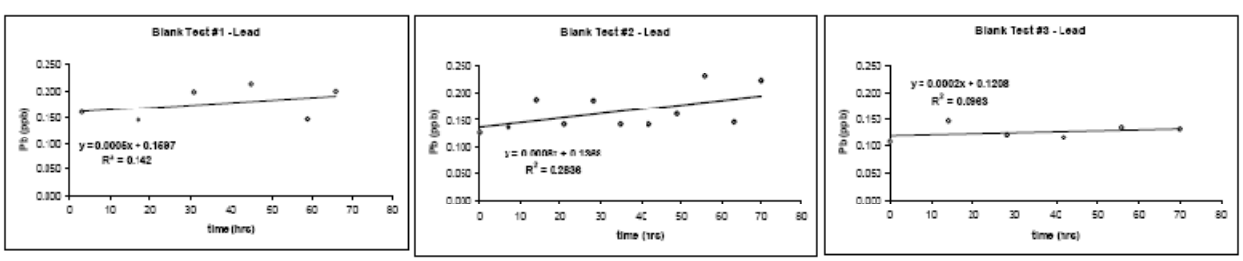



**Figure 25. Blank Performance for Lead (**Pb**).**

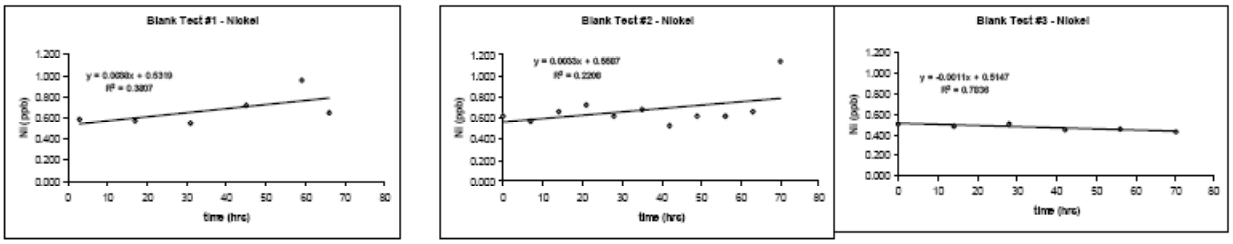



**Figure 26. Blank Performance for Nickel (**Ni**).**

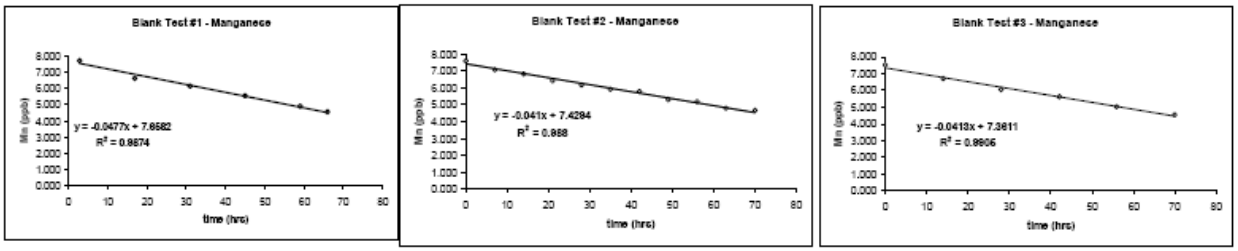



**Figure 27. Blank Performance for Manganese (**Mn**).**

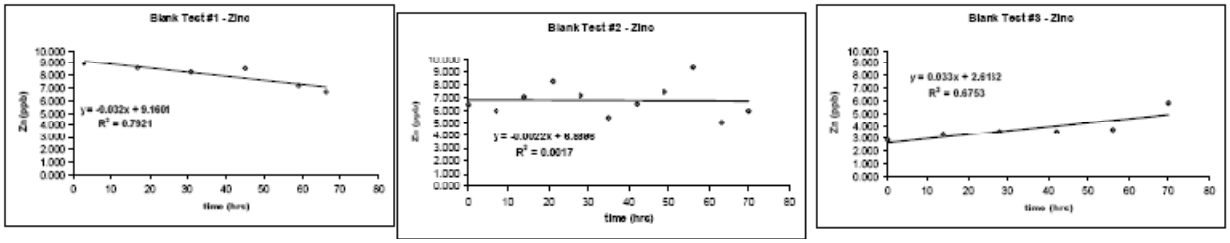



**Figure 28. Blank Performance for Zinc (**Zn**).**

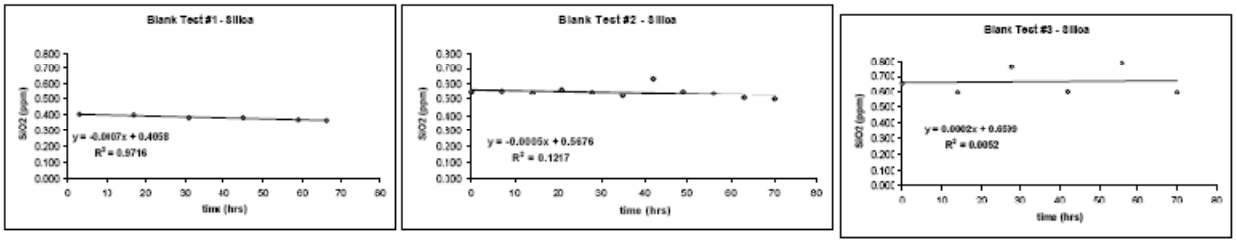



**Figure 29. Blank Performance for Silica (**$Sio_4$**).**

Scripps Institute of Oceanography analyzed silica concentrations, used to indicate chamber integrity and seal. The CA EPA request for an independent analysis of Silica could not be reasonably obtained from Battelle. Subsequent silica analyses were conducted on-site with field analytical systems (i.e., Hach Kit).

Results show a high, very repeatable level of Manganese uptake by the BFSD2. Results from earlier prototype BFSD blank tests were not consistent with this result and further investigation

is warranted. However, because manganese is not generally viewed as a toxic metal, the resolution of this issue is less critical than for other metals.
The somewhat higher blank fluxes observed for zinc are consistent with previous results and are attributed to the ubiquitous nature of zinc and associated contamination during sampling and analysis. Because previously measured flux rates for zinc generally lie outside the range of these blanks, and because of the higher toxicity thresholds for zinc relative to other metals, this is not considered as a serious problem. However, as with all trace metals, care must be taken to minimize zinc contamination during all phases of the experimental procedure. The higher variability between the zinc blank tests will make any results indicating small fluxes of zinc from sediments less conclusive.

#### 5.1.1.2 Discussion of Metals Blank Tests

Although the three blank tests were reasonably trouble free and produced generally high quality data there are a number of points deserving further discussion and explanation.

##### 5.1.1.2.1 Sensors

The flow-through sensors for dissolved oxygen and for pressure, Figures 30 and 31, produced data requiring explanation. The "noisy" dissolved oxygen data was discovered to be due to restricted flow over the sensing element. Flow improvements resolved the problem prior to the Paleta Creek demonstrations (see Figure 35). The oxygen measurements during the blank test are not critical because there is little oxygen depletion when no sediment is present. Drift of the pressure sensor readings was more problematic and resolution required trouble shooting at the factory, after the Paleta Creek demonstrations.

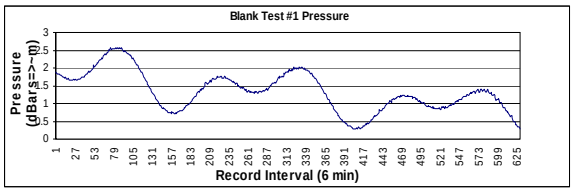



**Figure 30. Blank Test Dissolved Oxygen.**

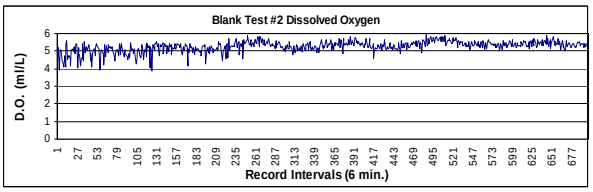



**Figure 31. Blank Test Pressure.**

##### 5.1.1.2.2 Ambient Seawater Sample

Sample bottle one was not used in blank test analyses, as well as subsequent Paleta Creek demonstration analyses. Analytical laboratory results clearly indicate that the metal concentrations in the water collected in bottle one as the BFSD2 descended to the test depth were not consistent with concentrations in the chamber after it was closed and sealed at the surface prior to descending to the test depth. CA EPA certification evaluators agreed that the sample taken at 6 minutes after the start of the test was a better representation of replacement water entering the chamber. The unused concentration value is still shown, in bold, in the spreadsheet. A sensitivity analysis of the affect of this change on dilution correction calculations and subsequent flux results show it to be insignificant. Consequently, an improved method to fill sample bottle one from more representative bottom water was implemented.

##### 5.1.1.2.3 Metals Sample Analysis

Not all samples were analyzed to minimize analytical costs. For Blank Test 1 only the six odd-numbered samples were analyzed (with further changes, see next paragraph); for Blank Test 2 all

twelve samples were analyzed; for Blank Test 3 only the six even-numbered samples were analyzed. Also, additional trace metals beyond those identified for CA EPA certification evaluation were analyzed for future applications.

Blank Test 1 suffered a "False Start" when an error in a software control loop shut the test down after six minutes, following sample bottle two filling. The error was corrected from the surface and the test was restarted three hours later without raising the BFSD2 from the test depth. Sample bottle three filled immediately upon restart and sample bottle two was retained as representative of ambient conditions. To complete the set of six samples, sample bottle twelve with a 7-hour interval was added to the other odd-numbered samples. Blank Test 1 was 66 hours total duration.

#### 5.1.1.3 Metals Blank Tests Assessment

It was concluded that the BFSD2 metals blank performance was statistically established and the values obtained were repeatable, precise and accurate enough to allow valid measurement of *in situ* sediment flux rates.

### 5.1.2 Organics Blank Tests

Three replicate 70-hour blank tests were conducted using BFSD2 between September 1, 2000 and November 27, 2000. The purpose of the tests was to establish system performance levels for selected polynuclear aromatic hydrocarbons (PAH) using standardized procedures as part of the demonstration project. Performance levels for selected polychlorinated biphenyl (PCB) congeners and pesticides were also measured for future potential applications. As shown in Figure 32, the tests were conducted *ex situ* at SSC San Diego using Naval Station San Diego (Paleta Creek) seawater.

**Figure 32. *Ex Situ* BFSD2 Organics Blank Test Physical Setup.**

The BFSD 2 collection chamber bottom was sealed with a polycarbonate plate and filled with seawater collected from the Paleta Creek industrial area within Naval Station San Diego, at the start of each 70-hour test. Paleta Creek has been designated as a "toxic hotspot" by the Regional Water Quality Control Board and has been selected for the initial demonstration of BFSD 2 for organics applications. Makeup seawater to replace collected sample volume and any leakage was likewise the same Paleta Creek source seawater. Prior to each test, routine procedures for decontamination of the sampling system were performed. The procedure differed from that used in metals applications only in that the Nitric acid rinse was omitted and a final Methanol rinse

was added. Samples were collected into 250ml precleaned amber glass sample bottles fitted with custom inline filter assemblies (Figure 6b). The filter element was a 47mm Gelman 1.0-micron binder-less borosilicate glass filter prepared by pre-combustion for 24 hours at 375 degrees Fahrenheit. The samples were collected, capped, labeled and shipped in the same commercially standard sample bottle. Routine chain of custody procedures were used for overnight shipment to Arthur D. Little, Inc. (ADL) analytical laboratory in Cambridge, MA. All samples were collected, shipped (chilled to 4 degrees), received and extracted within the EPA seven-day hold time requirement. Laboratory processing and analysis of the samples was in accordance with EPA SW-846 methods and procedures, including Methods 8270M and 8081A protocols modified based on results from a Method Detection Limit study performed under contract N66001-96-D-0050 by ADL for this project.

Each test produced twelve filtered 250ml (approximately) samples and one additional 500ml unfiltered source sample. Sample bottle one in each test was filled with source seawater passed through the chamber lid closure-activated valve at the initiation of the 70- hour test. Sample bottle two in each test was filled with seawater from the sealed chamber approximately 6 minutes after chamber lid closure. The remaining 10 sample bottles were filled from the sealed chamber at 7-hour intervals. The 500ml unfiltered sample was taken from the residual source seawater container at the conclusion of the test. Table 3, 4 and 5 are summaries of the results of the organics blank tests.

**Table 3. PAH Blank Tests Results Summary.**

| PAH | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| 1. Naphthalene | -243.5 | -448.1 | -629.3 | -440 | 218.4 | 193.0 |
| 2. Acenaphthene | -32.4 | ND | ND | -32.4 | n/a | n/a |
| 3. Acenaphthylene | -350.2 | 141.0 | 275.9 | 22.2 | 372.9 | 329.5 |
| 4. Fluorene | 125.5 | -69.3 | -84.2 | -9 | 132.4 | 117.0 |
| 5. Phenanthrene | 89.0 | -39.8 | -16.3 | 11 | 77.6 | 68.6 |
| 6. Anthracene | 182.3 | 53.1 | -324.8 | -30 | 298 | 263 |
| 7. Fluoranthene | -421.5 | -1539.0 | -1308.9 | -1089.8 | 667.8 | 590.1 |
| 8. Pyrene | 76.6 | -447.1 | -431.9 | -267.5 | 337.3 | 298.0 |
| 9. Benzo(a)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 10. Chrysene | 23.9 | -61.9 | ND | -19.0 | 84.2 | 60.7 |
| 11. Benzo(b)fluoranthene | ND | ND | -134.3 | -134.3 | n/a | n/a |
| 12. Benzo(k)fluoranthene | ND | ND | -9.0 | -9.0 | n/a | n/a |
| 13. Benzo(a)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 14.Indeno(1,2,3-c,d)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 15. Dibenz(a,h)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 16. Benzo(g,h,I)perylene | ND | 19.6 | ND | 19.6 | n/a | n/a |

**Table 4. PCB Blank Test Results Summary.**

| PCB | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| (8) 2,4'-Dichlorobiphenyl | -66.6 | ND | 47.8 | -9.4 | 112.2 | 80.9 |
| (18) 2,2',5-Trichlorobiphenyl | 205.2 | 23.3 | 27.0 | 85.2 | 117.6 | 104.0 |
| (28) 2,4,4'-Trichlorobiphenyl | -8.0 | ND | ND | -8.0 | n/a | n/a |
| (52) 2,2',5,5'-Tetrachlorobiphenyl | ND | 7.9 | 89.9 | 49 | 80.4 | 58.0 |
| (66) 2,3',4,4'-Tetrachlorobiphenyl | 53.6 | 16.6 | ND | 35 | 36.2 | 26.2 |
| (101) 2,2',4,5,5'-Pentachlorobiphenyl | 57.8 | 57.4 | -3.5 | 37 | 40 | 35 |
| (118) 2,3',4,4',5-Pentachlorobiphenyl | ND | 2.7 | 2.3 | 2.5 | 0.3 | 0.2 |
| (153) 2,2',4,4',5,5'-Hexachlorobiphenyl | ND | ND | 9.5 | 9.5 | n/a | n/a |
| (180) 2,2',3,4,4',5,5'-Heptachlorobiphenyl | ND | -9.6 | ND | -9.6 | n/a | n/a |
| (206) 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | -2.8 | 247.0 | -17.0 | 75.7 | 168.0 | 148.5 |
| (209) 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl | -18.5 | ND | ND | -18.5 | n/a | n/a |

**Table 5. Pesticide Blank Test Results Summary.**

| Pesticide | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| alpha-Chlordane | 7.0 | ND | ND | 7.0 | n/a | n/a |
| 2,4'-DDD | 7.0 | ND | ND | 7.0 | n/a | n/a |
| Methoxychlor | 25.7 | ND | ND | 25.7 | n/a | n/a |
| Endosulfan I | 48.8 | ND | ND | 48.8 | n/a | n/a |
| hexachlorobutadiene | ND | ND | 22.0 | 22.0 | n/a | n/a |
| Heptachlor | 304.5 | ND | ND | 304.5 | n/a | n/a |
| Heptachlor Epoxide | ND | ND | 8.8 | 8.8 | n/a | n/a |
| alpha-hexachlorocyclohexane | 3.3 | ND | ND | 3.3 | n/a | n/a |
| beta-hexachlorocyclohexane | 61.0 | ND | ND | 61.0 | n/a | n/a |
| lindane | 35.2 | 132.3 | 33.8 | 67.1 | 63.9 | 56.5 |
| trans-Nonachlor | 40.8 | ND | ND | 40.8 | n/a | n/a |

#### 5.1.2.1 Results of Organics Blank Tests

The Paleta Creek seawater collected for these tests contained a broad mixture of dissolved organic contaminants targeted by this study, but not all 63 of them. Of the 34 targeted organic contaminants that were detected, a number of them were not measurable in all three blank tests. Further, within a number of individual blank tests where a target contaminant was detected, one or more time-series samples fell below the detection limits. Notwithstanding such issues, analysis results plotted as time-series, with non-detects removed, show little if any, release or uptake of detected target contaminants by the BFSD2 with the exception of Naphthalene and Flouranthene. These two PAHs both consistently indicated an uptake trend likely due to sorption onto the many plastic surfaces of the collection chamber and recirculation system. Statistical analysis of the data for repeatability was applied to those tests with multiple measurements.

For the targeted EPA 16 Priority PAHs, the results were generally complete for the eight lowest molecular weight (through three Benzene rings) compounds. "Non detects" were much more prevalent with the eight heavier molecular weight PAHs (four-ring including Benzo(a)anthracene and higher) and four of the 16 targeted PAHs were not detected in all three blank tests although source seawater did indicate very low concentrations (less than 2 ng/L or parts/trillion) were present. Acenaphthene, a two-ring PAH, was the only low molecular weight compound not sufficiently detected in all three blank tests to establish repeatability statistics however a time-series flux trend (uptake or release) was established. Acenaphthene was detected in all three seawater source samples and in all 12 blank test 1 samples but dropped below detection limits in 10 of 12 blank test 2 samples and 9 of 12 blank test 3 samples. All remaining light-end PAHs (up to Pyrene) were detected in all 12 samples of all three blank tests and Table 3 provides full repeatability statistics for them. Time-series flux trends were also established for all of them. None of the heavier-end PAHs were detected sufficiently in all 12 samples of all three blank tests to yield full repeatability statistical results. Only Chrysene was detected sufficiently in two of the three blank tests to establish limited repeatability statistics. Benzo(b)fluoranthene, Benzo(k)fluoranthene and Benzo(g,h,I)perylene were detected sufficiently in only one blank test and repeatability statistics cannot be developed for them. Time-series flux trends were established for all four of these heavier-end PAHs. The remaining four PAHs (Benzo(a)anthracene, Benzo(a)pyrene, Indeno(1,2,3c,d)pyrene and Dibenz(a,h)anthracene) were not sufficiently detected in any of three blank tests to establish either repeatability statistics or time-series trends.

For the 20 targeted PCB congeners and 16 targeted pesticides, the results were somewhat less complete. Three PCB congeners (#18, #101, #206) and one pesticide (Lindane) were sufficiently detected in all three blank tests to establish full repeatability statistics and time-series flux trends. Two of the 20 PCBs and one of the 16 pesticides were detected sufficiently in two of the three blank tests to establish limited repeatability statistics and time-series flux trends. Four of 20 targeted PCBs and nine of the 16 targeted pesticides were detected in only one blank test with sufficient data to establish time-series flux trends, but not repeatability statistics. The remaining eleven PCB congeners and five pesticides were not detected sufficiently in any of the three blank tests to establish either repeatability statistics or time-series trends. Six of these remaining eleven PCB congeners and all five of these remaining pesticides were not detected in the unfiltered source seawater.

#### 5.1.2.2 Discussion of Organics Blank Tests

It was not unexpected to find very low levels of the heavier PAHs dissolved in the source seawater because of the known reduction in solubility of PAHs as the number of Benzene rings increase. This insolubility, combined with a low, but limited detection limit led to less complete and even non-detection of the heavier PAHs. However, the number of Benzene rings common within groupings of

PAHs allows a limited extension of the otherwise generally complete results. This applies for groupings of two and three-ring contaminants as well as the less complete and even missing results within the four, five and six-ring contaminant groupings. Within groups, time-series results for missing PAHs can be predicted to be consistent with those that were measured. This prediction can be made for both the complete lighter PAH results and the less complete heavier PAH results. Overall, the results establish that the various plastic and other materials of the BFSD2 which are in contact with the sampled seawater do not adversely adsorb or release the target PAHs within measurable limits, with the possible exceptions of Naphthalene and Flouranthene, as described in the Results section. Apparent adsorption of these two PAHs introduces a relatively small error to field measurements which are subsequently resolved by normalization during data processing. Furthermore, careful consideration was made when materials for the chamber, mixing mechanism and sample bottles were considered. Surfaces for minimal adsorption or release of the entire suite of contaminants analyzed were considered and practical decisions made. With polycarbonate chamber, Teflon flow lines and valves and glass sample bottles, the BFSDII has the most practical combination of materials for the minimal adsorption of release of these contaminants. Finally, although repeatability statistics requires more than a single data set, and three tests were conducted, those contaminants with only two data sets were analyzed albeit with lower confidence results. The repeatability of PAHs with a single data set can only be estimated, with no statistical confidence, and the four heavier PAHs with no data sets can only be predicted, as above. Thus, because of the common attributes of groups of PAHs and with the established results where data were available, it is estimated and predicted that field measurements of those PAHs with incomplete blank test results will be approximately similar to the other more complete PAHs measured. At sites where precise measurements are required for targeted PAHs which were not established with this series of blank tests an additional blank test using site-specific seawater or clean seawter or clean seawter spiked with the target PAH(s) may be necessary

Common features among PCB congeners allow much the same degree of extension of results discussed above for PAHs. Pesticides do not however support the same degree of extension because of the uncertainty of their composition and the limited results achieved. Pesticides were detected at much lower concentrations than the PAHs. For both PCBs and pesticides, blank test data sets that were sufficiently complete did establish acceptable repeatability considering such low levels (<1 ng/L). The remaining blank tests (with only one data set) established, as with PAHs, that the various plastic and other materials of the BFSD2 which are in contact with the sampled seawater do not adsorb or release the particular PCB congener or pesticide within measurable limits. The time-series flux trends for these contaminants show low and variable rates (slopes). It is noted that PCB congener 18 (2,2',5-Trichlorobiphenyl) showed a small release during the first blank test, but did not repeat in subsequent tests. In order to make the most from the available data, especially where only one of the three blank tests had sufficient detects (i.e., at least 6 measurements distributed evenly or grouped at one end), non-detects were removed and the remaining measurements used. This approach was used extensively for the PCB congeners and pesticides and much less for the heavier PAHs (only).

Ancillary data collected and recorded, including chamber temperature, pressure, salinity, pH and dissolved oxygen indicated chamber conditions remained stable throughout the tests. The pH sensor recorded a slight reduction in pH (<0.5) which occurred gradually over 70 hours in all three tests. The pressure sensor recorded changes in barometric conditions as well as the vacuum affect of each sample collection bottle being activated at 7-hour intervals during the tests.
Silica measurements used to confirm chamber integrity during BFSD2 metals applications will not be used for organics applications. The need to conserve sample volume to maximize detection levels

combined with experience in comparing onboard sensors with silica results in previous tests supports reliance on the sensors to identify any loss of chamber seal integrity. Dissolved oxygen an pH followed distinct trends when the silica test indicated a good seal. These two parameters show promise in interpreting seal integrity and will be used during organics applications.

#### 5.1.2.3 Organics Blank Tests Assessment

It was concluded that the BFSD2 organics blank performance was adequately established and the values obtained are sufficiently repeatable, precise and accurate to statistically distinguish differences from measured *in situ* sediment flux rates for a number of targeted PAHs. Measurement of *in situ* flux rates for selected PCB congeners and pesticides are also statistically distinguishable where blank test results are available.

### 5.1.3 San Diego Bay, Paleta Creek Metals Demonstrations

Two 70-hour metals demonstrations of BFSD 2 were conducted at the heavily industrialized Paleta Creek entrance to San Diego Bay (see Figure 33). The quiescent, marina-like area is used for mooring support craft and receives periodic stormwater inflow from the Paleta Creek drainage basin. The site was selected due to known levels of trace metals in the sediments, as established in two previous prototype BFSD tests, and because of its convenient location for an initial field test and first demonstration of BFSD2. Two demonstrations were conducted two weeks apart (June 6-8, 1998 and June 18-22, 1998) with the first demonstration being a full dress rehearsal for the second, formal demonstration. The locations for the tests were within 10 feet of one another and within the same proximity to two previous prototype BFSD deployments. The tests were conducted at about 18 +/- 3 feet depth, depending on tidal flow, and offshore about 30 feet from a quay wall. Deployment and retrieval was from the SSC SD research vessel R/V ECOS.

**Figure 33. BFSD2 Paleta Creek Metals Deployment.**

Prior to both tests, the BFSD 2 was cleaned and prepared using the same procedures used during the triplicate blank tests. Aboard R/V ECOS after loading and connecting various equipment (laptop computer, TV monitor and light, cabling) a standard pre-deployment checklist was followed. Once moored at the site with the GPS location logged, the BFSD 2 was lowered to within 2 feet of the bottom and a 15-minute test was started to stabilize the flow-through sensors and to measure the ambient dissolved oxygen level. This test was run twice during the first demonstration to assure repeatability. The ambient dissolved oxygen level is used to establish system control limits for maintaining a narrow range of dissolved oxygen in the collection chamber during the 70-hour test and for assessment of sediment oxygen uptake rates. As requested by CA EPA certification

evaluators, a second, independent dissolved oxygen measurement was made outside the collection chamber during the second demonstration by attaching an additional instrument to the BFSD 2 frame next to the collection chamber.

After entering the control limits into the 70-hour test program software and downloading it, the BFSD2 was raised for manual activation of the number one sample bottle valve. A new, higher mounting location for the valve was implemented following the blank tests to improve collection of representative ambient bottom water. With the BFSD2 partially submerged and the collection chamber approximately 3 feet below the surface, the valve was opened manually and the BFSD2 was immediately lowered back to approximately 2 feet from the bottom. After a short delay to arrange deck release lines, the BFSD2 was then allowed to free-fall to the bottom and insert its collection chamber into the sediment.

The landing and insertion were monitored using a video camera. Activation of the three insertion indicator lights was verified. The video camera, aided by a floodlight, also allowed a limited assessment of the site prior to initiating the 70-hour test. And, after starting the test, it also allowed confirmation of lid closure prior to complete detachment of lanyards and connections for autonomous operation. Both demonstration deployments were straightforward and without problems. The R/V ECOS returned to SSC SD and left the BFSD2 in its autonomous operation mode.

Retrieval of the BFSD2 after the tests was routine except for malfunction of the commercial acoustic recovery system. Recovery was with a separate line stowed at the site. Acoustic receiver burn-wire modification, latch modification, and most importantly, sandpaper cleaning of the ground electrode were subsequently implemented. Once BFSD2 was washed down and on deck, the twelve 250ml sample bottles were removed for processing using EPA handling and chain of custody procedures. During the first demonstration the samples were returned to SSC SD for splits (silica and metals). For the second demonstration splits were made aboard R/V ECOS using pre-acidified 125ml containers for metals samples and pre-cleaned 25ml beakers for silica measurements. Silica measurements were made aboard R/V ECOS using a field portable Hach model DR2010 Instrument. The metals samples were packaged and shipped to Battelle Marine Sciences Laboratory for analysis of the six metals selected for CA EPA certification evaluation. All data and results for the two demonstrations are compiled in Microsoft Excel spreadsheets “BFSD2 PCPD.xls” and “BFSD2 PCD.xls”, provided with the electronic submission of this report. Appendix C provides copies of the spreadsheet results and includes data and graphs for the BFSD2 flow-through sensors.

Tables 6 and 7 summarize the results of the two Paleta Creek metals demonstrations.

**Table 6. BFSD 2 Metals Results from the Paleta Creek Pre-Demonstration (**PCPD**).**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -1.75 | 19.71 | 38.1% | 2.82 | 8.73 | 165 | 1.54 |
| Cadmium (Cd) | 9.64 | 4.14 | 100.0% | -0.52 | 0.75 | 1.16 | 0.148 |
| Lead (Pb) | 11.06 | 7.94 | 100.0% | 3.16 | 1.59 | 98.9 | 0.1561 |
| Nickel (Ni) | 25.24 | 4.62 | 100.0% | 10.28 | 7.34 | 19.1 | 0.9262 |
| Manganese (Mn) | 71.33 | 701.54 | 80.7% | -264.85 | 7.49 | 405 | 28.12 |
| Manganese (Mn)[1] | 5763.99 | 23621.74 | 100.0% | -264.85 | 7.49 | 405 | 28.12 |
| Zinc (Zn) | 715.02 | 257.38 | 100.0% | -3.38 | 65.22 | 356 | 8.90 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1050.87 | 86.25 | na | na | na | na | 5.2 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 30.29 | 11.33 | 100% | -1.97 | 2.88 | na | 0.81 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

**Table 7. BFSD 2 Metals Results from the Paleta Creek Demonstration (**PCD**).**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -6.57 | 17.74 | 80.7% | 2.82 | 8.73 | 165 | 1.46 |
| Cadmium (Cd) | 7.02 | 3.87 | 100.0% | -0.52 | 0.75 | 1.16 | 0.06897 |
| Lead (Pb) | 4.32 | 12.39 | 65.6% | 3.16 | 1.59 | 98.9 | 0.07879 |
| Nickel (Ni) | 19.44 | 8.75 | 99.8% | 10.28 | 7.34 | 19.1 | 0.8378 |
| Manganese (Mn) | 103.94 | 957.14 | 73.3% | -264.85 | 7.49 | 405 | 24.02 |
| Manganese (Mn)[1] | 4194.24 | 101841.32 | 99.9% | -264.85 | 7.49 | 405 | 24.02 |
| Zinc (Zn) | 574.26 | 274.14 | 100% | -3.38 | -68.61 | 356 | 8.38 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1341.12 | 160.18 | na | na | na | na | 4.7 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 28.75 | 15.63 | 100% | -1.97 | 2.88 | na | 0.79 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

Numbers in the Flux Rate Confidence column indicate the statistical confidence that the measured flux rate is different than the blank flux rate. Results from the blank study, bulk sediment analysis, overlying water and oxygen uptake analysis are shown for comparison.

Figures 34 and 35 illustrate graphical comparison of the results.

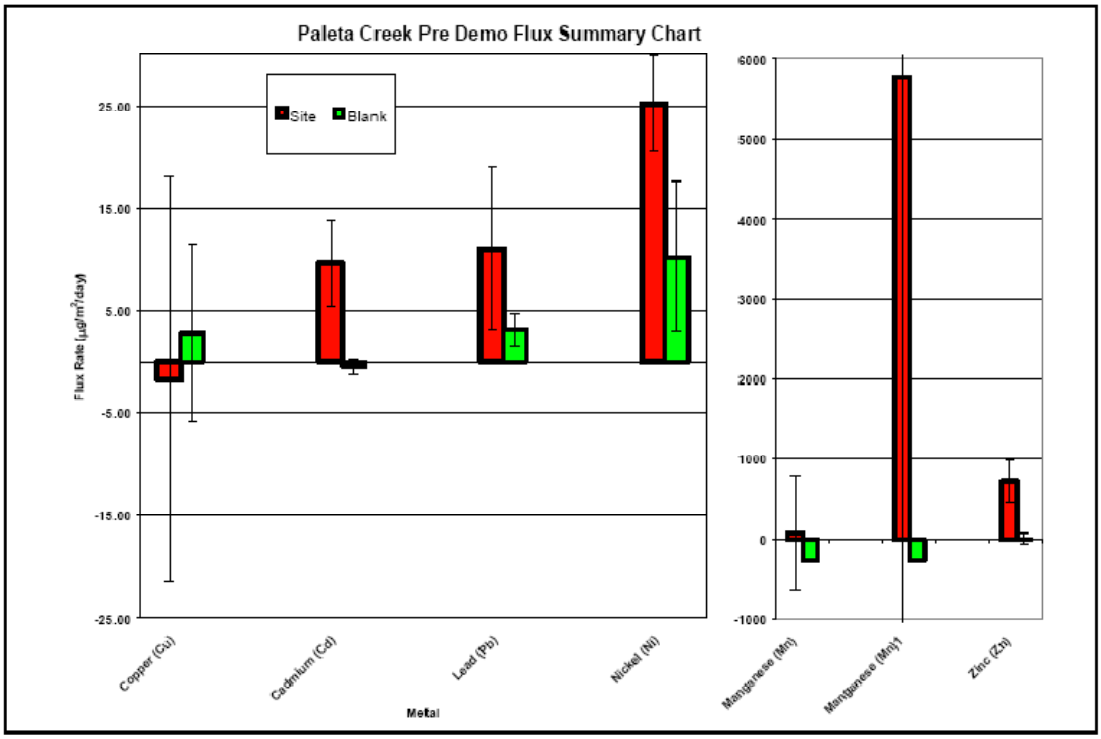



**Figure 34. Paleta Creek Metals Pre-Demonstration Results.**

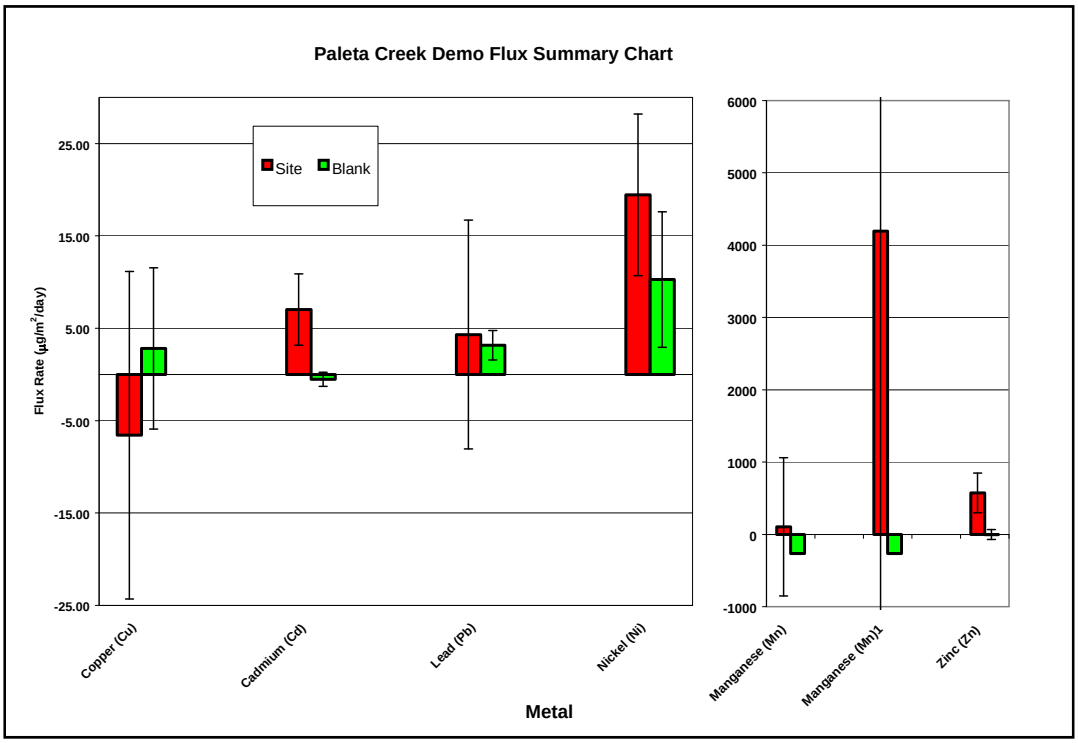



**Figure 35. Paleta Creek Metals Demonstration Results.**

#### 5.1.3.1 Discussion of Paleta Creek Demonstrations Results

In general, BFSD2 results from the two Paleta Creek demonstrations were similar and consistent with previous prototype deployments at this location. Figures 36 and 37 are the sets of graphs of concentration versus time for each analyte (red squares) in each of the demonstrations, compared with blank performance (blue triangles). The concentrations of analyte plotted on these graphs here and throughout this report are not the measured concentrations of each sample but concentrations that have been corrected for dilution effects from sampling water from the chamber and intercept corrected for the linear slope analysis. Therefore the concentrations shown could change depending on how many samples are included in the slope analysis. This is illustrated well in the manganese graphs where two slope analyses were performed with different numbers of samples. It appears concentrations for each sample are different. These graphs were generated in the process of calculation the slope or flux of each analyte, and it is the flux rate and not individual sample concentrations which are interpreted in these graphs.

The results for the Pre-Demonstration indicate that Cadmium, Lead, Nickel and Zinc had fluxes out of the sediment that were highly significant when compared to the blank chamber results. The flux of copper indicated a negative flux (sediment uptake) although the statistical confidence was only 65%.

Manganese fluxes showed a consistent trend or pattern here at Paleta as well as at subsequent deployments in Pearl Harbor. Flux curves would define a higher rate of flux in the first part of the test while becoming lower or negative in the later part. The reason for this drop is not known, but could be attributed to oxidation and subsequent precipitation or flocculation when the chamber water reached a high concentration which results in a “quenching”-like trend. Certainly some process was changing the flux rate of manganese as the test proceeded. So, in order to estimate actual flux rates of manganese from sediments as if the chamber were not present, the first three values obtained from the test was used for calculating a flux rate. This is similar to how dissolved oxygen demand is calculated before the system becomes anoxic and/or the oxygen feed system kicks in. This approach results in a more conservative estimate of flux rates for this metal, i.e. higher outward fluxes. We will use and discuss the flux values obtained from this later method of using the first three samples drawn from the chamber for manganese. However, flux curves and values from estimated from the entire test duration are also presented here for consideration. Therefore, manganese also had a positive outward flux as did cadmium, lead, nickel and zinc but the statistical confidence was somewhat lower.

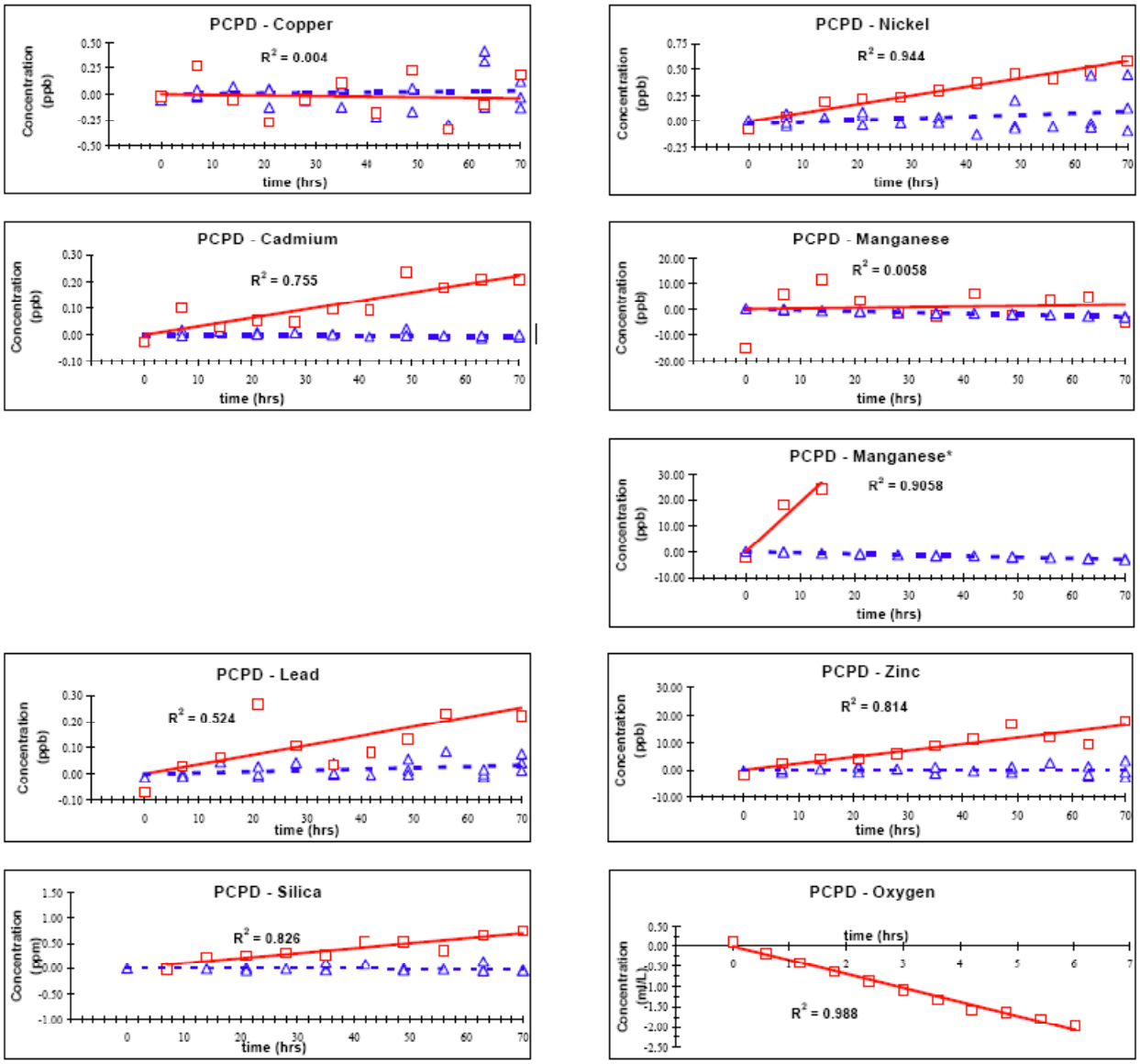



**Figure 36. Paleta Creek Metals Pre-Demonstration Concentration vs. Time.**

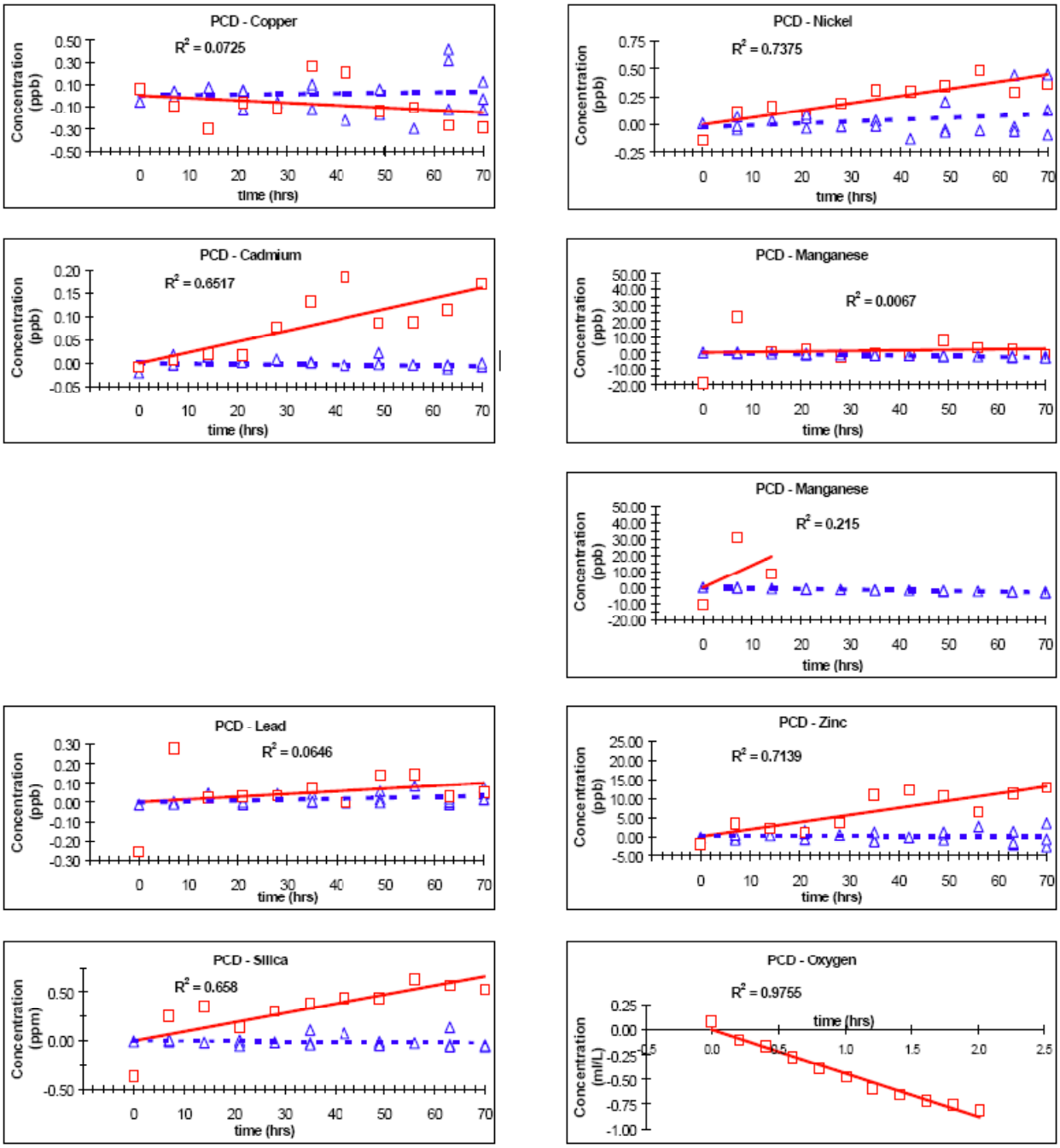



**Figure 37. Paleta Creek Metals Demonstration Concentration vs. Time.**

Results for the formal Demonstration were similar to those of the Pre-Demonstration with the exception of Lead. Cadmium, Nickel and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank results. The magnitude of the Cadmium, Nickel and Zinc fluxes for the Demo were similar, though slightly lower, than those observed for the Pre-Demonstration. Manganese again had a positive outward flux but a lower statistical confidence. As with the Pre-Demonstration, the flux of copper was negative (sediment uptake) although the statistical confidence was <0.1%.

#### 5.1.3.1.1 Flux Measurements

As shown in Tables 6 and 7, and illustrated in Figures 34 through 37, cadmium, lead, nickel, manganese and zinc all had positive flux rates which were statistically different from blank test results. Also, the relative magnitudes of the flux rates were consistent for both demonstrations and with earlier prototype work at the site. In other words, zinc had a larger flux rate than manganese; manganese was larger than nickel; nickel was larger than lead; lead and cadmium were very close to the same magnitude. The magnitude of the flux rates for the formal Demonstration were generally similar, though somewhat less (except manganese), than those of the Pre-Demonstration test two weeks earlier, however, the differences are not statistically significant. A correlation with sediment oxygen uptake is evident and may be an explanation for the slight downward shift of fluxes. The flux rate for manganese is likely more positive than measured when corrected by the large, very repeatable negative flux measured in the blank tests. Copper results indicate a slightly negative flux (sediment uptake) which has been observed in previous work. This may be attributed to pore water chemistry involving sulfide binding, complexation with organic matter, or elevated water column concentrations associated with hull leachate sources as discussed extensively in earlier reports. The oxygen uptake measured during both deployments is consistent and indicates continuous consumption of dissolved oxygen, which can be attributed to oxidation of organic matter and biological uptake at the sediment water interface.

### 5.1.3.2 Discussion of Paleta Creek Demonstrations Tests

Important aspects of the demonstrations including performance indicators and deployment problems are discussed below.

#### 5.1.3.2.1 Performance Indicators

Several methods were used to evaluate system performance of the BFSD2 during and after the demonstrations. To assure a proper seal of the chamber, the deployment was monitored with an underwater video camera, insertion light indicators connected to pressure sensors on the sealing flange were monitored, and silica, pH, and oxygen levels within the chamber were monitored for expected trends. Landing and insertion monitored with the video camera and landing lights indicated a good seal. After starting the test, the video camera also confirmed lid closure of the chamber.

A linear increase in silica during the deployments was used as another indicator of proper system performance and chamber seal. The results, shown on Figures 36 and 37, show that silica concentration increased linearly, and that the silica flux rates were consistent and repeatable for the two deployments, indicating proper system performance and chamber seal. Oxygen variations in the chamber were monitored to assure maintenance of ambient oxygen levels, proper chamber seal, and to evaluate sediment oxygen uptake. The rate of oxygen consumption (sediment uptake) during the deployments, also shown in

Figures 36 and 37, was sufficient to cause repeated cycling of the BFSD2 oxygen recharge subsystem. Figure 38 are graphs of the oxygen sensor data for the two deployments showing the operation of the control system. The control limits selected allowed the dissolved oxygen to remain within approximately 1 ml/L of the ambient level and still yield data to assess the sediment uptake rate. The multiple cycles for both recharge and uptake were consistent and repeatable.

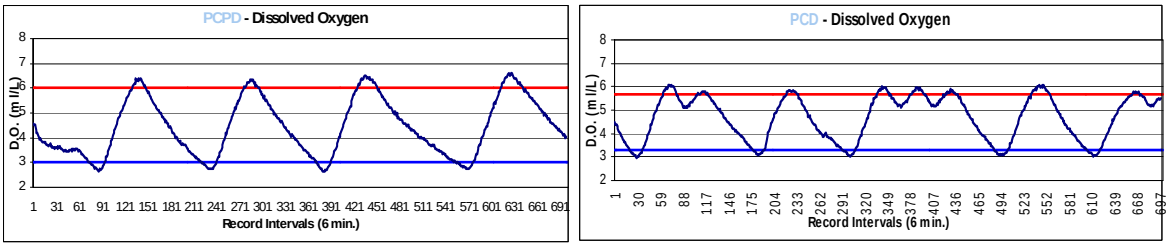



**Figure 38. Paleta Creek Metals Demonstrations Oxygen Control Results.**

As requested by CA EPA certification evaluators, an independent dissolved oxygen measurement of ambient bottom water at the BFSD2 test site was made during the formal Demonstration deployment. The measurement instrument was battery power-limited and operated for only the first 39 hours of the deployment. During that period, cyclic changes of approximately 0.5 ml/L occurred about the ambient level of approximately 5 ml/L. Thus oxygen results reconfirm that a proper chamber seal was achieved, and that oxygen levels within the chamber were maintained close to the ambient level and with similar, though slightly larger, variability to that observed outside the chamber.

In the properly sealed BFSD 2 chamber, the pH will generally show a decreasing trend as the breakdown of organic matter at the sediment water interface drives $CO_2$ into the chamber water. This decreasing trend was observed during both deployments as shown in Figure 39. Some small fluctuations from the expected steady decline in chamber pH were seen. While the exact cause of these fluctuations is not known, a number of factors including photosynthetic activity and sediment and pore water oxidation chemistry can account for the minor reversals. In the absence of other evidence of a breech in chamber seal, these small fluctuations were attributed to natural variations.

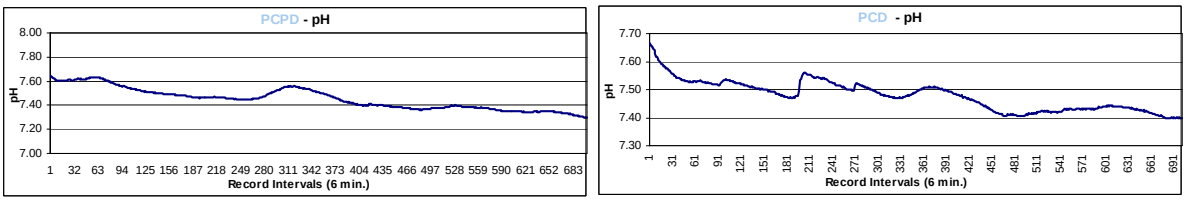



**Figure 39. Paleta Creek Metals Demonstrations pH Results.**

#### 5.1.3.2.2 Deployment and Recovery Problems

Two minor problems were encountered during the demonstrations. The first was failure of the commercial acoustic recovery system to function. During the Pre Demonstration the failure was attributed to one too many burn-wire strands which led to excessive time for functioning. One strand was removed for the next test, however the release latch mechanism was corroded and failed to release the buoy after the burn-wire had properly functioned. The latch was subsequently modified and is an inspection point as part of the pre-deployment checklist procedure. Most importantly it was determined that abrasive cleaning of the ground (plating) electrode with sandpaper must be performed after every use.

The second problem was the concentration of metals in the water collected from the open chamber, as it descended to the bottom was not consistent with concentrations in the chamber shortly after it reached the bottom. The values from laboratory analysis of the water in sample bottle one (which filled during descent, after manual operation of its valve near the surface) and from water in sample bottle number two (filled from the chamber 6 minutes after lid closure) were inconsistent. As with the blank tests, the concentration values from the second sample bottle were considered more representative of makeup water entering the chamber and were used in dilution correction calculations. And, as with the blank tests, a sensitivity analysis indicated an insignificant affect on flux results. A more acceptable method for collecting representative bottom water was subsequently implemented and test deployed prior to the Pearl Harbor demonstrations.

### 5.1.3.3 Discussion of Data Interpretation

In order to understand the significance of the measured flux rates in Paleta Creek from a water quality standpoint, it is necessary to estimate the potential loading and subsequent increase in metals concentrations within the overlying water. A simplified analysis is presented here in order to illustrate the utility of the BFSD2 data for this purpose.

The Paleta Creek study area where the demonstrations were performed is bordered by land on three sides, and open to San Diego Bay only to the southwest. The bounded area has a surface area of about 62400 $m^2$. The average depth of the area is about 7 m, and thus the overall volume is about 436800 $m^3$. The tidal range in San Diego Bay averages about 1.4 m. A simple estimate of the residence time can be obtained based on complete tidal flushing as

$$\tau_{res} = \frac{V_{pc}}{V_{tp}} = \frac{D_{pc}}{H_t N_t} = \frac{7}{1.4 \times 2} = 2.5\ days$$

Where $\tau_{res}$ is the residence time, $V_{pc}$ is the volume of the Paleta Creek study area, $V_{tp}$ is the tidal prism volume for the area, $D_{pc}$ is the depth of the study area, $H_t$ is the tidal range, and $N_t$ is the number of tides per day.

In steady state conditions, the residence time can be related to the overlying water concentration by the relation

$$\tau_{res} = \frac{m_{ow}}{\dot{m}_{sed}}$$

Where $m_{ow}$ is the mass of a given metal in the Paleta Creek study area overlying water, and $m_{sed}$ is the loading from the sediment.

The overlying water concentration can thus be estimated from the flux rates as

$$c_{ow} = \frac{m_{ow}}{V_{pc}} = \frac{\tau_{res}\dot{m}_{sed}}{V_{pc}} = \frac{\tau_{res}F_{sed}A_{pc}}{V_{pc}} = \frac{\tau_{res}F_{sed}}{D_{pc}}$$

Where $F_{sed}$ is the sediment flux rate measured by the BFSD, and $A_{pc}$ is the surface area of the sediment in the Paleta Creek study area. Using this relation, the estimated overlying water concentrations for each of the metals from each of the surveys can be estimated as shown in Table 8 below.

**Table 8. Estimated Sediment Flux Contribution to Overlying Water Concentrations for the Paleta Creek Study Area**.

| Metal | PCPD Flux | PCD Flux | $\tau_{res}$ | $D_{pc}$ | $C_{ow}$ PCPD | $C_{ow}$ PCD | $C_{ow}$ meas. | PCPD % of meas. | PCD % of meas. |
|---|---|---|---|---|---|---|---|---|---|
| | µg/m²/day | µg/m²/day | days | m | ug/l | ug/l | ug/l | | |
| Copper (Cu) | -2 | -7 | 2.5 | 7 | - | - | 2.41 | - | - |
| Cadmium (Cd) | 10 | 7 | 2.5 | 7 | 0.0036 | 0.0025 | 0.0786 | 4.54% | 3.2% |
| Lead (Pb) | 11 | 4 | 2.5 | 7 | 0.0039 | 0.0014 | 0.182 | 2.16% | 0.8% |
| Nickel (Ni) | 25 | 19 | 2.5 | 7 | 0.0089 | 0.0068 | 1.02 | 0.88% | 0.7% |
| Manganese (Mn) | 73 | 105 | 2.5 | 7 | 0.0261 | 0.0375 | 21.0 | 0.12% | 0.2% |
| Zinc (Zn) | 716 | 575 | 2.5 | 7 | 0.2557 | 0.2054 | 8.91 | 2.87% | 2.3% |
| Silica ($SiO_2$) | 30* | 30 | 2.5 | 7 | 0.011 ** | 0.011 ** | 0.79 ** | 1.35% | 1.4% |

*mg/m²/day **mg/l

Note: $C_{ow}$ measured is the overlying water concentration that was measured during the PCD study. The percent of measured column indicates the fraction of the overlying water concentration that can be explained by the sediment flux.

Comparing the estimated overlying water concentration to the measured concentration indicates that the contribution due to sediment fluxes ranges from a high of 4.5% for cadmium, to a low of about 0.2% for manganese. In practice, these estimates could be used to evaluate the potential benefit of a sediment removal or capping action compared to a no-action scenario. The simple model employed here neglects many factors such a s tidal flushing efficiency of the study area and scavenging of metals near the sediment-water interface that could influence the estimated concentrations. If the tidal flushing is not complete (which is realistic), then the residence time and estimated contribution from the sediments would increase. A typical flushing efficiency is about 50%, which wou ld increase the estimated Cow by a factor of 2. Colloid and particle scavenging near the sediment water interface would tend to reduce the s ediment flux contribution, although the magnitude of this process is not well known.

### 5.1.4 San Diego Bay, Paleta Creek Organics Demonstration

One 70-hour organics test using Benthic Flux Sampling Device 2 (BFSD2) was conducted March 2-5, 2001 at the heavily industrialized Paleta Creek entrance to San Diego Bay, within the borders Naval Station San Diego. Figure 40 is a picture o f the area which is used for mooring Navy industrial waste and sewage collection barges, emergency oil spill response vessels, and other transient industrial support vessels. The site was selected as one heavily studied over the years and likely to produce detectable and mobile organic contaminants. Also, the site was used for the BFSD2 *metals* flux demonstrations during June, 1998 and has subsequently been designated by the California Regional Water Quality Control Board as San Diego Bay's most "toxic hotspot". A sediment survey of the area conducted by SSC SD during December, 2000 using gravity core samples produced high levels of the US EPA's 16 priority Polynuclear Aromatic Hydrocarbons (PAH) expressed as Total Petroleum Hydrocarbons (TPH). The site was also a convenient location for this first organics field test. The tests were conducted at about 18 +/- 3 feet depth, depending on tidal flow, and offshore from a quay wall about 30 feet. Deployment and retrieval was from the SSC SD research vessel (R/V) Ecos.

**Figure 40. Paleta Creek, San Diego Bay.**

Prior to the test, the BFSD2 was cleaned and prepared using the same procedures used for the triplicate organics blank tests. Aboard R/V Ecos, after loading and connecting various equipment (laptop computer, TV monitor and light, cabling) a standard pre-deployment checklist was followed. Once moored at the site with the GPS location logged, the BFSD2 (shown in Figure 41) was lowered to near the bottom and the landing

**Figure 41. BFSD2 Paleta Creek Organics Deployment.**

site was surveyed by remote video for any obstructions or other features which could prevent successful insertion of the collection chamber into the sediment. The BFSD2 was then lowered to the bottom at the maximum rate allowed by the deck hoist (about 1ft/sec) and the landing and insertion were monitored using the video camera. Activation of three battery-powered lights by switches mounted on the chamber at the 3-inch level was verified and used to establish adequate sediment insertion. The landing produced a minimal amount of resuspension. The 15-minute "Sensor Check" program was then started to close the chamber lid, to stabilize the flow-through sensors and to measure the ambient dissolved oxygen level. Closing the chamber lid sealed the chamber and activated collection of an ambient water sample. Measurement of the ambient dissolved oxygen level was used to establish system control limits for maintaining a narrow range of dissolved oxygen in the collection chamber during the 70-hour test. Dissolved oxygen measurements data taken during the test are also used for assessment of sediment oxygen uptake rates.

After establishing and entering the dissolved oxygen control limits into the 70-hour test program and downloading it to the BFSD2, the flux test was started. The initial autonomous functions were monitored from R/V Ecos to assure proper operation of the BFSD2 prior to disconnecting the cables and dropping them overboard. Proper data recording and rotary sample valve commands were confirmed. R/V Ecos departed the site and left BFSD2 in place to perform the 70-hour autonomous sampling operation.

Retrieval of BFSD2 after completion of the test, shown in Figure 42, was routine except for malfunction of the commercial acoustic recovery system (the latch required subsequent modification). Recovery was aided by the clarity of the water and allowed a boat hook to be used to jar the recovery buoy loose from the BFSD2. Once BFSD2 was washed down and on deck, the twelve 250 ml sample bottles were removed for processing using EPA handling and chain of custody procedures. All bottles were full and inline filter elements were slightly discolored, indicating low turbidity within the chamber. Before moving location, a sediment sample was collected from the BFSD2 landing site. Onboard R/V Ecos, the sample bottle filter assemblies were removed and replaced with precleaned caps, preprinted labels were attached to the samples and packaging for overnight shipment was completed.

**Figure 42. BFSD 2 Paleta Creek Organics Demonstration Recovery.**

As the samples were being processed onboard R/V Ecos, the recorded data files from the 70-hour test were uploaded and entered into a standardized Excel spreadsheet template for data processing. The sensor data, plotted as time-series indicated a successful deployment. As can be seen in Figure 43, there was no sudden pH level shifts indicating loss of chamber seal and the oxygen control system maintained the dissolved oxygen level within the set limits. The slowly reducing trend for pH level was normal and is indicative of biological activity. The slight increases observed in pH near 28 hours and again near 50 hours correspond to midday periods and are most likely associated with benthic algal production and a corresponding consumption of $C0_2$ and increase in pH. Salinity, temperature and pressure were also normal.

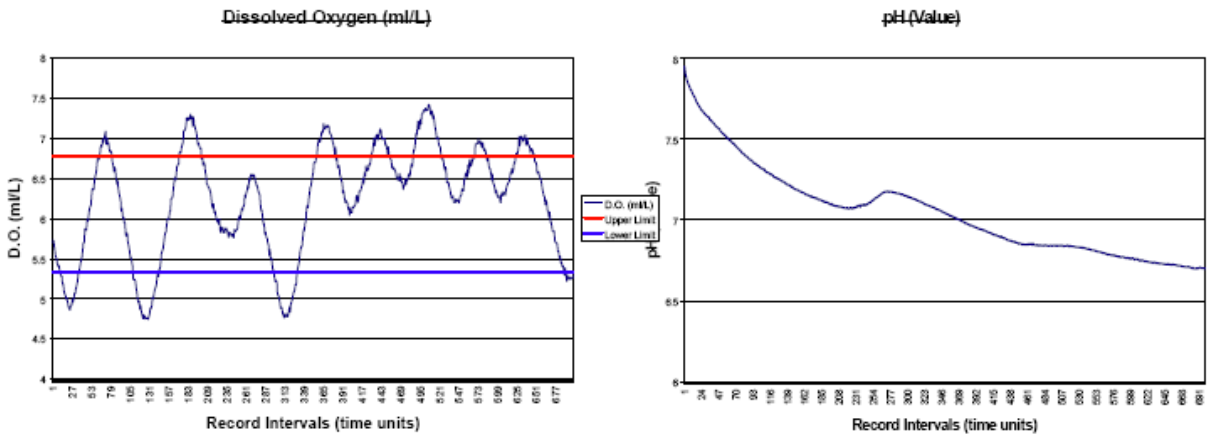



**Figure 43. BFSD 2 Paleta Creek Organics Demonstration Recovery.**

The samples were packaged and overnight air-shipped that afternoon to ADL for extraction and analysis in accordance with the processes, procedures and controls established under the Method Detection Limit study and used for the triplicate blank tests. All data and results for the demonstration are compiled in Microsoft Excel spreadsheets "PC Organics Demo - PAHs (Part1&2).xls", "PC Organics DemoPCBs.xls" and "PC Organics Demo-Pesticides.xls" provided with the electronic submission of this report. Appendix C provides copies of the spreadsheet results and includes data and graphs for the BFSD2 flow-through sensors.

Tables 9, 10 and 11 provide a summary of the flux results for selected PAHs, PCB congeners and pesticides for the Paleta Creek organics demonstration.

**Table 9. BFSD2 PAH Results Summary for Paleta Creek Demonstration.**

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 459.20 | 429.58 | 94.5% | -440.30 | 458.38 | 13 | 6.7 |
| 2. Acenaphthene | 337.58 | 178.97 | 100.0% | -32.40 | 50.34 | 19 | 9.7 |
| 3. Acenaphthylene | 105.51 | 183.82 | 33.8% | 208.47 | 112.60 | 220 | 7.6 |
| 4. Fluorene | 173.17 | 149.76 | 100.0% | -76.74 | 28.38 | 34 | 2.3 |
| 5. Phenanthrene | 489.25 | 659.77 | 100.0% | 10.95 | 10.95 | 240 | 8.2 |
| 6. Anthracene | 569.42 | 260.29 | 100.0% | 117.68 | 64.62 | 470 | 5.3 |
| 7. Fluoranthene | 365.55 | 397.63 | 100.0% | -1423.95 | 178.41 | 890 | 37 |
| 8. Pyrene | 951.97 | 755.67 | 100.0% | -439.51 | 70.73 | 740 | 13 |
| 14. Indeno(1,2,3-c,d)pyrene | -65.35 | 906.77 | NA | NA | NA | 470 | 1.4 |
| 16. Benzo(g,h,i)perylene | -46.63 | 263.97 | 67.7% | 20.15 | 65.15 | 400 | 1.4 |

**Table 10. BFSD2 PCB Results Summary for Paleta Creek Demonstration.**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 18 - 2,2',5-Trichlorobiphenyl | 52.21 | 103.93 | 4% | 76.82 | 36.49 | 2.6 | ND |
| 28 - 2,4,4'-Trichlorobiphenyl | 41.52 | 80.03 | 61% | -8.05 | 82.03 | 2.2 | 1.1 |
| 52 - 2,2',5,5'-Tetrachlorobiphenyl | 9.44 | 105.28 | 77% | 72.74 | 28.12 | 4.9 | 3 |
| 66 - 2,3',4,4'-Tetrachlorobiphenyl | -19.94 | 62.01 | 96% | 37.74 | 25.45 | 5.3 | ND |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | 45.99 | 84.57 | 17% | 57.59 | 31.49 | 13 | ND |
| 118 - 2,3',4,4',5-Pentachlorobiphenyl | -2.34 | 123.95 | 9% | 2.51 | 15.40 | 13 | ND |
| 153 - 2,2',4,4',5,5'-Hexachlorobiphenyl | 22.26 | 78.55 | 43% | 9.45 | 11.71 | 23 | 0.11 |

**Table 11. BFSD2 Pesticide Results Summary for Paleta Creek Demonstration.**

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 2,4'-DDT | 57.49 | 95.75 | NA | NA | 3.6 | 0.88 |
| 4,4'-DDT | 31.23 | 55.47 | NA | NA | 14 | ND |
| Dieldrin | -23.48 | 45.68 | NA | NA | 2 | ND |
| Hexachlorobenzene | 23.76 | 35.20 | NA | NA | 0.61 | ND |
| Mirex | 36.23 | 154.93 | NA | NA | ND | ND |

Numbers in the Flux Rate Confidence column indicate the statistical confidence that the measured flux rate is different than the blank flux rate. Results from the blank study, bulk sediment analysis and overlying water are shown for comparison.

Figures 44, 45 and 46 provide graphical comparison of the flux results with the blank tests results.

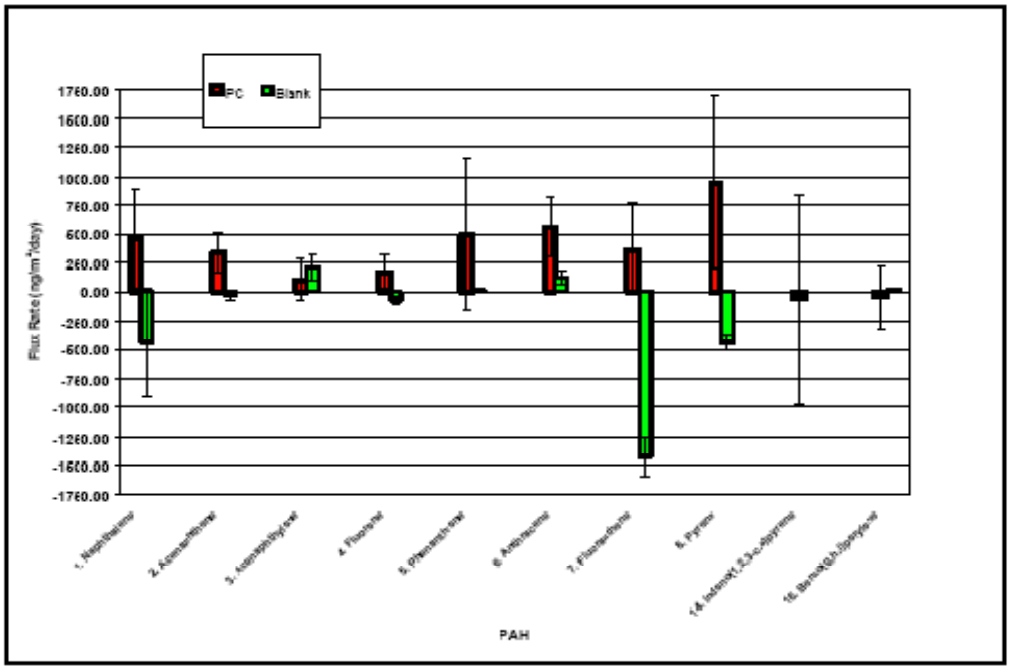



**Figure 44. Paleta Creek PAH Demonstration Results.**

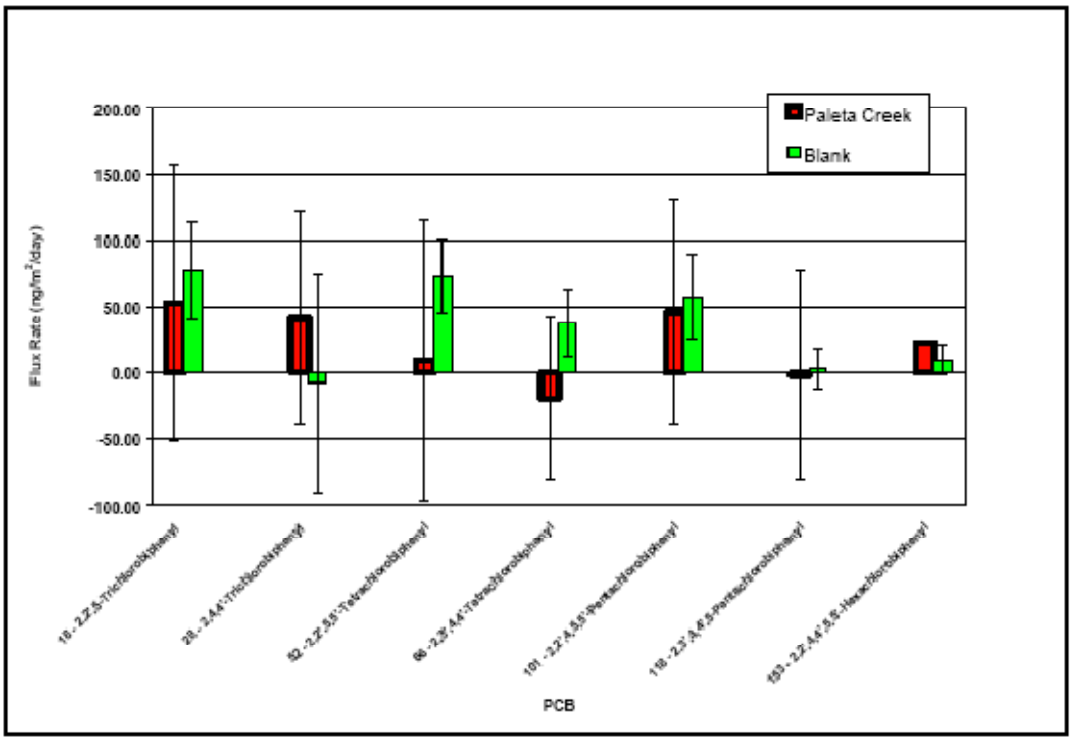



**Figure 45. Paleta Creek PCB Demonstration Results.**

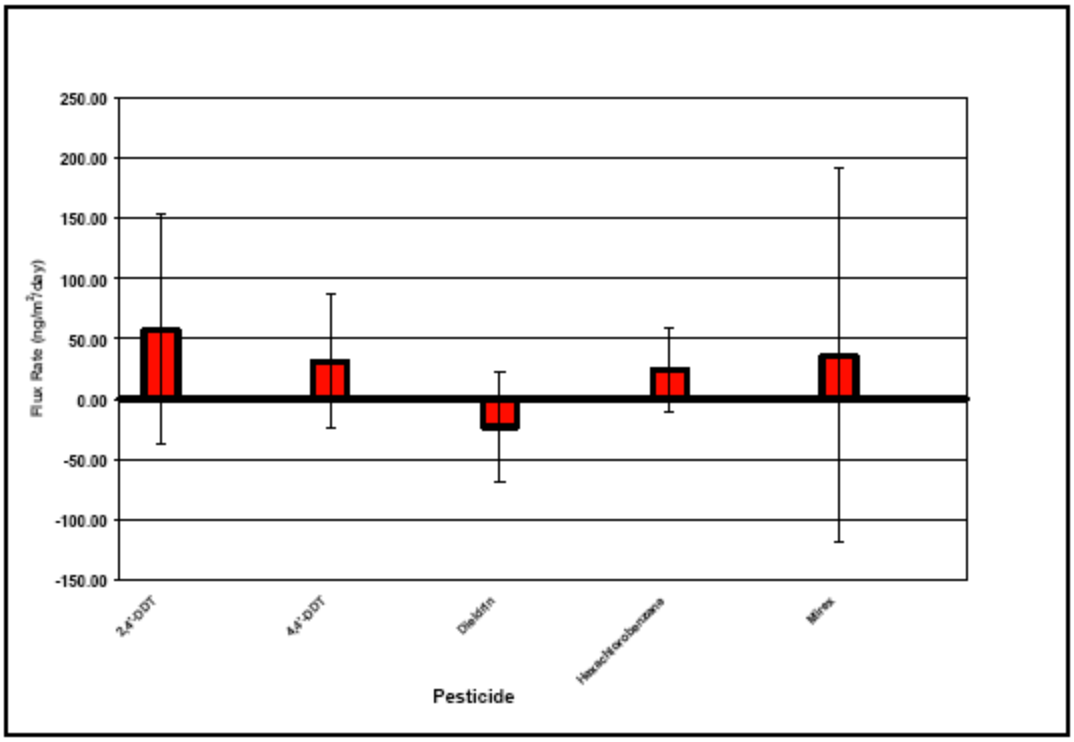



**Figure 46. Paleta Creek Pesticide Demonstration Results.**

### 5.1.4.1 Paleta Creek Organics Demonstrations Results

#### 5.1.4.1.1 Polynuclear Aromatic Hydrocarbons (PAHs) Results

Complete individual data sets were obtained for six of the first eight PAHs (Naphthalene, Acenaphthene, Acenaphthylene, Phenanthrene, Fluoranthene and Pyrene). For the two incomplete data sets, non-detects were reported in two samples for Fluorene (samples 4 and 6) and in one sample for Anthracene (sample 2). The non-detects were removed from the data series for flux computations. All trends in concentration change were positive over time (i.e. sediment *release*) and the largest change among the first eight PAHs during the 70-hour test, after correction for dilution, was 18.9 ng/L (parts per trillion) for Phenanthrene. Most of the other PAHs changed less than 10 ng/L. The resulting concentration trends, when compared to the statistically derived triplicate blank test trends showed significant flux for seven of the eight lightest molecular weight PAHs. The confidence that the flux was statistically different than the associated blank was 100% for six of the first eight PAHs and 94.5% for Naphthalene. Acenaphthylene was the only PAH in the first eight with a flux less than the associated blank tests and it had a resultant flux rate confidence of 33.8%. Appendix D ("PC Organics Demo-PAHs (Part 1).xls") includes time-series graphs showing flux and blank tests concentrations over time for the eight lightest molecular weight PAHs. These graphs show reasonable linearity of the time-series flux test data and allow intuitive comparison of the flux and blank test results.

Of the remaining eight targeted PAHs with the heaviest molecular weights all but two were non-detectable throughout the full set of 12 samples. For the two with detects, Indeno(1,2,3-c,d)pyrene yielded four (samples 1,3,5,and 12) and Benzo(g,h,i)perylene yielded five (samples 1,3,5,8,and12) detectable concentrations. Additionally, only Benzo(g,h,i)perylene had adequate blank test results during the earlier triplicate test series for comparison. The Benzo(g,h,i)perylene flux, adjusted for

dilution, was negative (i.e. sediment *uptake*) and in comparison to its blank results there was a 67.7% confidence that the flux is different than the blank results. Indeno(1,2,3-c,d)pyrene also indicated a negative flux and there is no blank results for comparison. The time-series graphs included in Appendix D ("PC Organics Demo-PAHs (Part 2).xls") show the slight negative slopes, or concentration changes over time, for these two heavier molecular weight PAHs.

#### 5.1.4.1.2 Polychlorinated Biphenyl (PCB) Congeners Results

Seven PCB congeners yielded sufficiently complete data sets for flux computations. PCB #28 (2,4,4'-Trichlorobiphenyl) yielded a complete set of 12 detectable concentration values. PCBs # 18 (2,2',5-Trichlorobipheny) yielded 9 samples with detectable concentration levels, #52 (2,2',5,5'-Tetrachlorobiphenyl) yielded 11 samples with detectable concentration levels, #66 (2,3',4,4'-Tetrachlorobiphenyl) yielded 10 samples with detectable concentration levels, #101 (2,2',4,5,5'-Pentachlorobiphenyl) yielded 8 samples with detectable concentration levels, #118 (2,3',4,4',5-Pentachlorobiphenyl) yielded 8 samples with detectable concentration levels, and #153 (2,2',4,4',5,5'-Hexachlorobiphenyl) yielded 11 samples with detectable concentration levels. In most cases, the partial data sets were composed of consecutive sample detects following initial non-detects in the series. As with PAHs, the non-detects were removed from the data series for flux computations. Five of the seven PCBs exhibited a positive trend in concentration over time (i.e. sediment *release*) and two exhibited a negative trend (i.e. sediment *uptake*). Three of the five PCBs indicating sediment release exhibited flux levels higher than the associated blank test levels and two were lower. The two PCBs indicating negative flux (sediment *uptake*) had positive blank test flux values. All changes in PCB concentration over the 70-hour test were less than 2 ng/L (parts per trillion) with the largest change (approximately 1.5 ng/L) exhibited by PCB #52. Statistical flux confidence is not high for six of the computed flux values when compared to associated blank test results. Statistical flux confidence for PCB#66 (2,3',4,4'-Tetrachlorobiphenyl) was 96%, however negative, or *uptake*, value introduces concern of validity and may be the result of the low concentrations measured. Appendix D ("PC Organics Demo-PCBs.xls") includes time-series graphs showing flux and blank tests concentrations over time for the seven PCBs with detectable concentrations. These graphs show marginal linearity of the time-series flux and blank test data resulting from the very low concentrations measured. Intuitive comparison of the flux and blank test results is illustrative of the low computed flux confidence levels reported in Table 10.

#### 5.1.4.1.3 Pesticide Results

Five pesticides yielded sufficiently complete data sets for flux computations. 2,4 DDT yielded 11 samples with detectable concentration levels, 4,4 DDT yielded 9 samples with detectable concentration levels, Dieldrin yielded 8 samples with detectable concentration levels, Hexachlorobenzene yielded 11 samples with detectable concentration levels and Mirex yielded 6 samples with detectable concentration levels. Again, as with PCBs, the partial data sets consisted of consecutive sample detects following initial non-detects in all series except for Mirex. Mirex had a one sample data gap in an otherwise consecutive series. And again, the non-detects were removed from the data series for flux computations. One additional measurement (sample 6) of the Hexachlorobenzene data set was removed because it exceeded all other data in the set by an order of magnitude and introduced a large trend offset. Four of the five pesticides exhibited a positive trend in concentration over time (i.e. sediment *release*) and one, Dieldrin, exhibited a negative trend (i.e. sediment *uptake*). There were insufficient blank test samples with detectable concentrations of these five pesticides to compute comparable blank flux performance. All changes in pesticide concentration over the 70hour test were less than 2 ng/L (parts per trillion) with the largest change (approximately 1.8 ng/L) exhibited by 2,4'-DDT. Appendix D ("PC Organics Demo-Pesticides.xls") includes time-series graphs showing flux and blank tests concentrations over time for the five

pesticides with detectable concentrations. These graphs show reasonable linearity of the time-series flux with consideration of the very low concentrations measured.

#### 5.1.4.2 Interpretation of Paleta Creek Organics Results

Whereas the flux results for the lighter molecular weight PAHs indicate greater mobility from the sediment into the overlying water than the heavier compounds, the measured concentration of the heavier molecular weight PAHs in samples extracted from the bulk sediment were generally higher than those of the lighter compounds. It appears that the heavier molecular weight PAHs are significantly less mobile, even with higher concentrations in the bulk sediment, than the lighter compounds. Comparison of this finding with solubility measurements of the targeted PAHs in seawater shows the same trend: the heavier molecular weight PAHs are far less soluble. A unilateral reduction in solubility of approximately five orders of magnitude occurs from lightest-to-heaviest for the 16 targeted PAHs. This relationship between PAH flux and PAH solubility does not appear to be exclusive of other factors however. For example, Pyrene (a four-ring compound with a molecular weight of 202) had a flux rate of 952ng/m$^2$/day which is more than twice that of Naphthalene (a two-ring compound with a molecular weight of 128) with a flux rate of 459ng/m$^2$/day. This result is likely driven by the bulk sediment concentration of Pyrene which was about of 57 times larger than Naphthalene (740ng/g vs 13ng/g). It appears that the flux of a PAH from the sediment into the overlying water remains dependant, in part, on the level of bulk concentration in the sediment. Thus even a low mobility, heavier molecular weight PAH with a high enough concentration in the sediment may flux into the overlying water at a higher rate than a lighter compound at lower concentrations. For the Paleta Creek test, it appears that the generally higher sediment concentrations of the heavier targeted PAHs were still too low to produce measurable concentrations. This then suggests that for PAHs in sediments, the PAH flux will vary in direct proportion to molecular weight and solubility leading to preferential removal of low molecular weight PAHs, and a relative increase in the bulk sediment fraction of the heavy molecular weight PAHs. Reduction of PAH concentrations at the sediment surface due to these diffusive fluxes will lessen, over time, the concentration levels of PAHs available for biological uptake. This reduction when combined with other natural attenuation factors such as infaunal irrigation and bacterially mediated degradation may be considered as a possible strategy for sediment remediation. Providing that risk levels are not exceeded, flux results for PAHs can be used to estimate the time required to reduce bulk sediment concentrations in the biologically active region of the sediment to acceptable levels.

The above discussion also generally applies to PCBs. The mobility of PCBs as indicated by the flux results was generally in direct proportion to solubility and in inverse proportion to molecular weight. The concentration values for the overlying water and bulk sediment were also generally consistent with trends identified with PAHs. The very low concentration levels of the PCBs in the Paleta Creek sediments introduced considerable uncertainty but a general trend is evident.

Pesticides may behave as above, however molecular weight relationships are difficult to establish with the wide range and complexity of such compounds. And, as with PCBs, the low concentration levels measured in this test introduce considerable uncertainty but still allow identification of a general trend.

#### 5.1.4.3 Conclusions for Paleta Creek Organics Demonstration Test

The measurement of the mobility of organic compounds from contaminated sediments at the Paleta Creek location within Naval Station San Diego was successfully achieved. The measurements, when compared to triplicate blank test results resulted in quantification of statistically significant values with high confidence primarily for Polynuclear Aromatic Hydrocarbons (PAHs) fluxing into

overlying water. The complete range of targeted PAHs, Polychlorinated Biphenyl (PCB) Congeners and pesticides were not measured either because they were not present or because they were below analytical detection limits. PCBs and pesticides, where present and measurable, had very low concentrations which introduced significant data scatter and low statistical confidence levels. Some flux measurements of PCBs and all pesticides did not have blank test results for comparison. Future site measurements of known or suspected contaminants for which blank test results are not available would benefit from blank tests using spiked concentrations of targeted contaminants.

### 5.1.5 Pearl Harbor, Hawaii Metals Demonstrations

70-hour metals demonstrations using BFSD2 were conducted at two different sites in Pearl Harbor, Oahu, Hawaii during February 1999. The BFSD2 deployments were conducted as part of a combined demonstration with integrated sediment investigation technologies and included site screening prior to both BFSD2 deployments.

The first test was conducted Feb. 5-8, 1999 within the Naval Inactive Ship Mooring Facility (NISMF) at Middle Loch where approximately 70 moored ships await disposition (disposal, sale, temporary storage, etc.). The area is quiescent and approximately 26 feet deep with murky water and fine-grained sediment overlain with an easily disturbed 1-2 foot flocculent layer. Reports of sediment depths over 100 feet were not confirmed but are believable. Some benthic organisms were found in the sediment during screening. All work at the site was accomplished from an open-deck, 35-foot Navy workboat operated by enlisted personnel, see Figure 47. A portable generator was used to power the video monitor, underwater light and laptop computer during deployment, however for recovery all electrical connections were made after reaching the shore facility.

**Figure 47. BFSD2 Pearl Harbor, Middle Loch Metals Demonstration.**

The second metals test was conducted Feb. 11-14, 1999 within the area known as Alpha Docks, Marine Diving and Salvage Unit One (MDSU-1) located at Bishop Point on the entrance channel to the harbor, Figure 48. Again, historical, RI and screening data indicated elevated levels of trace

metals present in the sediment. This area is an active industrial location and included several Navy housing barges, which are moved about by tugboats. The area has a depth of approximately 25 feet with generally clear water and medium- to fine-grained sediments. Tidal currents are enough to minimize any flocculent layer. Some benthic organisms were found during sediment screening. The Navy workboat was used as before for deployment but because of proximity to the quay wall recovery was accomplished from shore using an 80-foot crane.

**Figure 18. BFSD2 Pearl Harbor, Bishop Point Metals Demonstration.**

Prior to both tests, the BFSD2 was cleaned and prepared using the same procedures used during triplicate metals blank tests as well as other deployments and demonstrations. For the first deployment at NISMF, Middle Loch cleaning was accomplished at SSC SD prior to loading the BFSD2 into its re-usable shipping container, Figures 49 and 50. The shipping container, designed for compatibility with commercial air cargo carriers, includes compartments, shelving and storage bays sufficient for shipment of BFSD2 as well as all materials and supplies required for extended field operations. Shipping weight was approximately 1450 pounds. For safety reasons the compressed oxygen cylinder was vented to less than 250 psi and no hazardous materials (i.e. Nitric Acid for cleaning and sample preservation) were air-shipped. The container proved convenient for onsite access and minimized working space requirements. After arrival and unpacking, system checks and oxygen bottle refilling operations preceded. Nitric acid was secured from the local Navy environmental laboratory.

**Figure 49. BFSD2 Container, Front View.**

**Figure 50. BFSD2 Container, Back View.**

Aboard the Navy workboat, after loading and connecting various equipment (laptop computer, TV monitor and light, cabling) to the portable generator, a standard pre-deployment checklist was followed. At the site, after tying off, lowering the bow platform and logging the GPS location, the BFSD2 was lowered by hand wench to near the bottom and either slowly lowered into the sediment (to minimize disturbance and maintain video coverage: as at Middle Loch) or released from about 2 feet for free-fall (to assure insertion when video coverage can be maintained as at Bishop Point). Activation of the battery-powered insertion lights by switches mounted on the chamber at the 3- inch level was verified and used to establish adequate sediment insertion. Once on the bottom a 15-minute program was started to stabilize the flow-through sensors and to measure the ambient

dissolved oxygen level. After entering the dissolved oxygen control limits into the 70-hour test program, downloading and verifying it, the test was started after visibility conditions for lid closure were confirmed. After starting the program, lid closure (which also activates #1 sample bottle) was viewed and commands for circulation pump activation (at 10 minutes) and sample valve activation (at 16 minutes) for sample bottle number two was monitored before disconnecting for autonomous operations. The disconnected cables were plugged, coiled and cast overboard in a direction away from the BFSD2. Both demonstration deployments were straightforward and without problems. For both tests, the BFSD2 was returned to the shore facility for all data recovery. After freshwater washdown and cleanup the twelve 250 ml sample bottles were removed for processing using EPA handling and chain of custody procedures. Pre-acidified 125ml containers were filled and capped, labeled, logged and refrigerated for subsequent analytical laboratory metals analysis. The remaining sample volume was used to measure silica concentrations with the field portable Hach model DR2010 Instrument. The silica concentrations plotted against time and the BFSD2 pH and dissolved oxygen sensor data, also plotted against time were reviewed for any possible sample compromise prior to shipment to the analytical laboratory. Tables 12 and 13 summarize the results of the Pearl Harbor Middle Loch and Bishop Point metals demonstrations.

**Table 12. BFSD2 Results for Pearl Harbor Middle Loch (**PHML**) Metals Demonstration.**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 14.79 | 3.46 | 99.9% | 2.82 | 8.73 | 195 | 0.80 |
| Cadmium (Cd) | 1.80 | 0.31 | 100.0% | -0.52 | 0.75 | 0.2 | 0.02277 |
| Lead (Pb) | -0.12 | 0.43 | 95.2% | 3.16 | 1.59 | 34 | 0.03879 |
| Nickel (Ni) | 27.17 | 15.91 | 100.0% | 10.28 | 7.34 | 214 | 0.9472 |
| Manganese (Mn) | -468.18 | 683.35 | 97.9% | -264.85 | 7.49 | 1180 | 52.19 |
| Manganese (Mn)[1] | 2131.59 | 904.57 | 100.0% | -264.85 | 7.49 | 1180 | 52.19 |
| Zinc (Zn) | 49.74 | 17.25 | 93.5% | -3.38 | 65.22 | 314 | 2.28 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1085.52 | 64.84 | na | na | na | na | 4.17 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 65.03 | 42.43 | 100% | -1.97 | 2.88 | na | 1.19 |

1. Mn flux calculated on the basis of first five samples due to non-linearity

**Table 13. BFSD 2 Results for Pearl Harbor, Bishop Point (PHBP) Metals Demonstration.**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 112.46 | 17.60 | 100.0% | 2.82 | 8.73 | 241 | 0.36 |
| Cadmium (Cd) | 1.85 | 1.96 | 99.4% | -0.52 | 0.75 | 0.3 | 0.009 |
| Lead (Pb) | 0.71 | 1.11 | 78.7% | 3.16 | 1.59 | 93 | 0.06519 |
| Nickel (Ni) | 21.04 | 15.41 | 96.3% | 10.28 | 7.34 | 42.9 | 0.3934 |
| Manganese (Mn) | 223.33 | 284.79 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Manganese (Mn)[1] | 2177.45 | 192.60 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Zinc (Zn) | 191.18 | 54.07 | 100.0% | -3.38 | 65.22 | 304 | 1.43 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -567.12 | 54.96 | na | na | na | na | 6.5 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 118.61 | 27.62 | 100% | -1.97 | 2.88 | na | 0.31 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

Numbers in the Flux Rate Confidence column indicate the statistical confidence that the measured flux rate is different than the blank flux rate. Results from the blank study, bulk sediment analysis, overlying water and oxygen uptake analysis are shown for comparison.

The results for Middle Loch indicate that Copper, Cadmium, and Nickel had fluxes out of the sediment that were highly significant when compared to the blank chamber results. Zinc also showed an outward flux but the statistical confidence was somewhat lower, and compared to blank results, any zinc flux is inconclusive. Lead had a negative flux (sediment uptake) but the statistical confidence was again somewhat lower. The flux of Manganese was negative when calculated using all the samples, but was positive when using only the first five samples. After the first five samples, the Manganese concentration in the chamber dropped dramatically. The reason for this drop is not known, and this effect and subsequent handling of the data are discussed in the Paleta Creek discussion in Section 5.1.3.1. The Silica flux was out of the sediment and was highly significant when compared to blank results. Dissolved Oxygen indicated a sediment uptake.

The results for Bishop Point were significantly different than those of Middle Loch with the exception of Cadmium, which was nearly identical. Copper, Cadmium, Manganese and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank chamber results and the magnitude of the Copper and Zinc fluxes were markedly higher than those observed for Middle Loch. The Nickel flux however was somewhat less and with a reduced confidence. Lead fluxed outward at Bishop Point, but confidence is only marginal when compared to blank chamber results. As with Middle Loch, the Manganese flux at Bishop Point was non-linear and the concentration in the chamber leveled off after the third sample. The Manganese flux calculated using only the first three samples is similar to the flux estimated using the first five samples at Middle Loch and similar to that measured at other sites. The flux calculated using all the samples is low but still positive. The Silica flux results were again highly significant compared to blank results and were

higher than Middle Loch. The Dissolved Oxygen sediment uptake was about half that of Middle Loch. Figures 50 and 51 belographically illustrate results

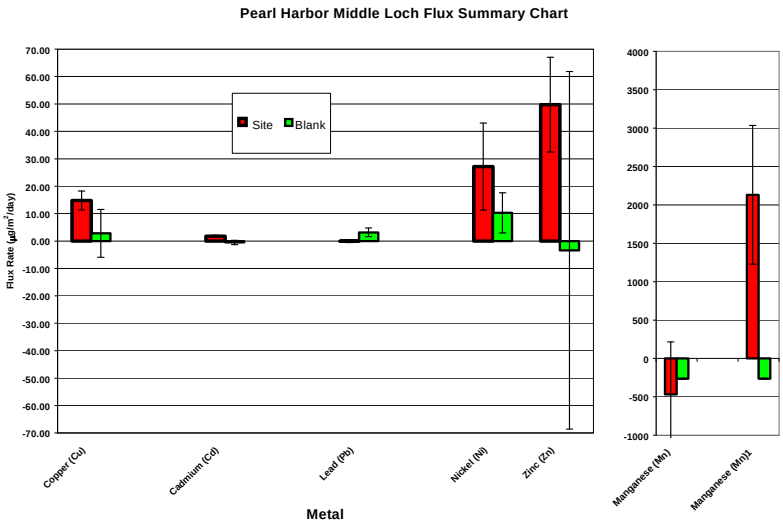



**Figure 51. Pearl Harbor Middle Loch Demonstration Results.**

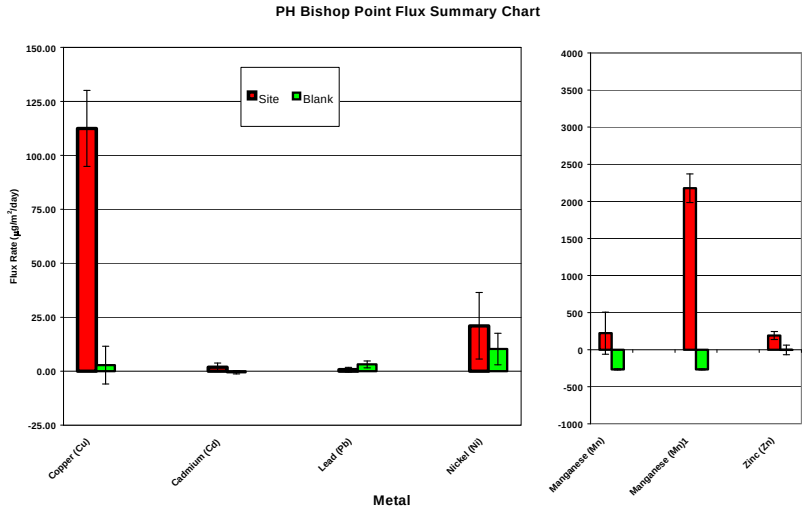



**Figure 52. Pearl Harbor Bishop Point Demonstration Results.**

#### 5.1.5.1 Discussion of Pearl Harbor Metals Demonstrations Results

In general, BFSD2 results from the two Pearl Harbor demonstration locations were significantly different than one another. Figures 53 and 54 are the sets of graphs of concentration versus time for each analyte in each of the demonstrations, compared with blank performance. The results for the Middle Loch demonstration indicate that Copper, Cadmium, and Nickel had fluxes out of the sediment that were highly significant when compared to the blank chamber results. Zinc also indicated an outward flux but the statistical confidence was low suggesting no conclusive flux rate. Zinc concentrations in Middle Loch were low compared to other sites and most likely not a problem

in this area. Lead had a negative flux (sediment uptake) but the statistical confidence was again somewhat lower. Manganese flux trends were similar to those observed in Paleta Creek and discussed in Section 5.1.3.1. The flux of Manganese was lower, even negative, when calculated using all the samples, but was positive when using only the first five samples. After the first five samples, the Manganese concentration in the chamber dropped dramatically. The Silica flux was out of the sediment and was highly significant when compared to blank results. Dissolved Oxygen indicated a sediment uptake.

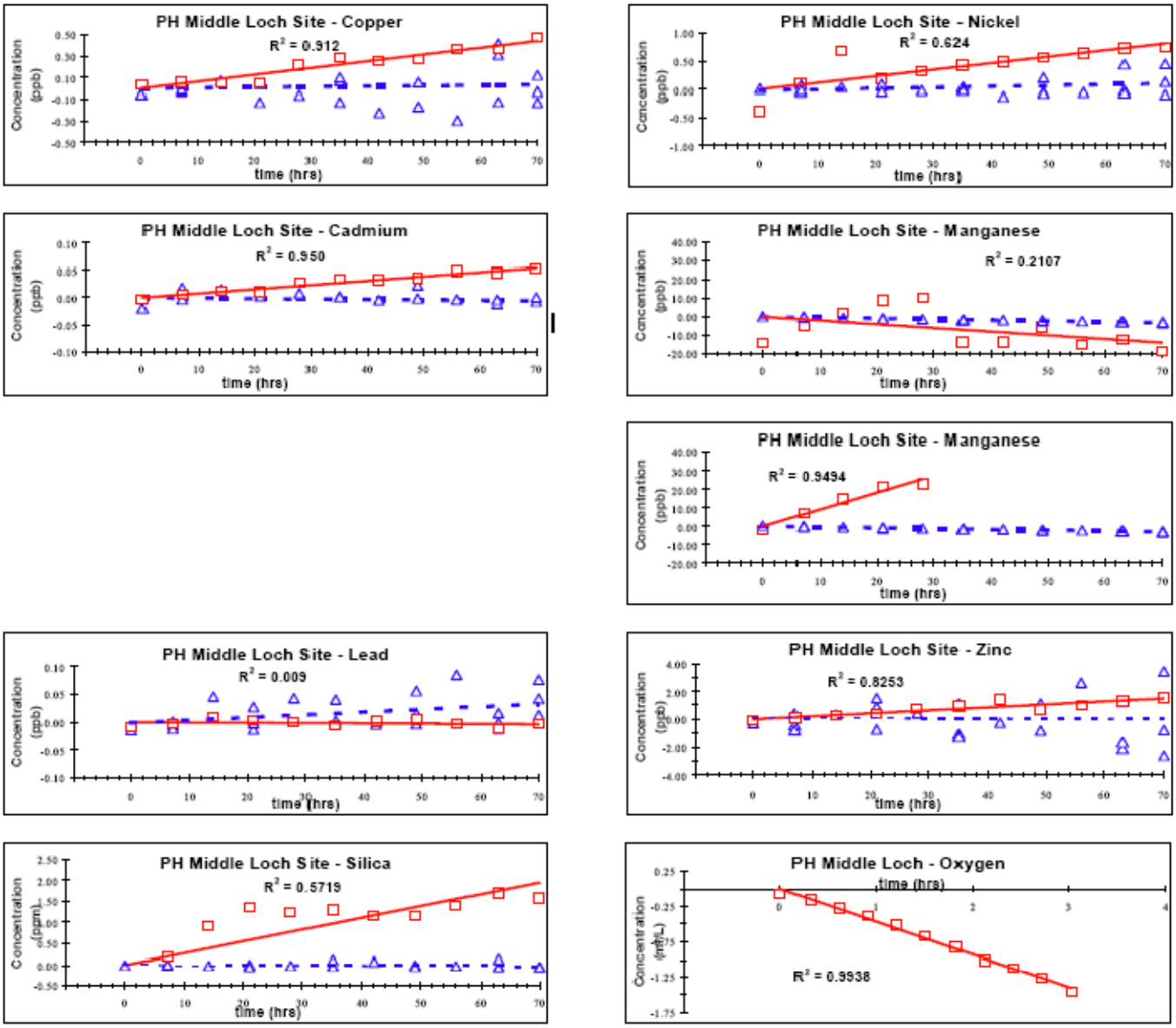



**Figure 53. Pearl Harbor Middle Loch Demonstration Concentration vs. Time.**

The results for Bishop Point were significantly different than those of Middle Loch with the exception of Cadmium, which was nearly identical. Copper, Cadmium, Manganese and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank chamber results and the magnitude of the Copper and Zinc fluxes were markedly higher than those observed for Middle Loch. The Nickel flux however was somewhat less and with a reduced confidence. Lead

fluxed outward at Bishop Point, but confidence is only marginal when compared to blank chamber results. As with Middle Loch, the Manganese flux at Bishop Point was non-linear and the concentration in the chamber leveled off after the third sample. The Manganese flux calculated using only the first three samples is similar to the flux estimated using the first five samples at Middle Loch and similar to that measured at other sites. The flux calculated using all the samples is low but still positive. The Silica flux results were again highly significant compared to blank results and were higher than Middle Loch. The Dissolved Oxygen sediment uptake was about half that of Middle Loch.

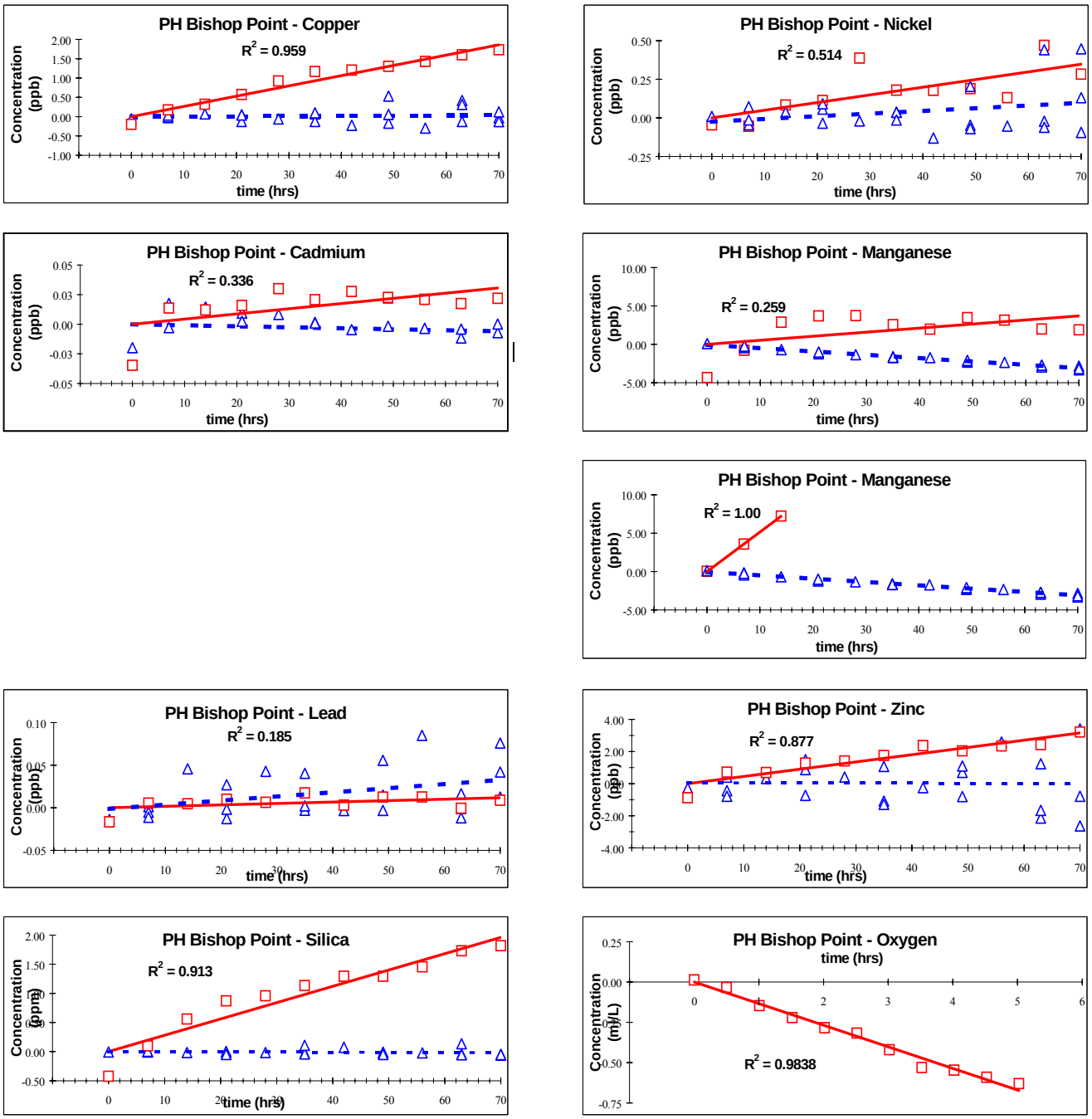



**Figure 54. Pearl Harbor Bishop Point demonstration Concentration vs. Time.**

#### 5.1.5.1.1 Metals Flux Measurements

Flux measurements were made for the metals cadmium, copper, lead, nickel, manganese and zinc. As shown in Tables 12 and 13, and illustrated in Figures 51 through 54, the BFSD2 results from the two Pearl Harbor demonstrations were significantly different from one another and from previous surveys.

Middle Loch fluxes were lower than those of Bishop Point, with the exception of Nickel (which was slightly higher). Of interest is that the Manganese flux at Middle Loch was initially almost the same (during the first 28 hours) as that at Bishop Point during the first 14 hours and then both exhibited an abrupt downward change. Possible explanations for this observation include complex reduction-oxidation interactions, sulfide binding, complexation with organic matter, or elevated water column concentrations associated with hull leachate sources at the sediment interface. The concentration-time graphs for both Manganese and Silica at Middle Loch show similar "quenching" trends, which are also apparent to a lesser degree in comparable data from Bishop Point.

Bishop Point fluxes were all outward and larger in magnitude than Middle Loch (except Nickel, as mentioned above). Copper, Cadmium, Manganese and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank chamber results and the magnitude of the Copper and Zinc fluxes were markedly higher than those observed for Middle Loch. The Nickel flux however was somewhat less and with a reduced confidence. Lead fluxed outward at Bishop Point, but confidence is only marginal when compared to blank chamber results. With consideration for the more subtle Manganese and Silica "quenching" trends and the relatively lower oxygen uptake rate at Bishop Point, the fluxes appear to be less affected by possible interactions and are mobilizing from the sediment more linearly. The larger sediment grain sizes and size distribution at Bishop Point, as determined during site screening, may also be contributing to the apparent linear mobility of the outward fluxing metals.

As with Middle Loch, the Manganese flux at Bishop Point was non-linear and the concentration in the chamber leveled off after the third sample. The Manganese flux calculated using only the first three samples is similar to the flux estimated using the first five samples at Middle Loch and similar to that measured at other sites. The flux calculated using all the samples is low but still positive. The Silica flux results were again highly significant compared to blank results and were higher at Bishop Point than Middle Loch. The Dissolved Oxygen sediment uptake at Bishop Point was about half that of Middle Loch.

### 5.1.5.2 Discussion of Pearl Harbor Metals Demonstration Tests

Important aspects of the demonstrations including performance indicators and deployment problems are discussed below.

#### 5.1.5.2.1 Performance Indicators

As discussed in Section 5.1.2.2.1, several methods were used to assure system performance of the BFSD 2 during and after the demonstrations. In both deployments the landing and insertion, monitored with the video camera and landing lights, indicated a good penetration and after the test was started, the video camera also confirmed successful lid closure. At Middle Loch the "soft" landing approach was used to minimize disturbance of the flocculent layer and maintain maximum visibility in the already murky water. Penetration was about twice normal (approximately 6 inches) and all visibility was lost. Test start and lid activation was delayed (about 15 minutes) until the water cleared enough to confirm closure. At Bishop Point a "free fall" landing approach was used from

about one foot above the sediment without significant loss of visibility. The resulting outward-traveling small cloud of disturbed sediment clearly showed the "low bow-wave" design of the BFSD2 to function effectively. The color underwater video camera made viewing this performance possible.

A monotonic increase in silica during the demonstrations was used as another indicator of proper system performance and chamber seal. As shown in Figures 50 and 51, for both deployments the silica concentration increased over the duration of the test indicating proper system performance and chamber seal. The flux magnitudes were high compared to previous mainland surveys, and may be explained by the tropical conditions (i.e., calciferous-rich). Bishop Point Silica results were reasonably linear, but Middle Loch Silica flux was not. Following a rate of increase during the first 24 hours of almost twice that of Bishop Point, Middle Loch Silica flux slowed significantly for the remainder of the test. The non-linearity in both Silica and Manganese fluxes suggest that as the concentrations in the chamber build, the fluxes may be altered by the presence of the chamber itself. This could be attributed either to time/concentration dependent reactions within the chamber, or changes in fluxes due to changes in the gradient between the porewater and the overlying water trapped within the chamber.

The Dissolved Oxygen level in the chamber was monitored and recorded to assure maintenance of ambient oxygen levels, proper chamber seal, and to evaluate sediment oxygen uptake. The rate of oxygen consumption (sediment uptake) during the deployments, was shown in Figures 53 and 54, and was sufficient to cause repeated cycling of the BFSD2 oxygen control subsystem. Figure 55 are graphs of the oxygen sensor data for the two deployments showing the operation of the control system. The control limits selected allowed the dissolved oxygen to remain within approximately 1 ml/L of the ambient level and still yield data to assess the sediment uptake rate. Functioning of the system in this manner assured that chamber isolation of the water was maintained. The ambient oxygen level at Middle Loch was about one half that of Bishop Point and the sediment uptake rate was about twice that of Bishop Point. These conditions, when combined with the pH results discussed below indicate Middle Loch has a higher level of organic decomposition. Again, this is reasonable when considering the differences between the sites.

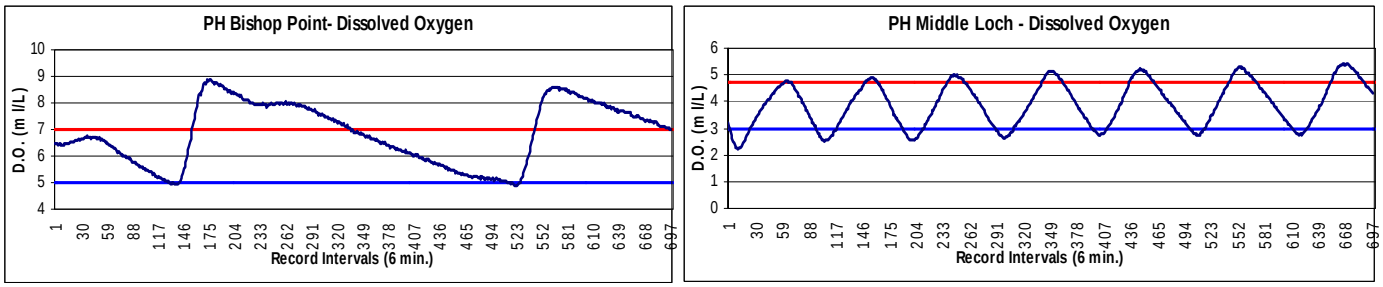



**Figure 55. Pearl Harbor Demonstrations Oxygen Control Results.**

The pH level in the chamber was monitored and recorded as another assurance indicator of seal integrity. In a sealed BFSD2 chamber, the pH will generally show a decreasing trend as the breakdown of organic matter at the sediment water interface drives $CO_2$ into the chamber water. This decreasing trend was observed during both deployments as shown in Figure 56. And, as would be expected from results of oxygen uptake discussed above, the pH level dropped at a higher rate throughout the entire 70-hour test duration at Middle Loch.

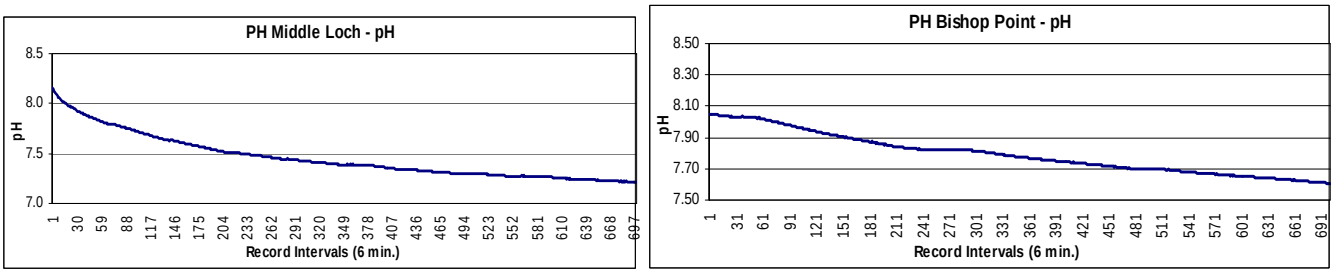



**Figure 56. Pearl Harbor Demonstrations pH Results.**

#### 5.1.5.2.2 Deployment and Recovery Problems

One minor problem was encountered during recovery at the Middle Loch demonstration and no deployment problems were encountered at either site and. At Middle Loch the commercial acoustic recovery system failed to function following several transmissions of the coded signal. Diver assistance was required to deploy the marker buoy and routine recovery operations were then followed. Subsequent analysis indicated absorption of the acoustic energy by the sediment due to the depth of BFSD2 insertion (almost covering the acoustic receiver window) and a near overhead aspect during transmission. Use of a standoff distance from the approximate location of the BFSD2 for future tests will minimize reoccurrence. Buoy activation was normal (within 8 minutes) after the Bishop Point deployment.

#### 5.1.5.3 Discussion of Metals Data Interpretation

Although the measurements from Pearl Harbor are limited to two locations, they provide significant insight into the importance of understanding contaminant mobility. One way to interpret the flux chamber measurements for Pearl Harbor is to evaluate them in the context of the exposure pathways defined in the RI study. In the RI study, sight-specific Biota-to-Sediment Accumulation Factors (BSAFs) were developed by comparing the tissue burdens of wild-caught organisms to the sediment concentrations found in the same region. In this approach, 100% of the tissue burden is attributed to sediment exposure. One of the primary pathways of sediment exposure is thought to be via remobilization of chemicals to the dissolved phase and subsequent uptake by the organism. The results from the flux chamber measurements allow us to quantify and examine this key pathway.

As an example, we can consider the potential exposure for copper in sediments at the two sites. A cursory examination of the bulk sediment data in Tables 7 and 8 indicate that the exposure levels at the two sites would be about the same, with a slightly lower level at Middle Loch than at Bishop Point. Thus the predicted bioaccumulation for the two sites would also be similar. However, examination of the flux rates for copper at the two sites suggests a much different scenario. The flux rate of copper at Middle Loch was much lower than the flux rate measured at Bishop Point. This indicates that the bulk sediment levels at the two sites do not necessarily reflect the exposure potential. This is further supported by evaluation of the bulk sediment data on a scale normalized for iron content. This analysis indicates that while the levels of copper at Middle Loch fall along the ambient trend, the copper levels at Bishop Point have sources of copper beyond that available from background weathering as shown in Figure 57. In addition, the high oxygen uptake rates at Middle Loch indicate presence of reducing sediments that are likely to contain strong copper binding phases such as sulfides.

These results suggest consideration of a refined exposure model for organisms where the primary exposure is thought to be via the dissolved phase. For example, using the measured flux rates for

copper, the contribution of the sediments to the water can be estimated. This would then be used to quantify the fraction of the biological exposure that could be attributed to this pathway. If this exposure mechanism cannot account for observed uptake or effects, then other pathways or sources must be considered.

Thus the flux rate measurements at the two Pearl Harbor sites illustrate the usefulness of the system in identifying and quantifying exposure pathways between sediments and organisms. The flux results are also consistent with existing knowledge of sediment geochemistry. The results suggest that incorporation of flux measurements on a broader scale will help to improve ecological risk assessments by providing stronger links between bulk sediment chemistry and biological exposure

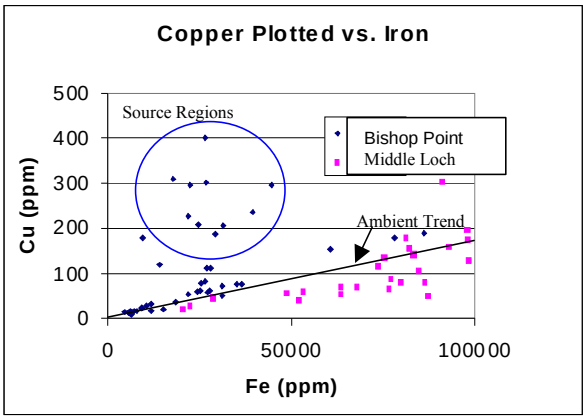



**Figure 57. Pearl Harbor Demonstration Data with Iron-Normalized Bulk Sediment Copper Concentrations.**

### 5.1.6 Pearl Harbor, Hawaii Organics Demonstration

One 72-hour test to demonstrate the application of the Benthic Flux Sampling Device 2 (BFSD 2) in *organics*-contaminated sediments was conducted September 7-10, 2001. The test was conducted at the Navy's Marine Diving and Salvage Unit 1 (MDSU-1) facility located at Bishop Point, Pearl Harbor, Hawaii. Pearl Harbor is identified on the National Priority List (Super Fund) for environmental cleanup and is currently completing a four-year Remediation Investigation (RI) study. The site was selected based on RI results and field screening results conducted in February 1999. It had also been previously used for BFSD2 metals-contaminated sediment studies and provided excellent test conditions (access, support, facilities). The MDSU-1 area is an active industrial location and includes several Navy housing barges, which are periodically moved by tugboats. The area has a depth of approximately 25 feet with generally clear water and medium- to fine-grained sediments. Tidal currents are enough to minimize any flocculent layer. The Alpha Dock site selected is near the site used for the metals test and was close enough to the quay wall to allow both deployment and recovery from shore using an 80-foot crane (See Figure 58).

**Figure 58. BFSD2 Pearl Harbor, Bishop Point Organics Demonstration.**

The BFSD2 was cleaned and prepared at Space and Naval Warfare Systems Center, San Diego (SSC SD) using the same procedures used during triplicate blank tests and the first organics demonstration. It was then loaded into its re-usable shipping container for air-shipment to Hawaii. The shipping container, designed for compatibility with commercial air cargo carriers, includes compartments, shelving and storage bays sufficient for shipment of BFSD2 as well as all materials and supplies required for extended field operations. Shipping weight was approximately 1450 pounds. For safety reasons the compressed oxygen cylinder was vented to less than 250 psi and no hazardous materials were air-shipped. The container is convenient for onsite storage and access and minimizes working space requirements. After arrival and unpacking, system checks were performed to assure no degradation during shipment had occurred. Oxygen bottle refilling was a problem in that compressed-gas suppliers were not willing to fill the small SCUBA-type cylinder and recreational dive shops would fill it but didn't carry pure oxygen. The problem was resolved when vandals stole the tank and refill fittings from
the rental car trunk. A new, air-filled small dive tank was purchased as a replacement. It was recognized that the lower oxygen content of the compressed air would be marginal in maintaining ambient chamber conditions, however it was generally believed that the diffusive flux component of organic compounds are not dependant on dissolved oxygen levels. Test results were not anticipated to be affected by the use of compressed air.

At the site near the quay wall the crane was positioned with its lift lines measured to allow placement of the BFSD2 at the desired location. An electrical extension cord was connected to a nearby building to provide power for the various deployment equipment (laptop computer, TV monitor and cabling) located in the trunk of the rental car (Figure 59). Preparations for the deployment followed a standard pre-deployment checklist (Figure 60).

**Figure 59. Deployment Equipment.**

**Figure 60. Pre-Deployment Checklist.**

After the BFSD2 was lowered to within view of the sediment surface it was established that no obstructions to chamber penetration were present and the decision to deploy was made. The crane lowered the BFSD2 at its maximum descent rate and a good landing was observed with the underwater video monitor. The bottom landing created a minimal amount of sediment resuspension and the water cleared within 15 seconds.

After video confirmation of sufficient sediment penetration to achieve a sea l the 10minute sensor check program was initiated. This program activated closure of the chamber lid which, while closing, simultaneously opened a hinge-mounted valve to collect the ambient-condition water sample (bottle #1). Following lid closure and activation of the recirculation subsystem, measurements of the enclosed water for dissolved oxygen, pH, temperature, pressure and salinity were made and recorded at 6second intervals for 10 minutes. Following completion of the 10-minute program t he sensor data was uploaded, processed and entered into a custom data template to confirm sensor functions and to establish initial ambient water conditions. The measurement for ambient dissolved oxygen was used to establish limits for the BFSD2 oxygen control subsystem. These values were entered into the 72-hour flux test program and downloaded to the submerged BFSD2. The limits selected reflected the use of compressed air in place of pure oxygen and allowed a near anoxic lower threshold to be reached before activating the oxygen (i.e. air) recharge valve. Figure 61 shows the ambient dissolved oxygen measurement with the upper and lower control limits superimposed and Figure 62 shows the ambient pH measurement.

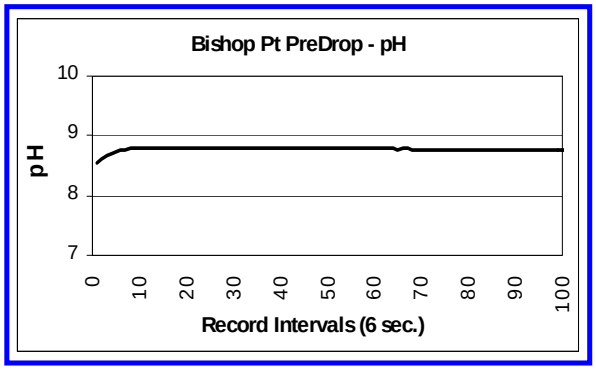



**Figure 61. Ambient Dissolved Oxygen.**

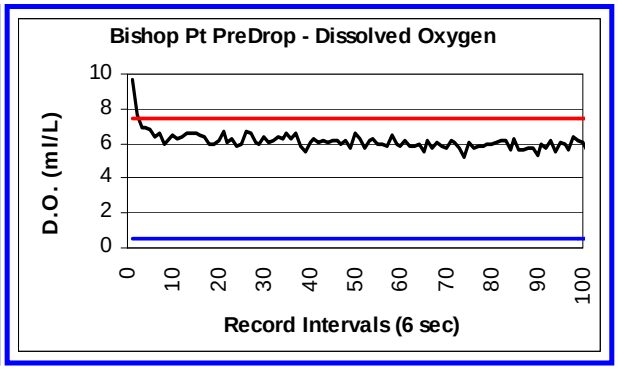



**Figure 62. Ambient pH.**

With the BFSD2 in place on the bottom, the downloaded 72-hour flux test program with the selected control limits was verified and the program was started. The BFSD2 connections were maintained to monitor and confirm collection of the first chamber sample (bottle #2) and sensor measurement recordings at 6-minute intervals. The crane tackle block was then disengaged from the deployment line and the crane was moved from the area. The deployment line and communication cables were stowed on the pier pilings to facilitate recovery at the completion of the 72-hour flux test.

At the conclusion of the 72-hour time period the BFSD2 communication cable was reconnected to the laptop computer to verify completion of the flux test program and to upload the recorded sensor data. The crane was then repositioned, rigged for recovery and the BFSD2 was lifted off the bottom and onto shore. Once secure on land an initial inspection indicated no damage, all components were intact and all twelve sample bottles were full. From a floating platform positioned over the deployment site a hand-held GPS location record was made and a 250-ml sediment sample was collected. The samples were then removed and transported to the field lab facility for filter removal, lid installation, labeling and preparation for shipment to the Arthur D. Little (ADL) analytical laboratory in Cambridge, MA. The BFSD2 was flushed and cleaned with freshwater, the gel-cell batteries were recharged and the sample collection subsystem was purged with deionized water and dried with forced-air in preparation for the return shipment to SSC SD.

As the samples were being processed, the recorded data files for the 72-hour test were uploaded and entered into a standardized Excel spreadsheet template for data processing. The sensor data, plotted as time-series indicated a successful deployment. As can be seen in Figure 63, there was no sudden pH level shifts indicating loss of chamber seal. The slowly reducing trend for pH level was normal and is indicative of biological activity. The dissolved oxygen level, Figure 64, shows the expected steady decline and control system activation as the level dropped below the lower limit. The decline was temporarily reversed, most likely due to residual pure oxygen in the system, however the recharge was not maintained due to the low oxygen content of the compressed air and the chamber eventually fell below the lower limit and remained at a near anoxic level until the test was completed. It is also noted that the slope of the declining pH became approximately level as the chamber approached anoxic conditions, indicating reduced biological activity. Salinity, temperature and pressure were normal.

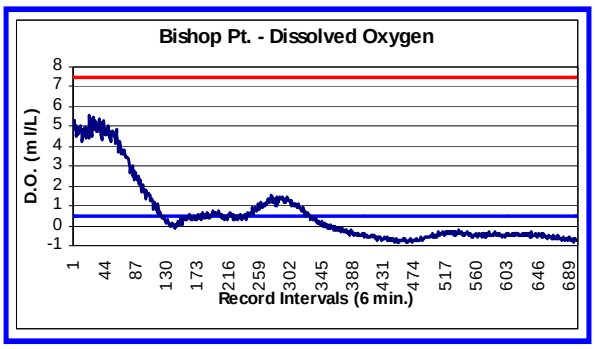



**Figure 63. Chamber pH.**

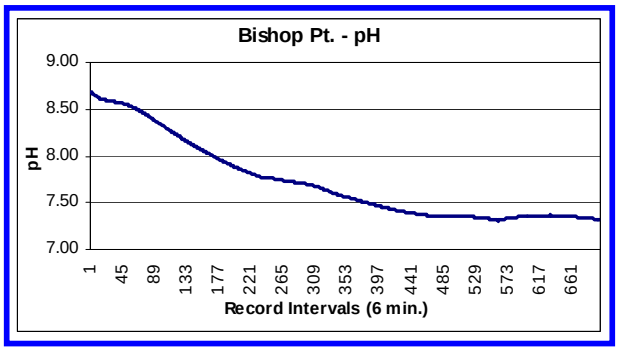



**Figure 64. Chamber Dissolved Oxygen.**

The samples were air-shipped from Honolulu International Airport by overnight express (FedEx) the afternoon of Sept 10, 2001. But the events of Sept 11, 2001 grounded all flights nation-wide and the samples were stopped and delayed in Oakland, CA until delivery to ADL on Sept 17, 2001. The samples were intact but exceeded the maximum extraction holding time (7 days) and maximum

storage temperature (4 degrees C.) when received. The conditions were noted and the decision to continue with processing and analysis was made.

#### 5.1.6.1 Pearl Harbor Organics Demonstration Results.

Tables 14, 15 and 16 below provide a summary of the flux results for selected PAHs, PCB congeners and pesticides, respectively. Figures 65, 66, and 67 provide graphical comparison of the flux results with the blank tests results.

**Table 14. Summary Results for PAHs.**

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | 75.00 | 306.84 | NA | NA | NA | 16,000 | Non-Detect |
| 10. CHRYSENE | 1048.91 | 1012.25 | 98.5% | 23.94 | 22.32 | 48,000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 919.89 | 375.56 | 99.8% | -134.30 | 297.91 | 36,000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 234.99 | 156.43 | 93.3% | -9.71 | 36.30 | 10,000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12,000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 6.72 | 67.06 | NA | NA | NA | 7,400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1,500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 7.91 | 64.14 | 11.6% | 20.15 | 65.15 | 5,300 | 1.7 |

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | -110.07 | 596.59 | 38.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 2680.41 | 10124.62 | 51.2% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 627.85 | 1483.64 | 82.7% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 75.17 | 1894.31 | 23.4% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | -552.72 | 1305.06 | 98.2% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 4053.72 | 3094.52 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 4435.81 | 10157.65 | 97.4% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 38.99 | 4132.13 | 28.5% | -439.51 | 70.73 | 150,000 | 20 |

**Table 15. Summary Results for PCBs.**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | -2.62 | 93.70 | 4% | 57.59 | 31.49 | Non Detect | 2.1 |

**Table 16. Summary Results for Pesticides.**

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| Mirex | 61.81 | 110.60 | NA | NA | Non Detect | 1.00 |

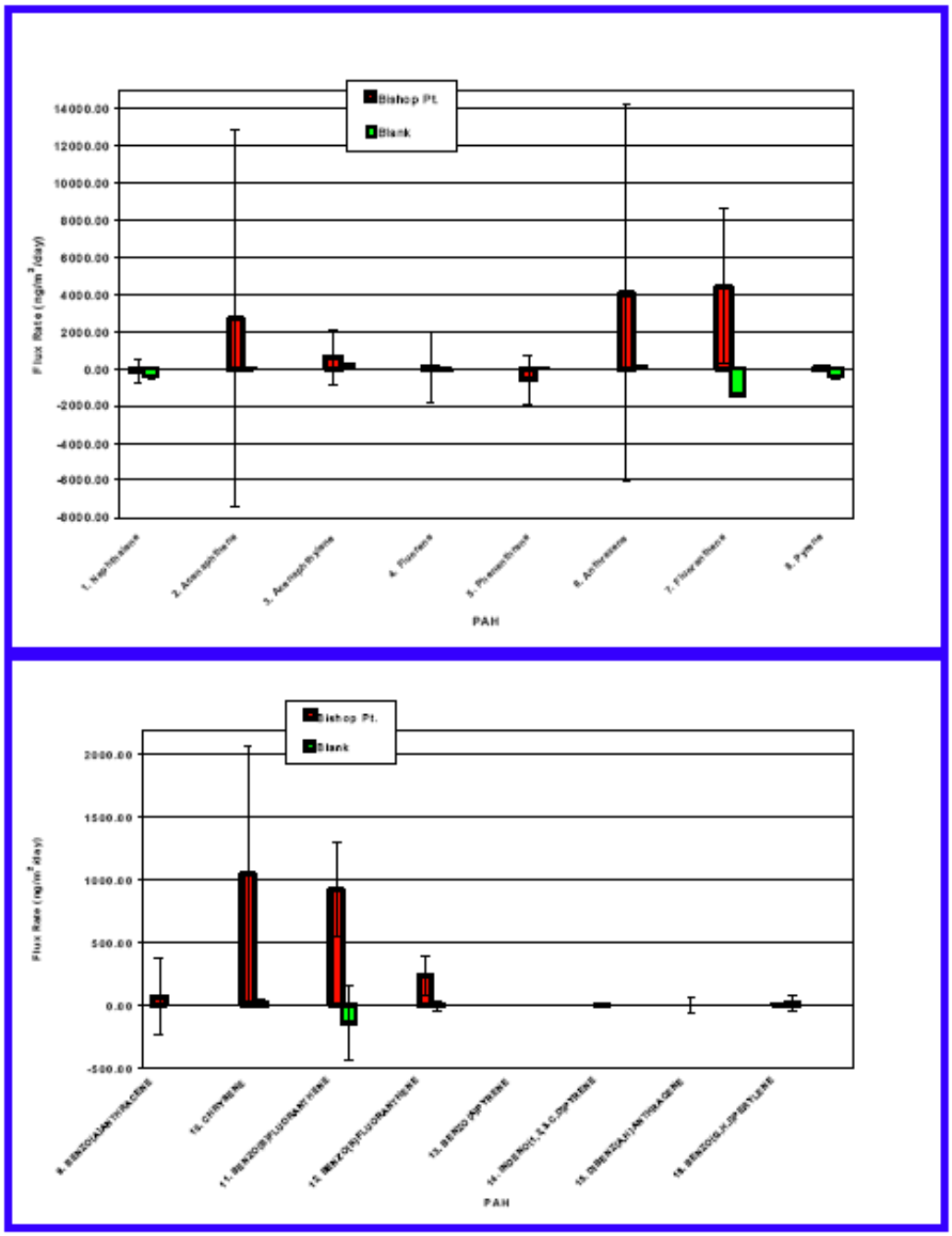



**Figure 65. Flux to Blank Comparison for PAHs.**

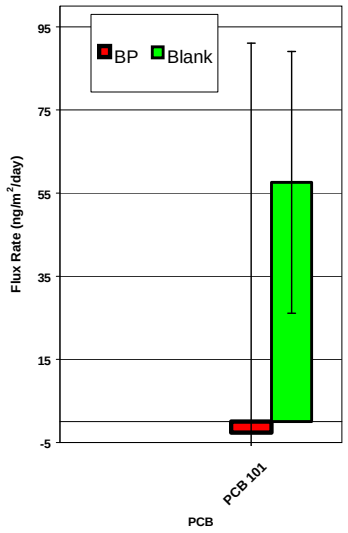



**Figure 66**. **Flux to Blank Comparison for PCBs.**

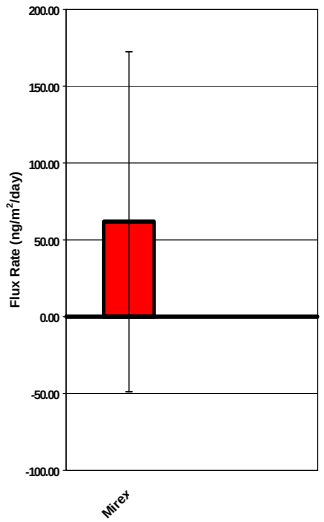



**Figure 67. Flux to Blank Comparison for Pesticides.**

**5.1.6.1.1 Polynuclear Aromatic Hydrocarbons (PAHs) Results**

Complete individual data sets were obtained for all of the first eight lighter molecular weight PAHs (Naphthalene, Acenaphthene, Acenaphthylene, Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene). Complete individual data sets were also obtained for five of the eight heavier molecular weight PAHs (Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-c,d)pyrene and Benzo(g,h,I)perylene). Partial data sets were obtained for Benzo[a]anthracene (9 of 12 detects) and Dibenzo[a,h]anthracene (4 of 12 detected). No detects were obtained for Benzo[a]pyrene. Flux analysis was accomplished for all complete data sets and the partial data set for Benzo[a]anthracene. However, the Benzo[a]anthracene analysis was abandoned since two of the

three non-detects occurred in the first four samples, as discussed below, and was compounded by a lack of blank test data for statistical comparison.

All trends in concentration change (i.e. flux) were strongly positive for the first four samples in each series of twelve. $R^2$ linearity factors for these initial trends were exceptionally high for all except Phenanthrene, Indeno(1,2,3-c,d)pyrene and Benzo(g,h,I)perylene. The concentration trends for the last eight samples in each series were generally flat or slightly negative with only Benzo(k)fluoranthene maintaining a lowered, but steady increase. $R^2$ linearity factors for these trends were correspondingly low. Due to this apparent change in concentration trends occurring after sample number four, coincident with the chamber dissolved oxygen level falling below the control limit at about 15 hours, separate analyses of the first four samples in each series and for the last eight samples in each series were accomplished. Also supporting this approach, the bulk sediment concentration levels for all the analyzed PAHs was directly related to the flux of the first four samples in the series and not for the last eight. And, whereas the relationship between bulk sediment concentrations and overlying water concentrations (measured in the number one sample) appear to be consistent with the solubility relationships discussed in the BFSD Paleta Creek demonstration report, the trend relationships identified for flux, bulk sediment concentrations and solubility appear to hold only for the first four samples. Table 17 shows these relationships for the first four PAH samples and Figure 68 shows the graphical comparison of the measured flux with the blank tests for the first four PAH samples.

**Table 17. Summary Results for First Four PAH Samples.**

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 1,848 | 4,406 | 59.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 71,053 | 327,574 | 100.0% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 6,862 | 14,388 | 100.0% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 10,387 | 110,972 | 100.0% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | 3,031 | 106,689 | 99.4% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 26,955 | 27,293 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 69,812 | 380,980 | 100.0% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 24,512 | 190,722 | 100.0% | -439.51 | 70.73 | 150,000 | 20 |

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 16000 | Non-Detect |
| 10. CHRYSENE | 8792.74 | 10650.17 | 100.0% | 23.94 | 22.32 | 48000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 3080.74 | 17862.21 | 99.4% | -134.30 | 297.91 | 36000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 977.52 | 3135.53 | 99.7% | -9.71 | 36.30 | 10000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 122.97 | 7141.99 | NA | NA | NA | 7400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 33.19 | 5249.47 | 7.0% | 20.15 | 35.15 | 5300 | 1.7 |

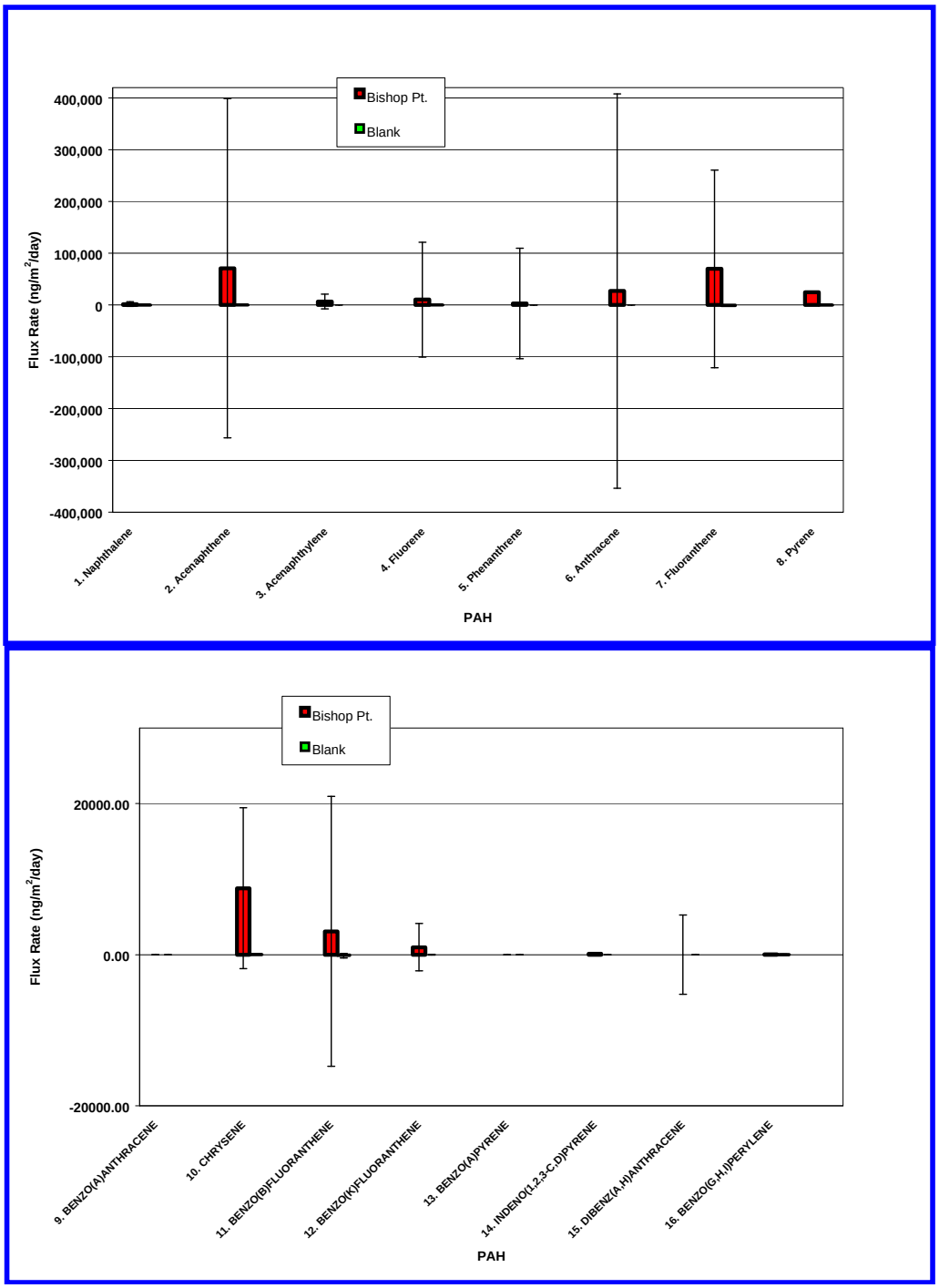



**Figure 68. Flux to Blank Comparison for First Four PAH Samples.**

The concentration trend (or flux) for the first four samples in the series, when compared to the statistically derived triplicate blank test trends showed large, significant flux for all of the eight lighter molecular weight PAHs. For seven of these eight PAHs the confidence that the flux was statistically different than the associated blank results was approximately 100%. The confidence for Naphthalene was 59.1%. For the five heavier molecular weight PAHs with complete data sets, the first four samples for Chrysene, Benzo(b)fluoranthene and Benzo(k)fluoranthene had high confidence (approximately 100%); Benzo(g,h,I)perylene had low confidence (7.0%); and

Indeno(1,2,3-c,d)pyrene had insufficient blank test data for comparison. For all the analyzed PAHs except Anthracene of the lighter molecular weight PAHs, and Benzo[b]fluoranthene and Benzo[k]fluoranthene of the heavier molecular weight PAHs, the last eight samples in the series exhibited concentration trends with low and/or negative trends as well as low confidence levels when compared to blank test results. Appendix D ("BP Organics Demo-PAHs.xls") includes time-series graphs showing flux and blank tests concentrations over time for the PAHs. Graphs for the complete data sets (12 samples), for the first four samples and for the last eight samples allow comparison of the flux and blank test results.

#### 5.1.6.1.2 Polychlorinated Biphenyl (PCB) Congeners Results

One complete individual data set was obtained for PCB Congener number 101 (2,2',3,4,4',5,5'-Heptachlorobiphenyl). Partial data sets were obtained for ten PCB Congeners: number 8 (2,4'-Dichlorobiphenyl) with 2 of 12 detections; number 44 (2,2',3,5'-Tetrachlorobiphenyl) with 5 of 12 detections; number 52 (2,2',5,5'-Tetrachlorobiphenyl) with 5 of 12 detections; number 66 (2,3',4,4'-Tetrachlorobiphenyl) with 2 of 12 detections; number 105 (2,3,3',4,4'-Pentachlorobiphenyl) with 5 of 12 detections; number 118 (2,3',4,4',5-Pentachlorobiphenyl) with 1 of 12 detections; number 153 (2,2',4,4',5,5'-Hexachlorobiphenyl) with 1 of 12 detections; number 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl) with 7 of 12 detections; number 206 (2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl) with 4 of 12 detections; and number 209 (2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl) with 1 of 12 detections. The remaining nine targeted PCB Congeners were not detected in the samples.

Flux analysis is reported for PCB Congener number 101 only, including statistical comparison with blank test data. The flux was small compared to the blank and it was negative (i.e. uptake). The 95% confidence limit values for the computed flux were large and the statistical confidence that the flux value was different than the corresponding blank was very small (4%). PCB Congener number 101 was not detected in the bulk sediment sample. The high flux rate trend noted in the first four samples for PAHs, prior to anoxic chamber conditions, was not evident for PCB Congener number 101 and separate analysis was not undertaken. Appendix D ("BP Organics Demo-PCBs.xls") includes a time-series graph showing flux and blank tests concentrations over time for PCB Congener number 101.

Flux analysis for the remaining PCBs having partial data sets was abandoned due to the degree of incomplete data and/or large intervals between data. Also, none of the PCB congeners with detections in seawater were reported in the bulk sediment analysis results.

#### 5.1.6.1.3 Pesticides

Partial data sets were obtained for six pesticides: 2,4'-DDT with 1 of 12 detections; 4,4'-DDT with 3 of 12 detections; 4,4'-DDD with 4 of 12 detections; Dieldrin with 1 of 12 detections; Endrin with 7 of 12 detections; Mirex with 10 of 12 detections. The remaining ten targeted pesticides were not detected in the samples.

Flux analysis was accomplished for the pesticide Mirex only. No blank test results were available for this pesticide and therefore statistical comparison cannot be made. The computed flux value for Mirex was small with large 95% confidence limit values. Mirex was also not detected in the bulk sediment sample. The high flux rate trend noted in the first four samples for PAHs, prior to anoxic chamber conditions, was not evident for Mirex and separate analysis was not undertaken. Appendix A, Excel spreadsheets(.xls"), includes a time-series graph showing flux and blank tests concentrations over time for the pesticide Mirex.

Flux analysis for the remaining pesticides having partial data sets was not accomplished due to the degree of incomplete data and/or large intervals between data. And again, none were reported in the bulk sediment analysis results.

#### 5.1.6.2 Discussion of Bishop Point Organics Results

Prior to data reduction and analysis, close inspection of the analytical laboratory results indicated a change or "knee" in sample concentration trends occurring after sample four for most PAHs, coincident with the dissolved oxygen level falling below control limits. The same change was not evident for the PCBs or pesticides, however the preponderance of "non detect" concentration levels in the seawater samples coincident with like results in the bulk sediment sample resulted in sufficient seawater data for only one PCB congener and one pesticide flux analysis. The PAHs on the other hand exhibited very large concentrations in the bulk sediment sample and 13 of sixteen yielded sufficient data for flux analysis. After correction for dilution and normalization for comparison to the blank tests the shift in concentration trends became even more evident for the PAHs and remained obscured by low concentration levels for the PCBs and pesticides. Thus separating the data sets into pre- and post-anoxic conditions for analysis allowed the affect of the low oxygen conditions on the PAH flux rates to be isolated to the last eight samples. The mechanism for this observed damping or stopping of the release of PAHs from the sediment is not known but may be related to reduction-oxidation chemistry changes causing soluble metals to precipitate and bind with organic compounds releasing from the sediment. Another possible explanation for the observed flux change may be loss of the irrigation component of the flux due to oxygen deprivation of the infaunal micro-organisms. Whatever the mechanism, it is clear that the large PAH concentrations in the sediment are the source of large flux levels entering the water column, albeit evidenced by only the first four samples. It is also clear that maintenance of at least a minimum level of dissolved oxygen (approximately 1.0 ml/L) in the chamber is required to achieve complete flux results for the full duration of the test. As a result of using compressed air in place of pure oxygen for maintenance of the chamber dissolved oxygen conditions, only the four samples collected during the first 14 hours of the test are considered valid for analysis. Of these four, only the last three were collected from the chamber at time intervals of 7 hours and thus the full value of the 12-sample, 70-hour test was not achieved. However, minimum statistical standards are met with the four samples and the following discussion and conclusions derived from them are considered valid.

As found in the Paleta Creek demonstration, the flux results for the lighter molecular weight PAHs indicate greater mobility from the sediment into the overlying water than the heavier compounds. Of interest is the measured concentration of the PAHs in the bulk sediment sample being higher for the mid-molecular weight compounds than for the lighter or the heavier compounds. This distribution of sediment concentrations resulting from the industrial and operational activity at the site, led to high flux levels for even the less soluble heavier molecular weight PAHs compared to the lighter molecular weight PAHs. Notwithstanding this result, it appears that the heavier molecular weight PAHs are significantly less mobile, even with higher concentrations in the bulk sediment, than the lighter compounds. For example, the flux value for Acenaphthene (molecular weight-154) was about the same as Fluoranthene (molecular weight-202), but the bulk sediment concentration is about 1.4% that of Fluoranthene. And, as before, comparison of this finding with solubility measurements of the targeted PAHs in seawater shows the same trend: the heavier molecular weight PAHs are far less soluble. In the example above, Acenaphthene is approximately 16.6 times more soluble than Fluoranthene. Thus even a low mobility, heavier molecular weight PAH with a high enough concentration in the sediment may flux into the overlying water at a higher rate than a lighter compound at lower concentrations.

Based on molecular weight and solubility, the above discussion also generally applies to PCBs and pesticides, i.e. their mobility as indicated by the flux results will be generally in direct proportion to solubility and in inverse proportion to molecular weight. This premise cannot be supported by the results of this demonstration due to the very low concentration levels of the PCBs and pesticides in the sediment. The one PCB and one pesticide detected with sufficient data to allow analysis yielded results with low confidence and no conclusions can be drawn from either the full set of data or the first four samples. It does appear however that both PCBs and pesticides are not a water quality issue for this site.

#### 5.1.6.3 Conclusions for Bishop Point Organics Demonstration Test

The BFSD2 demonstration at Bishop Point, Pearl Harbor was a qualified success. A single factor, use of compressed air in place of pure oxygen for chamber dissolved oxygen maintenance, was responsible for loss of valid data after approximately 14 hours into the 72-hour test. The affect of anoxic level conditions to stop, reduce or interfere with the release of organic compounds from contaminated sediment, previously not anticipated, was established. And, prior to this affect occurring, valid data was obtained.

The results from the first 14 hours of the 72-hour test show that measurement of the mobility of organic compounds from the highly contaminated sediments at the Bishop Point site within the Pearl Harbor Naval Complex was successfully achieved. The measurements, when compared to triplicate blank test results resulted in quantification of large, statistically significant values with high confidence for Polynuclear Aromatic Hydrocarbons (PAHs) fluxing into overlying water. Complete data sets for nearly all of the targeted US EPA priority PAHs were achieved and the flux results are consistent with bulk sediment concentrations, modified by the relative solubility of the compounds. Polychlorinated Biphenyl (PCB) Congeners and pesticides were not measured either because they were not present or because they were below analytical detection limits.

Ideally, a repeat of this test should be conducted to resolve potential questions regarding oxygen control during the measurement of organic contaminant fluxes. It could be conducted at the Bishop Point site or any other site where high levels of targeted organic compounds are present in the sediment. Whereas the first demonstration at Paleta Creek established the capability of the BFSD2 and the related data analysis process to extract meaningful results at a site with moderate levels of contaminants in the sediments, this demonstration only partially established the BFSD2 performance at a site with high levels of organic contaminants in the sediment. A full 72-hour test at such a site would help to demonstrate and establish BFSD2 performance as concentration levels become very large in a high flux level condition. However, even in lieu of this additional testing, it is clear that the BFSD2 can statistically resolve fluxes for a number of organic contaminants even when the number of samples is limited.

### 5.1.7 Pearl Harbor, Bishop Point, Combined Demonstration

One 72-hour test was conducted to demonstrate the ability of the Benthic Flux Sampling Device 2 to collect samples for both metals and PAH analysis in a single deployment. The The MUDSU-1 facility at Bishop Point, Pearl Harbor, Hawaii was selected because both a metals deployment and a deployment for PAH's were made in the area. The combined demonstration was successfully conducted on December 9-12, 2002. A previous attempt was made in October of 2003, but because of a technical malfunction and issues with the electronic control unit of the BFSD2, that deployment was unsuccessful.

The combined demo followed the metals demonstration by 3 years and 10 months and the PAH demonstration by 1 year and 3 months. Although all the deployments were made along the quay wall at the MUDSU-1 facility, deployment logistics made it impossible to sample the exact spot in all three deployments. Hence, the combined demo position was 20 meters west of the metals deployment and 34 meters east of the PAH deployment (Figure 69). These distances should not be significant in comparing overall operation of the BFSD between deployments at a general site, but some patchy contamination of sediments may be exhibited in the results with some contaminants. Also, the difference in time between deployments could conceivably show some variability in results.

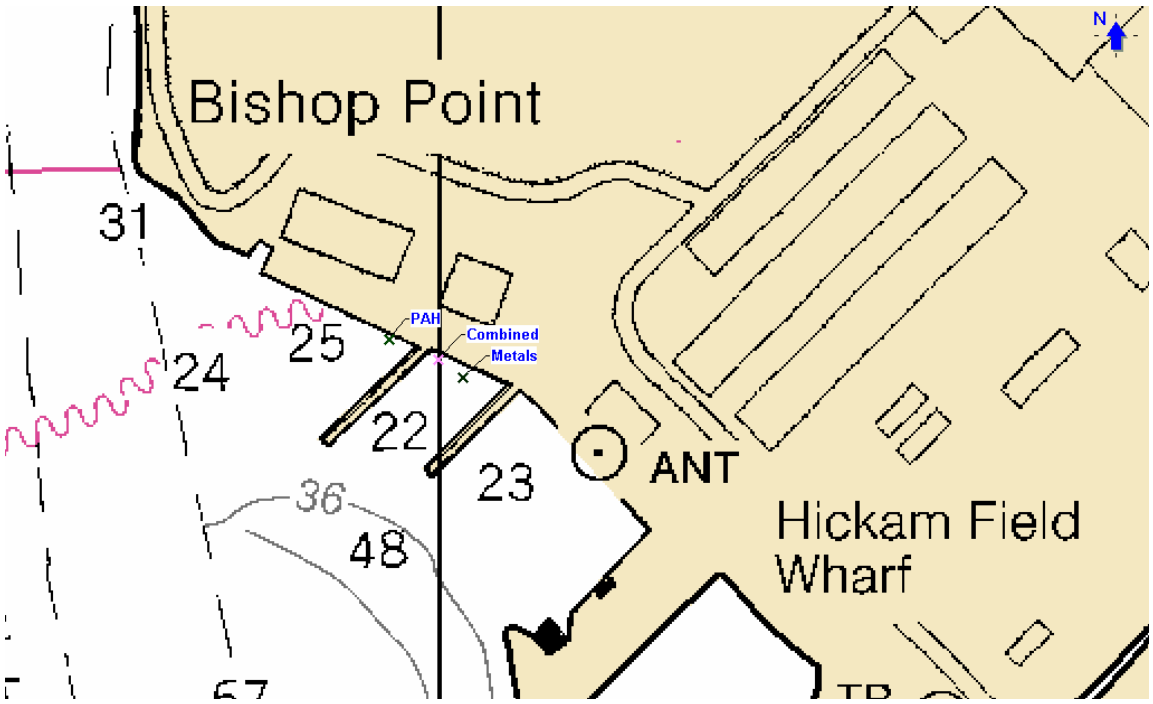



**Figure 69. Pearl Harbor, Bishop Point Demonstration Locations.**

The preparation and deployment for the combined demo followed very closely the procedures and events of the previous PAH demonstration deployment. The BFSD2 was cleaned, packed and shipped from SSC San Diego. When unpacked at Pearl Harbor, all systems were assembled, inspected and checked. The oxygen bottle was filled with $O_2$, and no problem with oxygen limitations was anticipated or encountered during the deployment as it was with the PAH deployment.

The BFSD2 was lowered into the water with a crane along the quay wall, and a pre- deployment checklist was followed. After the bottom was scanned with the onboard video camera and determined to be appropriate, the BFSD2 was landed and pre-deployment measurements taken. After the 10-minute pretest, sensors had stabilized and an oxygen range to be maintained could then be programmed for the 72-hour test from values taken during the pretest (Fig. 70). The 72-hour test was then started. Cables leading from the BFSD were disconnected from power, computers and video monitors and, together with a recovery line, were coiled and stored along the quay wall.

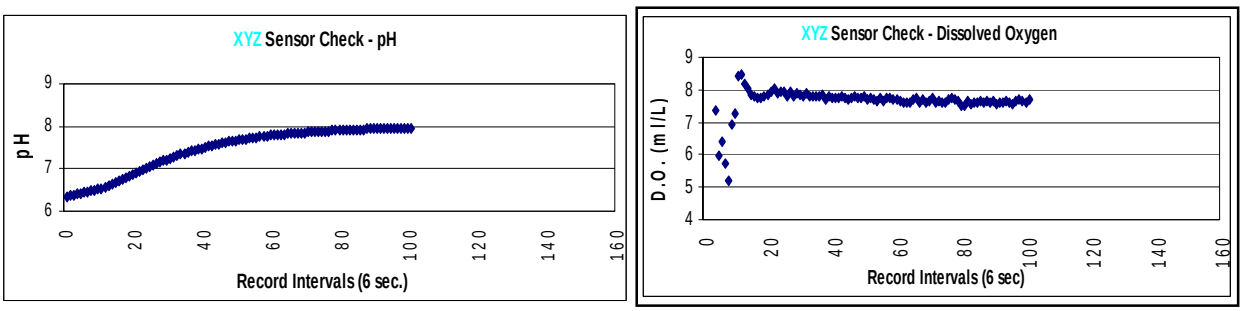



**Figure 70. Pearl Harbor, Bishop Point Combined Metals Pre-Deployment Sensor Graphs.**

Occasionally during the test, the cables were reconnected to the computer and video monitor and status was determined. All appeared normal during these checks and the cables resecured.

After 72 hours, the test was halted. Before the BFSD2 was raised from the bottom, data were uploaded via the stored cables on the quay wall. The BFSD2 was then raised from the bottom with the crane and deposited on the pier. The 24 sample bottles were briefly checked and found to be all full. They were then washed down, disconnected and removed from their racks. Samples were then taken to the field lab where filters were removed, labels added and they were shipped to Battelle labs for analysis.

Logged data were entered into Excel spreadsheets templates for processing. Oxygen and pH data show the deployment was successful in maintaining a tight seal and maintenance of the flux chamber integrity. Figure 71 shows a steady decline in pH which indicates no loss of seal or sudden contamination from outside the chamber. Figure 71 also shows the chamber was maintained oxic with the assistance of the $O_2$ feedback and injection system.

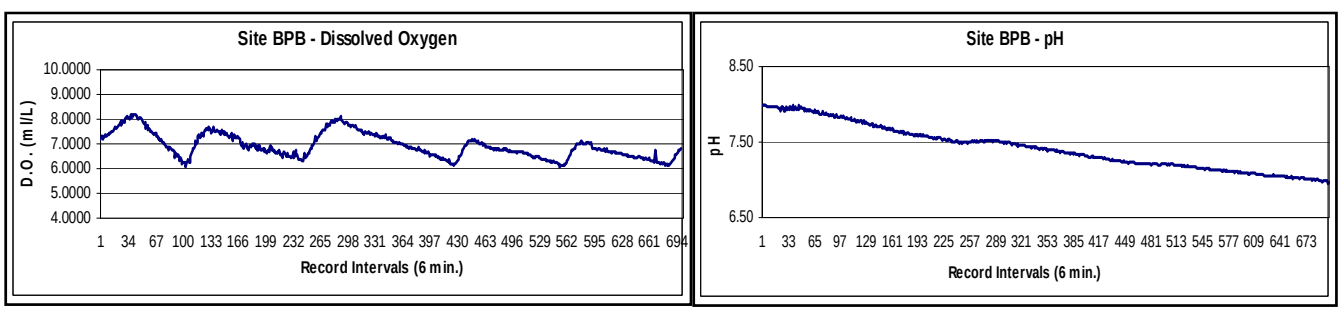



**Figure 71. Pearl Harbor, Bishop Point Combined Metals Full Test Sensor Graphs.**

#### 5.1.7.1 Pearl Harbor Combined Demonstration Results

Table 18 gives a summary of the flux results for metals and Figure 72 show these in graphical form. Flux of dissolved oxygen from the chamber, or the oxygen demand of the sediments, is also given in Table 18. This was calculated from the $O_2$ data logged from the chamber during the first decreasing slope in the 72-hour test before the $O_2$ feedback injection system raised the $O_2$ level.

Metals behaved similarly in this combined demonstration as they did in the original metals demonstration at the Bishop Point Site except for copper (Figure 73). Cadmium, lead, nickel, manganese and zinc all fluxed out of the sediments, a trend which is consistent with previous work,

while copper was adsorbed by the sediment. Copper fluxed out of the sediments during the initial study. Manganese behaved similarly in both studies in that it exhibited a higher flux rate during the first three samples of the test then leveled off for the remainder of the test period. This trend with Manganese is discussed in the Paleta Creek discussion section 5.1.3.1. Flux rates for manganese for the first 14 hours of the test as well as for the entire test are presented here. In general, flux rates were higher during this combined demonstration than during the metals-only demonstration.

PAH flux results are presented in two ways. First, the entire 72-hour test results with all twelve samples are presented. These data are presented in Figures 74 and 75 and Table 19. Then, secondly, results from the first four samples of the test, those up to 21.3 hours into the test, are shown. This is for comparison to the original organics-only demonstration where flux rates showed an initial slope then plateaued. In the original test, oxygen depletion in the chamber was theorized as the cause for this plateau, but oxygen levels were successfully maintained in the chamber during the second test. For whatever reasons this plateauing occurs, the trend seemed to repeat itself during the combined demonstration. For comparison purposes, the "first four" data are used to calculate flux rates.

**Table 18. Pearl Harbor, Bishop Point Combined Metals Summary of Metals.**

| Metal | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux (□g/m$^2$/day) | |
|---|---|---|---|---|---|
| | (□g/m$^2$/day)* | (□g/m$^2$/day) | (%) | Average | +/- 95% C.L. |
| Arsenic (As) | 23.48 | 6.94 | 100% | -5.16 | 2.10 |
| Copper (Cu) | -71.30 | 39.43 | 100.0% | 2.82 | 8.73 |
| Cadmium (Cd) | 1.31 | 1.63 | 98.1% | -0.52 | 0.75 |
| Lead (Pb) | 17.40 | 24.63 | 99.0% | 3.16 | 1.59 |
| Nickel (Ni) | 59.18 | 55.96 | 100.0% | 10.28 | 7.34 |
| Manganese (Mn) | 427.65 | 238.42 | 100.0% | -264.85 | 7.49 |
| Manganese (Mn)[1] | 1940.13 | 3853.39 | 100.0% | -264.85 | 7.49 |
| Silver (Ag) | -0.36 | 0.88 | 86.1% | 0.64 | 0.68 |
| Zinc (Zn) | 374.36 | 133.74 | 100.0% | -3.38 | 65.22 |
| **Other** | | | | | |
| Oxygen ($O_2$)* (*ml/m$^2$/day) | -1457.09 | 48.92 | na | na | na |
| Silica ($SiO_2$)* (*mg/m$^2$/day) | 0.00 | 0.00 | 48% | -1.97 | 2.88 |

1. Mn flux calculated on the first three samples due to non-linearity and to compare with metals-only demonstration

Flux rates for PAH's were similar in this combined test as it was in the original test. All PAH's that were measured fluxed out of the sediments except for phenanthrene. The largest flux rate measurement was for fluoranthene which also showed a large presence in the original test. This was followed by anthracene, acenaphthene and naphthalene, again similar to the original test. Similarities from the first test were also seen in the heavier molecular weight PAH's as benzo(a)pyrene,

benzo(k)flouranthene and chrysene showed large presence. Benzo(a)pyrene also showed a spike in this test but wasn't detected in the original test.

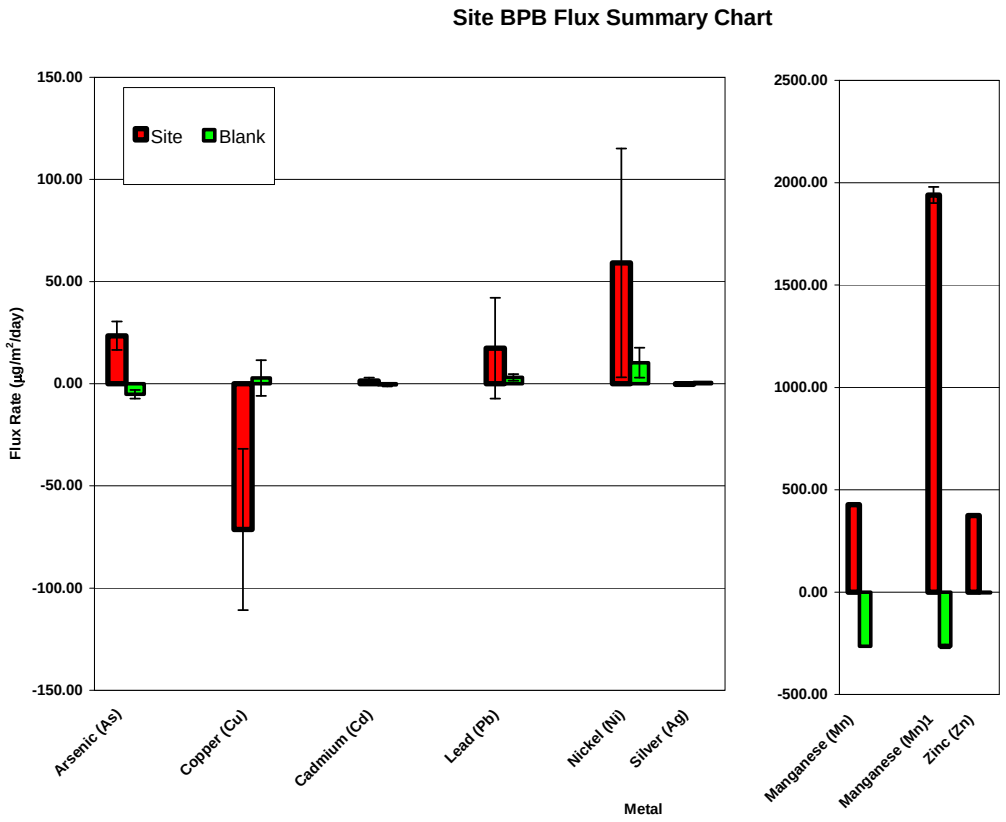



**Figure 72. Pearl Harbor, Bishop Point Combined Metals Comparison of Flux and Blanks.**

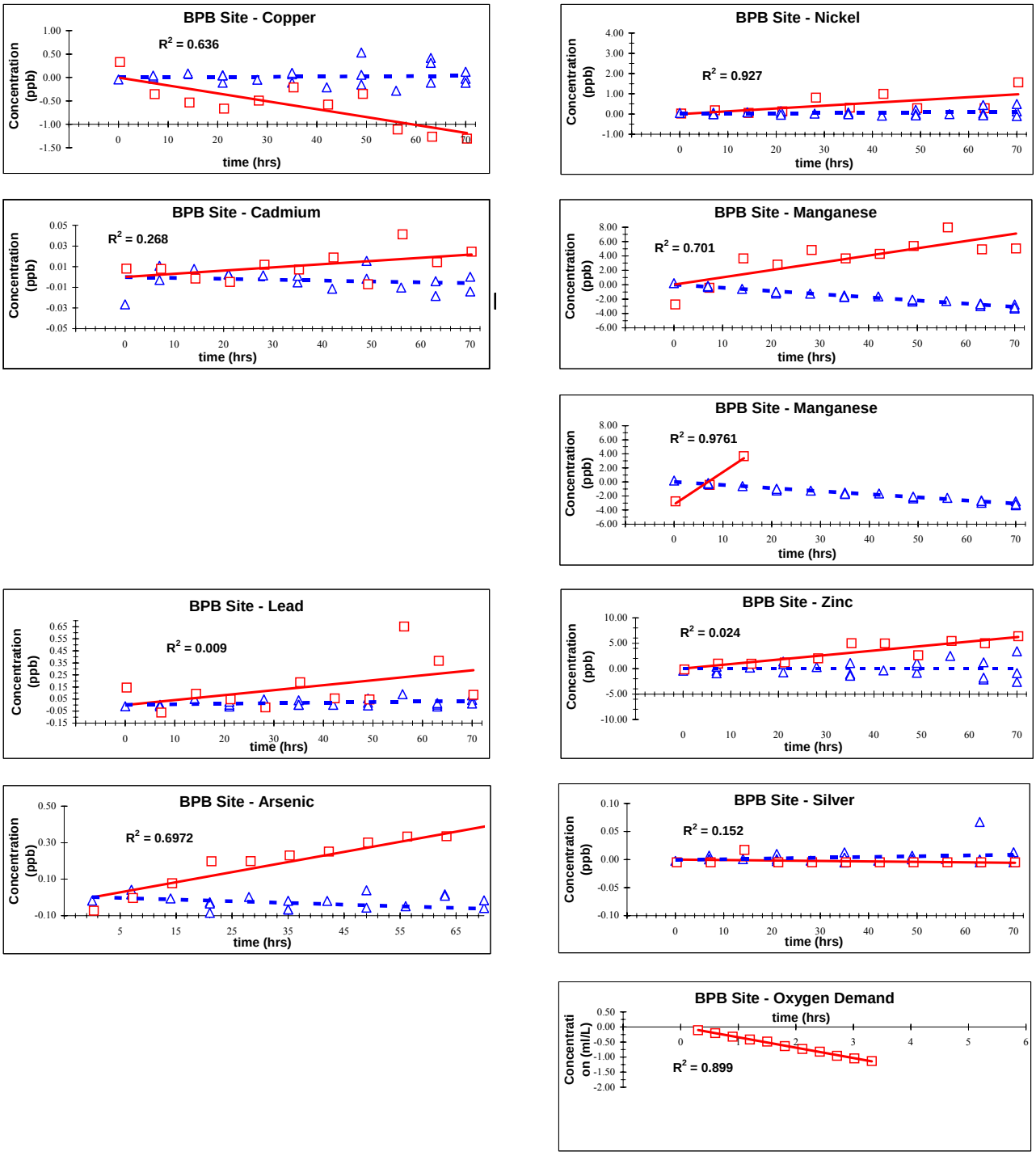
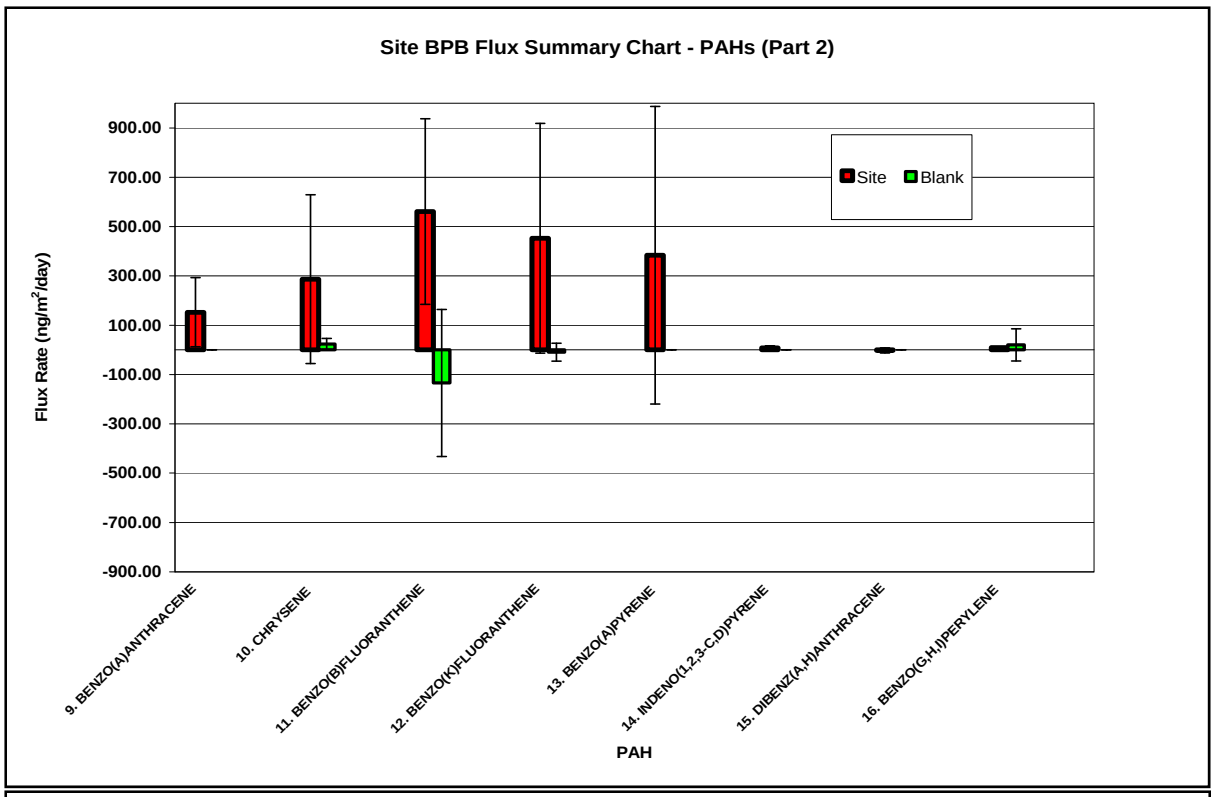



**Figure 73. Pearl Harbor Bishop Point Combined Demonstration Metals Time Series Graphs.**

**Table 19. Pearl Harbor, Bishop Point Combined Demo Summary Results for PAH's (**all samples**).**

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. |
|---|---|---|---|---|---|
| 1. Naphthalene | 711.03 | 2352.17 | 92.8% | -440.30 | 458.38 |
| 2. Acenaphthene | -1387.81 | 1989.31 | 91.4% | -32.40 | 50.34 |
| 3. Acenaphthylene | 106.66 | 213.64 | 31.9% | 208.47 | 112.60 |
| 4. Fluorene | -359.38 | 256.56 | 100.0% | -76.74 | 28.38 |
| 5. Phenanthrene | -639.76 | 1228.00 | 99.6% | 10.95 | 10.95 |
| 6. Anthracene | 763.68 | 546.29 | 100.0% | 117.68 | 64.62 |
| 7. Fluoranthene | 2749.93 | 3651.35 | 100.0% | -1423.95 | 178.41 |
| 8. Pyrene | 2191.62 | 2392.29 | 100.0% | -439.51 | 70.73 |

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. |
|---|---|---|---|---|---|
| 9. BENZO(A)ANTHRACENE | 152.67 | 140.49 | NA | NA | NA |
| 10. CHRYSENE | 286.65 | 341.92 | 94.7% | 23.94 | 22.32 |
| 11. BENZO(B)FLUORANTHENE | 561.07 | 376.08 | 97.9% | -134.30 | 297.91 |
| 12. BENZO(K)FLUORANTHENE | 452.24 | 465.75 | 82.8% | -9.71 | 36.30 |
| 13. BENZO(A)PYRENE | 383.46 | 603.38 | NA | NA | NA |
| 14. INDENO(1,2,3-C,D)PYRENE | 8.68 | 10.98 | NA | NA | NA |
| 15. DIBENZ(A,H)ANTHRACENE | -1.97 | 7.69 | NA | NA | NA |
| 16. BENZO(G,H,I)PERYLENE | 8.77 | 10.59 | 12.9% | 20.15 | 65.15 |



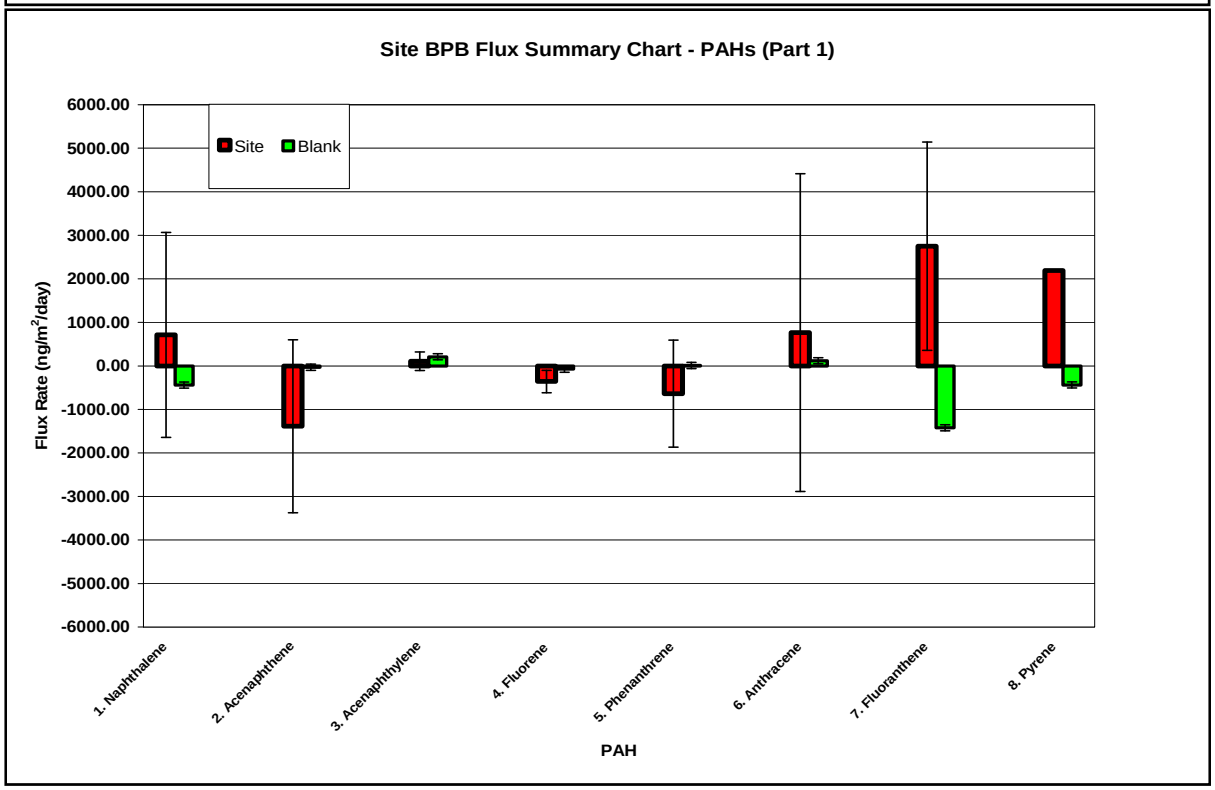




**Figure 74. Pearl Harbor, Bishop Point Combined PAH Comparison of Flux to Blanks (**all samples**).**

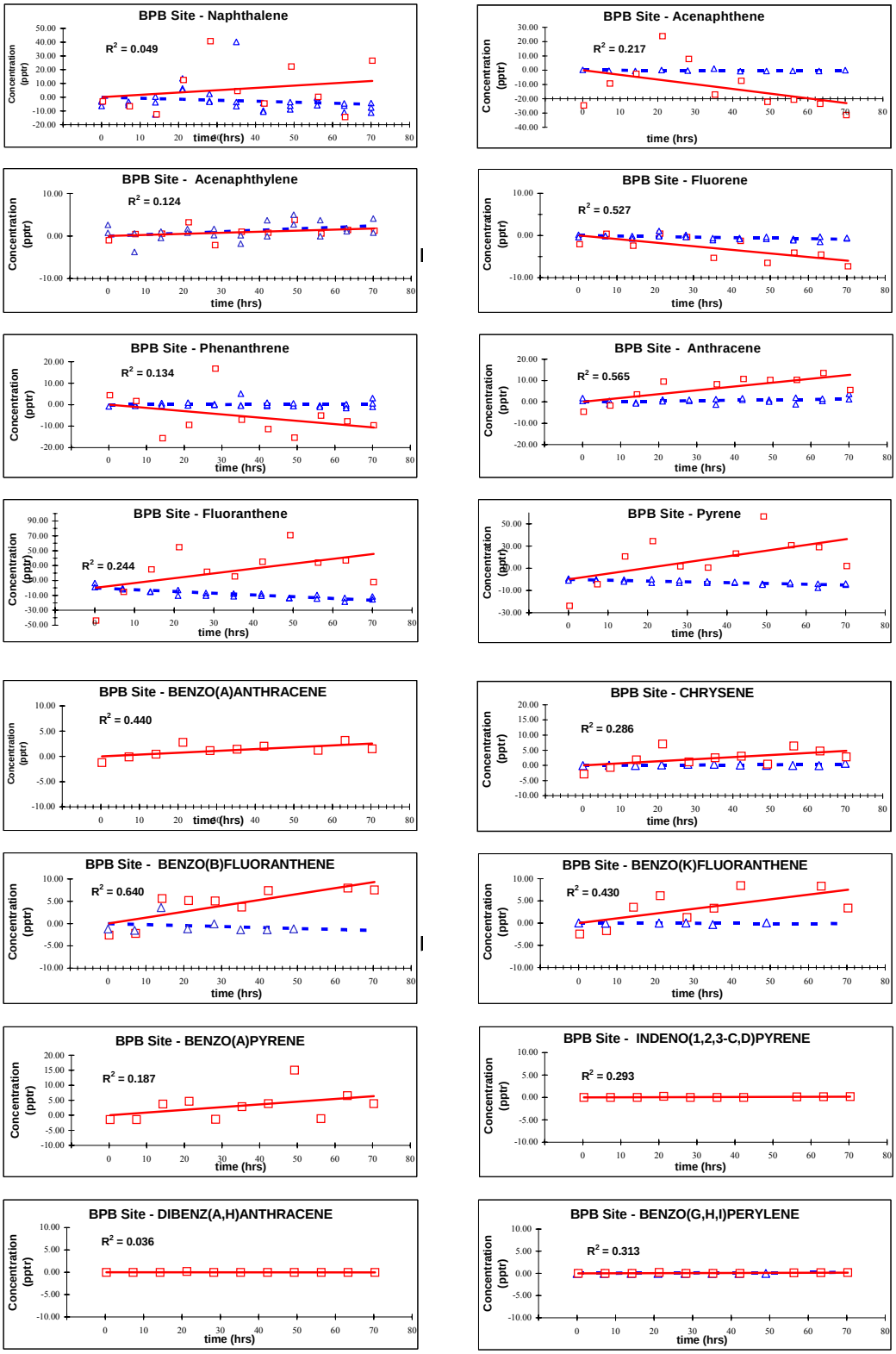



**Figure 75. Pearl Harbor, Bishop Point Combined Demonstration PAH Time Series Graphs (**all samples**).**

**Table 20. Pearl Harbor, Bishop Point Combined Demo Summary Results for PAH's (**First 4 samples**).**

| PAH | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m2/day) Average | +/- 95% C.L. |
|---|---|---|---|---|---|
| 1. Naphthalene | 2456.72 | 13211.63 | 100.0% | -440.30 | 458.38 |
| 2. Acenaphthene | 9222.27 | 6867.34 | 100.0% | -32.40 | 50.34 |
| 3. Acenaphthylene | 778.37 | 880.29 | 100.0% | 208.47 | 112.60 |
| 4. Fluorene | 285.70 | 2021.66 | 100.0% | -76.74 | 28.38 |
| 5. Phenanthrene | -3555.98 | 7892.27 | 100.0% | 10.95 | 10.95 |
| 6. Anthracene | 2874.10 | 1330.22 | 100.0% | 117.68 | 64.62 |
| 7. Fluoranthene | 19696.65 | 3869.67 | 100.0% | -1423.95 | 178.41 |
| 8. Pyrene | 12101.21 | 3884.64 | 100.0% | -439.51 | 70.73 |
| **PAH** | **Flux (ng/m2/day)*** | **+/- 95% C.L. (ng/m2/day)** | **Flux rate Confidence (%)** | **Triplicate Blank Flux (ng/m2/day) Average** | **+/- 95% C.L.** |
| 9. BENZO(A)ANTHRACI | 760.90 | 668.14 | NA | NA | NA |
| 10. CHRYSENE | 1949.20 | 1370.02 | 100.0% | 23.94 | 22.32 |
| 11. BENZO(B)FLUORAN | 1878.90 | 2921.78 | 100.0% | -134.30 | 297.91 |
| 12. BENZO(K)FLUORAN | 1890.04 | 1526.34 | 100.0% | -9.71 | 36.30 |
| 13. BENZO(A)PYRENE | 1413.41 | 1785.07 | NA | NA | NA |
| 14. INDENO(1,2,3-C,D)PY | 41.71 | 103.62 | NA | NA | NA |
| 15. DIBENZ(A,H)ANTHR | 34.46 | 85.60 | NA | NA | NA |
| 16. BENZO(G,H,I)PERYI | 39.90 | 99.12 | 43.2% | 20.15 | 65.15 |

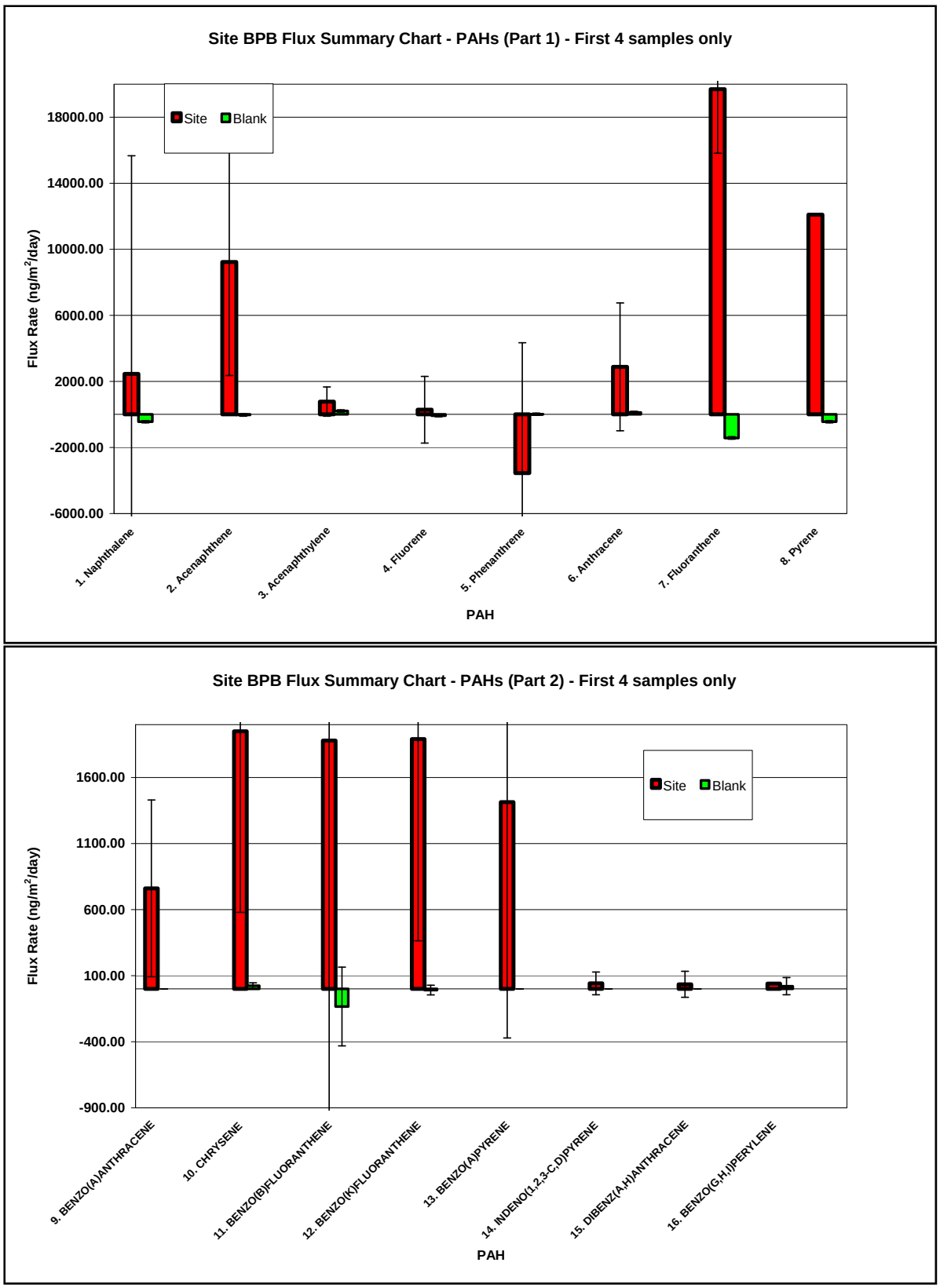



**Figure 76. Pearl Harbor, Bishop Point Combined PAH Comparison of Flux to Blanks (**First 4 samples**).**

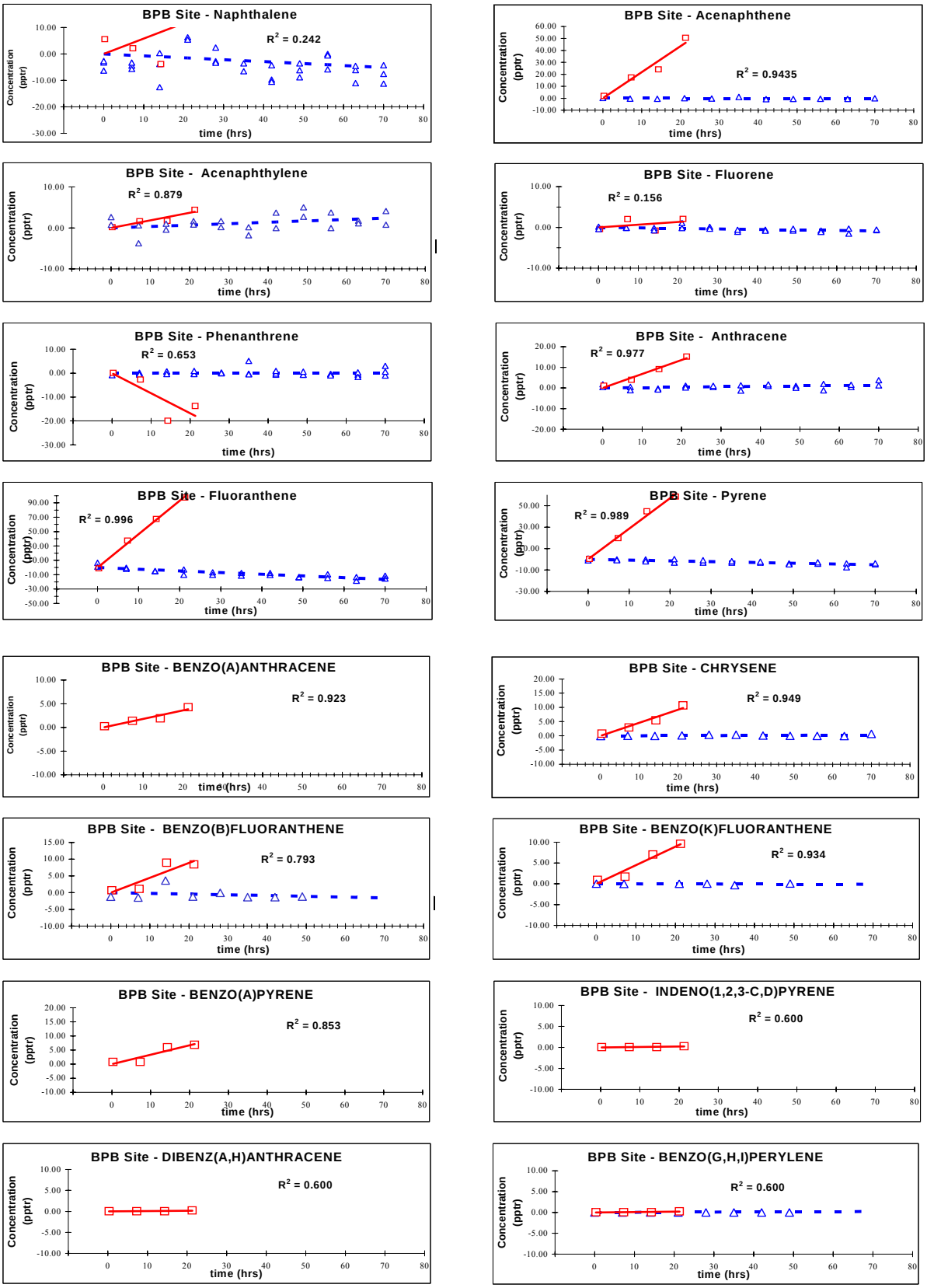



**Figure 77. Pearl Harbor, Bishop Point Combined Demonstration PAH Time Series Graphs (**First 4 samples**).**

### 5.1.7.2 Pearl Harbor Combined Demonstration Discussion

For the most part, flux rates for metals and organics behaved similarly at the Bishop Point sight for both the organics-only, metals-only and this combined demonstration of both organics and metals. Tables 21 and 22 show a side by side comparison of these demonstration flux results.

**Table 21. Comparison of Flux Rates from Metals-only and Combined Demonstrations.**

| | Combined Demo | | | Metals Only Demo | |
|---|---|---|---|---|---|
| Metal | Flux (□g/m2/day)* | +/- 95% C.L. (□g/m2/day) | | Flux (□g/m2/day)* | +/- 95% C.L. (□g/m2/day) |
| Arsenic (As) | 23.48 | 6.94 | | | |
| Copper (Cu) | -71.30 | 39.43 | | 112.46 | 17.60 |
| Cadmium (Cd) | 1.31 | 1.63 | | 1.85 | 1.96 |
| Lead (Pb) | 17.40 | 24.63 | | 0.71 | 1.11 |
| Nickel (Ni) | 59.18 | 55.96 | | 21.04 | 15.41 |
| Manganese (Mn) | 427.65 | 238.42 | | 223.33 | 284.79 |
| Manganese (Mn)1 | 1940.13 | 3853.39 | | 2177.45 | 192.60 |
| Silver (Ag) | -0.36 | 0.88 | | | |
| Zinc (Zn) | 374.36 | 133.74 | | 191.18 | 54.07 |

Copper and zinc are the only metals which showed a significant difference between sampling during the first metals only demo and the combined demo. Copper actually showed a reverse trend during the second test. Zinc flux rate was higher during the combined demo than during the first. However, cadmium, lead, nickel and manganese showed similar trends and lay within the 95% confidence intervals of the calculated slopes. Arsenic and silver were not reported during the first test and could not be compared here.

Flux rates for PAH's were calculated for the first 4 samples taken in order to compare with the original Bishop Point organics test. Concentrations for PAH's for both tests evened out or plateaued after the fourth sample was collected at about 22 hours. The "first four" flux rates are probably more realistic as that was measured before any interference or interaction with natural, in-situ processes caused by the chamber itself. The only organic which was significantly different from the first test was Phenanthrene which showed a negative flux or and absorption into sediments during the combined demo. All other organic compounds measured during the first test showed similar flux rates when compared to the 95% confidence limits of the flux curves.

The cause for the organic concentrations leveling off is not immediately known. Low oxygen levels and anoxic conditions inside the chamber during the first test were blamed for the effect. However

adequate oxygen conditions were maintained during the second test with the same result. High bulk sediment concentrations measured at Bishop Point may suggest a loading or saturation of PAH's within the chamber after 22 hours which would result in a dampening of the flux processes.

**Table 22. Comparison of Flux Rates from PAH-only and Combined Demonstration.**

| | Combined Demo | | PAH Only Demo | |
|---|---|---|---|---|
| PAH | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) |
| 1. Naphthalene | 2456.72 | 13211.63 | 1848.00 | 4406.00 |
| 2. Acenaphthene | 9222.27 | 6867.34 | 71053.00 | 327574.00 |
| 3. Acenaphthylene | 778.37 | 880.29 | 6862.00 | 14388.00 |
| 4. Fluorene | 285.70 | 2021.66 | 10387.00 | 110972.00 |
| 5. Phenanthrene | -3555.98 | 7892.27 | 3031.00 | 106689.00 |
| 6. Anthracene | 2874.10 | 1330.22 | 26955.00 | 27293.00 |
| 7. Fluoranthene | 19696.65 | 3869.67 | 69812.00 | 380980.00 |
| 8. Pyrene | 12101.21 | 3884.64 | 24512.00 | 190722.00 |
| PAH | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) |
| 9. BENZO(A)ANTHRACENE | 760.90 | 668.14 | Non-Detect | NA |
| 10. CHRYSENE | 1949.20 | 1370.02 | 8792.74 | 10650.17 |
| 11. BENZO(B)FLUORANTHENE | 1878.90 | 2921.78 | 3080.74 | 17862.21 |
| 12. BENZO(K)FLUORANTHENE | 1890.04 | 1526.34 | 977.52 | 3135.53 |
| 13. BENZO(A)PYRENE | 1413.41 | 1785.07 | Non-Detect | NA |
| 14. INDENO(1,2,3-C,D)PYRENE | 41.71 | 103.62 | 122.97 | 7141.99 |
| 15. DIBENZ(A,H)ANTHRACENE | 34.46 | 85.60 | Non-Detect | NA |
| 16. BENZO(G,H,I)PERYLENE | 39.90 | 99.12 | 33.19 | 5249.47 |

### 5.1.8 Paleta Creek and Pearl Harbor Metals Demonstrations Data Assessment.

BFSD2 performance assurance indicators show that: (1) a proper seal was achieved during both sets of demonstration deployments and chamber isolation of test water was maintained; (2) oxygen levels were maintained close to ambient levels, and; (3) silica, oxygen and pH trends varied as expected.

It was concluded that the two sets of deployments of BFSD2 at Paleta Creek and at Pearl Harbor, Hawaii demonstrated consistent performance and the ability to measure trace metal mobility at distinctly different sites. Ease of operation and reliability were also demonstrated. It was further concluded that BFSD2 can provide accurate and repeatable measurements of the mobility of trace metal contaminants to and from shallow water marine sediments when certain prerequisite conditions

are met. These sediment flux rates can be established with high confidence when the routine procedures, standard methods and protocols demonstrated during this study are followed. The BFSD2 and its support equipment are mobile by air transport, field portable and can be operated with a minimum of resources. Comparison of measured sediment fluxes with blank-chamber fluxes provides a statistical benchmark for the significance of the measured flux rates. Where statistically significant fluxes are observed, evaluation of impacts on water quality can be carried out, or comparisons can be made to bioaccumulation measurements to help identify exposure pathways. The resulting analysis will provide a significant new tool in evaluating potential cleanup options at contaminated sediment sites.

### 5.1.9 Technology Comparison

There are no directly comparable technologies to the Benthic Flux Sampling Device for *in situ* contaminated sediment flux measurements. Current alternative approaches, such as bulk sediment analysis, have been discussed throughout this report. Alternate methods and associated costs are discussed in section 6.1.4. Site specific considerations must be considered in determining which combination of technologies will provide the best information. Data analysis and interpretation is likewise dependent on site specific considerations as illustrated in this report.

# 6. Cost Assessment

## 6.1 Cost Performance

The expected operational costs for the Benthic Flux Sampling Device 2 (BFSD2) are largely driven by analytical laboratory costs. Although typical analytical laboratory prices have shown reductions, the detection level required to achieve meaningful BFSD2 flux measurements requires specialized equipment and highly skilled technicians available at limited sources. Other BFSD2 expected operational costs are driven primarily by labor, supplies and transportation costs during the pre-operational, operational and post-operational phases of deployment. The combined metals and organics demo has shown how a single deployment can collect data for both metals and organic compounds thus reducing the cost if both are desired at a single location. Lab analysis costs are increased but are offset by logistical and travel costs.

### 6.1.1 Pre-Operational Phase Costs

The costs incurred prior to field operations are derived from expenses involved with: site research and applicability; logistics planning and scheduling; equipment maintenance and repair; and pre-deployment readiness preparations (supplies, packing, checkout). Table 23 and Figure 78 below include expected pre-operational phase costs and an associated schedule of activities.

**Table 23. Expected Pre-Operational Phase Costs for BFSD2 Deployment.**

| | Labor | | Non-Labor | | Totals |
|---|---|---|---|---|---|
| | Govt | Contr | Matls | Other | |
| **Site Research** | $5,580 | $0 | n/a | $1,000 | **$6,580** |
| **Logistics Plans** | $7,000 | $0 | n/a | $0 | **$7,000** |
| **Maint and Repair** | $1,600 | $4,200 | $500 | $0 | **$6,300** |
| **Readiness Prep** | $2,000 | $10,850 | $500 | $0 | **$13,350** |
| **Totals** | **$16,180** | **$15,050** | **1000** | **$1,000** | **$33,230** |

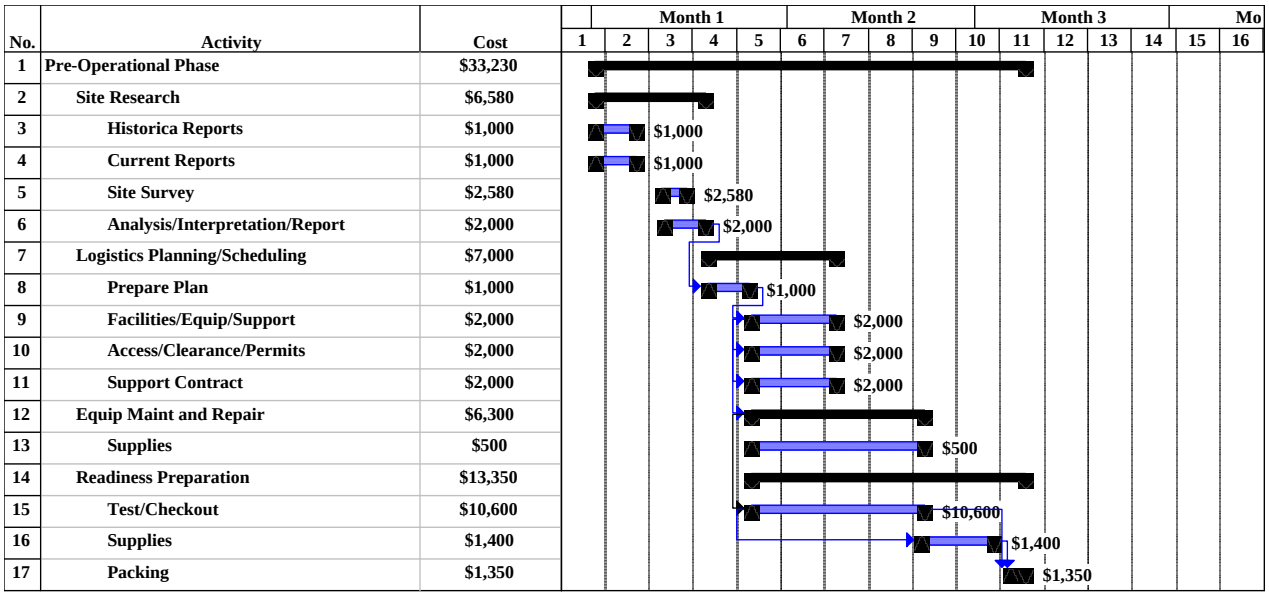



**Figure 78. Expected Pre-Operational Phase Schedule for BFSD2 Deployment.**

### 6.1.2 Operational Phase Costs

The costs incurred for field operations are derived from expenses involved with: equipment transportation; personnel travel and per diem; field facilities (shoreside work area, surface vessel, handling equipment); deployment, recovery and turnaround on a 5-day cycle; and analytical laboratory costs for one blank test and the required number of sites. Table 24 and Figure 79 below include expected operational phase costs and an associated schedule of activities.

**Table 24. Expected Operational Phase Costs for BFSD2 Deployment.**

| | Labor | | Non-Labor | | | Totals |
|---|---|---|---|---|---|---|
| | Govt | Contr | Matls | Lab | Other | |
| **Equip Trans** | $100 | $200 | $0 | n/a | $1,000 | **$1,300** |
| **Travel** | $800 | $600 | $0 | n/a | $1,240 | **$2,640** |
| **Equip/Facilities** | $1,600 | $1,200 | $0 | $0 | $0 | **$2,800** |
| **Blank Test** | $4,000 | $3,000 | $0 | $12,000 | $1,200 | **$20,200** |
| **Site #1** | $4,000 | $3,000 | $0 | $12,000 | $2,700 | **$21,700** |
| **Site #2** | $4,000 | $3,000 | $0 | $12,000 | $2,700 | **$21,700** |
| **Totals** | **$14,500** | **$11,000** | **$0** | **$36,000** | **$8,840** | **$70,340** |

| No. | Activity | Cost |
|---|---|---|
| 18 | Operational Phase | $70,340 |
| 19 | Equipment Transportation | $1,300 |
| 20 | Personnel Travel | $2,640 |
| 21 | Equipment/Facilities setup/checkout | $2,800 |
| 22 | Blank Test | $20,200 |
| 23 | Blank Test | $8,200 |
| 24 | Lab Anaysis | $12,000 |
| 25 | Site #1 | $21,700 |
| 26 | Decon/Deploy/Recover | $9,700 |
| 27 | Lab Analysis | $12,000 |
| 28 | Site #2 | $21,700 |
| 29 | Decon/Deploy/Recover | $9,700 |
| 30 | Lab Analysis | $12,000 |

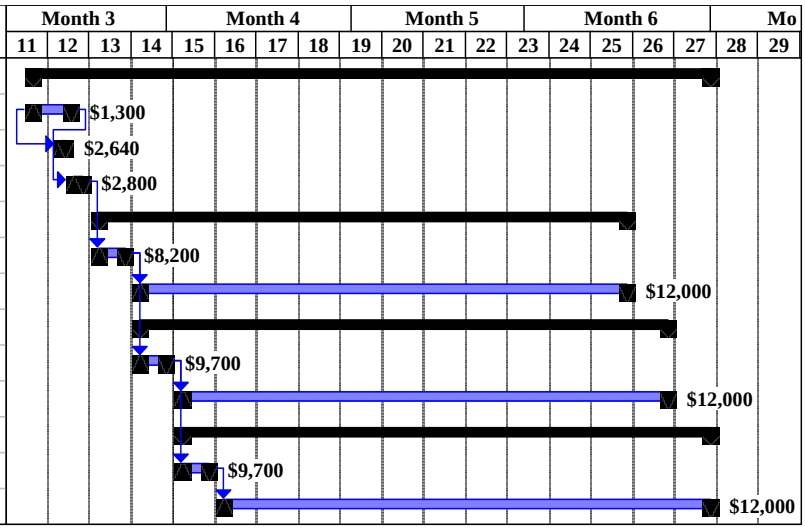



**Figure 79. Expected Operational Phase Schedule for BFSD2 Deployment.**

The operational phase costs for one site, which includes the costs for transportation, setup and a blank test are $48,640, of which 49% is for analysis of the samples. Each additional site adds $21,700 to the total, of which 55% is for analysis of the samples. The operational phase schedule is likewise strongly driven by the standard 60-day laboratory analysis time, which can be shortened to 30-days or less, at additional cost. The 5-day operations period for a BFSD2 72-hour deployment, recovery and turnaround cycle fits conveniently with a standard workweek schedule. An accelerated schedule which shortens turnaround time and includes weekend work periods can achieve two deployments per week.

### 6.1.3 Post-Operational Phase Costs

The costs incurred following completion of site operations are derived from expenses involved with: equipment packing and transportation; personnel travel; data processing, analysis and interpretation; report preparation. Table 25 and Figure 80 below include expected post-operational phase costs and an associated schedule of activities.

**Table 25. Expected Post-Operational Phase Costs for BFSD2 Deployment.**

| | Labor | | Non-Labor | | | Totals |
|---|---|---|---|---|---|---|
| | Govt | Contr | Matls | Lab | Other | |
| **Equip Pkg/Trans** | $0 | $1,500 | $0 | n/a | $1,000 | **$2,500** |
| **Travel** | $800 | $600 | $0 | n/a | $1,240 | **$2,640** |
| **Data Review** | $20,000 | $13,000 | $0 | $0 | $0 | **$33,000** |
| **Report Prep** | $24,000 | $0 | $0 | n/a | $0 | **$24,000** |
| **Totals** | **$44,800** | **$15,100** | **$0** | **$0** | **$2,240** | **$62,140** |

| No. | Activity | Cost |
|---|---|---|
| 31 | Post-Operational Phase | $62,260 |
| 32 | Equipment Packing/Transportation | $2,500 |
| 33 | Personnel Travel | $2,640 |
| 34 | Data Processing, Analysis, Interpretat | $33,120 |
| 35 | Report Preparation | $24,000 |

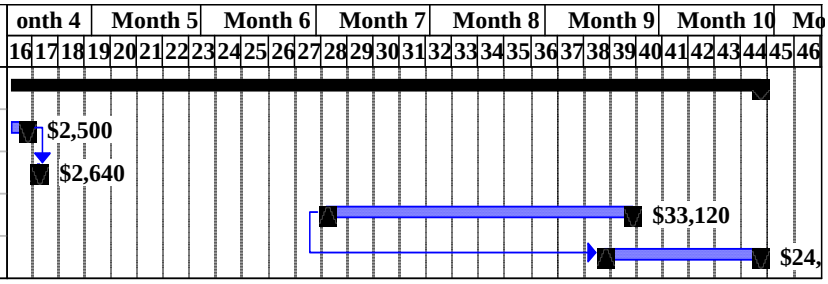



**Figure 80. Expected Post-Operational Phases Schedule for BFSD2 Deployment.**

The post-operational phase costs are largely the labor costs to process, analyze, interpret and report the results of the BFSD2 deployments. The costs are approximately the same regardless of the number of deployments as long as the sites have generally common geophysical and geochemical characteristics. The schedule is driven by the inactive period of time while awaiting results from laboratory analysis of the samples.

### 6.1.4 Alternative Methods

As discussed extensively in key reference 3, alternative sample collection methods to BFSD2's *in situ* collection and filtering of samples from the sediment-water diffusive interface are available. As with BFSD2, samples collected with alternative methods will require equivalent specialized laboratory analyses in order to determine contaminant flux rates. Those costs would be equivalent. Thus a direct comparison focusing on the method of sample collection is useful. Available alternate methods fall into two approaches, *ex situ* and *in situ*. Either of the approaches introduce error sources not present with BFSD2 and minimizing the affects of the error sources increases costs and complexity. Sample integrity becomes a significant factor. These issues aside, *ex situ* approaches can be as much as 50% cheaper for the field work, but this advantage quickly disappears with sediment processing costs. Alternative *In Situ* approaches, where applicable, may yield even greater savings than 50% for the field work, but careful consideration of the factors discussed below may discourage their use.

Both alternative approaches involve isolation of sediment pore water. With either approach, the primary source of error is the oxidation of anoxic pore water, which can significantly alter the aqueous phase trace metals. To prevent oxidation, samples must be processed and handled in an inert atmosphere, typically nitrogen or argon. *Ex Situ* methods typically first collect sediment samples which then require additional processing to extract pore water – requiring an inert atmosphere. Centrifuging or squeezing the sediment are accepted practices, but they too introduce error sources including solid-solution interactions. Sectioning samples prior to extraction to resolve sample depth for gradient determinations also adds cost and introduces errors. In addition, *Ex Situ* samplers must be rugged enough for field use yet provide isolation of the sediment sample from metal components. This is particularly difficult for dredging and grab sampling equipment however coring equipment can include non-metallic sleeves. Alternative *in situ* methods collect pore water samples at the sediment interface using either suction filtration techniques or dialysis. *In Situ* filtration techniques are limited to coarse grain sediments and do not offer depth resolution. Dialysis techniques incur minimum error sources, but suffer sample collection times as long as 20 days and produce small sample volumes. Periodic sample collection comparable to BFSD2 could require months, which in turn raises a number of additional issues.

# 7. Regulatory Issues

## 7.1 Approach to Regulatory Compliance and Acceptance

Regulatory acceptance has been a fundamental part of this project from the start and was included in the initial execution plan. The approach included application to the California Environmental Protection Agency (CA EPA), Department of Toxic Substances Control (DTSC) program known as "Cal Cert". A formal "Services Agreement" was signed with the State of California and funded for technology evaluation and certification services. In addition, CA EPA membership in the Interstate Technology and Regulatory Cooperation (ITRC) group of the Western Governors Association (WGA) and the resulting multi-state recognition of certified technologies by at least the 26 member states' environmental protection agencies promotes recognition and acceptance the BFSD2. Recognition and acceptance by the U.S. Environmental Protection Agency (US EPA), as well as private sector, Native American and foreign interests, is also promoted by their active participation in the ITRC. And, US EPA, state, local and private environmental professionals, as well as CA EPA evaluators were in attendance at field demonstrations, which included technology briefings and displays. Finally, certification by CA EPA includes public notifications and listings officially distributed to a wide range of recipients.

The Cal Cert application involved CA EPA review of the technology including background publications, reports, test and evaluation data, and a SSC SD site visit for technical discussions and equipment inspection. Due to the unique nature of the BFSD2 technology, a DTSC-wide search for a qualified lead technology evaluator was necessary to locate and secure the services needed for this project. Following acceptance of the Cal Cert application a performance claim was made by SSC SD After initial certification for metals, the CA Cert formal Services Agreement was amended to include organics applications. Additional funds to support their organics evaluation were provided also as amendments to previous documents.

The demonstrations performed for this project were key elements in the Cal Cert process. CA EPA evaluators reviewed the site selections, the test plans and attended the field demonstrations. Independent measurements, data review and analyses were accomplished by the CA EPA evaluators. Appendix F is the formal Cal Cert certificate and publicly released report. The Final Technology Evaluation report is listed in References, Section 10.

# 8. Technology Implementation

## 8.1 DoD Need

Sediments in many US bays and harbors are contaminated with potentially harmful metal and organic compounds. Contamination occurred directly through disposal of shipyard and shipboard waste, and indirectly through urban runoff and groundwater exchange with land sites. Federal, state and local regulatory agencies are in the process of adopting strict sediment quality criteria. These regulations represent a significant compliance issue for the DoD relative to discharge practices, dredging operations and clean-up techniques. Previous studies indicate that biological uptake, accumulation, and toxicity result primarily from the fraction of the toxicant pool that is readily solubilized. In surface sediments, the production of this soluble fraction will, in most cases, cause it to migrate through the pore water and across the sediment-water interface. Contaminated sediments at DoD sites pose a potential human health and ecological risk. Source control programs will not eliminate sediment contamination immediately because of the slow degradation and cycling processes that control many pollutants in these systems

For these reasons, benthic toxicant fluxes can provide a unique *in situ* indicator of bioavailability and hence an estimate of the potential for risk to human health or environmental harm. Using direct measurements, DoD can reduce the escalating costs of compliance and remediation of contaminated sediments by determining if the contamination poses a significant risk for remobilization. Quantifying the mobility of these in-place contaminants is an essential requirement for deciding the proper method of remediation. The complexity of marine sediment systems makes it very difficult to predict contaminant mobility by indirect methods. There is currently no other satisfactory direct means of quantifying the mobility of contaminants from marine sediments except the Benthic Flux Sampling Device (BFSD2 and its prototype version).

## 8.2 Transition

Technology transition of the BFSD2 is well underway. It consists of commercialization, regulatory acceptance, product improvement, and performance extension elements.

### 8.2.1 Commercialization

BFSD2 is a commercialized version of the prototype BFSD. The prototype BFSD was used during the Research, Development, Test and Evaluation (RDTE) phase of the program and was followed by fabrication of BFSD2 during the subsequent Acquisition phase. A Technical Data Package (TDP) and procurement package were generated to support a fixed-price, competitive contract solicitation for fabrication of a commercialized version of the prototype BFSD, called BFSD2. The winner, Ocean Sensors, Incorporated in San Diego, utilized commercial-off-the-shelf (COTS) and replaceable/repairable assemblies in meeting the requirements of the TDP.

#### 8.2.1.1 Cooperative Research and Development Agreement

A Cooperative Research and Development Agreement (CRADA) was negotiated with Ocean Sensors, Inc., however it was not formalized and consummated. The company suggested, and SSC SD agreed, that a formal CRADA would not promote its goals for producing additional systems for other customers in response to market demand. No conflicting intellectual property issues were identified with their strategy and the company is currently awaiting new orders.

### 8.2.2 Regulatory Acceptance

See Approach to Regulatory Compliance and Acceptance, Section 7.1.

### 8.2.3 Product Improvement

Both incremental and continuing product improvements have been included in technology implementation. New methods, processes and procedures applicable to the BFSD2 were evaluated for use as a result of problems, constraints or other drawbacks identified during operations.

#### 8.2.3.1 Incremental Product Improvements

Incremental improvements were implemented during the project, such as: reconfiguring the circulation pump for improved flow rate control: reconfiguring for *in situ* sample filtration using vacuum-filled collection bottles; installation of a insertion sensor subsystem to assure minimum sediment penetration; installation of a subsystem to inject sodium bromide into the collection chamber as a conservative tracer to facilitate more accurate volume determination. Care was taken to assure that such improvements did not invalidate ongoing certification efforts.

#### 8.2.3.2 Continuing Product Improvements

Continuing improvements were implemented during the project, such as: method, timing and location for collection of a suitable ambient water sample; numerous computational spreadsheet data reduction, processing and display improvements; numerous improvements for turnaround cleaning and preparation; processes and procedures to improve maintenance and minimize corrosion. Again, care was taken to assure that such improvements did not invalidate ongoing certification efforts.

# 9. Lessons Learned

## 9.1 Flexibility

This project has been relatively straight forward and trouble free. As with any multi-faceted program which involves a complex new technology, flexibility must be maintained in order to accommodate any number of emergent issues. Plans and schedules must flex to allow for changes. This project suffered delayed funding at several points, but plans were flexible enough to allow work around efforts which ultimately recovered schedule losses. Technical approaches must flex to allow for changes. This project benefited from a number of incremental and continuing product improvements which were accommodated within the technical approach without invalidating demonstration results.

## 9.2 Mother Nature

Earlier studies had forecast it and it was clear from demonstration results that contaminated sediments are non-homogeneous and are subject to influences involving benthic organisms, complex marine geochemistry, and other factors. Accommodation of differences between blank measurements made a few days apart and site measurements made a few feet apart were necessary.

## 9.3 Statistics

With consideration for the very low levels of contaminants being measured (parts per *billion* and lower!) metrics involving statistical methods were needed to put meaning to results. Accommodation for results in terms of probabilities and confidence levels must be made to tease out the true meaning of some flux measurements. All throughout, consistent and repeatable materials, processes and procedures were necessary to minimize their influence on true results.

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# Appendix A

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# Appendix B

## Spreadsheet Products for Each Demonstration

Bishop Point Combined - PAHs first 4 (Part 1)
Bishop Point Combined - PAHs first 4 (Part 2)
BP Organics Demo - PAHs (Part1)
BP Organics Demo - PAHs (Part1-First 4 Samples)
BP Organics Demo - PAHs (Part1-last 8 samples)
BP Organics Demo - PAHs (Part 2)
BP Organics Demo - PAHs (Part 2
BP Organics Demo - PAHs (Part 2
BP Organics Demo-PCBs
BP Organics Demo-Pesticides
PC Organics Demo - PAHs (Part1)
PC Organics Demo - PAHs (Part 2)
PC Organics Demo-PCBs
PC Organics Demo-Pesticides
BFSD2 Blank Tests (CA Cert)-Metals
BFSD2 Blank Tests- PAHs (CA Cert)
BFSD2 Blank Tests- PCBs (CA Cert)
BFSD2 Blank Tests- Pesticides (CA Cert)
BFSD2 PCD(All-CA Cert)
BFSD2 PCPD(All-CA Cert)
BFSD2 PHBP(All-CA Cert)
BFSD2 PHML(All-CA Cert)
Bishop Point Combined - Metals_1
Bishop Point Combined - PAHs (Part 1)
Bishop Point Combined - PAHs (Part 2)

# BFSD 2 Triplicate Blank Tests
# Copper

**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

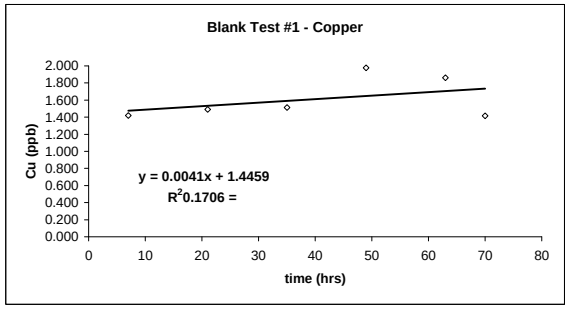
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

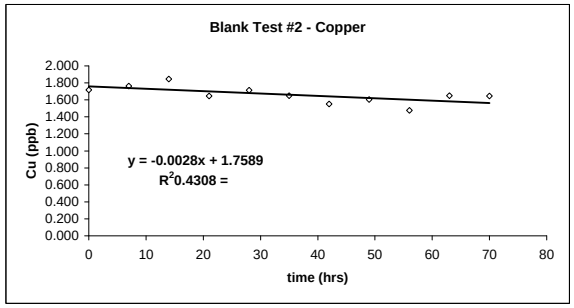
| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | $cm^2$ |

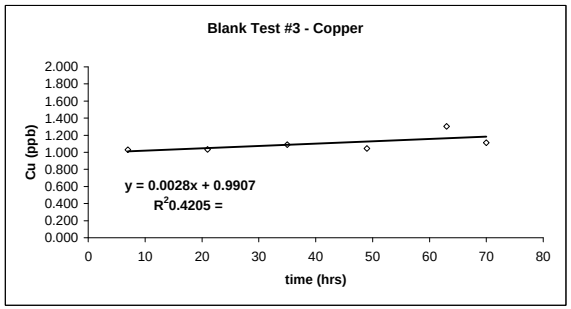
| Sample id | BFSD 2 Data: Measured Concentration (ppb)** | BFSD 2 Data: Sample No.* | BFSD 2 Data: Elapsed Time (hrs) | Dilution Correction: Measured Concentration (ppb)** | Dilution Correction: Corrected Concentration (ppb)** | Dilution Correction: # of Dilutions | From Regression Concentration (ppb)** |
|---|---|---|---|---|---|---|---|
| **Copper (Cu)** | | | | | | | |
| **Test #1** | | | | | | | |
| | 1.42 | T-#0 | | 1.420 | | | |
| **BT1-03** | 1.42 | #1 | 7 | 1.420 | 1.420 | 0 | 1.475 |
| **BT1-05** | 1.50 | #2 | 21 | 1.500 | 1.492 | 2 | 1.532 |
| **BT1-07** | 1.53 | #3 | 35 | 1.530 | 1.515 | 4 | 1.590 |
| **BT1-09** | 2.00 | #4 | 49 | 2.000 | 1.978 | 6 | 1.648 |
| **BT1-11** | 1.89 | #5 | 63 | 1.890 | 1.863 | 8 | 1.705 |
| **BT1-12** | 1.44 | #6 | 70 | 1.440 | 1.416 | 9 | 1.734 |
| **Test #2** | | | | | | | |
| **BT2-01** | 2.57 | T-#0 | -0.1 | 2.574 | | n/a | |
| **BT2-02** | 1.72 | #1 | 0 | 1.718 | 1.718 | 0 | 1.759 |
| **BT2-03** | 1.77 | #2 | 7 | 1.769 | 1.764 | 1 | 1.739 |
| **BT2-04** | 1.85 | #3 | 14 | 1.853 | 1.844 | 2 | 1.719 |
| **BT2-05** | 1.66 | #4 | 21 | 1.660 | 1.647 | 3 | 1.700 |
| **BT2-06** | 1.73 | #5 | 28 | 1.730 | 1.712 | 4 | 1.680 |
| **BT2-07** | 1.67 | #6 | 35 | 1.671 | 1.648 | 5 | 1.660 |
| **BT2-08** | 1.58 | #7 | 42 | 1.579 | 1.551 | 6 | 1.640 |
| **BT2-09** | 1.64 | #8 | 49 | 1.639 | 1.606 | 7 | 1.621 |
| **BT2-10** | 1.52 | #9 | 56 | 1.515 | 1.477 | 8 | 1.601 |
| **BT2-11** | 1.69 | #10 | 63 | 1.693 | 1.649 | 9 | 1.581 |
| **BT2-12** | 1.69 | #11 | 70 | 1.693 | 1.644 | 10 | 1.561 |
| **Test #3** | | | | | | | |
| | 1.03 | T-#0 | | 1.030 | | | |
| **BT3-02** | 1.03 | #1 | 7 | 1.030 | 1.030 | 0 | 1.010 |
| **BT3-04** | 1.04 | #2 | 21 | 1.040 | 1.034 | 2 | 1.049 |
| **BT3-06** | 1.10 | #3 | 35 | 1.102 | 1.091 | 4 | 1.087 |
| **BT3-08** | 1.06 | #4 | 49 | 1.063 | 1.047 | 6 | 1.126 |
| **BT3-10** | 1.33 | #5 | 63 | 1.326 | 1.304 | 8 | 1.164 |
| **BT3-12** | 1.14 | #6 | 70 | 1.140 | 1.114 | 10 | 1.184 |

**Linear Regression Statistics**

| Test #1 | | Test #2 | | Test #3 | |
|---|---|---|---|---|---|
| Regression Output: | | Regression Output: | | Regression Output: | |
| Constant | 1.446 | Constant | 1.759 | Constant | 0.991 |
| Std Err of Y Est | 0.211 | Std Err of Y Est | 0.045 | Std Err of Y Est | 0.075 |
| R Squared | 0.171 | R Squared | 0.431 | R Squared | 0.420 |
| No. of Observations | 6 | No. of Observations | 12 | No. of Observations | 6 |
| Degrees of Freedom | 4 | Degrees of Freedom | 4 | Degrees of Freedom | 4 |
| X Coefficient(s) | 0.004 | X Coefficient(s) | -0.003 | X Coefficient(s) | 0.003 |
| Std Err of Coef. | 0.005 | Std Err of Coef. | 0.001 | Std Err of Coef. | 0.002 |
| **Flux = 25 ug/m^2/day** | | **Flux = -17 ug/m^2/day** | | **Flux = 17 ug/m^2/day** | |
| 80% CI (low) = | **-17** $\mu g/m^2/day$ | 80% CI (low) = | **-27** $\mu g/m^2/day$ | 80% CI (low) = | **2** $\mu g/m^2/day$ |
| (high) = | **67** $\mu g/m^2/day$ | (high) = | **-7** $\mu g/m^2/day$ | (high) = | **32** $\mu g/m^2/day$ |



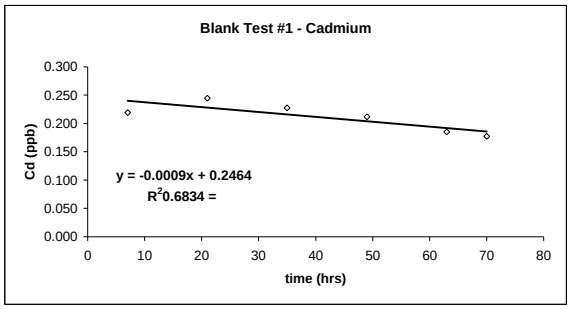
# BFSD 2 Triplicate Blank Tests
# Cadmium

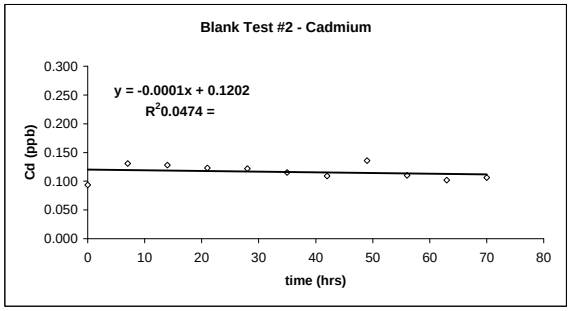
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

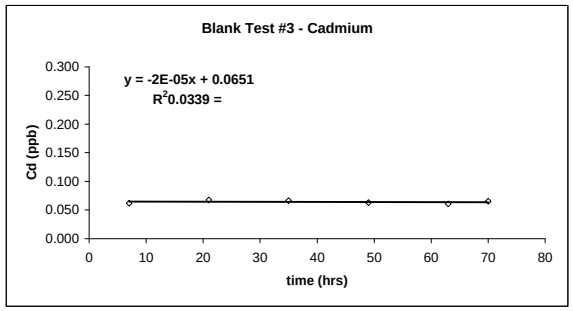
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | | |
| | | | | | | | | | | Bottle Volume = | 0.235 | liters |
| | | | | | | | | | | Blank Chamber Volume = | 42.97 | liters |
| | | | | | | | | | | Chamber Area = | 1701.4 | $cm^2$ |
| **Cadmium (Cd)** | | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | | |
| | 0.219 | T-#0 | | 0.219 | | | | Constant | 0.246 | | | |
| **BT1-03** | 0.219 | #1 | 7 | 0.219 | 0.219 | 0 | 0.240 | Std Err of Y Est | 0.014 | | | |
| **BT1-05** | 0.246 | #2 | 21 | 0.246 | 0.245 | 2 | 0.228 | R Squared | 0.683 | | | |
| **BT1-07** | 0.230 | #3 | 35 | 0.230 | 0.228 | 4 | 0.216 | No. of Observations | 6 | **Flux = -5.3 ug/m^2/day** | | |
| **BT1-09** | 0.215 | #4 | 49 | 0.215 | 0.212 | 6 | 0.204 | Degrees of Freedom | 4 | | | |
| **BT1-11** | 0.190 | #5 | 63 | 0.190 | 0.185 | 8 | 0.192 | | | 80% CI (low) = | **-8.0** | $\mu g/m^2/day$ |
| **BT1-12** | 0.182 | #6 | 70 | 0.182 | 0.177 | 9 | 0.186 | X Coefficient(s) | -0.001 | (high) = | **-2.5** | $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.000 | | | |
| **Test #2** | | | | | | | | Regression Output: | | | | |
| **BT2-01** | 0.0752 | T-#0 | -0.1 | 0.075 | | n/a | | Constant | 0.120 | | | |
| **BT2-02** | 0.0937 | #1 | 0 | 0.094 | 0.094 | 0 | 0.120 | Std Err of Y Est | 0.008 | | | |
| **BT2-03** | 0.131 | #2 | 7 | 0.131 | 0.131 | 1 | 0.119 | R Squared | 0.047 | | | |
| **BT2-04** | 0.128 | #3 | 14 | 0.128 | 0.128 | 2 | 0.118 | No. of Observations | 12 | **Flux = -0.7 ug/m^2/day** | | |
| **BT2-05** | 0.122 | #4 | 21 | 0.122 | 0.123 | 3 | 0.118 | Degrees of Freedom | 4 | | | |
| **BT2-06** | 0.121 | #5 | 28 | 0.121 | 0.122 | 4 | 0.117 | | | 80% CI (low) = | **-2.5** | $\mu g/m^2/day$ |
| **BT2-07** | 0.114 | #6 | 35 | 0.114 | 0.115 | 5 | 0.116 | X Coefficient(s) | 0.000 | (high) = | **1.0** | $\mu g/m^2/day$ |
| **BT2-08** | 0.108 | #7 | 42 | 0.108 | 0.109 | 6 | 0.115 | | | | | |
| **BT2-09** | 0.134 | #8 | 49 | 0.134 | 0.136 | 7 | 0.114 | | | | | |
| **BT2-10** | 0.108 | #9 | 56 | 0.108 | 0.110 | 8 | 0.113 | | | | | |
| **BT2-11** | 0.0998 | #10 | 63 | 0.100 | 0.102 | 9 | 0.112 | | | | | |
| **BT2-12** | 0.104 | #11 | 70 | 0.104 | 0.106 | 10 | 0.112 | | | | | |
| | | | | | | | | Std Err of Coef. | 0.000 | | | |
| **Test #3** | | | | | | | | Regression Output: | | | | |
| | 0.0622 | T-#0 | | 0.062 | | | | Constant | 0.065 | | | |
| **BT3-02** | 0.0622 | #1 | 7 | 0.062 | 0.062 | 0 | 0.065 | Std Err of Y Est | 0.002 | | | |
| **BT3-04** | 0.0679 | #2 | 21 | 0.068 | 0.068 | 2 | 0.065 | R Squared | 0.034 | | | |
| **BT3-06** | 0.0669 | #3 | 35 | 0.067 | 0.066 | 4 | 0.064 | No. of Observations | 6 | **Flux = -0.12 ug/m^2/day** | | |
| **BT3-08** | 0.0643 | #4 | 49 | 0.064 | 0.063 | 6 | 0.064 | Degrees of Freedom | 4 | | | |
| **BT3-10** | 0.0623 | #5 | 63 | 0.062 | 0.061 | 8 | 0.064 | | | 80% CI (low) = | **-0.59** | $\mu g/m^2/day$ |
| **BT3-12** | 0.0670 | #6 | 70 | 0.067 | 0.065 | 10 | 0.064 | X Coefficient(s) | 0.000 | (high) = | **0.36** | $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.000 | | | |



# BFSD 2 Triplicate Blank Tests
## Lead

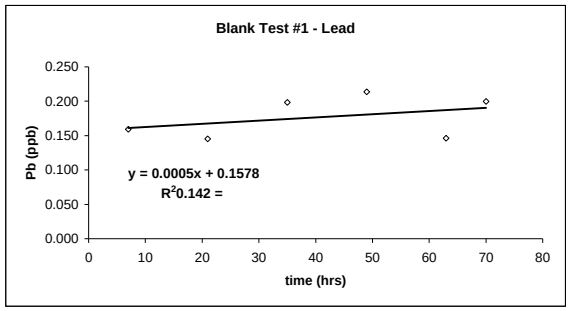
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

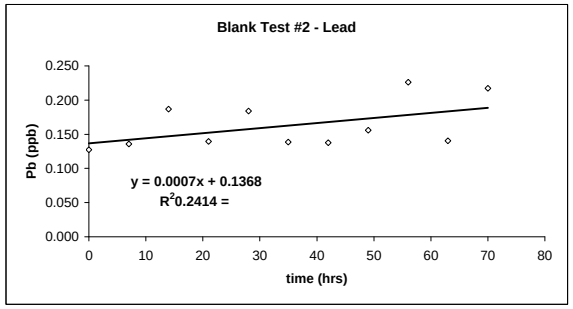
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

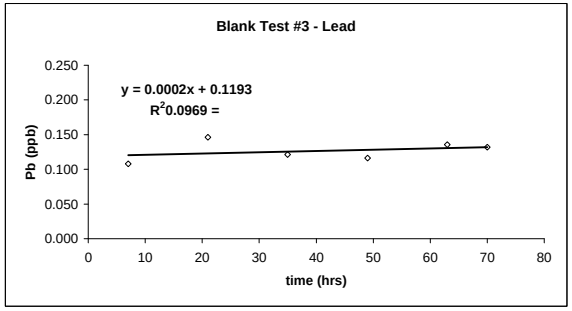
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | |
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | |
| **Lead (Pb)** | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | |
| | 0.159 | T-#0 | | 0.159 | | | | Constant | 0.158 | | |
| **BT1-03** | 0.159 | #1 | 7 | 0.159 | 0.159 | 0 | 0.161 | Std Err of Y Est | 0.027 | | |
| **BT1-05** | 0.146 | #2 | 21 | 0.146 | 0.145 | 2 | 0.168 | R Squared | 0.142 | | |
| **BT1-07** | 0.200 | #3 | 35 | 0.200 | 0.198 | 4 | 0.174 | No. of Observations | 6 | **Flux = 2.8 ug/m^2/day** | |
| **BT1-09** | 0.216 | #4 | 49 | 0.216 | 0.214 | 6 | 0.181 | Degrees of Freedom | 4 | | |
| **BT1-11** | 0.149 | #5 | 63 | 0.149 | 0.146 | 8 | 0.187 | | | 80% CI (low) = | **-2.5** µg/m$^2$/day |
| **BT1-12** | 0.203 | #6 | 70 | 0.203 | 0.200 | 9 | 0.191 | X Coefficient(s) | 0.000 | (high) = | **8.2** µg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.001 | | |
| **Test #2** | | | | | | | | Regression Output: | | | |
| **BT2-01** | 0.237 | T-#0 | -0.1 | 0.237 | | n/a | | Constant | 0.137 | | |
| **BT2-02** | 0.128 | #1 | 0 | 0.128 | 0.128 | 0 | 0.137 | Std Err of Y Est | 0.018 | | |
| **BT2-03** | 0.137 | #2 | 7 | 0.137 | 0.136 | 1 | 0.142 | R Squared | 0.241 | | |
| **BT2-04** | 0.188 | #3 | 14 | 0.188 | 0.187 | 2 | 0.147 | No. of Observations | 12 | **Flux = 4.5 ug/m^2/day** | |
| **BT2-05** | 0.141 | #4 | 21 | 0.141 | 0.140 | 3 | 0.152 | Degrees of Freedom | 4 | | |
| **BT2-06** | 0.186 | #5 | 28 | 0.186 | 0.184 | 4 | 0.158 | | | 80% CI (low) = | **0.4** µg/m$^2$/day |
| **BT2-07** | 0.141 | #6 | 35 | 0.141 | 0.138 | 5 | 0.163 | X Coefficient(s) | 0.001 | (high) = | **8.6** µg/m$^2$/day |
| **BT2-08** | 0.141 | #7 | 42 | 0.141 | 0.138 | 6 | 0.168 | | | | |
| **BT2-09** | 0.159 | #8 | 49 | 0.159 | 0.156 | 7 | 0.173 | | | | |
| **BT2-10** | 0.230 | #9 | 56 | 0.230 | 0.226 | 8 | 0.178 | | | | |
| **BT2-11** | 0.144 | #10 | 63 | 0.144 | 0.140 | 9 | 0.183 | | | | |
| **BT2-12** | 0.221 | #11 | 70 | 0.221 | 0.217 | 10 | 0.189 | | | | |
| | | | | | | | | Std Err of Coef. | 0.000 | | |
| **Test #3** | | | | | | | | Regression Output: | | | |
| | 0.108 | T-#0 | | 0.108 | | | | Constant | 0.119 | | |
| **BT3-02** | 0.108 | #1 | 7 | 0.108 | 0.108 | 0 | 0.121 | Std Err of Y Est | 0.013 | | |
| **BT3-04** | 0.147 | #2 | 21 | 0.147 | 0.146 | 2 | 0.123 | R Squared | 0.097 | | |
| **BT3-06** | 0.123 | #3 | 35 | 0.123 | 0.122 | 4 | 0.126 | No. of Observations | 6 | **Flux = 1.1 ug/m^2/day** | |
| **BT3-08** | 0.118 | #4 | 49 | 0.118 | 0.116 | 6 | 0.128 | Degrees of Freedom | 4 | | |
| **BT3-10** | 0.138 | #5 | 63 | 0.138 | 0.136 | 8 | 0.131 | | | 80% CI (low) = | **-1.5** µg/m$^2$/day |
| **BT3-12** | 0.134 | #6 | 70 | 0.134 | 0.132 | 10 | 0.132 | X Coefficient(s) | 0.000 | (high) = | **3.6** µg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.000 | | |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | cm$^2$ |



# BFSD 2 Triplicate Blank Tests
# Nickle

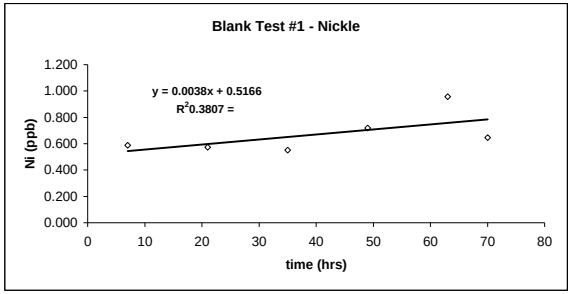
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

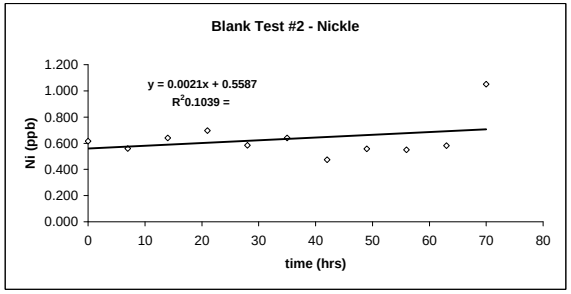
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

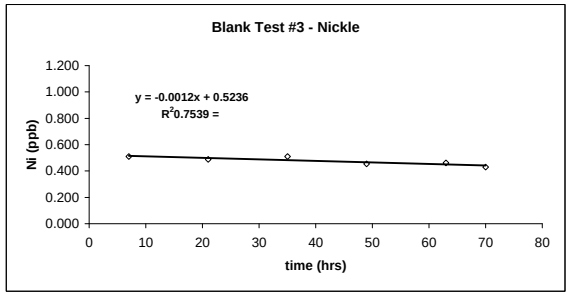
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | |
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | |
| **Nickle (Ni)** | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | |
| | 0.589 | T-#0 | | 0.589 | | | | Constant | 0.517 | | |
| **BT1-03** | 0.589 | #1 | 7 | 0.589 | 0.589 | 0 | 0.543 | Std Err of Y Est | 0.114 | | |
| **BT1-05** | 0.577 | #2 | 21 | 0.577 | 0.574 | 2 | 0.597 | R Squared | 0.381 | | |
| **BT1-07** | 0.559 | #3 | 35 | 0.559 | 0.552 | 4 | 0.651 | No. of Observations | 6 | **Flux = 23 ug/m^2/day** | |
| **BT1-09** | 0.730 | #4 | 49 | 0.730 | 0.720 | 6 | 0.705 | Degrees of Freedom | 4 | | |
| **BT1-11** | 0.970 | #5 | 63 | 0.970 | 0.958 | 8 | 0.758 | | | 80% CI (low) = | **1** μg/m$^2$/day |
| **BT1-12** | 0.657 | #6 | 70 | 0.657 | 0.647 | 9 | 0.785 | X Coefficient(s) | 0.004 | (high) = | **46** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.002 | | |
| **Test #2** | | | | | | | | Regression Output: | | | |
| **BT2-01** | 2.13 | T-#0 | -0.1 | 2.126 | | n/a | | Constant | 0.559 | | |
| **BT2-02** | 0.615 | #1 | 0 | 0.615 | 0.615 | 0 | 0.559 | Std Err of Y Est | 0.085 | | |
| **BT2-03** | 0.568 | #2 | 7 | 0.568 | 0.560 | 1 | 0.573 | R Squared | 0.104 | | |
| **BT2-04** | 0.658 | #3 | 14 | 0.658 | 0.641 | 2 | 0.588 | No. of Observations | 12 | **Flux = 13 ug/m^2/day** | |
| **BT2-05** | 0.721 | #4 | 21 | 0.721 | 0.696 | 3 | 0.603 | Degrees of Freedom | 4 | | |
| **BT2-06** | 0.618 | #5 | 28 | 0.618 | 0.585 | 4 | 0.617 | | | 80% CI (low) = | **-6** μg/m$^2$/day |
| **BT2-07** | 0.681 | #6 | 35 | 0.681 | 0.640 | 5 | 0.632 | X Coefficient(s) | 0.002 | (high) = | **32** μg/m$^2$/day |
| **BT2-08** | 0.523 | #7 | 42 | 0.523 | 0.474 | 6 | 0.647 | | | | |
| **BT2-09** | 0.614 | #8 | 49 | 0.614 | 0.556 | 7 | 0.661 | | | | |
| **BT2-10** | 0.617 | #9 | 56 | 0.617 | 0.551 | 8 | 0.676 | | | | |
| **BT2-11** | 0.656 | #10 | 63 | 0.656 | 0.582 | 9 | 0.691 | | | | |
| **BT2-12** | 1.13 | #11 | 70 | 1.134 | 1.052 | 10 | 0.705 | | | | |
| | | | | | | | | Std Err of Coef. | 0.002 | | |
| **Test #3** | | | | | | | | Regression Output: | | | |
| | 0.511 | T-#0 | | 0.511 | | | | Constant | 0.524 | | |
| **BT3-02** | 0.511 | #1 | 7 | 0.511 | 0.511 | 0 | 0.515 | Std Err of Y Est | 0.016 | | |
| **BT3-04** | 0.492 | #2 | 21 | 0.492 | 0.489 | 2 | 0.499 | R Squared | 0.754 | | |
| **BT3-06** | 0.516 | #3 | 35 | 0.516 | 0.510 | 4 | 0.483 | No. of Observations | 6 | **Flux = -7.1 ug/m^2/day** | |
| **BT3-08** | 0.462 | #4 | 49 | 0.462 | 0.454 | 6 | 0.466 | Degrees of Freedom | 4 | | |
| **BT3-10** | 0.474 | #5 | 63 | 0.474 | 0.462 | 8 | 0.450 | | | 80% CI (low) = | **-10.2** μg/m$^2$/day |
| **BT3-12** | 0.444 | #6 | 70 | 0.444 | 0.429 | 10 | 0.442 | X Coefficient(s) | -0.001 | (high) = | **-4.0** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.000 | | |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | cm$^2$ |



# BFSD 2 Triplicate Blank Tests
## Manganese

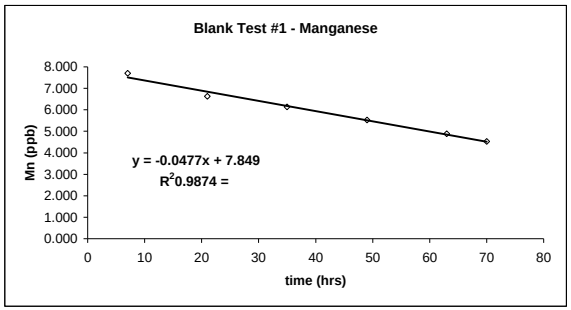
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

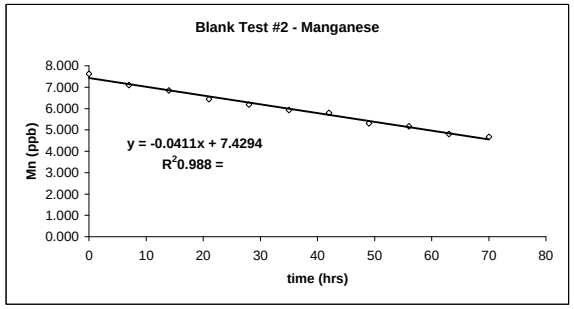
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

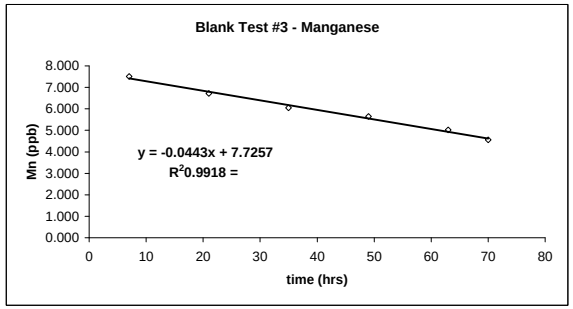
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | |
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | |
| **Manganese(Mn)** | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | |
| | 7.70 | T-#0 | | 7.700 | | | | Constant | 7.849 | | |
| **BT1-03** | 7.70 | #1 | 7 | 7.700 | 7.700 | 0 | 7.515 | Std Err of Y Est | 0.125 | | |
| **BT1-05** | 6.67 | #2 | 21 | 6.670 | 6.628 | 2 | 6.847 | R Squared | 0.987 | | |
| **BT1-07** | 6.23 | #3 | 35 | 6.230 | 6.140 | 4 | 6.179 | No. of Observations | 6 | **Flux = -289 ug/m^2/day** | |
| **BT1-09** | 5.66 | #4 | 49 | 5.660 | 5.520 | 6 | 5.512 | Degrees of Freedom | 4 | | |
| **BT1-11** | 5.08 | #5 | 63 | 5.080 | 4.887 | 8 | 4.844 | | | 80% CI (low) = | **-314** μg/m$^2$/day |
| **BT1-12** | 4.74 | #6 | 70 | 4.740 | 4.532 | 9 | 4.510 | X Coefficient(s) | -0.048 | (high) = | **-264** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.003 | | |
| **Test #2** | | | | | | | | Regression Output: | | | |
| **BT2-01** | 7.80 | T-#0 | -0.1 | 7.803 | | n/a | | Constant | 7.429 | | |
| **BT2-02** | 7.63 | #1 | 0 | 7.632 | 7.632 | 0 | 7.429 | Std Err of Y Est | 0.063 | | |
| **BT2-03** | 7.10 | #2 | 7 | 7.097 | 7.096 | 1 | 7.141 | R Squared | 0.988 | | |
| **BT2-04** | 6.85 | #3 | 14 | 6.854 | 6.849 | 2 | 6.853 | No. of Observations | 12 | **Flux = -249 ug/m^2/day** | |
| **BT2-05** | 6.45 | #4 | 21 | 6.454 | 6.444 | 3 | 6.565 | Degrees of Freedom | 4 | | |
| **BT2-06** | 6.20 | #5 | 28 | 6.198 | 6.181 | 4 | 6.277 | | | 80% CI (low) = | **-263** μg/m$^2$/day |
| **BT2-07** | 5.96 | #6 | 35 | 5.961 | 5.935 | 5 | 5.989 | X Coefficient(s) | -0.041 | (high) = | **-235** μg/m$^2$/day |
| **BT2-08** | 5.84 | #7 | 42 | 5.837 | 5.801 | 6 | 5.702 | | | | |
| **BT2-09** | 5.35 | #8 | 49 | 5.349 | 5.302 | 7 | 5.414 | | | | |
| **BT2-10** | 5.23 | #9 | 56 | 5.232 | 5.172 | 8 | 5.126 | | | | |
| **BT2-11** | 4.88 | #10 | 63 | 4.877 | 4.803 | 9 | 4.838 | | | | |
| **BT2-12** | 4.76 | #11 | 70 | 4.761 | 4.671 | 10 | 4.550 | | | | |
| | | | | | | | | Std Err of Coef. | 0.002 | | |
| **Test #3** | | | | | | | | Regression Output: | | | |
| | 7.50 | T-#0 | | 7.503 | | | | Constant | 7.726 | | |
| **BT3-02** | 7.50 | #1 | 7 | 7.503 | 7.503 | 0 | 7.416 | Std Err of Y Est | 0.094 | | |
| **BT3-04** | 6.76 | #2 | 21 | 6.762 | 6.721 | 2 | 6.795 | R Squared | 0.992 | | |
| **BT3-06** | 6.14 | #3 | 35 | 6.137 | 6.051 | 4 | 6.175 | No. of Observations | 6 | **Flux = -269 ug/m^2/day** | |
| **BT3-08** | 5.78 | #4 | 49 | 5.777 | 5.642 | 6 | 5.555 | Degrees of Freedom | 4 | | |
| **BT3-10** | 5.21 | #5 | 63 | 5.208 | 5.023 | 8 | 4.934 | | | 80% CI (low) = | **-287** μg/m$^2$/day |
| **BT3-12** | 4.80 | #6 | 70 | 4.797 | 4.558 | 10 | 4.624 | X Coefficient(s) | -0.044 | (high) = | **-250** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.002 | | |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | cm$^2$ |



# BFSD 2 Triplicate Blank Tests
# Zinc

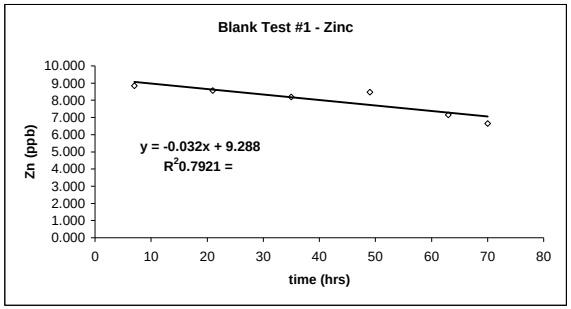
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

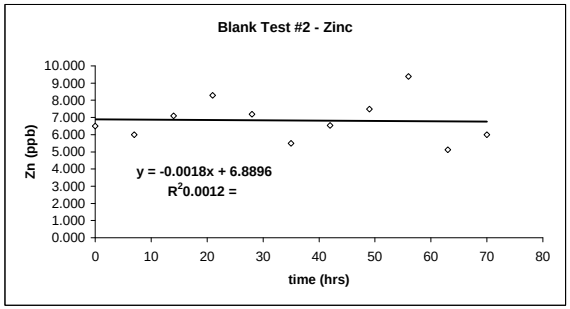
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

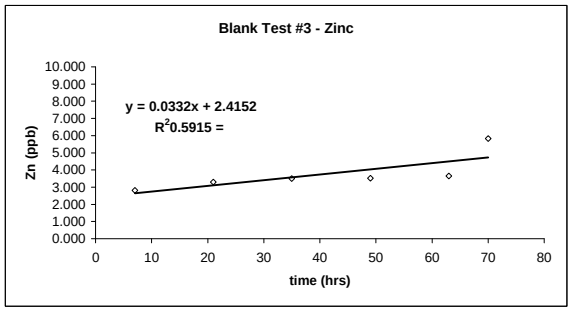
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | $cm^2$ |

| Sample id | BFSD 2 Data: Measured Concentration (ppb)** | BFSD 2 Data: Sample No.* | BFSD 2 Data: Elapsed Time (hrs) | Dilution Correction: Measured Concentration (ppb)** | Dilution Correction: Corrected Concentration (ppb)** | Dilution Correction: # of Dilutions | From Regression Concentration (ppb)** | Linear Regression Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Zinc (Zn)** | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | |
| | 8.85 | T-#0 | | 8.850 | | | | Constant | 9.288 | |
| **BT1-03** | 8.85 | #1 | 7 | 8.850 | 8.850 | 0 | 9.064 | Std Err of Y Est | 0.381 | |
| **BT1-05** | 8.61 | #2 | 21 | 8.610 | 8.562 | 2 | 8.617 | R Squared | 0.792 | |
| **BT1-07** | 8.30 | #3 | 35 | 8.300 | 8.202 | 4 | 8.169 | No. of Observations | 6 | **Flux = -194 ug/m^2/day** |
| **BT1-09** | 8.63 | #4 | 49 | 8.630 | 8.480 | 6 | 7.722 | Degrees of Freedom | 4 | |
| **BT1-11** | 7.35 | #5 | 63 | 7.350 | 7.151 | 8 | 7.274 | | | 80% CI (low) = **-270** $\mu g/m^2/day$ |
| **BT1-12** | 6.86 | #6 | 70 | 6.860 | 6.653 | 9 | 7.051 | X Coefficient(s) | -0.032 | (high) = **-118** $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.008 | |
| **Test #2** | | | | | | | | Regression Output: | | |
| **BT2-01** | 6.04 | T-#0 | -0.1 | 6.037 | | n/a | | Constant | 6.890 | |
| **BT2-02** | 6.50 | #1 | 0 | 6.497 | 6.497 | 0 | 6.890 | Std Err of Y Est | 0.742 | |
| **BT2-03** | 5.99 | #2 | 7 | 5.992 | 5.995 | 1 | 6.877 | R Squared | 0.001 | |
| **BT2-04** | 7.10 | #3 | 14 | 7.102 | 7.104 | 2 | 6.864 | No. of Observations | 12 | **Flux = -11 ug/m^2/day** |
| **BT2-05** | 8.28 | #4 | 21 | 8.276 | 8.284 | 3 | 6.851 | Degrees of Freedom | 4 | |
| **BT2-06** | 7.17 | #5 | 28 | 7.173 | 7.193 | 4 | 6.838 | | | 80% CI (low) = **-178** $\mu g/m^2/day$ |
| **BT2-07** | 5.46 | #6 | 35 | 5.460 | 5.487 | 5 | 6.825 | X Coefficient(s) | -0.002 | (high) = **155** $\mu g/m^2/day$ |
| **BT2-08** | 6.51 | #7 | 42 | 6.510 | 6.533 | 6 | 6.812 | | | |
| **BT2-09** | 7.46 | #8 | 49 | 7.458 | 7.484 | 7 | 6.799 | | | |
| **BT2-10** | 9.35 | #9 | 56 | 9.349 | 9.383 | 8 | 6.787 | | | |
| **BT2-11** | 5.06 | #10 | 63 | 5.064 | 5.116 | 9 | 6.774 | | | |
| **BT2-12** | 5.96 | #11 | 70 | 5.955 | 6.002 | 10 | 6.761 | | | |
| | | | | | | | | Std Err of Coef. | 0.018 | |
| **Test #3** | | | | | | | | Regression Output: | | |
| | 2.82 | T-#0 | | 2.817 | | | | Constant | 2.415 | |
| **BT3-02** | 2.82 | #1 | 7 | 2.817 | 2.817 | 0 | 2.647 | Std Err of Y Est | 0.641 | |
| **BT3-04** | 3.31 | #2 | 21 | 3.313 | 3.298 | 2 | 3.112 | R Squared | 0.592 | |
| **BT3-06** | 3.52 | #3 | 35 | 3.521 | 3.493 | 4 | 3.576 | No. of Observations | 6 | **Flux = 201 ug/m^2/day** |
| **BT3-08** | 3.56 | #4 | 49 | 3.558 | 3.518 | 6 | 4.040 | Degrees of Freedom | 4 | |
| **BT3-10** | 3.71 | #5 | 63 | 3.708 | 3.657 | 8 | 4.504 | | | 80% CI (low) = **73** $\mu g/m^2/day$ |
| **BT3-12** | 5.90 | #6 | 70 | 5.895 | 5.833 | 10 | 4.737 | X Coefficient(s) | 0.033 | (high) = **329** $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.014 | |



# BFSD 2 Triplicate Blank Tests
## Silica Dioxide

**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

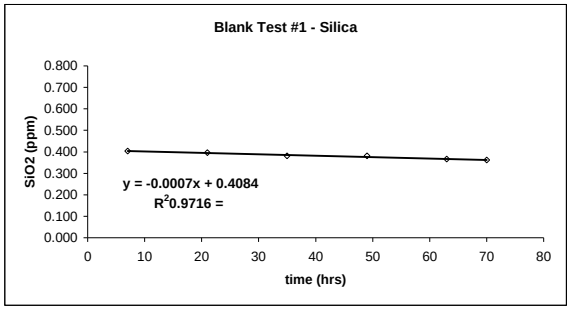
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

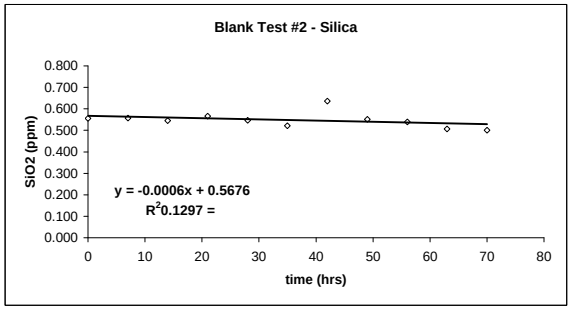
**Bottle Volume =** 0.235 liters
**Blank Chamber Volume =** 42.97 liters
**Chamber Area =** 1701.4 $cm^2$

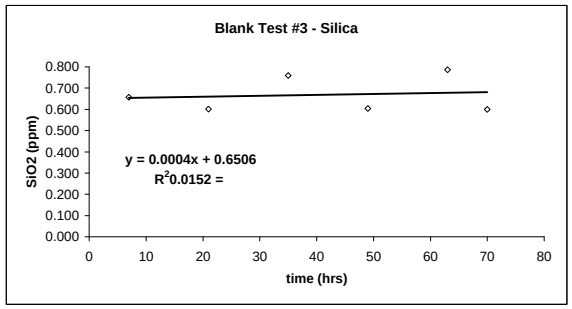
| Sample id | BFSD 2 Data: Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Dilution Correction: Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | From Regression Concentration (ppb)** |
|---|---|---|---|---|---|---|---|
| **Silica ($SiO_2$)** | **Concentrations are in ppm (mg/L) | | | | | | |
| **Test #1** | | | | | | | |
| | 0.403 | T-#0 | | 0.403 | | | |
| **BT1-03** | 0.403 | #1 | 7 | 0.403 | 0.403 | 0 | 0.404 |
| **BT1-05** | 0.398 | #2 | 21 | 0.398 | 0.396 | 2 | 0.395 |
| **BT1-07** | 0.386 | #3 | 35 | 0.386 | 0.382 | 4 | 0.386 |
| **BT1-09** | 0.388 | #4 | 49 | 0.388 | 0.381 | 6 | 0.376 |
| **BT1-11** | 0.376 | #5 | 63 | 0.376 | 0.367 | 8 | 0.367 |
| **BT1-12** | 0.371 | #6 | 70 | 0.371 | 0.362 | 9 | 0.363 |
| **Test #2** | | | | | | | |
| **BT2-01** | 0.581 | T-#0 | -0.1 | 0.581 | | n/a | |
| **BT2-02** | 0.556 | #1 | 0 | 0.556 | 0.556 | 0 | 0.568 |
| **BT2-03** | 0.557 | #2 | 7 | 0.557 | 0.557 | 1 | 0.564 |
| **BT2-04** | 0.545 | #3 | 14 | 0.545 | 0.545 | 2 | 0.560 |
| **BT2-05** | 0.566 | #4 | 21 | 0.566 | 0.566 | 3 | 0.556 |
| **BT2-06** | 0.548 | #5 | 28 | 0.548 | 0.547 | 4 | 0.552 |
| **BT2-07** | 0.523 | #6 | 35 | 0.523 | 0.522 | 5 | 0.548 |
| **BT2-08** | 0.638 | #7 | 42 | 0.638 | 0.637 | 6 | 0.544 |
| **BT2-09** | 0.552 | #8 | 49 | 0.552 | 0.551 | 7 | 0.540 |
| **BT2-10** | 0.540 | #9 | 56 | 0.540 | 0.539 | 8 | 0.536 |
| **BT2-11** | 0.508 | #10 | 63 | 0.508 | 0.507 | 9 | 0.532 |
| **BT2-12** | 0.503 | #11 | 70 | 0.503 | 0.501 | 10 | 0.528 |
| **Test #3** | | | | | | | |
| | 0.657 | T-#0 | | 0.657 | | | |
| **BT3-02** | 0.657 | #1 | 7 | 0.657 | 0.657 | 0 | 0.654 |
| **BT3-04** | 0.605 | #2 | 21 | 0.605 | 0.602 | 2 | 0.660 |
| **BT3-06** | 0.766 | #3 | 35 | 0.766 | 0.759 | 4 | 0.665 |
| **BT3-08** | 0.614 | #4 | 49 | 0.614 | 0.604 | 6 | 0.671 |
| **BT3-10** | 0.801 | #5 | 63 | 0.801 | 0.787 | 8 | 0.677 |
| **BT3-12** | 0.617 | #6 | 70 | 0.617 | 0.600 | 10 | 0.680 |

**Linear Regression Statistics**

| | | | | |
|---|---|---|---|---|
| **Test #1** Regression Output: | | | | |
| Constant | 0.408 | **Flux = -4.0 mg/m^2/day** | | |
| Std Err of Y Est | 0.003 | | | |
| R Squared | 0.972 | | | |
| No. of Observations | 6 | 80% CI (low) = | **-4.5** | $mg/m^2/day$ |
| Degrees of Freedom | 4 | (high) = | **-3.4** | $mg/m^2/day$ |
| X Coefficient(s) | -0.001 | | | |
| Std Err of Coef. | 0.000 | | | |
| **Test #2** Regression Output: | | | | |
| Constant | 0.568 | **Flux = -3.4 mg/m^2/day** | | |
| Std Err of Y Est | 0.020 | | | |
| R Squared | 0.130 | | | |
| No. of Observations | 12 | 80% CI (low) = | **-7.9** | $mg/m^2/day$ |
| Degrees of Freedom | 4 | (high) = | **1.1** | $mg/m^2/day$ |
| X Coefficient(s) | -0.001 | | | |
| Std Err of Coef. | 0.000 | | | |
| **Test #3** Regression Output: | | | | |
| Constant | 0.651 | **Flux = 2.6 mg/m^2/day** | | |
| Std Err of Y Est | 0.080 | | | |
| R Squared | 0.015 | | | |
| No. of Observations | 6 | 80% CI (low) = | **-13.3** | $mg/m^2/day$ |
| Degrees of Freedom | 4 | (high) = | **18.5** | $mg/m^2/day$ |
| X Coefficient(s) | 0.000 | | | |
| Std Err of Coef. | 0.002 | | | |



***BATTELLE MARINE SCIENCES LABORATORY***
1529 West Sequim Bay Road
Sequim, WA 98382-9099
360/681-3604

TETRA TECH
METALS IN SEAWATER
(Samples Received 6/3/98)

(concentrations in µg/L - not blank corrected)

| MSL Code | Sponsor ID | Sb | As | Cd | Cu | Pb | Mn | Ni | Se | Ag | Tl | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1225-2 | BFSD2-BT1-3 | 0.125 | 1.25 | 0.219 | 1.42 | 0.159 | 7.70 | 0.589 | 0.568 | 0.0120 | 0.0113 | 8.85 |
| 1225-4 | BFSD2-BT1-5 | 0.126 | 1.16 | 0.246 | 1.50 | 0.146 | 6.67 | 0.577 | 0.521 | 0.0151 | 0.0119 | 8.61 |
| 1225-6 | BFSD2-BT1-7 | 0.121 | 1.18 | 0.230 | 1.53 | 0.200 | 6.23 | 0.559 | 0.488 | 0.0181 | 0.0115 | 8.30 |
| 1225-8 | BFSD2-BT1-9 | 0.192 | 1.14 | 0.215 | 2.00 | 0.216 | 5.66 | 0.730 | 0.468 | 0.0120 | 0.0125 | 8.63 |
| 1225-10 | BFSD2-BT1-11 | 0.142 | 1.10 | 0.190 | 1.89 | 0.149 | 5.08 | 0.970 | 0.452 | 0.0722 | 0.0118 | 7.35 |
| 1225-11 | BFSD2-BT1-12 | 0.143 | 1.15 | 0.182 | 1.44 | 0.203 | 4.74 | 0.657 | 0.450 | 0.0181 | 0.0119 | 6.86 |
| 1225-12 | BFSD2-BT2-EB | 0.0168 | 0.00728 J | 0.0120 | 0.376 | 0.0998 | 0.664 J | 0.0522 J | 0.0351 J | 0.00903 | 0.000499 J | 3.32 |
| 1225-13 | BFSD2-BT2-SB | 0.0248 | 0.00745 J | 0.00750 | 0.169 | 4.33 | 0.689 J | 0.0729 J | 0.0248 J | 0.0120 | 0.00121 | 0.984 |
| 1225-14 | BFSD2-BT2-1 | 0.117 | 1.16 | 0.0752 | 2.57 | 0.237 | 7.80 | 2.13 | 0.372 | 0.00903 | 0.0109 | 6.04 |
| 1225-15 | BFSD2-BT2-2 | 0.127 | 1.13 | 0.0937 | 1.72 | 0.128 | 7.63 | 0.615 | 0.519 | 0.0151 | 0.0110 | 6.50 |
| 1225-16 | BFSD2-BT2-3 | 0.118 | 1.16 | 0.131 | 1.77 | 0.137 | 7.10 | 0.568 | 0.461 | 0.0181 | 0.0114 | 5.99 |
| 1225-17 | BFSD2-BT2-4 | 0.124 | 1.14 | 0.128 | 1.85 | 0.188 | 6.85 | 0.658 | 0.410 | 0.0181 | 0.0111 | 7.10 |
| 1225-18 | BFSD2-BT2-5 | 0.113 | 1.12 | 0.122 | 1.66 | 0.141 | 6.45 | 0.721 | 0.405 | 0.0181 | 0.0112 | 8.28 |
| 1225-19 | BFSD2-BT2-6 | 0.0770 | 1.15 | 0.121 | 1.73 | 0.186 | 6.20 | 0.618 | 0.443 | 0.0151 | 0.0116 | 7.17 |
| 1225-20 | BFSD2-BT2-7 | 0.0761 | 1.13 | 0.114 | 1.67 | 0.141 | 5.96 | 0.681 | 0.430 | 0.0120 | 0.0122 | 5.46 |
| 1225-21 | BFSD2-BT2-8 | 0.104 | 1.13 | 0.108 | 1.58 | 0.141 | 5.84 | 0.523 | 0.454 | 0.0151 | 0.0114 | 6.51 |
| 1225-22 | BFSD2-BT2-9 | 0.0551 | 1.09 | 0.134 | 1.64 | 0.159 | 5.35 | 0.614 | 0.427 | 0.0181 | 0.0117 | 7.46 |
| 1225-23 | BFSD2-BT2-10 | 0.0783 | 1.10 | 0.108 | 1.52 | 0.230 | 5.23 | 0.617 | 0.407 | 0.0181 | 0.0118 | 9.35 |
| 1225-24 | BFSD2-BT2-11 | 0.0689 | 1.16 | 0.0998 | 1.69 | 0.144 | 4.88 | 0.656 | 0.418 | 0.0120 | 0.0124 | 5.06 |
| 1225-25 | BFSD2-BT2-12 | 0.0807 | 1.09 | 0.104 | 1.69 | 0.221 | 4.76 | 1.13 | 0.349 | 0.0120 | 0.0123 | 5.96 |
| 1225-27 | BFSD2-BT3-2 | 0.0759 | 1.12 | 0.0622 | 1.03 | 0.108 | 7.50 | 0.511 | 0.453 | 0.0120 | 0.0113 | 2.82 |
| 1225-29 | BFSD2-BT3-4 | 0.0750 | 1.05 | 0.0679 | 1.04 | 0.147 | 6.76 | 0.492 | 0.341 | 0.00903 | 0.0118 | 3.31 |
| 1225-31 | BFSD2-BT3-6 | 0.130 | 1.03 | 0.0669 | 1.10 | 0.123 | 6.14 | 0.516 | 0.441 | 0.0151 | 0.0113 | 3.52 |
| 1225-33 | BFSD2-BT3-8 | 0.0867 | 1.14 | 0.0643 | 1.06 | 0.118 | 5.78 | 0.462 | 0.435 | 0.0120 | 0.0121 | 3.56 |
| 1225-35 | BFSD2-BT3-10 | 0.0612 | 1.12 | 0.0623 | 1.33 | 0.138 | 5.21 | 0.474 | 0.453 | 0.0120 | 0.0119 | 3.71 |
| 1225-37 | BFSD2-BT3-12 | 0.125 | 1.10 | 0.0670 | 1.14 | 0.134 | 4.80 | 0.444 | 0.373 | 0.0120 | 0.0112 | 5.90 |
| BLANKS | | | | | | | | | | | | |
| 1225-blk r1 | | 0.0158 | 0.0227 J | 0.000444 J | 0.0420 J | 0.00580 J | 0.510 J | 0.0165 J | 0.0529 J | 0.00903 | 0.00070 J | 0.119 J |
| 1225-blk r2 | | 0.0145 | 0.0180 J | 0.000611 J | 0.0395 J | 0.00800 | 0.596 J | 0.0178 J | 0.0212 J | 0.00602 | 0.00054 J | 0.140 J |
| Mean | | 0.0152 | 0.0204 J | 0.000528 J | 0.0407 J | 0.00690 | 0.553 J | 0.0171 J | 0.0371 J | 0.00753 | 0.00062 J | 0.130 J |
| DETECTION LIMIT | | 0.01 | 0.12 | 0.007 | 0.076 | 0.006 | 0.87 | 0.08 | 0.16 | 0.00532 | 0.001 | 0.66 |

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1529 West Sequim Bay Road
Sequim, WA 98382-9099
360/681-3604

TETRA TECH
METALS IN SEAWATER
(Samples Received 6/3/98)

(concentrations in µg/L - not blank corrected)

| MSL Code | Sponsor ID | Sb | As | Cd | Cu | Pb | Mn | Ni | Se | Ag | Tl | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLANK SPIKE RESULTS | | | | | | | | | | | | |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Mean Blank | | 0.0152 | 0.0204 | 0.00053 J | 0.0407 | 0.00690 | 0.553 | 0.0171 | 0.0371 | 0.00753 | 0.00062 J | 0.130 |
| Blank Spike | | 3.66 | 2.98 | 3.69 | 4.31 | 4.60 | 5.07 | 4.30 | 1.26 | 2.12 | 4.70 | 4.61 |
| Amount Recovered | | 3.64 | 2.96 | 3.69 | 4.27 | 4.59 | 4.52 | 4.29 | 1.22 | 2.11 | 4.69 | 4.48 |
| Percent Recovery | | 73% # | 59% # | 74% # | 85% | 92% | 90% | 86% | 24% # | 42% # | 94% | 90% |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Mean Blank | | 0.0152 | 0.0204 | 0.00053 J | 0.0407 | 0.00690 | 0.553 | 0.0171 | 0.0371 | 0.00753 | 0.00062 J | 0.130 |
| Blank Spike Dup | | 3.84 | 3.04 | 3.64 | 4.38 | 4.69 | 5.19 | 4.53 | 1.61 | 2.09 | 4.87 | 4.64 |
| Amount Recovered | | 3.83 | 3.01 | 3.63 | 4.34 | 4.68 | 4.64 | 4.51 | 1.57 | 2.08 | 4.87 | 4.51 |
| Percent Recovery | | 77% | 60% # | 73% # | 87% | 94% | 93% | 90% | 31% # | 42% # | 97% | 90% |
| RPD | | 5% | 2% | 1% | 2% | 2% | 3% | 5% | 25% | 1% | 4% | 1% |
| MATRIX SPIKE RESULTS | | | | | | | | | | | | |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 1225-24 | | 0.0689 | 1.16 | 0.0998 | 1.69 | 0.144 | 4.88 | 0.656 | 0.418 | 0.0120 | 0.0124 | 5.06 |
| 1225-24 MS | | 2.48 | 5.21 | 4.74 | 5.99 | 5.15 | 9.53 | 4.84 | 4.92 | 4.40 | 5.20 | 8.71 |
| Amount Recovered | | 2.41 | 4.05 | 4.64 | 4.29 | 5.00 | 4.66 | 4.18 | 4.50 | 4.39 | 5.19 | 3.64 |
| Percent Recovery | | 48% # | 81% | 93% | 86% | 100% | 93% | 84% | 90% | 88% | 104% | 73% # |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 1225-24 | | 0.0689 | 1.16 | 0.0998 | 1.69 | 0.144 | 4.88 | 0.656 | 0.418 | 0.0120 | 0.0124 | 5.06 |
| 1225-24 MSD | | 3.12 | 5.30 | 4.74 | 5.93 | 5.17 | 9.58 | 4.89 | 4.97 | 4.44 | 5.18 | 8.56 |
| Amount Recovered | | 3.05 | 4.14 | 4.64 | 4.24 | 5.02 | 4.71 | 4.24 | 4.55 | 4.43 | 5.17 | 3.50 |
| Percent Recovery | | 61% # | 83% | 93% | 85% | 100% | 94% | 85% | 91% | 89% | 103% | 70% # |
| RPD | | 24% | 2% | 0% | 1% | 0% | 1% | 1% | 1% | 1% | 0% | 4% |

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Sequim, WA 98382-9099
360/681-3604

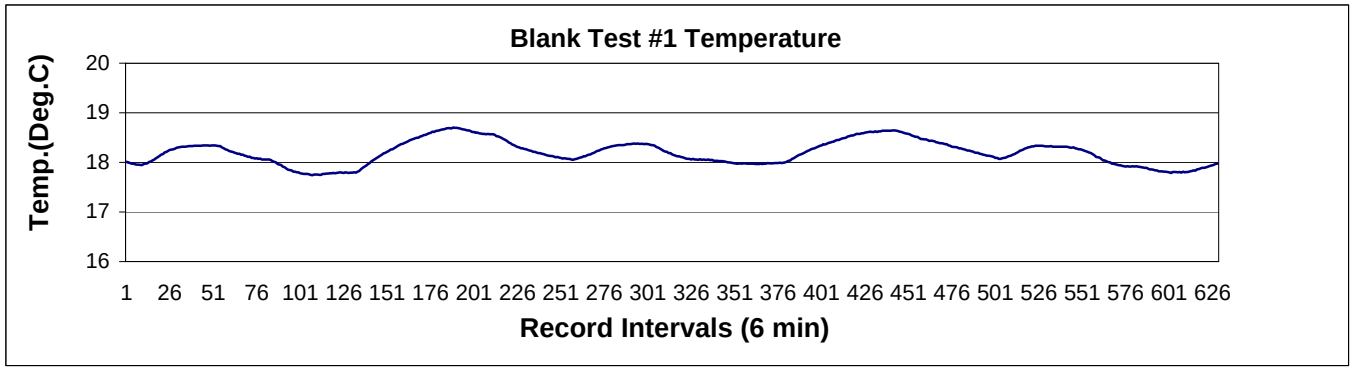
TETRA TECH
METALS IN SEAWATER
(Samples Received 6/3/98)

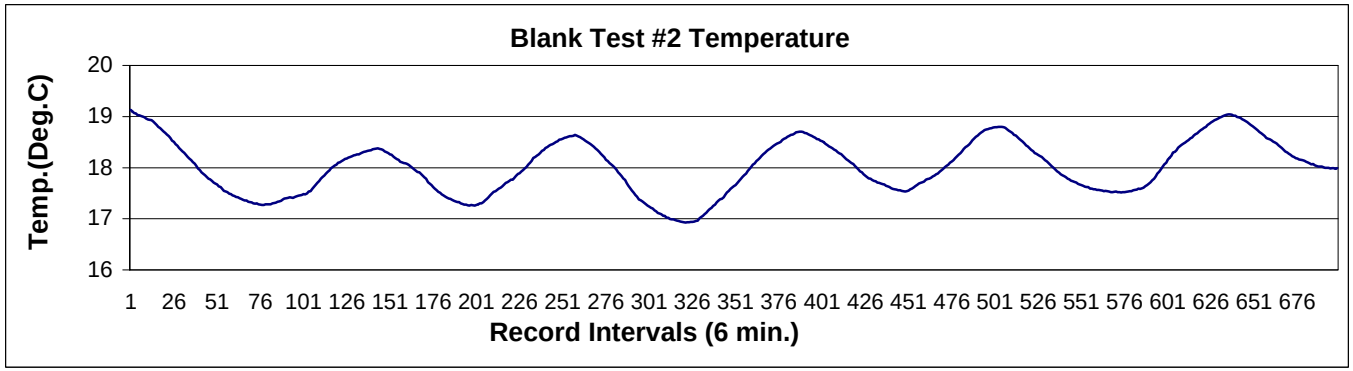
(concentrations in µg/L - not blank corrected)

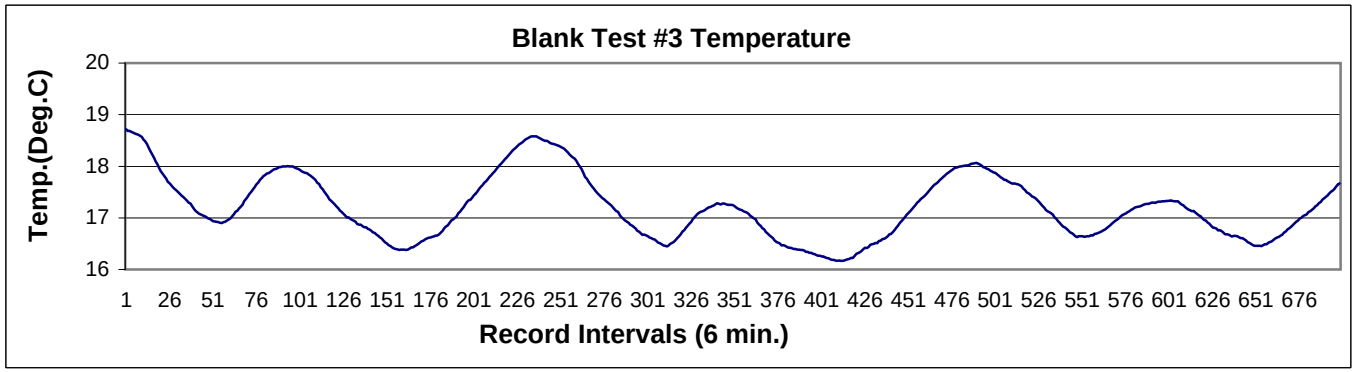
| MSL Code | Sponsor ID | Sb | As | Cd | Cu | Pb | Mn | Ni | Se | Ag | Tl | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STANDARD REFERENCE MATERIAL | | | | | | | | | | | | |
| cass3 r1 | | 0.139 | 0.975 | 0.0339 | 0.550 | 0.0230 | 3.10 | 0.417 | 0.441 | 0.0120 | 0.0127 | 1.25 |
| cass3 r2 | | 0.112 | 0.961 | 0.0345 | 0.529 | 0.0230 | 3.03 | 0.400 | 0.404 | 0.0120 | 0.0119 | 1.21 |
| | certified value | NC | 1.09 | 0.030 | 0.517 | 0.0120 | 2.51 | 0.386 | 0.042 r | NC | NC | 1.24 |
| | range | | ±0.07 | ±0.005 | ±0.062 | ±0.004 | ±0.36 | ±0.062 | | | | ±0.25 |
| | percent difference | NA | 11% | 13% | 6% | 91% # | 23% | 8% | NA | NA | NA | 1% |
| | | NA | 12% | 15% | 2% | 91% # | 21% | 4% | NA | NA | NA | 2% |

| | |
|---|---|
| # | Outside QA limits of ±25% |
| r | Reference value only; not certified |
| J | Value reported is below DL shown |
| NA | Not available/applicable |
| NC | Not certified |
| RPD | Relative percent difference |

# BFSD 2
# Triplicate Blank Tests
# Temperature

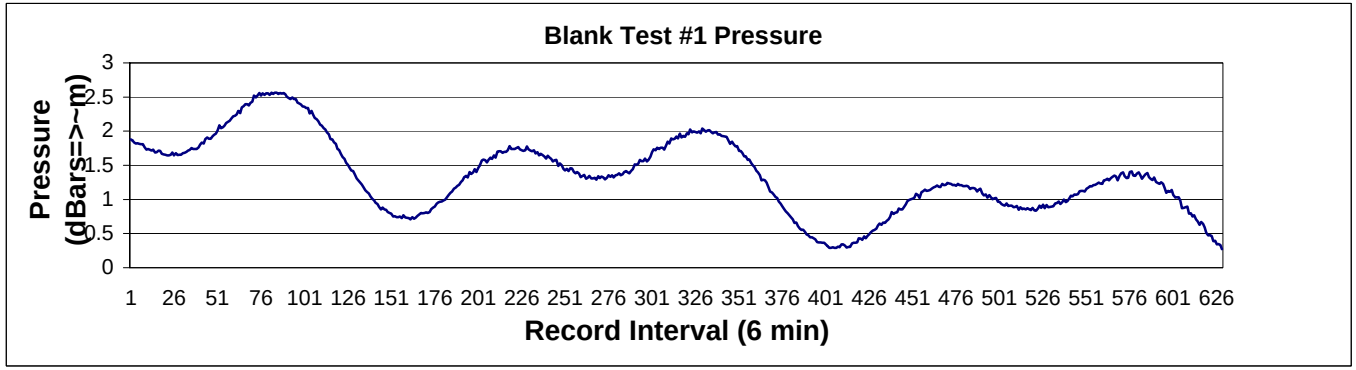


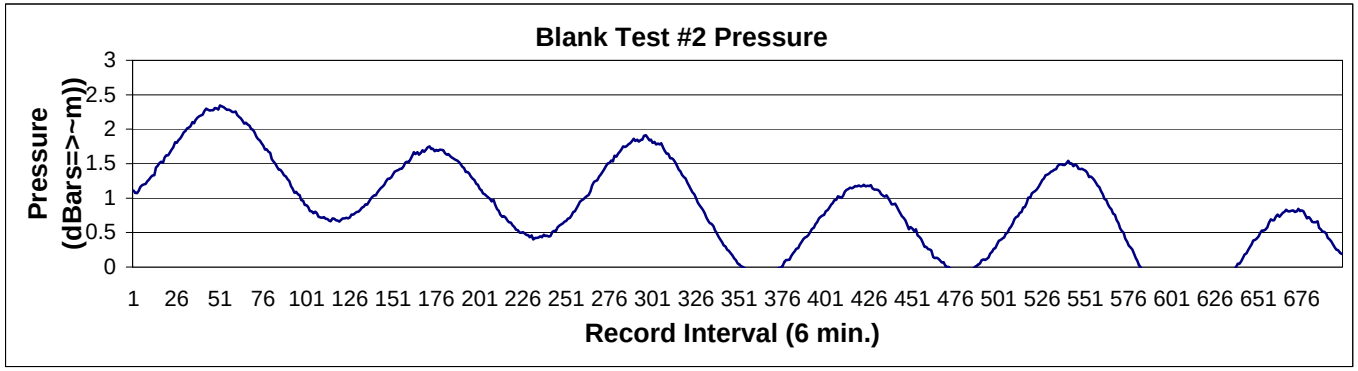



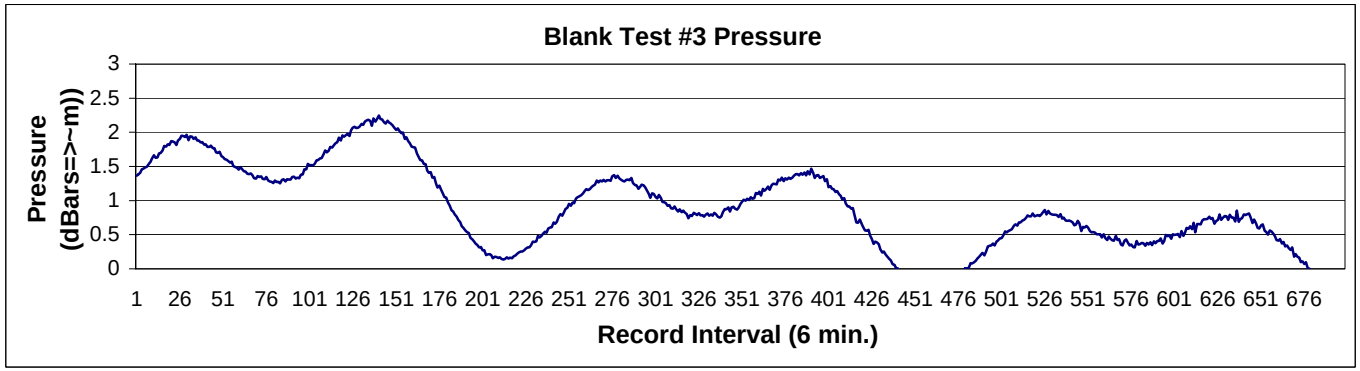



# BFSD 2
# Triplicate BlankTests
# Pressure

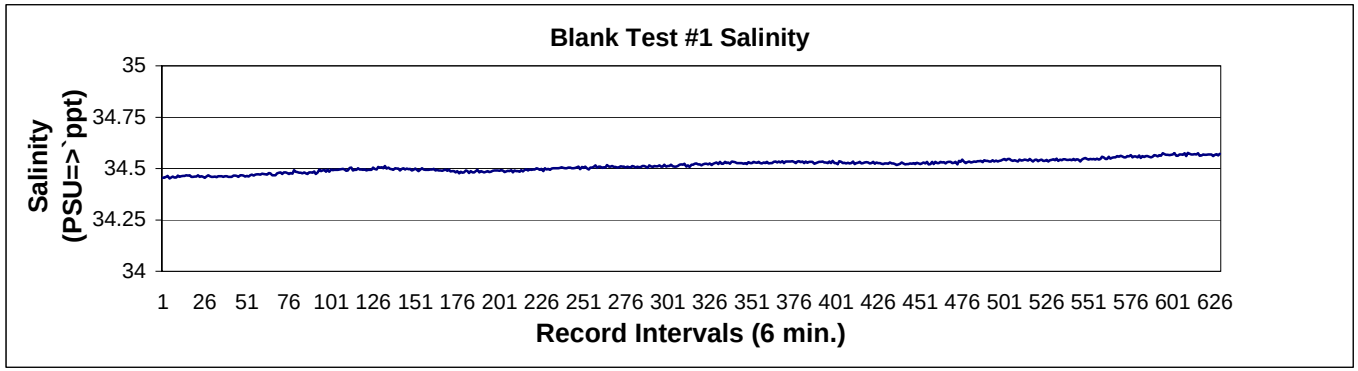
Note: Allow for (faulty) sensor drift
(subsequently corrected)

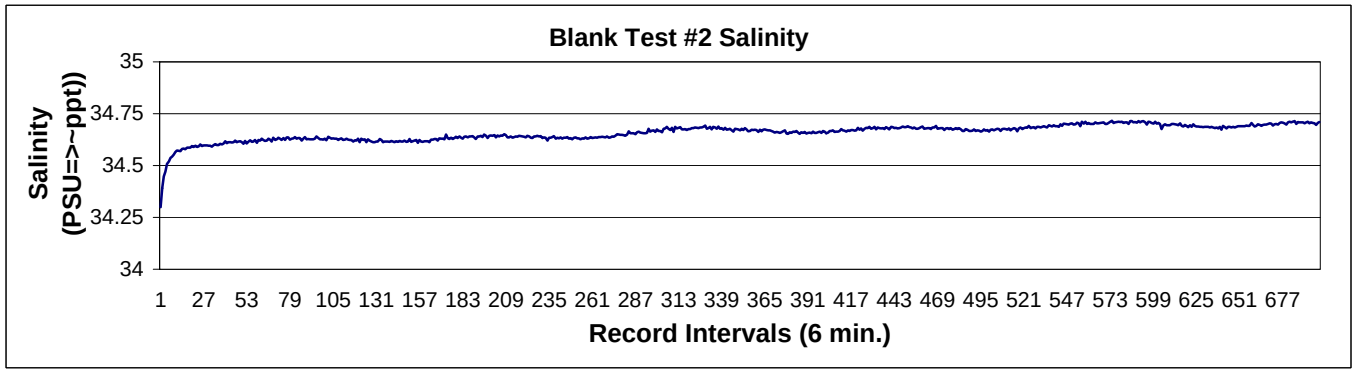


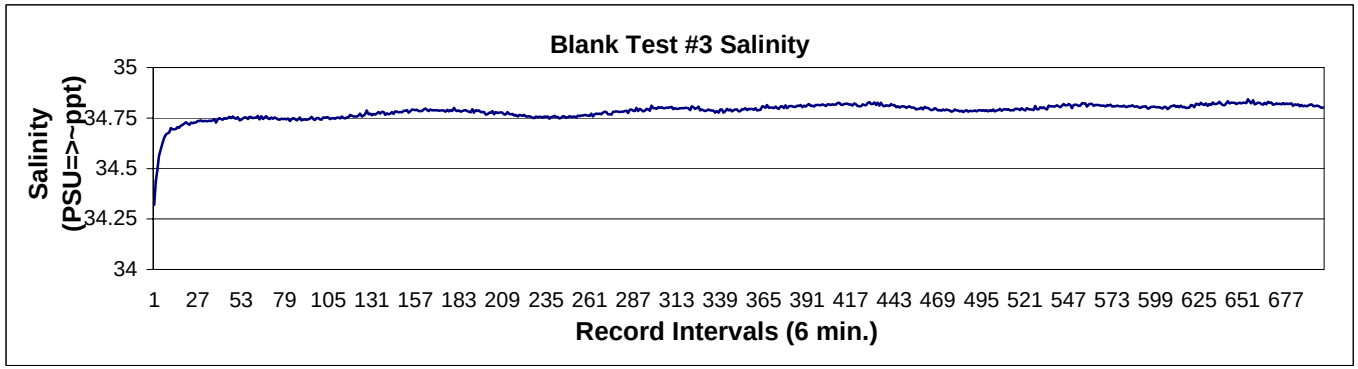



# BFSD 2
# Triplicate BlankTests
# Salinity

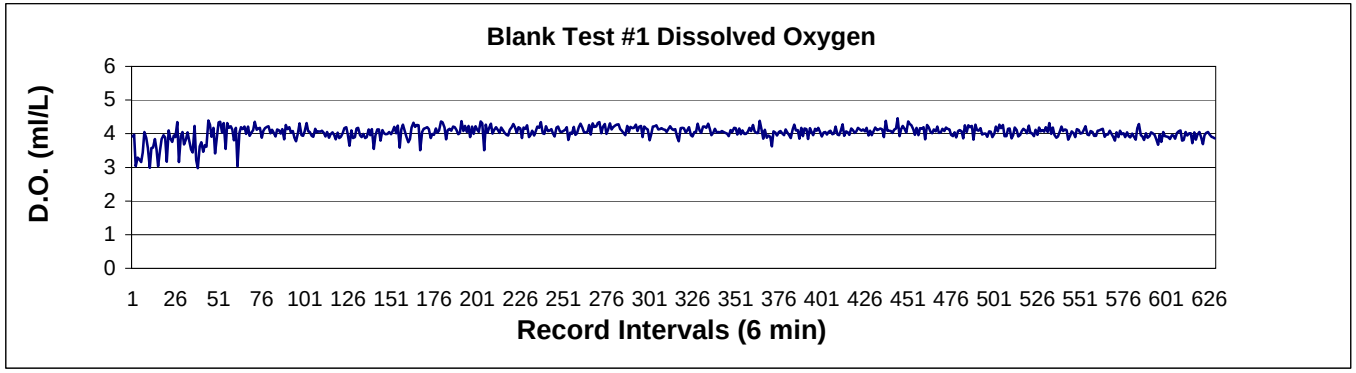


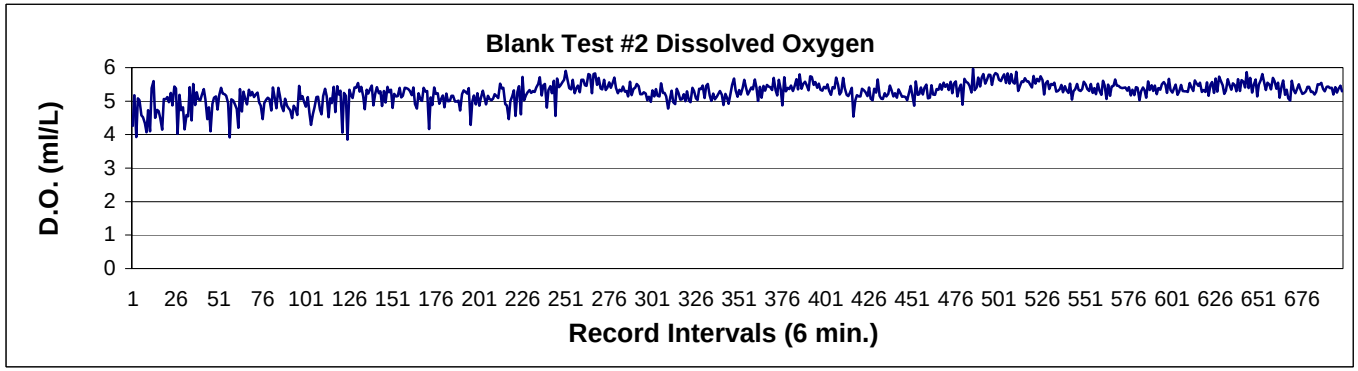



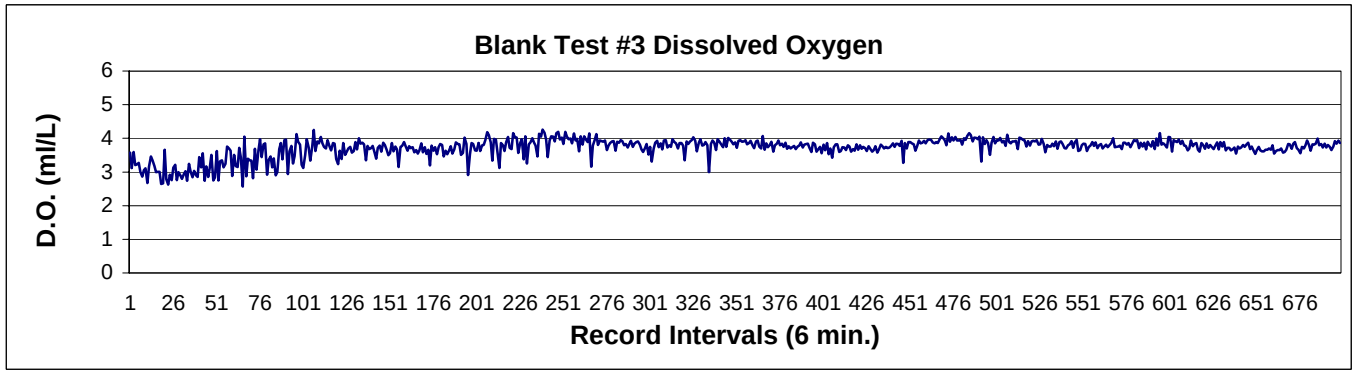



# BFSD 2
# Triplicate BlankTests
# Dissolved Oxygen

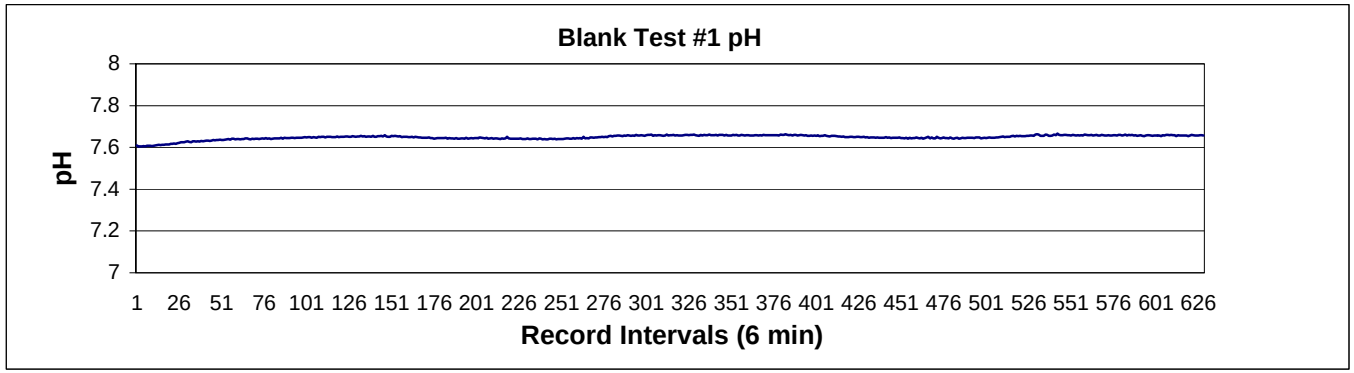
Note: "Noisey" traces due to restricted flow over sensor (subsequently corrected)

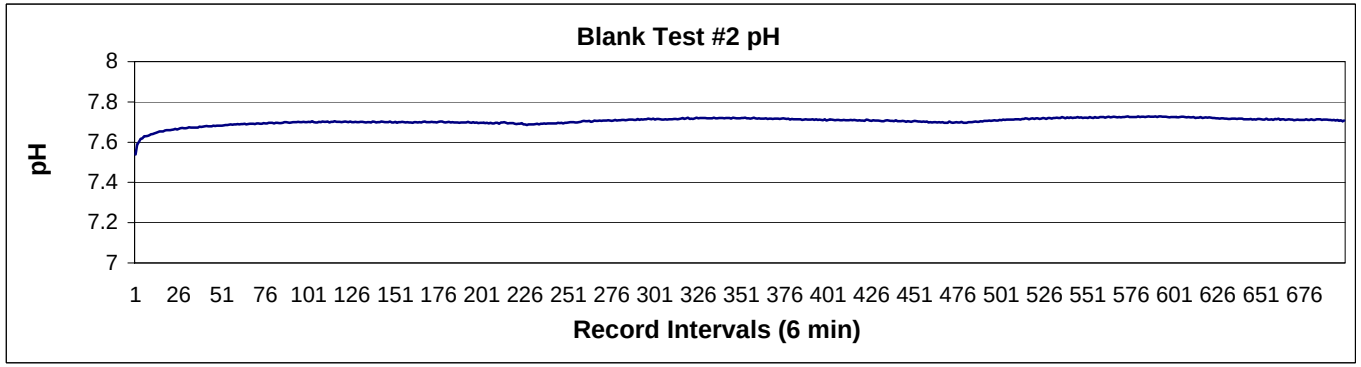


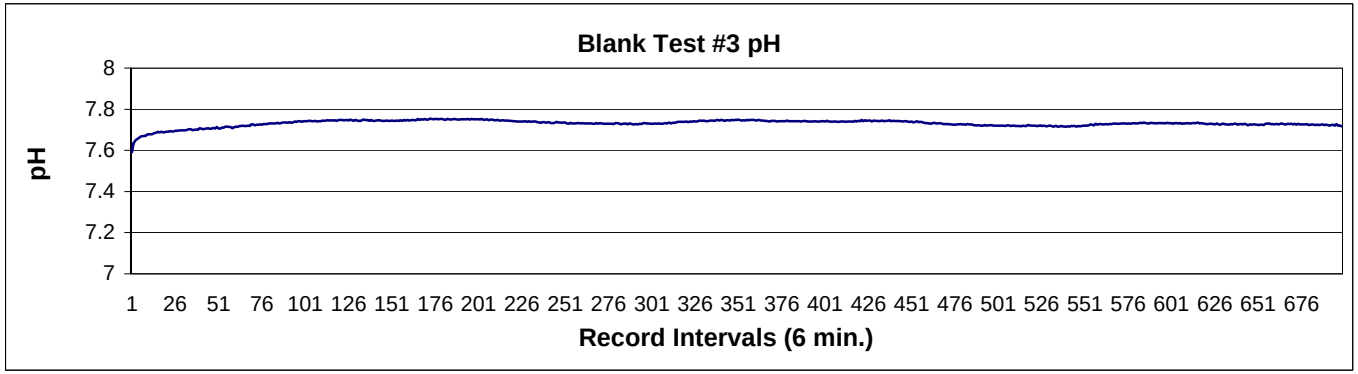



# BFSD 2
# Triplicate BlankTests
# pH



# Blank Test #1 Sensor Data

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45.276 | 18.011 | 1.881 | 34.455 | 13.262 | 2339916 | 2456346 | 5/14/1998 | 14:34:30.70 | 3.917 | 7.610 |
| 2 | 45.265 | 17.998 | 1.866 | 34.457 | 13.312 | 2346641 | 2455075 | 5/14/1998 | 14:40:31.49 | 3.963 | 7.605 |
| 3 | 45.255 | 17.986 | 1.834 | 34.459 | 13.325 | 2211156 | 2455165 | 5/14/1998 | 14:46:32.28 | 3.034 | 7.605 |
| 4 | 45.248 | 17.972 | 1.817 | 34.464 | 13.334 | 2248927 | 2455032 | 5/14/1998 | 14:52:33.07 | 3.293 | 7.604 |
| 5 | 45.233 | 17.971 | 1.823 | 34.452 | 13.337 | 2241082 | 2455530 | 5/14/1998 | 14:58:33.86 | 3.239 | 7.607 |
| 6 | 45.227 | 17.96 | 1.813 | 34.457 | 13.342 | 2228945 | 2455191 | 5/14/1998 | 15:04:34.65 | 3.156 | 7.605 |
| 7 | 45.225 | 17.953 | 1.811 | 34.461 | 13.342 | 2270518 | 2455686 | 5/14/1998 | 15:10:35.44 | 3.441 | 7.607 |
| 8 | 45.222 | 17.955 | 1.808 | 34.457 | 13.344 | 2359142 | 2455926 | 5/14/1998 | 15:16:36.23 | 4.049 | 7.608 |
| 9 | 45.212 | 17.947 | 1.769 | 34.456 | 13.309 | 2333397 | 2455695 | 5/14/1998 | 15:22:37.02 | 3.873 | 7.607 |
| 10 | 45.223 | 17.946 | 1.731 | 34.466 | 13.334 | 2290483 | 2455503 | 5/14/1998 | 15:28:37.81 | 3.578 | 7.606 |
| 11 | 45.236 | 17.967 | 1.738 | 34.459 | 13.339 | 2204401 | 2455996 | 5/14/1998 | 15:34:38.60 | 2.987 | 7.609 |
| 12 | 45.245 | 17.971 | 1.73 | 34.463 | 13.34 | 2289578 | 2456336 | 5/14/1998 | 15:40:39.39 | 3.572 | 7.610 |
| 13 | 45.257 | 17.982 | 1.715 | 34.464 | 13.342 | 2291758 | 2456695 | 5/14/1998 | 15:46:40.18 | 3.587 | 7.612 |
| 14 | 45.279 | 18.004 | 1.73 | 34.464 | 13.343 | 2328554 | 2456877 | 5/14/1998 | 15:52:40.97 | 3.839 | 7.612 |
| 15 | 45.295 | 18.017 | 1.686 | 34.467 | 13.345 | 2284263 | 2456437 | 5/14/1998 | 15:58:41.76 | 3.535 | 7.610 |
| 16 | 45.317 | 18.041 | 1.69 | 34.465 | 13.345 | 2211735 | 2456885 | 5/14/1998 | 16:04:42.55 | 3.038 | 7.612 |
| 17 | 45.335 | 18.057 | 1.715 | 34.467 | 13.346 | 2279745 | 2456945 | 5/14/1998 | 16:10:43.34 | 3.504 | 7.613 |
| 18 | 45.356 | 18.087 | 1.709 | 34.46 | 13.346 | 2328233 | 2457334 | 5/14/1998 | 16:16:44.13 | 3.837 | 7.614 |
| 19 | 45.375 | 18.106 | 1.668 | 34.46 | 13.345 | 2346193 | 2457414 | 5/14/1998 | 16:22:44.92 | 3.960 | 7.615 |
| 20 | 45.401 | 18.131 | 1.661 | 34.461 | 13.348 | 2335558 | 2457412 | 5/14/1998 | 16:28:45.71 | 3.887 | 7.615 |
| 21 | 45.422 | 18.152 | 1.657 | 34.461 | 13.346 | 2230192 | 2458049 | 5/14/1998 | 16:34:46.50 | 3.164 | 7.617 |
| 22 | 45.447 | 18.17 | 1.646 | 34.467 | 13.347 | 2365600 | 2458046 | 5/14/1998 | 16:40:47.29 | 4.094 | 7.617 |
| 23 | 45.47 | 18.203 | 1.647 | 34.459 | 13.347 | 2332186 | 2458176 | 5/14/1998 | 16:46:48.08 | 3.864 | 7.618 |
| 24 | 45.488 | 18.216 | 1.654 | 34.463 | 13.347 | 2316255 | 2458154 | 5/14/1998 | 16:52:48.87 | 3.755 | 7.618 |
| 25 | 45.502 | 18.235 | 1.687 | 34.459 | 13.346 | 2343800 | 2458859 | 5/14/1998 | 16:58:49.66 | 3.944 | 7.621 |
| 26 | 45.511 | 18.249 | 1.646 | 34.455 | 13.346 | 2337673 | 2458981 | 5/14/1998 | 17:04:50.45 | 3.902 | 7.621 |
| 27 | 45.528 | 18.258 | 1.676 | 34.461 | 13.346 | 2402169 | 2459741 | 5/14/1998 | 17:10:51.24 | 4.345 | 7.625 |
| 28 | 45.541 | 18.263 | 1.648 | 34.468 | 13.345 | 2229313 | 2459899 | 5/14/1998 | 17:16:52.03 | 3.158 | 7.625 |
| 29 | 45.551 | 18.28 | 1.656 | 34.463 | 13.328 | 2341141 | 2459764 | 5/14/1998 | 17:22:52.82 | 3.926 | 7.625 |
| 30 | 45.563 | 18.295 | 1.657 | 34.46 | 13.336 | 2359001 | 2460457 | 5/14/1998 | 17:28:53.61 | 4.048 | 7.628 |
| 31 | 45.566 | 18.3 | 1.68 | 34.459 | 13.34 | 2305131 | 2460661 | 5/14/1998 | 17:34:54.40 | 3.679 | 7.629 |
| 32 | 45.577 | 18.309 | 1.682 | 34.461 | 13.339 | 2327314 | 2460177 | 5/14/1998 | 17:40:55.19 | 3.831 | 7.627 |
| 33 | 45.579 | 18.314 | 1.698 | 34.458 | 13.34 | 2357361 | 2459776 | 5/14/1998 | 17:46:55.98 | 4.037 | 7.625 |
| 34 | 45.586 | 18.316 | 1.714 | 34.462 | 13.339 | 2323358 | 2460836 | 5/14/1998 | 17:52:56.77 | 3.804 | 7.629 |
| 35 | 45.587 | 18.318 | 1.726 | 34.462 | 13.339 | 2282749 | 2460833 | 5/14/1998 | 17:58:57.56 | 3.525 | 7.629 |
| 36 | 45.593 | 18.322 | 1.752 | 34.463 | 13.34 | 2271057 | 2460620 | 5/14/1998 | 18:04:58.35 | 3.445 | 7.629 |
| 37 | 45.593 | 18.327 | 1.739 | 34.459 | 13.34 | 2386149 | 2460929 | 5/14/1998 | 18:10:59.14 | 4.235 | 7.630 |
| 38 | 45.6 | 18.329 | 1.737 | 34.463 | 13.339 | 2237429 | 2460319 | 5/14/1998 | 18:16:59.93 | 3.214 | 7.627 |
| 39 | 45.6 | 18.329 | 1.739 | 34.463 | 13.338 | 2202846 | 2460996 | 5/14/1998 | 18:23:00.72 | 2.977 | 7.630 |
| 40 | 45.602 | 18.336 | 1.763 | 34.459 | 13.339 | 2296880 | 2460929 | 5/14/1998 | 18:29:01.51 | 3.622 | 7.630 |
| 41 | 45.605 | 18.338 | 1.804 | 34.46 | 13.339 | 2314948 | 2461308 | 5/14/1998 | 18:35:02.30 | 3.746 | 7.632 |
| 42 | 45.604 | 18.336 | 1.831 | 34.46 | 13.338 | 2273005 | 2461633 | 5/14/1998 | 18:41:03.09 | 3.458 | 7.633 |
| 43 | 45.607 | 18.333 | 1.82 | 34.466 | 13.336 | 2302834 | 2461552 | 5/14/1998 | 18:47:03.88 | 3.663 | 7.633 |
| 44 | 45.609 | 18.335 | 1.883 | 34.465 | 13.337 | 2295581 | 2461217 | 5/14/1998 | 18:53:04.67 | 3.613 | 7.631 |
| 45 | 45.612 | 18.339 | 1.906 | 34.464 | 13.337 | 2409399 | 2461591 | 5/14/1998 | 18:59:05.46 | 4.394 | 7.633 |
| 46 | 45.611 | 18.345 | 1.888 | 34.459 | 13.336 | 2391571 | 2462197 | 5/14/1998 | 19:05:06.25 | 4.272 | 7.635 |
| 47 | 45.616 | 18.339 | 1.889 | 34.468 | 13.336 | 2338360 | 2461855 | 5/14/1998 | 19:11:07.04 | 3.907 | 7.634 |
| 48 | 45.617 | 18.341 | 1.922 | 34.468 | 13.336 | 2377738 | 2462122 | 5/14/1998 | 19:17:07.83 | 4.177 | 7.635 |
| 49 | 45.611 | 18.338 | 1.946 | 34.465 | 13.338 | 2266786 | 2462090 | 5/14/1998 | 19:23:08.62 | 3.415 | 7.635 |
| 50 | 45.607 | 18.339 | 1.966 | 34.461 | 13.336 | 2340669 | 2462577 | 5/14/1998 | 19:29:09.41 | 3.922 | 7.637 |
| 51 | 45.612 | 18.339 | 2.004 | 34.464 | 13.335 | 2401428 | 2462098 | 5/14/1998 | 19:35:10.20 | 4.339 | 7.635 |
| 52 | 45.608 | 18.34 | 2.084 | 34.461 | 13.335 | 2403924 | 2462223 | 5/14/1998 | 19:41:10.99 | 4.357 | 7.635 |
| 53 | 45.61 | 18.335 | 2.042 | 34.467 | 13.337 | 2356018 | 2462593 | 5/14/1998 | 19:47:11.78 | 4.028 | 7.637 |
| 54 | 45.606 | 18.326 | 2.059 | 34.47 | 13.333 | 2397528 | 2462807 | 5/14/1998 | 19:53:12.57 | 4.313 | 7.638 |
| 55 | 45.6 | 18.327 | 2.081 | 34.465 | 13.333 | 2285816 | 2463198 | 5/14/1998 | 19:59:13.36 | 3.546 | 7.640 |
| 56 | 45.584 | 18.303 | 2.117 | 34.471 | 13.333 | 2398260 | 2462569 | 5/14/1998 | 20:05:14.15 | 4.318 | 7.637 |
| 57 | 45.567 | 18.285 | 2.137 | 34.472 | 13.332 | 2377051 | 2463576 | 5/14/1998 | 20:11:14.94 | 4.172 | 7.641 |
| 58 | 45.544 | 18.263 | 2.153 | 34.472 | 13.331 | 2383918 | 2463667 | 5/14/1998 | 20:17:15.73 | 4.219 | 7.642 |
| 59 | 45.531 | 18.25 | 2.191 | 34.471 | 13.331 | 2368433 | 2463074 | 5/14/1998 | 20:23:16.52 | 4.113 | 7.639 |
| 60 | 45.52 | 18.235 | 2.219 | 34.475 | 13.331 | 2323805 | 2463263 | 5/14/1998 | 20:29:17.31 | 3.807 | 7.640 |
| 61 | 45.504 | 18.221 | 2.226 | 34.473 | 13.331 | 2376991 | 2463289 | 5/14/1998 | 20:35:18.10 | 4.172 | 7.640 |
| 62 | 45.493 | 18.21 | 2.244 | 34.472 | 13.333 | 2210825 | 2463077 | 5/14/1998 | 20:41:18.89 | 3.031 | 7.639 |
| 63 | 45.48 | 18.2 | 2.297 | 34.47 | 13.33 | 2355678 | 2463360 | 5/14/1998 | 20:47:19.68 | 4.025 | 7.640 |
| 64 | 45.477 | 18.187 | 2.263 | 34.478 | 13.33 | 2379611 | 2463320 | 5/14/1998 | 20:53:20.47 | 4.190 | 7.640 |
| 65 | 45.465 | 18.176 | 2.349 | 34.476 | 13.331 | 2371687 | 2464053 | 5/14/1998 | 20:59:21.26 | 4.135 | 7.643 |
| 66 | 45.452 | 18.173 | 2.369 | 34.468 | 13.327 | 2383050 | 2464100 | 5/14/1998 | 21:05:22.05 | 4.213 | 7.644 |
| 67 | 45.437 | 18.158 | 2.397 | 34.468 | 13.327 | 2351063 | 2463189 | 5/14/1998 | 21:11:22.84 | 3.994 | 7.640 |
| 68 | 45.43 | 18.152 | 2.397 | 34.467 | 13.326 | 2383023 | 2463037 | 5/14/1998 | 21:17:23.63 | 4.213 | 7.639 |
| 69 | 45.422 | 18.133 | 2.375 | 34.477 | 13.326 | 2343310 | 2463752 | 5/14/1998 | 21:23:24.42 | 3.941 | 7.642 |
| 70 | 45.417 | 18.126 | 2.416 | 34.479 | 13.328 | 2355325 | 2463448 | 5/14/1998 | 21:29:25.21 | 4.023 | 7.641 |
| 71 | 45.406 | 18.112 | 2.431 | 34.481 | 13.327 | 2367457 | 2463585 | 5/14/1998 | 21:35:26.00 | 4.106 | 7.641 |
| 72 | 45.401 | 18.116 | 2.52 | 34.473 | 13.324 | 2403576 | 2463594 | 5/14/1998 | 21:42:08.00 | 4.354 | 7.641 |
| 73 | 45.388 | 18.093 | 2.496 | 34.481 | 13.324 | 2369041 | 2463392 | 5/14/1998 | 21:48:08.79 | 4.117 | 7.641 |
| 74 | 45.387 | 18.091 | 2.521 | 34.482 | 13.323 | 2373998 | 2463809 | 5/14/1998 | 21:54:09.58 | 4.151 | 7.642 |
| 75 | 45.37 | 18.078 | 2.559 | 34.478 | 13.324 | 2377182 | 2463890 | 5/14/1998 | 22:00:10.37 | 4.173 | 7.643 |
| 76 | 45.371 | 18.084 | 2.524 | 34.474 | 13.324 | 2334801 | 2463724 | 5/14/1998 | 22:06:11.16 | 3.882 | 7.642 |
| 77 | 45.365 | 18.074 | 2.555 | 34.478 | 13.322 | 2365159 | 2464469 | 5/14/1998 | 22:12:11.95 | 4.091 | 7.645 |
| 78 | 45.363 | 18.076 | 2.533 | 34.475 | 13.323 | 2375688 | 2463809 | 5/14/1998 | 22:18:12.74 | 4.163 | 7.642 |
| 79 | 45.362 | 18.055 | 2.555 | 34.492 | 13.323 | 2381254 | 2464032 | 5/14/1998 | 22:24:13.53 | 4.201 | 7.643 |
| 80 | 45.357 | 18.059 | 2.556 | 34.484 | 13.325 | 2384078 | 2463464 | 5/14/1998 | 22:30:14.32 | 4.220 | 7.641 |
| 81 | 45.354 | 18.057 | 2.53 | 34.483 | 13.322 | 2353772 | 2463593 | 5/14/1998 | 22:36:15.11 | 4.012 | 7.641 |
| 82 | 45.349 | 18.055 | 2.563 | 34.48 | 13.321 | 2368779 | 2463860 | 5/14/1998 | 22:42:15.90 | 4.115 | 7.643 |
| 83 | 45.348 | 18.056 | 2.543 | 34.479 | 13.321 | 2356085 | 2463896 | 5/14/1998 | 22:48:16.69 | 4.028 | 7.643 |
| 84 | 45.342 | 18.053 | 2.566 | 34.476 | 13.32 | 2340172 | 2464056 | 5/14/1998 | 22:54:17.48 | 3.919 | 7.643 |
| 85 | 45.323 | 18.027 | 2.562 | 34.482 | 13.32 | 2370278 | 2463957 | 5/14/1998 | 23:00:18.27 | 4.126 | 7.643 |
| 86 | 45.306 | 18.016 | 2.546 | 34.477 | 13.319 | 2366424 | 2464550 | 5/14/1998 | 23:06:19.06 | 4.099 | 7.646 |
| 87 | 45.287 | 17.999 | 2.558 | 34.474 | 13.318 | 2352180 | 2463720 | 5/14/1998 | 23:12:19.85 | 4.001 | 7.642 |
| 88 | 45.264 | 17.968 | 2.552 | 34.481 | 13.318 | 2372135 | 2464649 | 5/14/1998 | 23:18:20.64 | 4.138 | 7.646 |
| 89 | 45.252 | 17.955 | 2.558 | 34.482 | 13.318 | 2327818 | 2464429 | 5/14/1998 | 23:24:21.43 | 3.834 | 7.645 |
| 90 | 45.24 | 17.946 | 2.539 | 34.48 | 13.319 | 2389883 | 2464399 | 5/14/1998 | 23:30:22.22 | 4.260 | 7.645 |
| 91 | 45.22 | 17.917 | 2.504 | 34.486 | 13.319 | 2371560 | 2464360 | 5/14/1998 | 23:36:23.01 | 4.134 | 7.645 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **92** | 45.193 | 17.905 | 2.486 | 34.474 | 13.316 | 2380525 | 2464586 | 5/14/1998 | 23:42:23.80 | 4.196 | 7.646 |
| **93** | 45.174 | 17.876 | 2.47 | 34.482 | 13.315 | 2356383 | 2464819 | 5/14/1998 | 23:48:24.59 | 4.030 | 7.647 |
| **94** | 45.165 | 17.852 | 2.495 | 34.495 | 13.316 | 2363233 | 2464439 | 5/14/1998 | 23:54:25.38 | 4.077 | 7.645 |
| **95** | 45.152 | 17.847 | 2.471 | 34.488 | 13.315 | 2334303 | 2464571 | 5/15/1998 | 00:00:26.17 | 3.879 | 7.646 |
| **96** | 45.145 | 17.836 | 2.471 | 34.491 | 13.315 | 2318677 | 2464603 | 5/15/1998 | 00:06:26.96 | 3.772 | 7.646 |
| **97** | 45.126 | 17.815 | 2.42 | 34.493 | 13.314 | 2354618 | 2464559 | 5/15/1998 | 00:12:27.75 | 4.018 | 7.646 |
| **98** | 45.112 | 17.811 | 2.403 | 34.484 | 13.315 | 2396418 | 2464540 | 5/15/1998 | 00:18:28.54 | 4.305 | 7.645 |
| **99** | 45.111 | 17.797 | 2.39 | 34.495 | 13.313 | 2345937 | 2465214 | 5/15/1998 | 00:24:29.33 | 3.959 | 7.648 |
| **100** | 45.1 | 17.797 | 2.364 | 34.485 | 13.314 | 2343263 | 2465354 | 5/15/1998 | 00:30:30.12 | 3.940 | 7.649 |
| **101** | 45.095 | 17.781 | 2.36 | 34.496 | 13.314 | 2361929 | 2464998 | 5/15/1998 | 00:36:30.91 | 4.068 | 7.647 |
| **102** | 45.085 | 17.776 | 2.338 | 34.492 | 13.312 | 2397693 | 2465248 | 5/15/1998 | 00:42:31.70 | 4.314 | 7.649 |
| **103** | 45.082 | 17.77 | 2.339 | 34.494 | 13.313 | 2361991 | 2465327 | 5/15/1998 | 00:48:32.49 | 4.069 | 7.649 |
| **104** | 45.077 | 17.766 | 2.26 | 34.493 | 13.311 | 2359765 | 2464850 | 5/15/1998 | 00:54:33.28 | 4.054 | 7.647 |
| **105** | 45.078 | 17.765 | 2.297 | 34.494 | 13.311 | 2343112 | 2465278 | 5/15/1998 | 01:00:34.07 | 3.939 | 7.649 |
| **106** | 45.073 | 17.759 | 2.24 | 34.495 | 13.31 | 2339118 | 2465036 | 5/15/1998 | 01:06:34.86 | 3.912 | 7.648 |
| **107** | 45.067 | 17.75 | 2.192 | 34.497 | 13.309 | 2373443 | 2464837 | 5/15/1998 | 01:12:35.65 | 4.147 | 7.647 |
| **108** | 45.06 | 17.743 | 2.175 | 34.498 | 13.309 | 2358277 | 2465788 | 5/15/1998 | 01:18:36.44 | 4.043 | 7.651 |
| **109** | 45.069 | 17.754 | 2.147 | 34.495 | 13.309 | 2361881 | 2465250 | 5/15/1998 | 01:24:37.23 | 4.068 | 7.649 |
| **110** | 45.061 | 17.754 | 2.095 | 34.489 | 13.308 | 2360513 | 2465788 | 5/15/1998 | 01:30:38.02 | 4.059 | 7.651 |
| **111** | 45.064 | 17.755 | 2.082 | 34.491 | 13.308 | 2365125 | 2465730 | 5/15/1998 | 01:36:38.81 | 4.090 | 7.651 |
| **112** | 45.071 | 17.748 | 2.043 | 34.503 | 13.308 | 2354717 | 2465046 | 5/15/1998 | 01:42:39.60 | 4.019 | 7.648 |
| **113** | 45.076 | 17.75 | 2.024 | 34.505 | 13.307 | 2339792 | 2465843 | 5/15/1998 | 01:48:40.39 | 3.916 | 7.651 |
| **114** | 45.074 | 17.767 | 1.981 | 34.49 | 13.307 | 2359431 | 2465605 | 5/15/1998 | 01:54:41.18 | 4.051 | 7.650 |
| **115** | 45.077 | 17.765 | 1.954 | 34.493 | 13.308 | 2334336 | 2465603 | 5/15/1998 | 02:00:41.97 | 3.879 | 7.650 |
| **116** | 45.085 | 17.773 | 1.883 | 34.493 | 13.308 | 2349904 | 2465524 | 5/15/1998 | 02:06:42.76 | 3.986 | 7.650 |
| **117** | 45.092 | 17.771 | 1.879 | 34.501 | 13.307 | 2357965 | 2465475 | 5/15/1998 | 02:12:43.55 | 4.041 | 7.650 |
| **118** | 45.096 | 17.781 | 1.838 | 34.496 | 13.307 | 2346763 | 2465589 | 5/15/1998 | 02:18:44.34 | 3.964 | 7.650 |
| **119** | 45.096 | 17.782 | 1.815 | 34.495 | 13.306 | 2327530 | 2466033 | 5/15/1998 | 02:24:45.13 | 3.832 | 7.652 |
| **120** | 45.095 | 17.785 | 1.74 | 34.493 | 13.307 | 2356530 | 2465461 | 5/15/1998 | 02:30:45.92 | 4.031 | 7.649 |
| **121** | 45.099 | 17.783 | 1.727 | 34.497 | 13.308 | 2333205 | 2465944 | 5/15/1998 | 02:36:46.71 | 3.871 | 7.652 |
| **122** | 45.093 | 17.785 | 1.662 | 34.491 | 13.306 | 2337882 | 2465861 | 5/15/1998 | 02:42:47.50 | 3.903 | 7.651 |
| **123** | 45.106 | 17.795 | 1.62 | 34.494 | 13.305 | 2355699 | 2465839 | 5/15/1998 | 02:48:48.29 | 4.026 | 7.651 |
| **124** | 45.108 | 17.797 | 1.596 | 34.493 | 13.306 | 2375615 | 2466033 | 5/15/1998 | 02:54:49.08 | 4.162 | 7.652 |
| **125** | 45.107 | 17.795 | 1.538 | 34.494 | 13.304 | 2380729 | 2466074 | 5/15/1998 | 03:00:49.87 | 4.197 | 7.652 |
| **126** | 45.113 | 17.79 | 1.505 | 34.504 | 13.303 | 2346873 | 2465608 | 5/15/1998 | 03:06:50.66 | 3.965 | 7.650 |
| **127** | 45.117 | 17.799 | 1.463 | 34.498 | 13.303 | 2299817 | 2465916 | 5/15/1998 | 03:12:51.45 | 3.642 | 7.651 |
| **128** | 45.108 | 17.795 | 1.426 | 34.496 | 13.302 | 2365956 | 2466497 | 5/15/1998 | 03:18:52.24 | 4.096 | 7.654 |
| **129** | 45.115 | 17.786 | 1.414 | 34.508 | 13.302 | 2333427 | 2466179 | 5/15/1998 | 03:24:53.03 | 3.873 | 7.653 |
| **130** | 45.115 | 17.791 | 1.368 | 34.504 | 13.302 | 2337033 | 2465739 | 5/15/1998 | 03:30:53.82 | 3.898 | 7.651 |
| **131** | 45.121 | 17.793 | 1.31 | 34.507 | 13.303 | 2374985 | 2466073 | 5/15/1998 | 03:36:54.61 | 4.158 | 7.652 |
| **132** | 45.125 | 17.803 | 1.281 | 34.502 | 13.302 | 2376677 | 2466292 | 5/15/1998 | 03:42:55.40 | 4.170 | 7.653 |
| **133** | 45.126 | 17.792 | 1.249 | 34.512 | 13.302 | 2345688 | 2466780 | 5/15/1998 | 03:48:56.19 | 3.957 | 7.655 |
| **134** | 45.133 | 17.814 | 1.217 | 34.5 | 13.301 | 2336899 | 2466162 | 5/15/1998 | 03:54:56.98 | 3.897 | 7.653 |
| **135** | 45.148 | 17.825 | 1.183 | 34.504 | 13.301 | 2351237 | 2466577 | 5/15/1998 | 04:00:57.77 | 3.995 | 7.654 |
| **136** | 45.178 | 17.863 | 1.134 | 34.498 | 13.303 | 2333080 | 2465691 | 5/15/1998 | 04:06:58.56 | 3.870 | 7.650 |
| **137** | 45.205 | 17.891 | 1.111 | 34.497 | 13.303 | 2336919 | 2466221 | 5/15/1998 | 04:12:59.35 | 3.897 | 7.653 |
| **138** | 45.224 | 17.913 | 1.089 | 34.494 | 13.303 | 2371025 | 2466294 | 5/15/1998 | 04:19:00.14 | 4.131 | 7.653 |
| **139** | 45.257 | 17.937 | 1.044 | 34.502 | 13.303 | 2345181 | 2465861 | 5/15/1998 | 04:25:00.93 | 3.953 | 7.651 |
| **140** | 45.285 | 17.968 | 1.008 | 34.5 | 13.301 | 2372030 | 2466755 | 5/15/1998 | 04:31:01.72 | 4.138 | 7.655 |
| **141** | 45.305 | 17.988 | 0.987 | 34.5 | 13.301 | 2285279 | 2465932 | 5/15/1998 | 04:37:02.51 | 3.542 | 7.652 |
| **142** | 45.327 | 18.02 | 0.95 | 34.491 | 13.302 | 2344166 | 2465843 | 5/15/1998 | 04:43:44.53 | 3.946 | 7.651 |
| **143** | 45.362 | 18.048 | 0.933 | 34.498 | 13.3 | 2369962 | 2466366 | 5/15/1998 | 04:49:45.32 | 4.123 | 7.653 |
| **144** | 45.381 | 18.062 | 0.892 | 34.502 | 13.3 | 2369947 | 2466500 | 5/15/1998 | 04:55:46.11 | 4.123 | 7.654 |
| **145** | 45.399 | 18.088 | 0.855 | 34.495 | 13.299 | 2322085 | 2466747 | 5/15/1998 | 05:01:46.90 | 3.795 | 7.655 |
| **146** | 45.427 | 18.111 | 0.882 | 34.5 | 13.299 | 2368270 | 2466240 | 5/15/1998 | 05:07:47.69 | 4.112 | 7.653 |
| **147** | 45.446 | 18.133 | 0.855 | 34.497 | 13.299 | 2353575 | 2467488 | 5/15/1998 | 05:13:48.48 | 4.011 | 7.658 |
| **148** | 45.468 | 18.154 | 0.849 | 34.499 | 13.3 | 2350109 | 2466098 | 5/15/1998 | 05:19:49.27 | 3.987 | 7.652 |
| **149** | 45.482 | 18.179 | 0.817 | 34.49 | 13.299 | 2351218 | 2465947 | 5/15/1998 | 05:25:50.06 | 3.995 | 7.652 |
| **150** | 45.501 | 18.194 | 0.803 | 34.493 | 13.3 | 2359344 | 2465720 | 5/15/1998 | 05:31:50.85 | 4.051 | 7.651 |
| **151** | 45.526 | 18.21 | 0.79 | 34.5 | 13.298 | 2349084 | 2466761 | 5/15/1998 | 05:37:51.64 | 3.980 | 7.655 |
| **152** | 45.543 | 18.234 | 0.749 | 34.494 | 13.299 | 2362851 | 2466357 | 5/15/1998 | 05:43:52.43 | 4.075 | 7.653 |
| **153** | 45.561 | 18.261 | 0.757 | 34.488 | 13.298 | 2381029 | 2466728 | 5/15/1998 | 05:49:53.22 | 4.199 | 7.655 |
| **154** | 45.574 | 18.266 | 0.74 | 34.495 | 13.298 | 2353587 | 2466647 | 5/15/1998 | 05:55:54.01 | 4.011 | 7.655 |
| **155** | 45.598 | 18.282 | 0.741 | 34.501 | 13.298 | 2386931 | 2466048 | 5/15/1998 | 06:01:54.80 | 4.240 | 7.652 |
| **156** | 45.612 | 18.303 | 0.751 | 34.496 | 13.298 | 2291650 | 2466400 | 5/15/1998 | 06:07:55.59 | 3.586 | 7.654 |
| **157** | 45.634 | 18.327 | 0.727 | 34.494 | 13.299 | 2371093 | 2465348 | 5/15/1998 | 06:13:56.38 | 4.131 | 7.649 |
| **158** | 45.654 | 18.347 | 0.769 | 34.494 | 13.298 | 2391363 | 2465810 | 5/15/1998 | 06:19:57.17 | 4.270 | 7.651 |
| **159** | 45.672 | 18.365 | 0.735 | 34.493 | 13.299 | 2362448 | 2465915 | 5/15/1998 | 06:25:57.96 | 4.072 | 7.651 |
| **160** | 45.687 | 18.377 | 0.729 | 34.496 | 13.298 | 2338958 | 2465723 | 5/15/1998 | 06:31:58.75 | 3.911 | 7.651 |
| **161** | 45.702 | 18.394 | 0.726 | 34.496 | 13.299 | 2314425 | 2465538 | 5/15/1998 | 06:37:59.54 | 3.742 | 7.650 |
| **162** | 45.72 | 18.408 | 0.708 | 34.498 | 13.299 | 2328691 | 2465559 | 5/15/1998 | 06:44:00.33 | 3.840 | 7.650 |
| **163** | 45.732 | 18.429 | 0.741 | 34.491 | 13.298 | 2379082 | 2465707 | 5/15/1998 | 06:50:01.12 | 4.186 | 7.651 |
| **164** | 45.748 | 18.443 | 0.719 | 34.493 | 13.298 | 2399845 | 2465226 | 5/15/1998 | 06:56:01.91 | 4.329 | 7.648 |
| **165** | 45.762 | 18.459 | 0.731 | 34.491 | 13.297 | 2380967 | 2465836 | 5/15/1998 | 07:02:02.70 | 4.199 | 7.651 |
| **166** | 45.772 | 18.47 | 0.759 | 34.491 | 13.297 | 2390271 | 2465550 | 5/15/1998 | 07:08:03.49 | 4.263 | 7.650 |
| **167** | 45.786 | 18.486 | 0.777 | 34.489 | 13.297 | 2388876 | 2465017 | 5/15/1998 | 07:14:04.28 | 4.253 | 7.648 |
| **168** | 45.802 | 18.497 | 0.801 | 34.492 | 13.297 | 2280680 | 2465085 | 5/15/1998 | 07:20:05.07 | 3.511 | 7.648 |
| **169** | 45.808 | 18.5 | 0.799 | 34.496 | 13.296 | 2359304 | 2464679 | 5/15/1998 | 07:26:05.86 | 4.050 | 7.646 |
| **170** | 45.824 | 18.524 | 0.801 | 34.489 | 13.297 | 2372525 | 2464574 | 5/15/1998 | 07:32:06.65 | 4.141 | 7.646 |
| **171** | 45.835 | 18.527 | 0.809 | 34.496 | 13.295 | 2375619 | 2464652 | 5/15/1998 | 07:38:07.44 | 4.162 | 7.646 |
| **172** | 45.846 | 18.549 | 0.8 | 34.486 | 13.295 | 2380342 | 2464870 | 5/15/1998 | 07:44:08.23 | 4.195 | 7.647 |
| **173** | 45.857 | 18.557 | 0.816 | 34.488 | 13.295 | 2371967 | 2465125 | 5/15/1998 | 07:50:09.02 | 4.137 | 7.648 |
| **174** | 45.867 | 18.569 | 0.86 | 34.487 | 13.296 | 2333301 | 2464295 | 5/15/1998 | 07:56:09.81 | 3.872 | 7.644 |
| **175** | 45.879 | 18.589 | 0.882 | 34.481 | 13.295 | 2351599 | 2464428 | 5/15/1998 | 08:02:10.60 | 3.997 | 7.645 |
| **176** | 45.892 | 18.593 | 0.895 | 34.488 | 13.295 | 2346469 | 2463816 | 5/15/1998 | 08:08:11.39 | 3.962 | 7.642 |
| **177** | 45.903 | 18.618 | 0.937 | 34.477 | 13.294 | 2374377 | 2463877 | 5/15/1998 | 08:14:12.18 | 4.154 | 7.643 |
| **178** | 45.911 | 18.616 | 0.956 | 34.485 | 13.295 | 2356857 | 2464421 | 5/15/1998 | 08:20:12.97 | 4.034 | 7.645 |
| **179** | 45.919 | 18.631 | 0.966 | 34.479 | 13.294 | 2366693 | 2464477 | 5/15/1998 | 08:26:13.76 | 4.101 | 7.645 |
| **180** | 45.931 | 18.64 | 0.97 | 34.482 | 13.293 | 2405428 | 2464468 | 5/15/1998 | 08:32:14.55 | 4.367 | 7.645 |
| **181** | 45.947 | 18.645 | 0.984 | 34.491 | 13.293 | 2400302 | 2464281 | 5/15/1998 | 08:38:15.34 | 4.332 | 7.644 |
| **182** | 45.958 | 18.661 | 0.997 | 34.487 | 13.276 | 2378810 | 2464468 | 5/15/1998 | 08:44:16.14 | 4.184 | 7.645 |
| **183** | 45.952 | 18.666 | 1.029 | 34.478 | 13.257 | 2326999 | 2464612 | 5/15/1998 | 08:50:16.93 | 3.829 | 7.646 |
| **184** | 45.971 | 18.673 | 1.067 | 34.488 | 13.27 | 2367434 | 2463728 | 5/15/1998 | 08:56:17.72 | 4.106 | 7.642 |
| **185** | 45.972 | 18.682 | 1.095 | 34.481 | 13.276 | 2373371 | 2464243 | 5/15/1998 | 09:02:18.51 | 4.147 | 7.644 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **186** | 45.98 | 18.691 | 1.115 | 34.481 | 13.281 | 2364539 | 2464082 | 5/15/1998 | 09:08:19.30 | 4.086 | 7.644 |
| **187** | 45.985 | 18.688 | 1.156 | 34.487 | 13.28 | 2383525 | 2464173 | 5/15/1998 | 09:14:20.09 | 4.217 | 7.644 |
| **188** | 45.992 | 18.687 | 1.172 | 34.494 | 13.282 | 2380216 | 2463707 | 5/15/1998 | 09:20:20.88 | 4.194 | 7.642 |
| **189** | 45.992 | 18.703 | 1.202 | 34.481 | 13.28 | 2368968 | 2464278 | 5/15/1998 | 09:26:21.67 | 4.117 | 7.644 |
| **190** | 45.992 | 18.694 | 1.213 | 34.488 | 13.283 | 2350019 | 2463640 | 5/15/1998 | 09:32:22.46 | 3.987 | 7.642 |
| **191** | 45.987 | 18.694 | 1.254 | 34.484 | 13.28 | 2354642 | 2463795 | 5/15/1998 | 09:38:23.25 | 4.018 | 7.642 |
| **192** | 45.983 | 18.692 | 1.282 | 34.482 | 13.28 | 2406127 | 2463927 | 5/15/1998 | 09:44:24.04 | 4.372 | 7.643 |
| **193** | 45.976 | 18.682 | 1.325 | 34.484 | 13.282 | 2364024 | 2464092 | 5/15/1998 | 09:50:24.83 | 4.083 | 7.644 |
| **194** | 45.972 | 18.674 | 1.347 | 34.488 | 13.283 | 2385935 | 2463686 | 5/15/1998 | 09:56:25.62 | 4.233 | 7.642 |
| **195** | 45.96 | 18.667 | 1.324 | 34.483 | 13.28 | 2358993 | 2464565 | 5/15/1998 | 10:02:26.41 | 4.048 | 7.646 |
| **196** | 45.952 | 18.657 | 1.4 | 34.485 | 13.282 | 2385743 | 2463581 | 5/15/1998 | 10:08:27.20 | 4.232 | 7.641 |
| **197** | 45.948 | 18.648 | 1.374 | 34.489 | 13.28 | 2337293 | 2464040 | 5/15/1998 | 10:14:27.99 | 3.899 | 7.643 |
| **198** | 45.943 | 18.642 | 1.397 | 34.49 | 13.281 | 2382243 | 2464224 | 5/15/1998 | 10:20:28.78 | 4.208 | 7.644 |
| **199** | 45.935 | 18.633 | 1.442 | 34.491 | 13.28 | 2350789 | 2464025 | 5/15/1998 | 10:26:29.57 | 3.992 | 7.643 |
| **200** | 45.918 | 18.616 | 1.4 | 34.491 | 13.281 | 2383707 | 2464502 | 5/15/1998 | 10:32:30.36 | 4.218 | 7.645 |
| **201** | 45.914 | 18.614 | 1.461 | 34.489 | 13.28 | 2369711 | 2464506 | 5/15/1998 | 10:38:31.15 | 4.122 | 7.645 |
| **202** | 45.907 | 18.603 | 1.499 | 34.492 | 13.28 | 2361019 | 2464312 | 5/15/1998 | 10:44:31.94 | 4.062 | 7.645 |
| **203** | 45.898 | 18.597 | 1.57 | 34.49 | 13.28 | 2404815 | 2464943 | 5/15/1998 | 10:50:32.73 | 4.363 | 7.647 |
| **204** | 45.882 | 18.589 | 1.586 | 34.483 | 13.28 | 2396909 | 2464743 | 5/15/1998 | 10:56:33.52 | 4.308 | 7.646 |
| **205** | 45.878 | 18.581 | 1.573 | 34.486 | 13.279 | 2280660 | 2464190 | 5/15/1998 | 11:02:34.31 | 3.511 | 7.644 |
| **206** | 45.876 | 18.576 | 1.54 | 34.489 | 13.279 | 2391740 | 2464058 | 5/15/1998 | 11:08:35.10 | 4.273 | 7.643 |
| **207** | 45.87 | 18.572 | 1.58 | 34.487 | 13.278 | 2356241 | 2464542 | 5/15/1998 | 11:14:35.89 | 4.029 | 7.646 |
| **208** | 45.871 | 18.567 | 1.611 | 34.492 | 13.278 | 2378496 | 2463580 | 5/15/1998 | 11:20:36.68 | 4.182 | 7.641 |
| **209** | 45.864 | 18.572 | 1.593 | 34.482 | 13.278 | 2395631 | 2463980 | 5/15/1998 | 11:26:37.47 | 4.300 | 7.643 |
| **210** | 45.867 | 18.566 | 1.643 | 34.49 | 13.277 | 2352619 | 2464314 | 5/15/1998 | 11:32:38.26 | 4.004 | 7.645 |
| **211** | 45.868 | 18.57 | 1.614 | 34.487 | 13.277 | 2369975 | 2463766 | 5/15/1998 | 11:38:39.05 | 4.124 | 7.642 |
| **212** | 45.864 | 18.565 | 1.7 | 34.488 | 13.276 | 2379839 | 2464065 | 5/15/1998 | 11:45:21.07 | 4.191 | 7.643 |
| **213** | 45.851 | 18.556 | 1.707 | 34.484 | 13.276 | 2367463 | 2464065 | 5/15/1998 | 11:51:21.86 | 4.106 | 7.643 |
| **214** | 45.832 | 18.529 | 1.705 | 34.492 | 13.276 | 2354682 | 2463791 | 5/15/1998 | 11:57:22.65 | 4.019 | 7.642 |
| **215** | 45.82 | 18.523 | 1.683 | 34.486 | 13.276 | 2378706 | 2463284 | 5/15/1998 | 12:03:23.44 | 4.184 | 7.640 |
| **216** | 45.814 | 18.508 | 1.696 | 34.493 | 13.277 | 2366231 | 2463930 | 5/15/1998 | 12:09:24.23 | 4.098 | 7.643 |
| **217** | 45.798 | 18.488 | 1.698 | 34.497 | 13.274 | 2355692 | 2463649 | 5/15/1998 | 12:15:25.02 | 4.026 | 7.642 |
| **218** | 45.775 | 18.473 | 1.719 | 34.49 | 13.274 | 2346827 | 2463915 | 5/15/1998 | 12:21:25.81 | 3.965 | 7.643 |
| **219** | 45.758 | 18.449 | 1.779 | 34.496 | 13.272 | 2344638 | 2465705 | 5/15/1998 | 12:27:26.60 | 3.950 | 7.651 |
| **220** | 45.737 | 18.43 | 1.737 | 34.494 | 13.272 | 2368711 | 2464033 | 5/15/1998 | 12:33:27.39 | 4.115 | 7.643 |
| **221** | 45.712 | 18.403 | 1.74 | 34.496 | 13.273 | 2380056 | 2463707 | 5/15/1998 | 12:39:28.18 | 4.193 | 7.642 |
| **222** | 45.695 | 18.387 | 1.74 | 34.495 | 13.272 | 2393889 | 2463532 | 5/15/1998 | 12:45:28.97 | 4.288 | 7.641 |
| **223** | 45.677 | 18.361 | 1.753 | 34.501 | 13.271 | 2379914 | 2463815 | 5/15/1998 | 12:51:29.76 | 4.192 | 7.642 |
| **224** | 45.661 | 18.348 | 1.769 | 34.499 | 13.27 | 2355802 | 2463778 | 5/15/1998 | 12:57:30.55 | 4.026 | 7.642 |
| **225** | 45.637 | 18.331 | 1.736 | 34.493 | 13.27 | 2380692 | 2463615 | 5/15/1998 | 13:03:31.34 | 4.197 | 7.642 |
| **226** | 45.625 | 18.312 | 1.721 | 34.498 | 13.269 | 2375283 | 2463711 | 5/15/1998 | 13:09:32.13 | 4.160 | 7.642 |
| **227** | 45.605 | 18.305 | 1.709 | 34.488 | 13.269 | 2332420 | 2464032 | 5/15/1998 | 13:15:32.92 | 3.866 | 7.643 |
| **228** | 45.6 | 18.283 | 1.718 | 34.502 | 13.27 | 2379168 | 2463435 | 5/15/1998 | 13:21:33.71 | 4.187 | 7.641 |
| **229** | 45.594 | 18.284 | 1.776 | 34.496 | 13.269 | 2373904 | 2463396 | 5/15/1998 | 13:27:34.50 | 4.151 | 7.641 |
| **230** | 45.587 | 18.272 | 1.733 | 34.499 | 13.27 | 2389117 | 2463288 | 5/15/1998 | 13:33:35.29 | 4.255 | 7.640 |
| **231** | 45.569 | 18.262 | 1.717 | 34.493 | 13.267 | 2336928 | 2464156 | 5/15/1998 | 13:39:36.08 | 3.897 | 7.644 |
| **232** | 45.566 | 18.251 | 1.704 | 34.5 | 13.267 | 2347445 | 2463202 | 5/15/1998 | 13:45:36.87 | 3.969 | 7.640 |
| **233** | 45.553 | 18.236 | 1.719 | 34.501 | 13.267 | 2364355 | 2463414 | 5/15/1998 | 13:51:37.66 | 4.085 | 7.641 |
| **234** | 45.55 | 18.233 | 1.674 | 34.501 | 13.267 | 2344025 | 2463584 | 5/15/1998 | 13:57:38.45 | 3.945 | 7.641 |
| **235** | 45.533 | 18.216 | 1.692 | 34.502 | 13.266 | 2362191 | 2463667 | 5/15/1998 | 14:03:39.24 | 4.070 | 7.642 |
| **236** | 45.53 | 18.213 | 1.646 | 34.502 | 13.267 | 2383481 | 2463735 | 5/15/1998 | 14:09:40.03 | 4.216 | 7.642 |
| **237** | 45.52 | 18.201 | 1.668 | 34.503 | 13.268 | 2376804 | 2463101 | 5/15/1998 | 14:15:40.82 | 4.170 | 7.639 |
| **238** | 45.509 | 18.185 | 1.649 | 34.507 | 13.266 | 2402584 | 2464023 | 5/15/1998 | 14:21:41.61 | 4.347 | 7.643 |
| **239** | 45.503 | 18.184 | 1.629 | 34.503 | 13.266 | 2353467 | 2463492 | 5/15/1998 | 14:27:42.40 | 4.010 | 7.641 |
| **240** | 45.489 | 18.172 | 1.598 | 34.501 | 13.264 | 2351016 | 2463020 | 5/15/1998 | 14:33:43.19 | 3.993 | 7.639 |
| **241** | 45.482 | 18.165 | 1.639 | 34.501 | 13.265 | 2384912 | 2463441 | 5/15/1998 | 14:39:43.98 | 4.226 | 7.641 |
| **242** | 45.473 | 18.152 | 1.611 | 34.504 | 13.263 | 2363394 | 2463111 | 5/15/1998 | 14:45:44.77 | 4.078 | 7.639 |
| **243** | 45.463 | 18.141 | 1.592 | 34.505 | 13.263 | 2365024 | 2463029 | 5/15/1998 | 14:51:45.56 | 4.090 | 7.639 |
| **244** | 45.453 | 18.136 | 1.555 | 34.501 | 13.262 | 2371528 | 2463597 | 5/15/1998 | 14:57:46.35 | 4.134 | 7.641 |
| **245** | 45.448 | 18.13 | 1.575 | 34.502 | 13.262 | 2352113 | 2463504 | 5/15/1998 | 15:03:47.14 | 4.001 | 7.641 |
| **246** | 45.448 | 18.128 | 1.579 | 34.503 | 13.261 | 2339784 | 2463469 | 5/15/1998 | 15:09:47.93 | 3.916 | 7.641 |
| **247** | 45.442 | 18.117 | 1.492 | 34.507 | 13.262 | 2379245 | 2463490 | 5/15/1998 | 15:15:48.72 | 4.187 | 7.641 |
| **248** | 45.432 | 18.104 | 1.527 | 34.51 | 13.261 | 2383217 | 2462880 | 5/15/1998 | 15:21:49.51 | 4.214 | 7.638 |
| **249** | 45.423 | 18.11 | 1.499 | 34.497 | 13.261 | 2360587 | 2463319 | 5/15/1998 | 15:27:50.30 | 4.059 | 7.640 |
| **250** | 45.42 | 18.094 | 1.449 | 34.508 | 13.26 | 2359980 | 2463330 | 5/15/1998 | 15:33:51.09 | 4.055 | 7.640 |
| **251** | 45.41 | 18.091 | 1.425 | 34.503 | 13.259 | 2363695 | 2463184 | 5/15/1998 | 15:39:51.88 | 4.080 | 7.640 |
| **252** | 45.406 | 18.079 | 1.45 | 34.509 | 13.261 | 2368615 | 2463361 | 5/15/1998 | 15:45:52.67 | 4.114 | 7.640 |
| **253** | 45.399 | 18.082 | 1.415 | 34.501 | 13.26 | 2380394 | 2463643 | 5/15/1998 | 15:51:53.46 | 4.195 | 7.642 |
| **254** | 45.388 | 18.077 | 1.458 | 34.496 | 13.259 | 2324128 | 2464041 | 5/15/1998 | 15:57:54.25 | 3.809 | 7.643 |
| **255** | 45.394 | 18.071 | 1.451 | 34.505 | 13.258 | 2357274 | 2464178 | 5/15/1998 | 16:03:55.04 | 4.036 | 7.644 |
| **256** | 45.391 | 18.068 | 1.4 | 34.505 | 13.258 | 2351656 | 2463736 | 5/15/1998 | 16:09:55.83 | 3.998 | 7.642 |
| **257** | 45.385 | 18.058 | 1.381 | 34.508 | 13.258 | 2381841 | 2463657 | 5/15/1998 | 16:15:56.62 | 4.205 | 7.642 |
| **258** | 45.389 | 18.054 | 1.4 | 34.516 | 13.258 | 2346587 | 2464198 | 5/15/1998 | 16:21:57.41 | 3.963 | 7.644 |
| **259** | 45.386 | 18.066 | 1.378 | 34.503 | 13.258 | 2354135 | 2463708 | 5/15/1998 | 16:27:58.20 | 4.015 | 7.642 |
| **260** | 45.397 | 18.068 | 1.328 | 34.51 | 13.258 | 2381200 | 2464481 | 5/15/1998 | 16:33:58.99 | 4.201 | 7.645 |
| **261** | 45.41 | 18.084 | 1.345 | 34.509 | 13.258 | 2395788 | 2463932 | 5/15/1998 | 16:39:59.78 | 4.301 | 7.643 |
| **262** | 45.414 | 18.094 | 1.361 | 34.503 | 13.258 | 2377841 | 2464211 | 5/15/1998 | 16:46:00.57 | 4.178 | 7.644 |
| **263** | 45.429 | 18.104 | 1.301 | 34.507 | 13.259 | 2358469 | 2463743 | 5/15/1998 | 16:52:01.36 | 4.045 | 7.642 |
| **264** | 45.443 | 18.12 | 1.315 | 34.505 | 13.257 | 2356930 | 2465759 | 5/15/1998 | 16:58:02.15 | 4.034 | 7.651 |
| **265** | 45.458 | 18.123 | 1.344 | 34.517 | 13.258 | 2361082 | 2463896 | 5/15/1998 | 17:04:02.94 | 4.063 | 7.643 |
| **266** | 45.468 | 18.141 | 1.31 | 34.51 | 13.258 | 2390020 | 2464435 | 5/15/1998 | 17:10:03.73 | 4.261 | 7.645 |
| **267** | 45.479 | 18.152 | 1.308 | 34.509 | 13.258 | 2348005 | 2464148 | 5/15/1998 | 17:16:04.52 | 3.973 | 7.644 |
| **268** | 45.492 | 18.161 | 1.319 | 34.513 | 13.256 | 2396793 | 2465141 | 5/15/1998 | 17:22:05.31 | 4.308 | 7.648 |
| **269** | 45.508 | 18.183 | 1.289 | 34.508 | 13.258 | 2381427 | 2465049 | 5/15/1998 | 17:28:06.10 | 4.202 | 7.648 |
| **270** | 45.521 | 18.196 | 1.339 | 34.508 | 13.257 | 2382892 | 2464671 | 5/15/1998 | 17:34:06.89 | 4.212 | 7.646 |
| **271** | 45.533 | 18.213 | 1.313 | 34.504 | 13.256 | 2397674 | 2465097 | 5/15/1998 | 17:40:07.68 | 4.314 | 7.648 |
| **272** | 45.553 | 18.23 | 1.337 | 34.507 | 13.258 | 2402697 | 2465238 | 5/15/1998 | 17:46:08.47 | 4.348 | 7.649 |
| **273** | 45.566 | 18.238 | 1.322 | 34.511 | 13.257 | 2353153 | 2465328 | 5/15/1998 | 17:52:09.26 | 4.008 | 7.649 |
| **274** | 45.582 | 18.257 | 1.294 | 34.509 | 13.257 | 2380839 | 2465578 | 5/15/1998 | 17:58:10.05 | 4.198 | 7.650 |
| **275** | 45.598 | 18.272 | 1.316 | 34.509 | 13.256 | 2394227 | 2465849 | 5/15/1998 | 18:04:10.84 | 4.290 | 7.651 |
| **276** | 45.603 | 18.283 | 1.355 | 34.505 | 13.258 | 2351650 | 2465497 | 5/15/1998 | 18:10:11.63 | 3.998 | 7.650 |
| **277** | 45.62 | 18.293 | 1.331 | 34.51 | 13.254 | 2369528 | 2465711 | 5/15/1998 | 18:16:12.42 | 4.121 | 7.651 |
| **278** | 45.626 | 18.304 | 1.353 | 34.506 | 13.258 | 2397359 | 2465550 | 5/15/1998 | 18:22:13.21 | 4.312 | 7.650 |
| **279** | 45.635 | 18.312 | 1.321 | 34.507 | 13.255 | 2371123 | 2466458 | 5/15/1998 | 18:28:14.00 | 4.131 | 7.654 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **280** | 45.651 | 18.321 | 1.353 | 34.513 | 13.255 | 2380264 | 2466741 | 5/15/1998 | 18:34:14.79 | 4.194 | 7.655 |
| **281** | 45.657 | 18.332 | 1.359 | 34.509 | 13.255 | 2387365 | 2466233 | 5/15/1998 | 18:40:15.58 | 4.243 | 7.653 |
| **282** | 45.656 | 18.336 | 1.383 | 34.505 | 13.253 | 2391766 | 2466929 | 5/15/1998 | 18:46:57.62 | 4.273 | 7.656 |
| **283** | 45.67 | 18.344 | 1.353 | 34.509 | 13.253 | 2392285 | 2466969 | 5/15/1998 | 18:52:58.41 | 4.277 | 7.656 |
| **284** | 45.669 | 18.346 | 1.37 | 34.507 | 13.256 | 2371420 | 2467163 | 5/15/1998 | 18:58:59.20 | 4.134 | 7.657 |
| **285** | 45.675 | 18.351 | 1.4 | 34.508 | 13.254 | 2364223 | 2467230 | 5/15/1998 | 19:04:59.99 | 4.084 | 7.657 |
| **286** | 45.675 | 18.346 | 1.415 | 34.513 | 13.251 | 2354463 | 2466804 | 5/15/1998 | 19:11:00.78 | 4.017 | 7.655 |
| **287** | 45.677 | 18.347 | 1.397 | 34.513 | 13.252 | 2345955 | 2466627 | 5/15/1998 | 19:17:01.57 | 3.959 | 7.655 |
| **288** | 45.684 | 18.358 | 1.384 | 34.51 | 13.254 | 2385862 | 2467170 | 5/15/1998 | 19:23:02.36 | 4.233 | 7.657 |
| **289** | 45.686 | 18.368 | 1.418 | 34.503 | 13.252 | 2359116 | 2466945 | 5/15/1998 | 19:29:03.15 | 4.049 | 7.656 |
| **290** | 45.698 | 18.365 | 1.445 | 34.516 | 13.251 | 2381054 | 2467458 | 5/15/1998 | 19:35:03.94 | 4.200 | 7.658 |
| **291** | 45.697 | 18.369 | 1.513 | 34.511 | 13.25 | 2375820 | 2467191 | 5/15/1998 | 19:41:04.73 | 4.164 | 7.657 |
| **292** | 45.698 | 18.374 | 1.507 | 34.508 | 13.25 | 2377280 | 2467003 | 5/15/1998 | 19:47:05.52 | 4.174 | 7.656 |
| **293** | 45.706 | 18.378 | 1.524 | 34.512 | 13.25 | 2391057 | 2467266 | 5/15/1998 | 19:53:06.31 | 4.268 | 7.657 |
| **294** | 45.703 | 18.376 | 1.579 | 34.511 | 13.249 | 2362852 | 2466873 | 5/15/1998 | 19:59:07.10 | 4.075 | 7.656 |
| **295** | 45.705 | 18.378 | 1.563 | 34.511 | 13.249 | 2381681 | 2467730 | 5/15/1998 | 20:05:07.89 | 4.204 | 7.659 |
| **296** | 45.708 | 18.376 | 1.559 | 34.515 | 13.249 | 2385570 | 2467100 | 5/15/1998 | 20:11:08.68 | 4.231 | 7.657 |
| **297** | 45.7 | 18.375 | 1.599 | 34.509 | 13.248 | 2337237 | 2467344 | 5/15/1998 | 20:17:09.47 | 3.899 | 7.658 |
| **298** | 45.703 | 18.376 | 1.558 | 34.51 | 13.249 | 2382983 | 2467469 | 5/15/1998 | 20:23:10.26 | 4.213 | 7.658 |
| **299** | 45.702 | 18.365 | 1.58 | 34.519 | 13.249 | 2374780 | 2467039 | 5/15/1998 | 20:29:11.05 | 4.157 | 7.656 |
| **300** | 45.697 | 18.371 | 1.627 | 34.51 | 13.248 | 2370041 | 2466759 | 5/15/1998 | 20:35:11.84 | 4.124 | 7.655 |
| **301** | 45.696 | 18.366 | 1.691 | 34.513 | 13.247 | 2323110 | 2467521 | 5/15/1998 | 20:41:12.63 | 3.802 | 7.658 |
| **302** | 45.688 | 18.359 | 1.734 | 34.512 | 13.246 | 2349356 | 2468039 | 5/15/1998 | 20:47:13.42 | 3.982 | 7.661 |
| **303** | 45.687 | 18.351 | 1.722 | 34.518 | 13.247 | 2382767 | 2467841 | 5/15/1998 | 20:53:14.21 | 4.211 | 7.660 |
| **304** | 45.676 | 18.349 | 1.759 | 34.511 | 13.244 | 2384210 | 2468098 | 5/15/1998 | 20:59:15.00 | 4.221 | 7.661 |
| **305** | 45.661 | 18.335 | 1.741 | 34.509 | 13.245 | 2388360 | 2466741 | 5/15/1998 | 21:05:15.79 | 4.250 | 7.655 |
| **306** | 45.637 | 18.31 | 1.756 | 34.51 | 13.243 | 2369829 | 2467429 | 5/15/1998 | 21:11:16.58 | 4.123 | 7.658 |
| **307** | 45.624 | 18.294 | 1.759 | 34.513 | 13.245 | 2372489 | 2467231 | 5/15/1998 | 21:17:17.37 | 4.141 | 7.657 |
| **308** | 45.616 | 18.28 | 1.732 | 34.518 | 13.244 | 2376284 | 2467547 | 5/15/1998 | 21:23:18.16 | 4.167 | 7.658 |
| **309** | 45.597 | 18.259 | 1.783 | 34.52 | 13.241 | 2370010 | 2467382 | 5/15/1998 | 21:29:18.95 | 4.124 | 7.658 |
| **310** | 45.572 | 18.235 | 1.846 | 34.519 | 13.242 | 2369035 | 2467334 | 5/15/1998 | 21:35:19.74 | 4.117 | 7.658 |
| **311** | 45.56 | 18.217 | 1.82 | 34.523 | 13.243 | 2359090 | 2466974 | 5/15/1998 | 21:41:20.53 | 4.049 | 7.656 |
| **312** | 45.54 | 18.213 | 1.892 | 34.51 | 13.24 | 2373006 | 2467145 | 5/15/1998 | 21:47:21.32 | 4.144 | 7.657 |
| **313** | 45.524 | 18.19 | 1.88 | 34.516 | 13.24 | 2384965 | 2468153 | 5/15/1998 | 21:53:22.11 | 4.226 | 7.661 |
| **314** | 45.51 | 18.184 | 1.891 | 34.508 | 13.24 | 2372198 | 2467057 | 5/15/1998 | 21:59:22.90 | 4.139 | 7.656 |
| **315** | 45.501 | 18.163 | 1.922 | 34.519 | 13.24 | 2367592 | 2467374 | 5/15/1998 | 22:05:23.69 | 4.107 | 7.658 |
| **316** | 45.49 | 18.151 | 1.893 | 34.519 | 13.24 | 2371961 | 2467695 | 5/15/1998 | 22:11:24.48 | 4.137 | 7.659 |
| **317** | 45.482 | 18.138 | 1.963 | 34.524 | 13.238 | 2337747 | 2467876 | 5/15/1998 | 22:17:25.27 | 3.902 | 7.660 |
| **318** | 45.469 | 18.124 | 1.91 | 34.525 | 13.239 | 2319494 | 2467315 | 5/15/1998 | 22:23:26.06 | 3.777 | 7.657 |
| **319** | 45.461 | 18.121 | 1.931 | 34.52 | 13.239 | 2375343 | 2467483 | 5/15/1998 | 22:29:26.85 | 4.160 | 7.658 |
| **320** | 45.448 | 18.107 | 1.918 | 34.52 | 13.237 | 2377429 | 2467054 | 5/15/1998 | 22:35:27.64 | 4.175 | 7.656 |
| **321** | 45.435 | 18.1 | 1.969 | 34.516 | 13.238 | 2376011 | 2467161 | 5/15/1998 | 22:41:28.43 | 4.165 | 7.657 |
| **322** | 45.429 | 18.088 | 1.956 | 34.52 | 13.237 | 2356935 | 2467112 | 5/15/1998 | 22:47:29.22 | 4.034 | 7.657 |
| **323** | 45.423 | 18.08 | 2.023 | 34.523 | 13.237 | 2367734 | 2467518 | 5/15/1998 | 22:53:30.01 | 4.108 | 7.658 |
| **324** | 45.418 | 18.073 | 1.985 | 34.524 | 13.237 | 2379972 | 2467754 | 5/15/1998 | 22:59:30.80 | 4.192 | 7.659 |
| **325** | 45.414 | 18.073 | 1.998 | 34.52 | 13.237 | 2345571 | 2467752 | 5/15/1998 | 23:05:31.59 | 3.956 | 7.659 |
| **326** | 45.407 | 18.061 | 1.987 | 34.525 | 13.235 | 2339841 | 2467434 | 5/15/1998 | 23:11:32.38 | 3.917 | 7.658 |
| **327** | 45.408 | 18.071 | 1.978 | 34.517 | 13.236 | 2359499 | 2467795 | 5/15/1998 | 23:17:33.17 | 4.052 | 7.660 |
| **328** | 45.401 | 18.057 | 1.996 | 34.524 | 13.233 | 2358925 | 2467783 | 5/15/1998 | 23:23:33.96 | 4.048 | 7.660 |
| **329** | 45.405 | 18.058 | 1.971 | 34.526 | 13.234 | 2395086 | 2468229 | 5/15/1998 | 23:29:34.75 | 4.296 | 7.661 |
| **330** | 45.401 | 18.05 | 2.04 | 34.529 | 13.235 | 2365691 | 2467615 | 5/15/1998 | 23:35:35.54 | 4.094 | 7.659 |
| **331** | 45.405 | 18.062 | 2.014 | 34.522 | 13.234 | 2355304 | 2467233 | 5/15/1998 | 23:41:36.33 | 4.023 | 7.657 |
| **332** | 45.407 | 18.053 | 1.99 | 34.532 | 13.233 | 2383424 | 2467011 | 5/15/1998 | 23:47:37.12 | 4.216 | 7.656 |
| **333** | 45.4 | 18.056 | 2.009 | 34.523 | 13.232 | 2383121 | 2467779 | 5/15/1998 | 23:53:37.91 | 4.214 | 7.659 |
| **334** | 45.395 | 18.052 | 2.015 | 34.523 | 13.233 | 2377891 | 2467329 | 5/15/1998 | 23:59:38.70 | 4.178 | 7.658 |
| **335** | 45.405 | 18.05 | 1.989 | 34.533 | 13.232 | 2395826 | 2467853 | 5/16/1998 | 00:05:39.49 | 4.301 | 7.660 |
| **336** | 45.406 | 18.057 | 1.969 | 34.527 | 13.231 | 2373496 | 2467524 | 5/16/1998 | 00:11:40.28 | 4.148 | 7.658 |
| **337** | 45.395 | 18.042 | 1.985 | 34.53 | 13.231 | 2346109 | 2467578 | 5/16/1998 | 00:17:41.07 | 3.960 | 7.659 |
| **338** | 45.394 | 18.049 | 1.988 | 34.524 | 13.23 | 2356741 | 2468195 | 5/16/1998 | 00:23:41.86 | 4.033 | 7.661 |
| **339** | 45.389 | 18.031 | 1.952 | 34.535 | 13.231 | 2372855 | 2467422 | 5/16/1998 | 00:29:42.65 | 4.143 | 7.658 |
| **340** | 45.39 | 18.033 | 1.957 | 34.533 | 13.228 | 2356792 | 2467648 | 5/16/1998 | 00:35:43.44 | 4.033 | 7.659 |
| **341** | 45.386 | 18.033 | 1.932 | 34.531 | 13.233 | 2359037 | 2467677 | 5/16/1998 | 00:41:44.23 | 4.049 | 7.659 |
| **342** | 45.378 | 18.029 | 1.926 | 34.527 | 13.229 | 2357632 | 2467844 | 5/16/1998 | 00:47:45.02 | 4.039 | 7.660 |
| **343** | 45.375 | 18.027 | 1.923 | 34.526 | 13.228 | 2363040 | 2467285 | 5/16/1998 | 00:53:45.81 | 4.076 | 7.657 |
| **344** | 45.371 | 18.024 | 1.915 | 34.526 | 13.227 | 2359224 | 2467800 | 5/16/1998 | 00:59:46.60 | 4.050 | 7.660 |
| **345** | 45.37 | 18.022 | 1.862 | 34.526 | 13.231 | 2355096 | 2467827 | 5/16/1998 | 01:05:47.39 | 4.021 | 7.660 |
| **346** | 45.36 | 18.015 | 1.816 | 34.523 | 13.229 | 2352383 | 2467772 | 5/16/1998 | 01:11:48.18 | 4.003 | 7.659 |
| **347** | 45.351 | 18.003 | 1.846 | 34.527 | 13.229 | 2340953 | 2467358 | 5/16/1998 | 01:17:48.97 | 3.924 | 7.658 |
| **348** | 45.345 | 18.002 | 1.81 | 34.522 | 13.229 | 2367112 | 2467796 | 5/16/1998 | 01:23:49.76 | 4.104 | 7.660 |
| **349** | 45.345 | 17.992 | 1.778 | 34.531 | 13.23 | 2358870 | 2467168 | 5/16/1998 | 01:29:50.55 | 4.047 | 7.657 |
| **350** | 45.337 | 17.989 | 1.78 | 34.526 | 13.229 | 2377140 | 2467209 | 5/16/1998 | 01:35:51.34 | 4.173 | 7.657 |
| **351** | 45.331 | 17.982 | 1.712 | 34.527 | 13.229 | 2375405 | 2467268 | 5/16/1998 | 01:41:52.13 | 4.161 | 7.657 |
| **352** | 45.332 | 17.976 | 1.71 | 34.533 | 13.227 | 2348207 | 2467943 | 5/16/1998 | 01:48:34.16 | 3.974 | 7.660 |
| **353** | 45.329 | 17.976 | 1.685 | 34.53 | 13.226 | 2374527 | 2467638 | 5/16/1998 | 01:54:34.95 | 4.155 | 7.659 |
| **354** | 45.33 | 17.98 | 1.633 | 34.528 | 13.227 | 2349078 | 2467880 | 5/16/1998 | 02:00:35.74 | 3.980 | 7.660 |
| **355** | 45.328 | 17.973 | 1.631 | 34.532 | 13.225 | 2366638 | 2467221 | 5/16/1998 | 02:06:36.53 | 4.101 | 7.657 |
| **356** | 45.327 | 17.978 | 1.579 | 34.527 | 13.225 | 2350933 | 2467135 | 5/16/1998 | 02:12:37.32 | 3.993 | 7.657 |
| **357** | 45.327 | 17.981 | 1.583 | 34.525 | 13.226 | 2350551 | 2468078 | 5/16/1998 | 02:18:38.11 | 3.990 | 7.661 |
| **358** | 45.328 | 17.975 | 1.532 | 34.53 | 13.224 | 2360349 | 2467595 | 5/16/1998 | 02:24:38.90 | 4.058 | 7.659 |
| **359** | 45.32 | 17.971 | 1.498 | 34.527 | 13.225 | 2377524 | 2467360 | 5/16/1998 | 02:30:39.69 | 4.175 | 7.658 |
| **360** | 45.327 | 17.971 | 1.476 | 34.532 | 13.224 | 2362956 | 2467649 | 5/16/1998 | 02:36:40.48 | 4.075 | 7.659 |
| **361** | 45.32 | 17.973 | 1.422 | 34.525 | 13.223 | 2389833 | 2467475 | 5/16/1998 | 02:42:41.27 | 4.260 | 7.658 |
| **362** | 45.323 | 17.976 | 1.398 | 34.526 | 13.224 | 2361460 | 2467332 | 5/16/1998 | 02:48:42.06 | 4.065 | 7.658 |
| **363** | 45.317 | 17.969 | 1.356 | 34.526 | 13.222 | 2354738 | 2467231 | 5/16/1998 | 02:54:42.85 | 4.019 | 7.657 |
| **364** | 45.325 | 17.969 | 1.28 | 34.533 | 13.222 | 2354665 | 2467091 | 5/16/1998 | 03:00:43.64 | 4.019 | 7.657 |
| **365** | 45.327 | 17.969 | 1.289 | 34.535 | 13.222 | 2408383 | 2467583 | 5/16/1998 | 03:06:44.43 | 4.387 | 7.659 |
| **366** | 45.327 | 17.974 | 1.278 | 34.53 | 13.221 | 2367075 | 2467466 | 5/16/1998 | 03:12:45.22 | 4.104 | 7.658 |
| **367** | 45.324 | 17.967 | 1.248 | 34.534 | 13.222 | 2330680 | 2467166 | 5/16/1998 | 03:18:46.01 | 3.854 | 7.657 |
| **368** | 45.325 | 17.974 | 1.178 | 34.529 | 13.22 | 2369441 | 2467372 | 5/16/1998 | 03:24:46.80 | 4.120 | 7.658 |
| **369** | 45.332 | 17.973 | 1.115 | 34.536 | 13.22 | 2334352 | 2467339 | 5/16/1998 | 03:30:47.59 | 3.879 | 7.658 |
| **370** | 45.335 | 17.987 | 1.101 | 34.526 | 13.222 | 2343750 | 2467793 | 5/16/1998 | 03:36:48.38 | 3.944 | 7.660 |
| **371** | 45.338 | 17.981 | 1.073 | 34.534 | 13.219 | 2338593 | 2467577 | 5/16/1998 | 03:42:49.17 | 3.908 | 7.659 |
| **372** | 45.339 | 17.98 | 1.038 | 34.535 | 13.22 | 2297495 | 2467468 | 5/16/1998 | 03:48:49.96 | 3.626 | 7.658 |
| **373** | 45.34 | 17.983 | 1.022 | 34.534 | 13.219 | 2362710 | 2467716 | 5/16/1998 | 03:54:50.75 | 4.074 | 7.659 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **374** | 45.345 | 17.988 | 0.97 | 34.534 | 13.218 | 2356859 | 2467618 | 5/16/1998 | 04:00:51.54 | 4.034 | 7.659 |
| **375** | 45.345 | 17.986 | 0.936 | 34.536 | 13.22 | 2344295 | 2467594 | 5/16/1998 | 04:06:52.33 | 3.947 | 7.659 |
| **376** | 45.342 | 17.987 | 0.902 | 34.533 | 13.219 | 2359049 | 2467549 | 5/16/1998 | 04:12:53.12 | 4.049 | 7.658 |
| **377** | 45.341 | 17.993 | 0.858 | 34.526 | 13.22 | 2362960 | 2467567 | 5/16/1998 | 04:18:53.91 | 4.075 | 7.659 |
| **378** | 45.344 | 17.987 | 0.827 | 34.535 | 13.22 | 2354292 | 2467652 | 5/16/1998 | 04:24:54.70 | 4.016 | 7.659 |
| **379** | 45.353 | 17.994 | 0.798 | 34.536 | 13.217 | 2346094 | 2467114 | 5/16/1998 | 04:30:55.49 | 3.960 | 7.657 |
| **380** | 45.356 | 18.003 | 0.769 | 34.531 | 13.22 | 2370973 | 2468124 | 5/16/1998 | 04:36:56.28 | 4.130 | 7.661 |
| **381** | 45.367 | 18.01 | 0.74 | 34.534 | 13.221 | 2357293 | 2467836 | 5/16/1998 | 04:42:57.07 | 4.037 | 7.660 |
| **382** | 45.38 | 18.032 | 0.708 | 34.526 | 13.221 | 2345507 | 2467879 | 5/16/1998 | 04:48:57.86 | 3.956 | 7.660 |
| **383** | 45.399 | 18.041 | 0.655 | 34.535 | 13.223 | 2333597 | 2468524 | 5/16/1998 | 04:54:58.65 | 3.874 | 7.663 |
| **384** | 45.421 | 18.071 | 0.663 | 34.528 | 13.223 | 2370228 | 2467806 | 5/16/1998 | 05:00:59.44 | 4.125 | 7.660 |
| **385** | 45.44 | 18.086 | 0.61 | 34.532 | 13.222 | 2391255 | 2467502 | 5/16/1998 | 05:07:00.23 | 4.270 | 7.658 |
| **386** | 45.461 | 18.107 | 0.572 | 34.532 | 13.221 | 2366862 | 2467934 | 5/16/1998 | 05:13:01.02 | 4.102 | 7.660 |
| **387** | 45.48 | 18.126 | 0.555 | 34.532 | 13.222 | 2367017 | 2467180 | 5/16/1998 | 05:19:01.81 | 4.103 | 7.657 |
| **388** | 45.493 | 18.149 | 0.556 | 34.524 | 13.22 | 2330259 | 2468073 | 5/16/1998 | 05:25:02.60 | 3.851 | 7.661 |
| **389** | 45.509 | 18.161 | 0.526 | 34.527 | 13.221 | 2377135 | 2467749 | 5/16/1998 | 05:31:03.39 | 4.173 | 7.659 |
| **390** | 45.527 | 18.177 | 0.489 | 34.529 | 13.219 | 2341738 | 2467318 | 5/16/1998 | 05:37:04.18 | 3.930 | 7.658 |
| **391** | 45.545 | 18.192 | 0.473 | 34.532 | 13.22 | 2375006 | 2467446 | 5/16/1998 | 05:43:04.97 | 4.158 | 7.658 |
| **392** | 45.566 | 18.213 | 0.444 | 34.533 | 13.222 | 2372313 | 2467936 | 5/16/1998 | 05:49:05.76 | 4.140 | 7.660 |
| **393** | 45.585 | 18.231 | 0.447 | 34.534 | 13.222 | 2328565 | 2467610 | 5/16/1998 | 05:55:06.55 | 3.839 | 7.659 |
| **394** | 45.592 | 18.243 | 0.433 | 34.529 | 13.227 | 2375820 | 2467135 | 5/16/1998 | 06:01:07.34 | 4.164 | 7.657 |
| **395** | 45.611 | 18.262 | 0.416 | 34.53 | 13.223 | 2358893 | 2467654 | 5/16/1998 | 06:07:08.13 | 4.048 | 7.659 |
| **396** | 45.623 | 18.277 | 0.377 | 34.527 | 13.225 | 2346040 | 2466958 | 5/16/1998 | 06:13:08.92 | 3.959 | 7.656 |
| **397** | 45.639 | 18.284 | 0.368 | 34.534 | 13.225 | 2372790 | 2466916 | 5/16/1998 | 06:19:09.71 | 4.143 | 7.656 |
| **398** | 45.652 | 18.305 | 0.371 | 34.527 | 13.223 | 2364436 | 2467155 | 5/16/1998 | 06:25:10.50 | 4.086 | 7.657 |
| **399** | 45.67 | 18.313 | 0.364 | 34.537 | 13.224 | 2377688 | 2466795 | 5/16/1998 | 06:31:11.29 | 4.177 | 7.655 |
| **400** | 45.679 | 18.333 | 0.365 | 34.527 | 13.222 | 2357551 | 2467141 | 5/16/1998 | 06:37:12.08 | 4.038 | 7.657 |
| **401** | 45.689 | 18.345 | 0.343 | 34.526 | 13.222 | 2339971 | 2466786 | 5/16/1998 | 06:43:12.87 | 3.918 | 7.655 |
| **402** | 45.704 | 18.364 | 0.319 | 34.522 | 13.223 | 2356143 | 2467253 | 5/16/1998 | 06:49:13.66 | 4.029 | 7.657 |
| **403** | 45.716 | 18.36 | 0.289 | 34.536 | 13.224 | 2358772 | 2466608 | 5/16/1998 | 06:55:14.45 | 4.047 | 7.654 |
| **404** | 45.728 | 18.376 | 0.292 | 34.532 | 13.223 | 2348538 | 2466863 | 5/16/1998 | 07:01:15.24 | 3.976 | 7.656 |
| **405** | 45.739 | 18.393 | 0.299 | 34.527 | 13.226 | 2360453 | 2466802 | 5/16/1998 | 07:07:16.03 | 4.058 | 7.655 |
| **406** | 45.747 | 18.4 | 0.29 | 34.528 | 13.221 | 2365582 | 2467431 | 5/16/1998 | 07:13:16.82 | 4.093 | 7.658 |
| **407** | 45.759 | 18.416 | 0.289 | 34.525 | 13.221 | 2349223 | 2466994 | 5/16/1998 | 07:19:17.61 | 3.981 | 7.656 |
| **408** | 45.767 | 18.42 | 0.308 | 34.528 | 13.222 | 2352634 | 2466620 | 5/16/1998 | 07:25:18.40 | 4.005 | 7.654 |
| **409** | 45.781 | 18.438 | 0.298 | 34.525 | 13.222 | 2383224 | 2466270 | 5/16/1998 | 07:31:19.19 | 4.215 | 7.653 |
| **410** | 45.796 | 18.451 | 0.342 | 34.527 | 13.22 | 2348780 | 2466878 | 5/16/1998 | 07:37:19.98 | 3.978 | 7.656 |
| **411** | 45.807 | 18.454 | 0.34 | 34.534 | 13.221 | 2345413 | 2466815 | 5/16/1998 | 07:43:20.77 | 3.955 | 7.655 |
| **412** | 45.812 | 18.472 | 0.322 | 34.522 | 13.222 | 2363050 | 2466966 | 5/16/1998 | 07:49:21.56 | 4.076 | 7.656 |
| **413** | 45.829 | 18.484 | 0.296 | 34.527 | 13.222 | 2391920 | 2466354 | 5/16/1998 | 07:55:22.35 | 4.274 | 7.653 |
| **414** | 45.838 | 18.491 | 0.306 | 34.528 | 13.221 | 2343056 | 2466144 | 5/16/1998 | 08:01:23.14 | 3.939 | 7.652 |
| **415** | 45.851 | 18.5 | 0.303 | 34.532 | 13.222 | 2362069 | 2466077 | 5/16/1998 | 08:07:23.93 | 4.069 | 7.652 |
| **416** | 45.863 | 18.52 | 0.354 | 34.525 | 13.221 | 2358005 | 2465813 | 5/16/1998 | 08:13:24.72 | 4.041 | 7.651 |
| **417** | 45.876 | 18.532 | 0.366 | 34.526 | 13.22 | 2346991 | 2466243 | 5/16/1998 | 08:19:25.51 | 3.966 | 7.653 |
| **418** | 45.888 | 18.54 | 0.367 | 34.529 | 13.22 | 2374849 | 2465587 | 5/16/1998 | 08:25:26.30 | 4.157 | 7.650 |
| **419** | 45.894 | 18.545 | 0.368 | 34.531 | 13.219 | 2367514 | 2465572 | 5/16/1998 | 08:31:27.09 | 4.107 | 7.650 |
| **420** | 45.905 | 18.556 | 0.433 | 34.53 | 13.22 | 2355595 | 2465302 | 5/16/1998 | 08:37:27.88 | 4.025 | 7.649 |
| **421** | 45.914 | 18.572 | 0.427 | 34.525 | 13.221 | 2362177 | 2465679 | 5/16/1998 | 08:43:28.67 | 4.070 | 7.650 |
| **422** | 45.916 | 18.572 | 0.407 | 34.527 | 13.219 | 2376817 | 2465779 | 5/16/1998 | 08:50:10.73 | 4.171 | 7.651 |
| **423** | 45.928 | 18.577 | 0.46 | 34.533 | 13.22 | 2370694 | 2465513 | 5/16/1998 | 08:56:11.52 | 4.129 | 7.650 |
| **424** | 45.93 | 18.588 | 0.433 | 34.524 | 13.218 | 2364710 | 2465486 | 5/16/1998 | 09:02:12.31 | 4.087 | 7.650 |
| **425** | 45.934 | 18.587 | 0.466 | 34.529 | 13.219 | 2370880 | 2465688 | 5/16/1998 | 09:08:13.10 | 4.130 | 7.650 |
| **426** | 45.946 | 18.603 | 0.49 | 34.526 | 13.22 | 2362163 | 2465688 | 5/16/1998 | 09:14:13.89 | 4.070 | 7.650 |
| **427** | 45.951 | 18.607 | 0.519 | 34.526 | 13.217 | 2377732 | 2465540 | 5/16/1998 | 09:20:14.68 | 4.177 | 7.650 |
| **428** | 45.954 | 18.613 | 0.542 | 34.524 | 13.218 | 2343442 | 2465321 | 5/16/1998 | 09:26:15.47 | 3.941 | 7.649 |
| **429** | 45.958 | 18.619 | 0.555 | 34.522 | 13.218 | 2364455 | 2465740 | 5/16/1998 | 09:32:16.26 | 4.086 | 7.651 |
| **430** | 45.957 | 18.615 | 0.571 | 34.525 | 13.217 | 2345549 | 2465131 | 5/16/1998 | 09:38:17.05 | 3.956 | 7.648 |
| **431** | 45.958 | 18.616 | 0.619 | 34.525 | 13.217 | 2364135 | 2465252 | 5/16/1998 | 09:44:17.84 | 4.084 | 7.649 |
| **432** | 45.965 | 18.624 | 0.645 | 34.524 | 13.217 | 2378187 | 2464878 | 5/16/1998 | 09:50:18.63 | 4.180 | 7.647 |
| **433** | 45.962 | 18.615 | 0.629 | 34.53 | 13.216 | 2367755 | 2465241 | 5/16/1998 | 09:56:19.42 | 4.108 | 7.649 |
| **434** | 45.968 | 18.626 | 0.661 | 34.525 | 13.217 | 2371058 | 2465142 | 5/16/1998 | 10:02:20.21 | 4.131 | 7.648 |
| **435** | 45.971 | 18.629 | 0.655 | 34.525 | 13.218 | 2374850 | 2464974 | 5/16/1998 | 10:08:21.00 | 4.157 | 7.647 |
| **436** | 45.974 | 18.636 | 0.683 | 34.522 | 13.215 | 2370542 | 2464716 | 5/16/1998 | 10:14:21.79 | 4.127 | 7.646 |
| **437** | 45.971 | 18.639 | 0.709 | 34.517 | 13.218 | 2337076 | 2464915 | 5/16/1998 | 10:20:22.58 | 3.898 | 7.647 |
| **438** | 45.977 | 18.64 | 0.746 | 34.521 | 13.219 | 2407642 | 2464544 | 5/16/1998 | 10:26:23.37 | 4.382 | 7.646 |
| **439** | 45.981 | 18.64 | 0.815 | 34.524 | 13.215 | 2364894 | 2464814 | 5/16/1998 | 10:32:24.16 | 4.089 | 7.647 |
| **440** | 45.988 | 18.641 | 0.789 | 34.529 | 13.214 | 2365434 | 2464745 | 5/16/1998 | 10:38:24.95 | 4.092 | 7.646 |
| **441** | 45.98 | 18.638 | 0.808 | 34.525 | 13.214 | 2363864 | 2464677 | 5/16/1998 | 10:44:25.74 | 4.082 | 7.646 |
| **442** | 45.981 | 18.646 | 0.812 | 34.52 | 13.215 | 2355393 | 2465537 | 5/16/1998 | 10:50:26.53 | 4.024 | 7.650 |
| **443** | 45.983 | 18.645 | 0.865 | 34.522 | 13.214 | 2369408 | 2464854 | 5/16/1998 | 10:56:27.32 | 4.120 | 7.647 |
| **444** | 45.975 | 18.636 | 0.852 | 34.522 | 13.214 | 2375164 | 2465230 | 5/16/1998 | 11:02:28.11 | 4.159 | 7.648 |
| **445** | 45.972 | 18.63 | 0.854 | 34.525 | 13.213 | 2419238 | 2464471 | 5/16/1998 | 11:08:28.90 | 4.462 | 7.645 |
| **446** | 45.961 | 18.621 | 0.885 | 34.523 | 13.212 | 2341615 | 2464577 | 5/16/1998 | 11:14:29.69 | 3.929 | 7.646 |
| **447** | 45.954 | 18.61 | 0.929 | 34.527 | 13.212 | 2371574 | 2464745 | 5/16/1998 | 11:20:30.48 | 4.135 | 7.646 |
| **448** | 45.939 | 18.6 | 0.976 | 34.522 | 13.212 | 2386174 | 2464794 | 5/16/1998 | 11:26:31.27 | 4.235 | 7.647 |
| **449** | 45.935 | 18.589 | 0.992 | 34.528 | 13.211 | 2372143 | 2464763 | 5/16/1998 | 11:32:32.06 | 4.138 | 7.646 |
| **450** | 45.924 | 18.581 | 1.002 | 34.525 | 13.211 | 2356895 | 2464913 | 5/16/1998 | 11:38:32.85 | 4.034 | 7.647 |
| **451** | 45.911 | 18.572 | 1.013 | 34.522 | 13.21 | 2405453 | 2464511 | 5/16/1998 | 11:44:33.64 | 4.367 | 7.645 |
| **452** | 45.902 | 18.56 | 1.028 | 34.525 | 13.211 | 2394661 | 2464205 | 5/16/1998 | 11:50:34.43 | 4.293 | 7.644 |
| **453** | 45.889 | 18.542 | 1.084 | 34.529 | 13.21 | 2388545 | 2464097 | 5/16/1998 | 11:56:35.22 | 4.251 | 7.644 |
| **454** | 45.874 | 18.531 | 1.063 | 34.525 | 13.21 | 2369847 | 2464778 | 5/16/1998 | 12:02:36.01 | 4.123 | 7.647 |
| **455** | 45.867 | 18.515 | 1.023 | 34.533 | 13.21 | 2346747 | 2463775 | 5/16/1998 | 12:08:36.80 | 3.964 | 7.642 |
| **456** | 45.853 | 18.515 | 1.107 | 34.521 | 13.209 | 2377117 | 2464732 | 5/16/1998 | 12:14:37.59 | 4.173 | 7.646 |
| **457** | 45.839 | 18.499 | 1.12 | 34.522 | 13.209 | 2345139 | 2463841 | 5/16/1998 | 12:20:38.38 | 3.953 | 7.642 |
| **458** | 45.825 | 18.474 | 1.143 | 34.532 | 13.208 | 2376179 | 2464477 | 5/16/1998 | 12:26:39.17 | 4.166 | 7.645 |
| **459** | 45.81 | 18.47 | 1.125 | 34.522 | 13.208 | 2373567 | 2464374 | 5/16/1998 | 12:32:39.96 | 4.148 | 7.645 |
| **460** | 45.816 | 18.465 | 1.129 | 34.532 | 13.206 | 2380481 | 2464950 | 5/16/1998 | 12:38:40.75 | 4.196 | 7.647 |
| **461** | 45.807 | 18.462 | 1.137 | 34.527 | 13.209 | 2327573 | 2464215 | 5/16/1998 | 12:44:41.54 | 3.833 | 7.644 |
| **462** | 45.797 | 18.451 | 1.158 | 34.527 | 13.207 | 2389970 | 2464029 | 5/16/1998 | 12:50:42.33 | 4.261 | 7.643 |
| **463** | 45.788 | 18.435 | 1.178 | 34.533 | 13.206 | 2379758 | 2464539 | 5/16/1998 | 12:56:43.12 | 4.191 | 7.645 |
| **464** | 45.787 | 18.438 | 1.186 | 34.529 | 13.207 | 2358934 | 2463697 | 5/16/1998 | 13:02:43.91 | 4.048 | 7.642 |
| **465** | 45.781 | 18.431 | 1.207 | 34.531 | 13.206 | 2353875 | 2464250 | 5/16/1998 | 13:08:44.70 | 4.013 | 7.644 |
| **466** | 45.767 | 18.424 | 1.188 | 34.525 | 13.206 | 2370977 | 2465039 | 5/16/1998 | 13:14:45.49 | 4.130 | 7.648 |
| **467** | 45.757 | 18.407 | 1.183 | 34.531 | 13.203 | 2362247 | 2465663 | 5/16/1998 | 13:20:46.28 | 4.071 | 7.650 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **468** | 45.75 | 18.398 | 1.229 | 34.532 | 13.204 | 2382850 | 2463941 | 5/16/1998 | 13:26:47.07 | 4.212 | 7.643 |
| **469** | 45.739 | 18.386 | 1.211 | 34.533 | 13.203 | 2354702 | 2465103 | 5/16/1998 | 13:32:47.86 | 4.019 | 7.648 |
| **470** | 45.734 | 18.389 | 1.215 | 34.526 | 13.203 | 2358478 | 2464088 | 5/16/1998 | 13:38:48.65 | 4.045 | 7.644 |
| **471** | 45.727 | 18.38 | 1.242 | 34.528 | 13.202 | 2373397 | 2464084 | 5/16/1998 | 13:44:49.44 | 4.147 | 7.644 |
| **472** | 45.719 | 18.367 | 1.233 | 34.532 | 13.199 | 2363116 | 2465939 | 5/16/1998 | 13:50:50.23 | 4.077 | 7.652 |
| **473** | 45.706 | 18.367 | 1.227 | 34.521 | 13.2 | 2378673 | 2464619 | 5/16/1998 | 13:56:51.02 | 4.183 | 7.646 |
| **474** | 45.703 | 18.343 | 1.21 | 34.538 | 13.199 | 2372531 | 2463910 | 5/16/1998 | 14:02:51.81 | 4.141 | 7.643 |
| **475** | 45.685 | 18.333 | 1.214 | 34.532 | 13.199 | 2370729 | 2464530 | 5/16/1998 | 14:08:52.60 | 4.129 | 7.645 |
| **476** | 45.681 | 18.316 | 1.202 | 34.543 | 13.198 | 2346686 | 2464976 | 5/16/1998 | 14:14:53.39 | 3.964 | 7.647 |
| **477** | 45.662 | 18.308 | 1.228 | 34.533 | 13.2 | 2341954 | 2464430 | 5/16/1998 | 14:20:54.18 | 3.931 | 7.645 |
| **478** | 45.657 | 18.311 | 1.209 | 34.527 | 13.201 | 2357701 | 2464421 | 5/16/1998 | 14:26:54.97 | 4.039 | 7.645 |
| **479** | 45.653 | 18.302 | 1.209 | 34.531 | 13.199 | 2335402 | 2464029 | 5/16/1998 | 14:32:55.76 | 3.886 | 7.643 |
| **480** | 45.639 | 18.283 | 1.193 | 34.535 | 13.198 | 2363415 | 2465040 | 5/16/1998 | 14:38:56.55 | 4.079 | 7.648 |
| **481** | 45.632 | 18.282 | 1.196 | 34.53 | 13.199 | 2367654 | 2464068 | 5/16/1998 | 14:44:57.34 | 4.108 | 7.643 |
| **482** | 45.625 | 18.273 | 1.198 | 34.531 | 13.199 | 2361687 | 2463712 | 5/16/1998 | 14:50:58.13 | 4.067 | 7.642 |
| **483** | 45.616 | 18.262 | 1.192 | 34.534 | 13.199 | 2332234 | 2464235 | 5/16/1998 | 14:56:58.92 | 3.865 | 7.644 |
| **484** | 45.606 | 18.253 | 1.151 | 34.532 | 13.197 | 2387899 | 2464733 | 5/16/1998 | 15:02:59.71 | 4.247 | 7.646 |
| **485** | 45.599 | 18.241 | 1.165 | 34.536 | 13.198 | 2358923 | 2463690 | 5/16/1998 | 15:09:00.50 | 4.048 | 7.642 |
| **486** | 45.595 | 18.238 | 1.168 | 34.536 | 13.2 | 2388218 | 2464004 | 5/16/1998 | 15:15:01.29 | 4.249 | 7.643 |
| **487** | 45.583 | 18.223 | 1.159 | 34.538 | 13.197 | 2380298 | 2464683 | 5/16/1998 | 15:21:02.08 | 4.194 | 7.646 |
| **488** | 45.571 | 18.22 | 1.115 | 34.531 | 13.197 | 2386229 | 2464287 | 5/16/1998 | 15:27:02.87 | 4.235 | 7.644 |
| **489** | 45.566 | 18.203 | 1.143 | 34.541 | 13.197 | 2326244 | 2464329 | 5/16/1998 | 15:33:03.66 | 3.823 | 7.645 |
| **490** | 45.556 | 18.196 | 1.157 | 34.538 | 13.198 | 2391305 | 2464642 | 5/16/1998 | 15:39:04.45 | 4.270 | 7.646 |
| **491** | 45.552 | 18.193 | 1.087 | 34.537 | 13.196 | 2367932 | 2464694 | 5/16/1998 | 15:45:05.24 | 4.110 | 7.646 |
| **492** | 45.533 | 18.176 | 1.061 | 34.535 | 13.194 | 2364999 | 2464541 | 5/16/1998 | 15:51:47.30 | 4.089 | 7.646 |
| **493** | 45.526 | 18.17 | 1.072 | 34.534 | 13.195 | 2375858 | 2464794 | 5/16/1998 | 15:57:48.09 | 4.164 | 7.647 |
| **494** | 45.516 | 18.152 | 1.027 | 34.541 | 13.194 | 2348960 | 2464449 | 5/16/1998 | 16:03:48.88 | 3.979 | 7.645 |
| **495** | 45.504 | 18.147 | 1.062 | 34.535 | 13.194 | 2352109 | 2464971 | 5/16/1998 | 16:09:49.67 | 4.001 | 7.647 |
| **496** | 45.498 | 18.136 | 1.032 | 34.539 | 13.195 | 2352347 | 2464998 | 5/16/1998 | 16:15:50.46 | 4.003 | 7.647 |
| **497** | 45.493 | 18.136 | 1.005 | 34.535 | 13.194 | 2339196 | 2464992 | 5/16/1998 | 16:21:51.25 | 3.912 | 7.647 |
| **498** | 45.487 | 18.126 | 1.015 | 34.538 | 13.196 | 2361574 | 2464142 | 5/16/1998 | 16:27:52.04 | 4.066 | 7.644 |
| **499** | 45.482 | 18.12 | 1.022 | 34.539 | 13.193 | 2360144 | 2464436 | 5/16/1998 | 16:33:52.83 | 4.056 | 7.645 |
| **500** | 45.474 | 18.108 | 0.967 | 34.543 | 13.194 | 2337115 | 2464595 | 5/16/1998 | 16:39:53.62 | 3.898 | 7.646 |
| **501** | 45.463 | 18.091 | 0.964 | 34.547 | 13.193 | 2351100 | 2464490 | 5/16/1998 | 16:45:54.41 | 3.994 | 7.645 |
| **502** | 45.451 | 18.088 | 0.933 | 34.54 | 13.193 | 2383584 | 2464778 | 5/16/1998 | 16:51:55.20 | 4.217 | 7.647 |
| **503** | 45.446 | 18.074 | 0.921 | 34.547 | 13.192 | 2361530 | 2465183 | 5/16/1998 | 16:57:55.99 | 4.066 | 7.648 |
| **504** | 45.441 | 18.07 | 0.908 | 34.546 | 13.193 | 2391573 | 2464763 | 5/16/1998 | 17:03:56.78 | 4.272 | 7.646 |
| **505** | 45.448 | 18.085 | 0.943 | 34.54 | 13.193 | 2375491 | 2464601 | 5/16/1998 | 17:09:57.57 | 4.161 | 7.646 |
| **506** | 45.45 | 18.089 | 0.905 | 34.538 | 13.194 | 2389529 | 2464738 | 5/16/1998 | 17:15:58.36 | 4.258 | 7.646 |
| **507** | 45.46 | 18.097 | 0.91 | 34.54 | 13.192 | 2340969 | 2464962 | 5/16/1998 | 17:21:59.15 | 3.925 | 7.647 |
| **508** | 45.477 | 18.117 | 0.909 | 34.537 | 13.192 | 2342003 | 2464992 | 5/16/1998 | 17:27:59.94 | 3.932 | 7.647 |
| **509** | 45.488 | 18.132 | 0.888 | 34.534 | 13.192 | 2372901 | 2465404 | 5/16/1998 | 17:34:00.73 | 4.144 | 7.649 |
| **510** | 45.502 | 18.134 | 0.892 | 34.544 | 13.191 | 2374499 | 2465829 | 5/16/1998 | 17:40:01.52 | 4.155 | 7.651 |
| **511** | 45.518 | 18.157 | 0.904 | 34.539 | 13.188 | 2332155 | 2466200 | 5/16/1998 | 17:46:02.31 | 3.864 | 7.653 |
| **512** | 45.53 | 18.167 | 0.847 | 34.541 | 13.19 | 2345892 | 2465381 | 5/16/1998 | 17:52:03.10 | 3.958 | 7.649 |
| **513** | 45.553 | 18.186 | 0.888 | 34.543 | 13.19 | 2378091 | 2465739 | 5/16/1998 | 17:58:03.89 | 4.179 | 7.651 |
| **514** | 45.57 | 18.205 | 0.86 | 34.542 | 13.188 | 2367452 | 2465820 | 5/16/1998 | 18:04:04.68 | 4.106 | 7.651 |
| **515** | 45.591 | 18.23 | 0.865 | 34.539 | 13.188 | 2339761 | 2465898 | 5/16/1998 | 18:10:05.47 | 3.916 | 7.651 |
| **516** | 45.611 | 18.242 | 0.853 | 34.546 | 13.191 | 2346266 | 2466400 | 5/16/1998 | 18:16:06.26 | 3.961 | 7.654 |
| **517** | 45.623 | 18.261 | 0.871 | 34.54 | 13.188 | 2364061 | 2466960 | 5/16/1998 | 18:22:07.05 | 4.083 | 7.656 |
| **518** | 45.637 | 18.28 | 0.857 | 34.535 | 13.186 | 2372822 | 2466124 | 5/16/1998 | 18:28:07.84 | 4.143 | 7.652 |
| **519** | 45.656 | 18.293 | 0.844 | 34.542 | 13.187 | 2365685 | 2466685 | 5/16/1998 | 18:34:08.63 | 4.094 | 7.655 |
| **520** | 45.67 | 18.305 | 0.878 | 34.543 | 13.187 | 2353791 | 2466438 | 5/16/1998 | 18:40:09.42 | 4.013 | 7.654 |
| **521** | 45.668 | 18.312 | 0.839 | 34.536 | 13.184 | 2386575 | 2466954 | 5/16/1998 | 18:46:10.21 | 4.238 | 7.656 |
| **522** | 45.683 | 18.322 | 0.833 | 34.54 | 13.186 | 2354987 | 2466560 | 5/16/1998 | 18:52:11.00 | 4.021 | 7.654 |
| **523** | 45.692 | 18.325 | 0.869 | 34.544 | 13.187 | 2354107 | 2466625 | 5/16/1998 | 18:58:11.79 | 4.015 | 7.655 |
| **524** | 45.696 | 18.336 | 0.908 | 34.538 | 13.189 | 2341134 | 2466451 | 5/16/1998 | 19:04:12.58 | 3.926 | 7.654 |
| **525** | 45.694 | 18.335 | 0.875 | 34.538 | 13.187 | 2368882 | 2466764 | 5/16/1998 | 19:10:13.37 | 4.116 | 7.655 |
| **526** | 45.697 | 18.333 | 0.924 | 34.542 | 13.186 | 2347339 | 2466919 | 5/16/1998 | 19:16:14.16 | 3.968 | 7.656 |
| **527** | 45.693 | 18.337 | 0.87 | 34.535 | 13.186 | 2378758 | 2467027 | 5/16/1998 | 19:22:14.95 | 4.184 | 7.656 |
| **528** | 45.697 | 18.335 | 0.918 | 34.54 | 13.184 | 2362681 | 2467232 | 5/16/1998 | 19:28:15.74 | 4.074 | 7.657 |
| **529** | 45.694 | 18.331 | 0.886 | 34.542 | 13.187 | 2366986 | 2466913 | 5/16/1998 | 19:34:16.53 | 4.103 | 7.656 |
| **530** | 45.691 | 18.324 | 0.89 | 34.545 | 13.185 | 2360421 | 2468338 | 5/16/1998 | 19:40:17.32 | 4.058 | 7.662 |
| **531** | 45.687 | 18.325 | 0.894 | 34.541 | 13.183 | 2379600 | 2468490 | 5/16/1998 | 19:46:18.11 | 4.190 | 7.663 |
| **532** | 45.693 | 18.32 | 0.901 | 34.549 | 13.183 | 2359686 | 2468207 | 5/16/1998 | 19:52:18.90 | 4.053 | 7.661 |
| **533** | 45.689 | 18.33 | 0.941 | 34.537 | 13.185 | 2397885 | 2467017 | 5/16/1998 | 19:58:19.69 | 4.315 | 7.656 |
| **534** | 45.685 | 18.319 | 0.949 | 34.544 | 13.187 | 2350642 | 2466877 | 5/16/1998 | 20:04:20.48 | 3.991 | 7.656 |
| **535** | 45.679 | 18.317 | 0.969 | 34.54 | 13.184 | 2378571 | 2466798 | 5/16/1998 | 20:10:21.27 | 4.183 | 7.655 |
| **536** | 45.684 | 18.317 | 0.933 | 34.545 | 13.183 | 2346928 | 2468411 | 5/16/1998 | 20:16:22.06 | 3.965 | 7.662 |
| **537** | 45.682 | 18.314 | 0.962 | 34.545 | 13.185 | 2334539 | 2467785 | 5/16/1998 | 20:22:22.85 | 3.880 | 7.660 |
| **538** | 45.682 | 18.318 | 0.998 | 34.542 | 13.184 | 2339871 | 2467012 | 5/16/1998 | 20:28:23.64 | 3.917 | 7.656 |
| **539** | 45.68 | 18.317 | 0.961 | 34.542 | 13.185 | 2362783 | 2466783 | 5/16/1998 | 20:34:24.43 | 4.074 | 7.655 |
| **540** | 45.683 | 18.318 | 0.974 | 34.543 | 13.184 | 2383029 | 2467048 | 5/16/1998 | 20:40:25.22 | 4.213 | 7.656 |
| **541** | 45.681 | 18.318 | 1.006 | 34.541 | 13.182 | 2363565 | 2468321 | 5/16/1998 | 20:46:26.01 | 4.080 | 7.662 |
| **542** | 45.684 | 18.316 | 1.053 | 34.546 | 13.185 | 2369824 | 2467478 | 5/16/1998 | 20:52:26.80 | 4.123 | 7.658 |
| **543** | 45.67 | 18.308 | 1.047 | 34.541 | 13.182 | 2368282 | 2469173 | 5/16/1998 | 20:58:27.59 | 4.112 | 7.666 |
| **544** | 45.666 | 18.299 | 1.073 | 34.545 | 13.183 | 2326759 | 2467904 | 5/16/1998 | 21:04:28.38 | 3.827 | 7.660 |
| **545** | 45.66 | 18.295 | 1.068 | 34.543 | 13.182 | 2342929 | 2467685 | 5/16/1998 | 21:10:29.17 | 3.938 | 7.659 |
| **546** | 45.658 | 18.304 | 1.076 | 34.534 | 13.179 | 2361774 | 2467671 | 5/16/1998 | 21:16:29.96 | 4.067 | 7.659 |
| **547** | 45.653 | 18.286 | 1.12 | 34.544 | 13.181 | 2353908 | 2467763 | 5/16/1998 | 21:22:30.75 | 4.013 | 7.659 |
| **548** | 45.648 | 18.276 | 1.125 | 34.548 | 13.179 | 2337217 | 2467807 | 5/16/1998 | 21:28:31.54 | 3.899 | 7.660 |
| **549** | 45.639 | 18.264 | 1.127 | 34.551 | 13.179 | 2371271 | 2467590 | 5/16/1998 | 21:34:32.33 | 4.132 | 7.659 |
| **550** | 45.632 | 18.262 | 1.117 | 34.547 | 13.178 | 2367347 | 2467603 | 5/16/1998 | 21:40:33.12 | 4.106 | 7.659 |
| **551** | 45.617 | 18.25 | 1.157 | 34.544 | 13.178 | 2352441 | 2467076 | 5/16/1998 | 21:46:33.91 | 4.003 | 7.656 |
| **552** | 45.606 | 18.237 | 1.171 | 34.546 | 13.178 | 2354748 | 2467900 | 5/16/1998 | 21:52:34.70 | 4.019 | 7.660 |
| **553** | 45.592 | 18.224 | 1.195 | 34.545 | 13.178 | 2368829 | 2467686 | 5/16/1998 | 21:58:35.49 | 4.116 | 7.659 |
| **554** | 45.584 | 18.214 | 1.189 | 34.547 | 13.176 | 2384793 | 2467288 | 5/16/1998 | 22:04:36.28 | 4.225 | 7.657 |
| **555** | 45.563 | 18.198 | 1.21 | 34.543 | 13.176 | 2348787 | 2467643 | 5/16/1998 | 22:10:37.07 | 3.978 | 7.659 |
| **556** | 45.556 | 18.184 | 1.212 | 34.548 | 13.178 | 2345808 | 2467217 | 5/16/1998 | 22:16:37.86 | 3.958 | 7.657 |
| **557** | 45.532 | 18.165 | 1.227 | 34.544 | 13.176 | 2363619 | 2467489 | 5/16/1998 | 22:22:38.65 | 4.080 | 7.658 |
| **558** | 45.513 | 18.143 | 1.246 | 34.546 | 13.176 | 2359755 | 2467180 | 5/16/1998 | 22:28:39.44 | 4.053 | 7.657 |
| **559** | 45.491 | 18.108 | 1.232 | 34.557 | 13.175 | 2343311 | 2468087 | 5/16/1998 | 22:34:40.23 | 3.941 | 7.661 |
| **560** | 45.483 | 18.103 | 1.226 | 34.554 | 13.174 | 2342689 | 2467742 | 5/16/1998 | 22:40:41.02 | 3.936 | 7.659 |
| **561** | 45.467 | 18.098 | 1.279 | 34.546 | 13.171 | 2364423 | 2467491 | 5/16/1998 | 22:46:41.81 | 4.085 | 7.658 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **562** | 45.444 | 18.073 | 1.286 | 34.547 | 13.173 | 2365753 | 2467437 | 5/16/1998 | 22:53:23.87 | 4.095 | 7.658 |
| **563** | 45.422 | 18.039 | 1.301 | 34.557 | 13.171 | 2370680 | 2468064 | 5/16/1998 | 22:59:24.66 | 4.128 | 7.661 |
| **564** | 45.41 | 18.037 | 1.281 | 34.548 | 13.171 | 2372768 | 2467330 | 5/16/1998 | 23:05:25.45 | 4.143 | 7.658 |
| **565** | 45.397 | 18.017 | 1.311 | 34.553 | 13.171 | 2338758 | 2467691 | 5/16/1998 | 23:11:26.24 | 3.909 | 7.659 |
| **566** | 45.388 | 18.008 | 1.332 | 34.554 | 13.173 | 2347926 | 2467937 | 5/16/1998 | 23:17:27.03 | 3.972 | 7.660 |
| **567** | 45.38 | 17.998 | 1.349 | 34.555 | 13.172 | 2348759 | 2467185 | 5/16/1998 | 23:23:27.82 | 3.978 | 7.657 |
| **568** | 45.364 | 17.977 | 1.334 | 34.56 | 13.169 | 2365185 | 2467211 | 5/16/1998 | 23:29:28.61 | 4.091 | 7.657 |
| **569** | 45.358 | 17.972 | 1.278 | 34.558 | 13.171 | 2351984 | 2467960 | 5/16/1998 | 23:35:29.40 | 4.000 | 7.660 |
| **570** | 45.352 | 17.962 | 1.343 | 34.562 | 13.172 | 2337874 | 2467387 | 5/16/1998 | 23:41:30.19 | 3.903 | 7.658 |
| **571** | 45.34 | 17.954 | 1.382 | 34.559 | 13.17 | 2321696 | 2467304 | 5/16/1998 | 23:47:30.98 | 3.792 | 7.657 |
| **572** | 45.322 | 17.941 | 1.399 | 34.554 | 13.169 | 2358306 | 2467359 | 5/16/1998 | 23:53:31.77 | 4.044 | 7.658 |
| **573** | 45.319 | 17.939 | 1.339 | 34.554 | 13.17 | 2337583 | 2467462 | 5/16/1998 | 23:59:32.56 | 3.901 | 7.658 |
| **574** | 45.318 | 17.929 | 1.312 | 34.561 | 13.169 | 2365470 | 2467248 | 5/17/1998 | 00:05:33.35 | 4.093 | 7.657 |
| **575** | 45.312 | 17.925 | 1.315 | 34.559 | 13.167 | 2349387 | 2467050 | 5/17/1998 | 00:11:34.14 | 3.982 | 7.656 |
| **576** | 45.311 | 17.916 | 1.402 | 34.565 | 13.168 | 2353205 | 2467416 | 5/17/1998 | 00:17:34.93 | 4.008 | 7.658 |
| **577** | 45.301 | 17.92 | 1.411 | 34.554 | 13.166 | 2337473 | 2467619 | 5/17/1998 | 00:23:35.72 | 3.901 | 7.659 |
| **578** | 45.3 | 17.914 | 1.351 | 34.559 | 13.169 | 2358633 | 2467290 | 5/17/1998 | 00:29:36.51 | 4.046 | 7.657 |
| **579** | 45.306 | 17.919 | 1.343 | 34.559 | 13.167 | 2341838 | 2467741 | 5/17/1998 | 00:35:37.30 | 3.930 | 7.659 |
| **580** | 45.303 | 17.921 | 1.378 | 34.555 | 13.168 | 2335597 | 2467766 | 5/17/1998 | 00:41:38.09 | 3.888 | 7.659 |
| **581** | 45.306 | 17.914 | 1.395 | 34.564 | 13.168 | 2352442 | 2467056 | 5/17/1998 | 00:47:38.88 | 4.003 | 7.656 |
| **582** | 45.298 | 17.92 | 1.357 | 34.551 | 13.167 | 2339605 | 2467423 | 5/17/1998 | 00:53:39.67 | 3.915 | 7.658 |
| **583** | 45.304 | 17.916 | 1.302 | 34.56 | 13.172 | 2325629 | 2468335 | 5/17/1998 | 00:59:40.46 | 3.819 | 7.662 |
| **584** | 45.292 | 17.908 | 1.339 | 34.556 | 13.171 | 2375801 | 2467323 | 5/17/1998 | 01:05:41.25 | 4.164 | 7.658 |
| **585** | 45.291 | 17.901 | 1.371 | 34.561 | 13.171 | 2393714 | 2467936 | 5/17/1998 | 01:11:42.04 | 4.287 | 7.660 |
| **586** | 45.286 | 17.897 | 1.386 | 34.56 | 13.17 | 2344911 | 2467390 | 5/17/1998 | 01:17:42.83 | 3.952 | 7.658 |
| **587** | 45.277 | 17.892 | 1.328 | 34.557 | 13.171 | 2340091 | 2467983 | 5/17/1998 | 01:23:43.62 | 3.918 | 7.660 |
| **588** | 45.27 | 17.888 | 1.298 | 34.555 | 13.171 | 2324607 | 2467197 | 5/17/1998 | 01:29:44.41 | 3.812 | 7.657 |
| **589** | 45.256 | 17.871 | 1.286 | 34.557 | 13.17 | 2354488 | 2467486 | 5/17/1998 | 01:35:45.20 | 4.017 | 7.658 |
| **590** | 45.255 | 17.86 | 1.32 | 34.565 | 13.171 | 2334609 | 2466970 | 5/17/1998 | 01:41:45.99 | 3.881 | 7.656 |
| **591** | 45.249 | 17.855 | 1.255 | 34.564 | 13.168 | 2341522 | 2467301 | 5/17/1998 | 01:47:46.78 | 3.928 | 7.657 |
| **592** | 45.239 | 17.851 | 1.241 | 34.559 | 13.169 | 2357362 | 2467528 | 5/17/1998 | 01:53:47.57 | 4.037 | 7.658 |
| **593** | 45.233 | 17.838 | 1.227 | 34.565 | 13.168 | 2354461 | 2466798 | 5/17/1998 | 01:59:48.36 | 4.017 | 7.655 |
| **594** | 45.227 | 17.836 | 1.251 | 34.562 | 13.169 | 2346498 | 2466464 | 5/17/1998 | 02:05:49.15 | 3.962 | 7.654 |
| **595** | 45.223 | 17.818 | 1.228 | 34.574 | 13.169 | 2329462 | 2467108 | 5/17/1998 | 02:11:49.94 | 3.846 | 7.657 |
| **596** | 45.219 | 17.818 | 1.168 | 34.57 | 13.169 | 2303440 | 2467571 | 5/17/1998 | 02:17:50.73 | 3.667 | 7.659 |
| **597** | 45.215 | 17.818 | 1.099 | 34.567 | 13.168 | 2348828 | 2467607 | 5/17/1998 | 02:23:51.52 | 3.978 | 7.659 |
| **598** | 45.211 | 17.813 | 1.124 | 34.567 | 13.167 | 2315842 | 2467344 | 5/17/1998 | 02:29:52.31 | 3.752 | 7.658 |
| **599** | 45.207 | 17.811 | 1.113 | 34.566 | 13.168 | 2359304 | 2466972 | 5/17/1998 | 02:35:53.10 | 4.050 | 7.656 |
| **600** | 45.204 | 17.807 | 1.139 | 34.567 | 13.168 | 2341558 | 2467290 | 5/17/1998 | 02:41:53.89 | 3.929 | 7.657 |
| **601** | 45.197 | 17.797 | 1.066 | 34.569 | 13.166 | 2339620 | 2467203 | 5/17/1998 | 02:47:54.68 | 3.915 | 7.657 |
| **602** | 45.194 | 17.789 | 1.033 | 34.574 | 13.166 | 2336496 | 2467142 | 5/17/1998 | 02:53:55.47 | 3.894 | 7.657 |
| **603** | 45.197 | 17.805 | 1.031 | 34.562 | 13.167 | 2329092 | 2467169 | 5/17/1998 | 02:59:56.26 | 3.843 | 7.657 |
| **604** | 45.199 | 17.806 | 1.029 | 34.563 | 13.165 | 2345839 | 2466527 | 5/17/1998 | 03:05:57.05 | 3.958 | 7.654 |
| **605** | 45.202 | 17.804 | 0.98 | 34.568 | 13.166 | 2343813 | 2467411 | 5/17/1998 | 03:11:57.84 | 3.944 | 7.658 |
| **606** | 45.197 | 17.798 | 0.872 | 34.569 | 13.165 | 2330224 | 2467036 | 5/17/1998 | 03:17:58.63 | 3.851 | 7.656 |
| **607** | 45.2 | 17.804 | 0.878 | 34.567 | 13.164 | 2355436 | 2467817 | 5/17/1998 | 03:23:59.42 | 4.024 | 7.660 |
| **608** | 45.197 | 17.791 | 0.884 | 34.574 | 13.165 | 2361804 | 2467743 | 5/17/1998 | 03:30:00.21 | 4.068 | 7.659 |
| **609** | 45.202 | 17.813 | 0.897 | 34.56 | 13.165 | 2365687 | 2467669 | 5/17/1998 | 03:36:01.00 | 4.094 | 7.659 |
| **610** | 45.205 | 17.797 | 0.794 | 34.576 | 13.166 | 2321636 | 2467781 | 5/17/1998 | 03:42:01.79 | 3.792 | 7.660 |
| **611** | 45.209 | 17.807 | 0.795 | 34.571 | 13.165 | 2325346 | 2467497 | 5/17/1998 | 03:48:02.58 | 3.817 | 7.658 |
| **612** | 45.208 | 17.809 | 0.752 | 34.569 | 13.164 | 2359005 | 2467658 | 5/17/1998 | 03:54:03.37 | 4.048 | 7.659 |
| **613** | 45.216 | 17.817 | 0.768 | 34.569 | 13.164 | 2343460 | 2466552 | 5/17/1998 | 04:00:04.16 | 3.942 | 7.654 |
| **614** | 45.227 | 17.827 | 0.71 | 34.57 | 13.163 | 2353426 | 2467467 | 5/17/1998 | 04:06:04.95 | 4.010 | 7.658 |
| **615** | 45.235 | 17.836 | 0.678 | 34.569 | 13.164 | 2354205 | 2467116 | 5/17/1998 | 04:12:05.74 | 4.015 | 7.657 |
| **616** | 45.238 | 17.832 | 0.63 | 34.574 | 13.164 | 2310477 | 2467348 | 5/17/1998 | 04:18:06.53 | 3.715 | 7.658 |
| **617** | 45.25 | 17.858 | 0.668 | 34.563 | 13.164 | 2357586 | 2467347 | 5/17/1998 | 04:24:07.32 | 4.039 | 7.658 |
| **618** | 45.256 | 17.863 | 0.643 | 34.564 | 13.163 | 2326316 | 2467019 | 5/17/1998 | 04:30:08.11 | 3.824 | 7.656 |
| **619** | 45.276 | 17.877 | 0.591 | 34.569 | 13.164 | 2348954 | 2467217 | 5/17/1998 | 04:36:08.90 | 3.979 | 7.657 |
| **620** | 45.286 | 17.89 | 0.51 | 34.567 | 13.164 | 2359153 | 2466636 | 5/17/1998 | 04:42:09.69 | 4.049 | 7.655 |
| **621** | 45.285 | 17.889 | 0.474 | 34.567 | 13.163 | 2338852 | 2467149 | 5/17/1998 | 04:48:10.48 | 3.910 | 7.657 |
| **622** | 45.296 | 17.897 | 0.477 | 34.569 | 13.162 | 2306267 | 2467817 | 5/17/1998 | 04:54:11.27 | 3.686 | 7.660 |
| **623** | 45.307 | 17.908 | 0.463 | 34.569 | 13.164 | 2346058 | 2467430 | 5/17/1998 | 05:00:12.06 | 3.959 | 7.658 |
| **624** | 45.323 | 17.924 | 0.391 | 34.569 | 13.164 | 2355039 | 2467178 | 5/17/1998 | 05:06:12.85 | 4.021 | 7.657 |
| **625** | 45.322 | 17.934 | 0.395 | 34.56 | 13.162 | 2359708 | 2467231 | 5/17/1998 | 05:12:13.64 | 4.053 | 7.657 |
| **626** | 45.34 | 17.944 | 0.344 | 34.567 | 13.163 | 2348177 | 2467303 | 5/17/1998 | 05:18:14.43 | 3.974 | 7.657 |
| **627** | 45.352 | 17.952 | 0.345 | 34.57 | 13.163 | 2338359 | 2467454 | 5/17/1998 | 05:24:15.22 | 3.907 | 7.658 |
| **628** | 45.365 | 17.973 | 0.335 | 34.564 | 13.163 | 2335940 | 2467496 | 5/17/1998 | 05:30:16.01 | 3.890 | 7.658 |
| **629** | 45.373 | 17.973 | 0.273 | 34.571 | 13.164 | 2331284 | 2467326 | 5/17/1998 | 05:36:16.80 | 3.858 | 7.658 |
| **630** | 45.38 | 17.984 | 0.24 | 34.567 | 13.163 | 2322278 | 2467280 | 5/17/1998 | 05:42:17.59 | 3.796 | 7.657 |
| **631** | 45.398 | 18.004 | 0.211 | 34.566 | 13.164 | 2350069 | 2466876 | 5/17/1998 | 05:48:18.38 | 3.987 | 7.656 |

## Blank Test #2 Sensor Data

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 46.202 | 19.133 | 1.108 | 34.299 | 13.16 | 2390314 | 2440004 | 5/21/1998 | 13:38:51.25 | 4.263 | 7.539 |
| **2** | 46.278 | 19.098 | 1.076 | 34.39 | 13.167 | 2522865 | 2451441 | 5/21/1998 | 13:45:33.26 | 5.173 | 7.589 |
| **3** | 46.316 | 19.068 | 1.072 | 34.448 | 13.169 | 2340983 | 2454720 | 5/21/1998 | 13:51:34.06 | 3.925 | 7.603 |
| **4** | 46.337 | 19.061 | 1.105 | 34.471 | 13.172 | 2509529 | 2457809 | 5/21/1998 | 13:57:34.86 | 5.081 | 7.616 |
| **5** | 46.353 | 19.032 | 1.159 | 34.508 | 13.152 | 2501876 | 2458357 | 5/21/1998 | 14:03:35.66 | 5.029 | 7.619 |
| **6** | 46.359 | 19.024 | 1.187 | 34.52 | 13.162 | 2435298 | 2460954 | 5/21/1998 | 14:09:36.46 | 4.572 | 7.630 |
| **7** | 46.366 | 19.012 | 1.199 | 34.537 | 13.163 | 2427763 | 2460922 | 5/21/1998 | 14:15:37.26 | 4.520 | 7.630 |
| **8** | 46.363 | 19.001 | 1.208 | 34.543 | 13.163 | 2400872 | 2461056 | 5/21/1998 | 14:21:38.06 | 4.336 | 7.630 |
| **9** | 46.358 | 18.984 | 1.243 | 34.553 | 13.163 | 2361794 | 2461934 | 5/21/1998 | 14:27:38.86 | 4.067 | 7.634 |
| **10** | 46.353 | 18.964 | 1.269 | 34.565 | 13.162 | 2458406 | 2463035 | 5/21/1998 | 14:33:39.66 | 4.730 | 7.639 |
| **11** | 46.343 | 18.945 | 1.304 | 34.572 | 13.161 | 2365812 | 2463574 | 5/21/1998 | 14:39:40.46 | 4.095 | 7.641 |
| **12** | 46.334 | 18.937 | 1.328 | 34.571 | 13.16 | 2553596 | 2464094 | 5/21/1998 | 14:45:41.26 | 5.384 | 7.644 |
| **13** | 46.326 | 18.932 | 1.334 | 34.569 | 13.16 | 2584932 | 2464757 | 5/21/1998 | 14:51:42.06 | 5.599 | 7.646 |
| **14** | 46.312 | 18.904 | 1.444 | 34.581 | 13.159 | 2424556 | 2465466 | 5/21/1998 | 14:57:42.86 | 4.498 | 7.649 |
| **15** | 46.281 | 18.871 | 1.468 | 34.582 | 13.158 | 2459465 | 2466503 | 5/21/1998 | 15:03:43.66 | 4.738 | 7.654 |
| **16** | 46.243 | 18.838 | 1.51 | 34.579 | 13.159 | 2454382 | 2466498 | 5/21/1998 | 15:09:44.46 | 4.703 | 7.654 |
| **17** | 46.216 | 18.801 | 1.53 | 34.587 | 13.138 | 2423580 | 2466276 | 5/21/1998 | 15:15:45.26 | 4.491 | 7.653 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 46.184 | 18.77 | 1.512 | 34.586 | 13.148 | 2373287 | 2467426 | 5/21/1998 | 15:21:46.06 | 4.146 | 7.658 |
| 19 | 46.158 | 18.743 | 1.589 | 34.586 | 13.149 | 2507339 | 2467756 | 5/21/1998 | 15:27:46.86 | 5.066 | 7.659 |
| 20 | 46.132 | 18.708 | 1.619 | 34.594 | 13.15 | 2505078 | 2467849 | 5/21/1998 | 15:33:47.66 | 5.051 | 7.660 |
| 21 | 46.097 | 18.678 | 1.619 | 34.589 | 13.15 | 2515458 | 2467839 | 5/21/1998 | 15:39:48.46 | 5.122 | 7.660 |
| 22 | 46.072 | 18.646 | 1.66 | 34.596 | 13.148 | 2493683 | 2468153 | 5/21/1998 | 15:45:49.26 | 4.973 | 7.661 |
| 23 | 46.037 | 18.618 | 1.704 | 34.589 | 13.148 | 2533075 | 2468413 | 5/21/1998 | 15:51:50.06 | 5.243 | 7.662 |
| 24 | 46.006 | 18.582 | 1.735 | 34.593 | 13.146 | 2478840 | 2469294 | 5/21/1998 | 15:57:50.86 | 4.871 | 7.666 |
| 25 | 45.967 | 18.532 | 1.812 | 34.602 | 13.146 | 2561193 | 2468621 | 5/21/1998 | 16:03:51.66 | 5.436 | 7.663 |
| 26 | 45.927 | 18.502 | 1.803 | 34.594 | 13.146 | 2552714 | 2469184 | 5/21/1998 | 16:09:52.46 | 5.378 | 7.666 |
| 27 | 45.888 | 18.46 | 1.839 | 34.597 | 13.143 | 2355165 | 2470047 | 5/21/1998 | 16:15:53.26 | 4.022 | 7.669 |
| 28 | 45.854 | 18.426 | 1.869 | 34.597 | 13.143 | 2525326 | 2470359 | 5/21/1998 | 16:21:54.06 | 5.190 | 7.671 |
| 29 | 45.817 | 18.388 | 1.904 | 34.597 | 13.146 | 2458766 | 2469934 | 5/21/1998 | 16:27:54.86 | 4.733 | 7.669 |
| 30 | 45.78 | 18.352 | 1.956 | 34.596 | 13.142 | 2470958 | 2470148 | 5/21/1998 | 16:33:55.66 | 4.817 | 7.670 |
| 31 | 45.746 | 18.319 | 1.974 | 34.595 | 13.141 | 2374208 | 2470550 | 5/21/1998 | 16:39:56.46 | 4.153 | 7.671 |
| 32 | 45.712 | 18.289 | 2.009 | 34.591 | 13.14 | 2437755 | 2471185 | 5/21/1998 | 16:45:57.26 | 4.589 | 7.674 |
| 33 | 45.68 | 18.248 | 2.023 | 34.599 | 13.139 | 2431687 | 2470966 | 5/21/1998 | 16:51:58.06 | 4.547 | 7.673 |
| 34 | 45.645 | 18.207 | 2.044 | 34.604 | 13.14 | 2558848 | 2470882 | 5/21/1998 | 16:57:58.86 | 5.420 | 7.673 |
| 35 | 45.612 | 18.179 | 2.102 | 34.599 | 13.136 | 2413532 | 2470847 | 5/21/1998 | 17:03:59.66 | 4.423 | 7.673 |
| 36 | 45.579 | 18.148 | 2.085 | 34.598 | 13.135 | 2572176 | 2470840 | 5/21/1998 | 17:10:00.46 | 5.511 | 7.673 |
| 37 | 45.549 | 18.109 | 2.135 | 34.605 | 13.137 | 2480318 | 2470963 | 5/21/1998 | 17:16:01.26 | 4.881 | 7.673 |
| 38 | 45.514 | 18.078 | 2.167 | 34.602 | 13.135 | 2536597 | 2471746 | 5/21/1998 | 17:22:02.06 | 5.267 | 7.677 |
| 39 | 45.478 | 18.036 | 2.189 | 34.606 | 13.135 | 2505750 | 2471657 | 5/21/1998 | 17:28:02.86 | 5.055 | 7.676 |
| 40 | 45.442 | 17.985 | 2.199 | 34.618 | 13.133 | 2500701 | 2471833 | 5/21/1998 | 17:34:03.66 | 5.021 | 7.677 |
| 41 | 45.4 | 17.956 | 2.21 | 34.608 | 13.131 | 2525424 | 2472433 | 5/21/1998 | 17:40:04.46 | 5.190 | 7.680 |
| 42 | 45.363 | 17.912 | 2.26 | 34.613 | 13.13 | 2550208 | 2472446 | 5/21/1998 | 17:46:05.26 | 5.361 | 7.680 |
| 43 | 45.327 | 17.876 | 2.297 | 34.613 | 13.129 | 2506076 | 2472325 | 5/21/1998 | 17:52:06.06 | 5.058 | 7.679 |
| 44 | 45.301 | 17.852 | 2.283 | 34.611 | 13.129 | 2418967 | 2472158 | 5/21/1998 | 17:58:06.86 | 4.460 | 7.678 |
| 45 | 45.273 | 17.824 | 2.272 | 34.612 | 13.128 | 2471378 | 2472321 | 5/21/1998 | 18:04:07.66 | 4.820 | 7.679 |
| 46 | 45.246 | 17.786 | 2.274 | 34.621 | 13.127 | 2366864 | 2473064 | 5/21/1998 | 18:10:08.46 | 4.102 | 7.682 |
| 47 | 45.22 | 17.77 | 2.274 | 34.612 | 13.127 | 2485840 | 2472505 | 5/21/1998 | 18:16:09.26 | 4.919 | 7.680 |
| 48 | 45.197 | 17.742 | 2.307 | 34.615 | 13.125 | 2512483 | 2472953 | 5/21/1998 | 18:22:10.06 | 5.102 | 7.682 |
| 49 | 45.164 | 17.707 | 2.303 | 34.618 | 13.125 | 2517881 | 2473129 | 5/21/1998 | 18:28:10.86 | 5.139 | 7.683 |
| 50 | 45.143 | 17.691 | 2.285 | 34.612 | 13.124 | 2461695 | 2473022 | 5/21/1998 | 18:34:11.66 | 4.753 | 7.682 |
| 51 | 45.112 | 17.669 | 2.343 | 34.605 | 13.123 | 2521923 | 2473058 | 5/21/1998 | 18:40:12.46 | 5.166 | 7.682 |
| 52 | 45.091 | 17.631 | 2.329 | 34.619 | 13.123 | 2555670 | 2473504 | 5/21/1998 | 18:46:13.26 | 5.398 | 7.684 |
| 53 | 45.065 | 17.619 | 2.324 | 34.607 | 13.122 | 2530853 | 2473616 | 5/21/1998 | 18:52:14.06 | 5.228 | 7.685 |
| 54 | 45.037 | 17.581 | 2.304 | 34.615 | 13.123 | 2527753 | 2473714 | 5/21/1998 | 18:58:14.86 | 5.206 | 7.685 |
| 55 | 45.012 | 17.548 | 2.278 | 34.622 | 13.122 | 2520220 | 2474142 | 5/21/1998 | 19:04:15.66 | 5.155 | 7.687 |
| 56 | 44.988 | 17.534 | 2.286 | 34.614 | 13.122 | 2488670 | 2474554 | 5/21/1998 | 19:10:16.46 | 4.938 | 7.689 |
| 57 | 44.974 | 17.518 | 2.273 | 34.615 | 13.12 | 2340159 | 2473935 | 5/21/1998 | 19:16:17.26 | 3.919 | 7.686 |
| 58 | 44.958 | 17.492 | 2.253 | 34.624 | 13.12 | 2505343 | 2474372 | 5/21/1998 | 19:22:18.06 | 5.053 | 7.688 |
| 59 | 44.934 | 17.483 | 2.247 | 34.61 | 13.124 | 2499414 | 2474364 | 5/21/1998 | 19:28:18.86 | 5.012 | 7.688 |
| 60 | 44.923 | 17.458 | 2.259 | 34.623 | 13.12 | 2484125 | 2474709 | 5/21/1998 | 19:34:19.66 | 4.907 | 7.689 |
| 61 | 44.911 | 17.449 | 2.206 | 34.62 | 13.12 | 2463238 | 2474635 | 5/21/1998 | 19:40:20.46 | 4.764 | 7.689 |
| 62 | 44.899 | 17.426 | 2.177 | 34.629 | 13.119 | 2382057 | 2474805 | 5/21/1998 | 19:46:21.26 | 4.207 | 7.690 |
| 63 | 44.885 | 17.418 | 2.161 | 34.624 | 13.118 | 2550609 | 2474660 | 5/21/1998 | 19:52:22.06 | 5.363 | 7.689 |
| 64 | 44.864 | 17.402 | 2.125 | 34.619 | 13.119 | 2452850 | 2475328 | 5/21/1998 | 19:58:22.86 | 4.692 | 7.692 |
| 65 | 44.852 | 17.389 | 2.079 | 34.621 | 13.118 | 2539657 | 2474369 | 5/21/1998 | 20:04:23.66 | 5.288 | 7.688 |
| 66 | 44.845 | 17.372 | 2.096 | 34.629 | 13.116 | 2505340 | 2474789 | 5/21/1998 | 20:10:24.46 | 5.053 | 7.690 |
| 67 | 44.826 | 17.357 | 2.065 | 34.625 | 13.118 | 2483477 | 2475315 | 5/21/1998 | 20:16:25.26 | 4.903 | 7.692 |
| 68 | 44.816 | 17.358 | 2.054 | 34.615 | 13.117 | 2546740 | 2475066 | 5/21/1998 | 20:22:26.06 | 5.337 | 7.691 |
| 69 | 44.814 | 17.334 | 2.003 | 34.634 | 13.117 | 2521575 | 2475101 | 5/21/1998 | 20:28:26.86 | 5.164 | 7.691 |
| 70 | 44.796 | 17.329 | 1.99 | 34.623 | 13.116 | 2537269 | 2474887 | 5/21/1998 | 20:34:27.66 | 5.272 | 7.690 |
| 71 | 44.792 | 17.321 | 1.957 | 34.627 | 13.113 | 2514934 | 2475563 | 5/21/1998 | 20:40:28.46 | 5.118 | 7.693 |
| 72 | 44.784 | 17.304 | 1.888 | 34.634 | 13.114 | 2527107 | 2475467 | 5/21/1998 | 20:47:10.46 | 5.202 | 7.693 |
| 73 | 44.773 | 17.298 | 1.858 | 34.63 | 13.113 | 2535439 | 2475272 | 5/21/1998 | 20:53:11.26 | 5.259 | 7.692 |
| 74 | 44.769 | 17.301 | 1.835 | 34.624 | 13.111 | 2491451 | 2475189 | 5/21/1998 | 20:59:12.06 | 4.957 | 7.692 |
| 75 | 44.764 | 17.286 | 1.795 | 34.632 | 13.112 | 2478345 | 2476044 | 5/21/1998 | 21:05:12.86 | 4.867 | 7.695 |
| 76 | 44.747 | 17.28 | 1.764 | 34.623 | 13.111 | 2419311 | 2475569 | 5/21/1998 | 21:11:13.66 | 4.462 | 7.693 |
| 77 | 44.751 | 17.269 | 1.703 | 34.636 | 13.109 | 2489444 | 2475393 | 5/21/1998 | 21:17:14.46 | 4.944 | 7.692 |
| 78 | 44.753 | 17.271 | 1.71 | 34.636 | 13.111 | 2503768 | 2476429 | 5/21/1998 | 21:23:15.26 | 5.042 | 7.697 |
| 79 | 44.752 | 17.282 | 1.671 | 34.625 | 13.112 | 2512456 | 2476399 | 5/21/1998 | 21:29:16.06 | 5.101 | 7.697 |
| 80 | 44.761 | 17.285 | 1.659 | 34.63 | 13.11 | 2506785 | 2476267 | 5/21/1998 | 21:35:16.86 | 5.063 | 7.696 |
| 81 | 44.761 | 17.285 | 1.563 | 34.631 | 13.111 | 2457003 | 2475595 | 5/21/1998 | 21:41:17.66 | 4.721 | 7.693 |
| 82 | 44.767 | 17.284 | 1.527 | 34.637 | 13.109 | 2557588 | 2476434 | 5/21/1998 | 21:47:18.46 | 5.411 | 7.697 |
| 83 | 44.776 | 17.3 | 1.502 | 34.63 | 13.109 | 2509352 | 2476291 | 5/21/1998 | 21:53:19.26 | 5.080 | 7.696 |
| 84 | 44.786 | 17.308 | 1.449 | 34.633 | 13.108 | 2466104 | 2476058 | 5/21/1998 | 21:59:20.06 | 4.783 | 7.695 |
| 85 | 44.791 | 17.313 | 1.413 | 34.633 | 13.108 | 2555568 | 2476098 | 5/21/1998 | 22:05:20.86 | 5.397 | 7.695 |
| 86 | 44.8 | 17.335 | 1.413 | 34.621 | 13.108 | 2519069 | 2476377 | 5/21/1998 | 22:11:21.66 | 5.147 | 7.697 |
| 87 | 44.815 | 17.341 | 1.374 | 34.629 | 13.107 | 2476979 | 2476875 | 5/21/1998 | 22:17:22.46 | 4.858 | 7.699 |
| 88 | 44.834 | 17.351 | 1.333 | 34.637 | 13.108 | 2453701 | 2476864 | 5/21/1998 | 22:23:23.26 | 4.698 | 7.699 |
| 89 | 44.847 | 17.377 | 1.312 | 34.627 | 13.108 | 2508059 | 2476798 | 5/21/1998 | 22:29:24.06 | 5.071 | 7.698 |
| 90 | 44.867 | 17.395 | 1.276 | 34.628 | 13.107 | 2477922 | 2476404 | 5/21/1998 | 22:35:24.86 | 4.864 | 7.697 |
| 91 | 44.871 | 17.4 | 1.244 | 34.627 | 13.107 | 2466918 | 2476771 | 5/21/1998 | 22:41:25.66 | 4.789 | 7.698 |
| 92 | 44.876 | 17.406 | 1.175 | 34.627 | 13.108 | 2458859 | 2477017 | 5/21/1998 | 22:47:26.46 | 4.734 | 7.699 |
| 93 | 44.889 | 17.42 | 1.137 | 34.626 | 13.107 | 2423035 | 2476877 | 5/21/1998 | 22:53:27.26 | 4.488 | 7.699 |
| 94 | 44.887 | 17.412 | 1.077 | 34.63 | 13.107 | 2477639 | 2477159 | 5/21/1998 | 22:59:28.06 | 4.862 | 7.700 |
| 95 | 44.893 | 17.408 | 1.092 | 34.64 | 13.107 | 2463486 | 2477276 | 5/21/1998 | 23:05:28.86 | 4.765 | 7.701 |
| 96 | 44.906 | 17.428 | 1.052 | 34.633 | 13.108 | 2437951 | 2476897 | 5/21/1998 | 23:11:29.66 | 4.590 | 7.699 |
| 97 | 44.912 | 17.442 | 1.045 | 34.627 | 13.104 | 2564190 | 2477004 | 5/21/1998 | 23:17:30.46 | 5.456 | 7.699 |
| 98 | 44.921 | 17.451 | 0.969 | 34.627 | 13.105 | 2505644 | 2477244 | 5/21/1998 | 23:23:31.26 | 5.055 | 7.700 |
| 99 | 44.928 | 17.46 | 0.961 | 34.625 | 13.104 | 2519770 | 2476920 | 5/21/1998 | 23:29:32.06 | 5.152 | 7.699 |
| 100 | 44.939 | 17.466 | 0.902 | 34.63 | 13.106 | 2492289 | 2477066 | 5/21/1998 | 23:35:32.86 | 4.963 | 7.700 |
| 101 | 44.944 | 17.481 | 0.894 | 34.622 | 13.107 | 2474222 | 2477496 | 5/21/1998 | 23:41:33.66 | 4.839 | 7.701 |
| 102 | 44.958 | 17.475 | 0.867 | 34.639 | 13.103 | 2514833 | 2476933 | 5/21/1998 | 23:47:34.46 | 5.118 | 7.699 |
| 103 | 44.977 | 17.498 | 0.813 | 34.635 | 13.1 | 2447485 | 2478166 | 5/21/1998 | 23:53:35.26 | 4.656 | 7.704 |
| 104 | 45.006 | 17.533 | 0.81 | 34.63 | 13.1 | 2394625 | 2477179 | 5/21/1998 | 23:59:36.06 | 4.293 | 7.700 |
| 105 | 45.017 | 17.543 | 0.778 | 34.631 | 13.103 | 2441267 | 2476859 | 5/22/1998 | 00:05:36.86 | 4.613 | 7.699 |
| 106 | 45.057 | 17.586 | 0.803 | 34.629 | 13.103 | 2471410 | 2476729 | 5/22/1998 | 00:11:37.66 | 4.820 | 7.698 |
| 107 | 45.096 | 17.624 | 0.778 | 34.63 | 13.103 | 2515227 | 2477467 | 5/22/1998 | 00:17:38.46 | 5.120 | 7.701 |
| 108 | 45.129 | 17.666 | 0.731 | 34.623 | 13.103 | 2516008 | 2477202 | 5/22/1998 | 00:23:39.26 | 5.126 | 7.700 |
| 109 | 45.172 | 17.703 | 0.722 | 34.628 | 13.101 | 2461183 | 2477837 | 5/22/1998 | 00:29:40.06 | 4.750 | 7.703 |
| 110 | 45.214 | 17.742 | 0.717 | 34.631 | 13.103 | 2439726 | 2477267 | 5/22/1998 | 00:35:40.86 | 4.602 | 7.700 |
| 111 | 45.245 | 17.783 | 0.723 | 34.623 | 13.103 | 2519799 | 2477347 | 5/22/1998 | 00:41:41.66 | 5.152 | 7.701 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **112** | 45.278 | 17.814 | 0.702 | 34.625 | 13.102 | 2550837 | 2477708 | 5/22/1998 | 00:47:42.46 | 5.365 | 7.702 |
| **113** | 45.313 | 17.844 | 0.695 | 34.629 | 13.105 | 2519264 | 2476562 | 5/22/1998 | 00:53:43.26 | 5.148 | 7.697 |
| **114** | 45.349 | 17.886 | 0.675 | 34.625 | 13.102 | 2427305 | 2477508 | 5/22/1998 | 00:59:44.06 | 4.517 | 7.702 |
| **115** | 45.381 | 17.92 | 0.666 | 34.623 | 13.106 | 2510104 | 2477272 | 5/22/1998 | 01:05:44.86 | 5.085 | 7.701 |
| **116** | 45.409 | 17.948 | 0.706 | 34.623 | 13.106 | 2489018 | 2477992 | 5/22/1998 | 01:11:45.66 | 4.941 | 7.704 |
| **117** | 45.441 | 17.989 | 0.702 | 34.616 | 13.107 | 2559590 | 2477596 | 5/22/1998 | 01:17:46.46 | 5.425 | 7.702 |
| **118** | 45.474 | 18.014 | 0.676 | 34.622 | 13.106 | 2449186 | 2477557 | 5/22/1998 | 01:23:47.26 | 4.667 | 7.702 |
| **119** | 45.497 | 18.04 | 0.674 | 34.62 | 13.106 | 2562210 | 2477342 | 5/22/1998 | 01:29:48.06 | 5.443 | 7.701 |
| **120** | 45.529 | 18.062 | 0.66 | 34.629 | 13.106 | 2526724 | 2477193 | 5/22/1998 | 01:35:48.86 | 5.199 | 7.700 |
| **121** | 45.545 | 18.097 | 0.685 | 34.613 | 13.106 | 2543469 | 2477368 | 5/22/1998 | 01:41:49.66 | 5.314 | 7.701 |
| **122** | 45.573 | 18.105 | 0.706 | 34.629 | 13.106 | 2360954 | 2477673 | 5/22/1998 | 01:47:50.46 | 4.062 | 7.702 |
| **123** | 45.591 | 18.129 | 0.705 | 34.624 | 13.104 | 2533349 | 2477321 | 5/22/1998 | 01:53:51.26 | 5.245 | 7.701 |
| **124** | 45.608 | 18.145 | 0.715 | 34.626 | 13.104 | 2520575 | 2477208 | 5/22/1998 | 01:59:52.06 | 5.157 | 7.700 |
| **125** | 45.621 | 18.173 | 0.708 | 34.613 | 13.105 | 2329882 | 2477674 | 5/22/1998 | 02:05:52.86 | 3.848 | 7.702 |
| **126** | 45.641 | 18.176 | 0.722 | 34.627 | 13.104 | 2547123 | 2477206 | 5/22/1998 | 02:11:53.66 | 5.339 | 7.700 |
| **127** | 45.653 | 18.197 | 0.763 | 34.62 | 13.106 | 2523985 | 2477146 | 5/22/1998 | 02:17:54.46 | 5.181 | 7.700 |
| **128** | 45.66 | 18.208 | 0.761 | 34.616 | 13.104 | 2510639 | 2477250 | 5/22/1998 | 02:23:55.26 | 5.089 | 7.700 |
| **129** | 45.672 | 18.225 | 0.781 | 34.612 | 13.104 | 2556839 | 2476997 | 5/22/1998 | 02:29:56.06 | 5.406 | 7.699 |
| **130** | 45.688 | 18.24 | 0.798 | 34.613 | 13.102 | 2555538 | 2477086 | 5/22/1998 | 02:35:56.86 | 5.397 | 7.700 |
| **131** | 45.697 | 18.247 | 0.802 | 34.615 | 13.103 | 2577033 | 2477383 | 5/22/1998 | 02:41:57.66 | 5.545 | 7.701 |
| **132** | 45.713 | 18.261 | 0.826 | 34.616 | 13.104 | 2538299 | 2477239 | 5/22/1998 | 02:47:58.46 | 5.279 | 7.700 |
| **133** | 45.724 | 18.259 | 0.866 | 34.628 | 13.104 | 2559382 | 2477180 | 5/22/1998 | 02:53:59.26 | 5.423 | 7.700 |
| **134** | 45.738 | 18.279 | 0.873 | 34.623 | 13.104 | 2520177 | 2476853 | 5/22/1998 | 03:00:00.06 | 5.154 | 7.699 |
| **135** | 45.746 | 18.298 | 0.911 | 34.613 | 13.103 | 2462069 | 2477108 | 5/22/1998 | 03:06:00.86 | 4.756 | 7.700 |
| **136** | 45.758 | 18.308 | 0.906 | 34.615 | 13.102 | 2546888 | 2476971 | 5/22/1998 | 03:12:01.66 | 5.338 | 7.699 |
| **137** | 45.77 | 18.319 | 0.942 | 34.615 | 13.103 | 2531091 | 2476808 | 5/22/1998 | 03:18:02.46 | 5.229 | 7.699 |
| **138** | 45.781 | 18.33 | 0.988 | 34.616 | 13.101 | 2552020 | 2477715 | 5/22/1998 | 03:24:03.26 | 5.373 | 7.702 |
| **139** | 45.786 | 18.337 | 1.017 | 34.614 | 13.101 | 2564959 | 2477456 | 5/22/1998 | 03:30:04.06 | 5.462 | 7.701 |
| **140** | 45.798 | 18.344 | 1.04 | 34.619 | 13.101 | 2478992 | 2476837 | 5/22/1998 | 03:36:04.86 | 4.872 | 7.699 |
| **141** | 45.809 | 18.358 | 1.042 | 34.616 | 13.101 | 2531656 | 2476966 | 5/22/1998 | 03:42:05.66 | 5.233 | 7.699 |
| **142** | 45.813 | 18.365 | 1.081 | 34.613 | 13.1 | 2558407 | 2477173 | 5/22/1998 | 03:48:47.68 | 5.417 | 7.700 |
| **143** | 45.824 | 18.372 | 1.12 | 34.617 | 13.1 | 2531641 | 2477906 | 5/22/1998 | 03:54:48.48 | 5.233 | 7.703 |
| **144** | 45.825 | 18.376 | 1.145 | 34.614 | 13.1 | 2540305 | 2477434 | 5/22/1998 | 04:00:49.28 | 5.293 | 7.701 |
| **145** | 45.824 | 18.369 | 1.168 | 34.619 | 13.099 | 2476107 | 2477134 | 5/22/1998 | 04:06:50.08 | 4.852 | 7.700 |
| **146** | 45.808 | 18.357 | 1.198 | 34.616 | 13.1 | 2542306 | 2476991 | 5/22/1998 | 04:12:50.88 | 5.306 | 7.699 |
| **147** | 45.796 | 18.346 | 1.243 | 34.615 | 13.098 | 2491920 | 2477085 | 5/22/1998 | 04:18:51.68 | 4.960 | 7.700 |
| **148** | 45.777 | 18.319 | 1.283 | 34.621 | 13.097 | 2559809 | 2477640 | 5/22/1998 | 04:24:52.48 | 5.426 | 7.702 |
| **149** | 45.753 | 18.304 | 1.283 | 34.614 | 13.097 | 2535834 | 2476651 | 5/22/1998 | 04:30:53.28 | 5.262 | 7.698 |
| **150** | 45.738 | 18.286 | 1.306 | 34.616 | 13.097 | 2546808 | 2476655 | 5/22/1998 | 04:36:54.08 | 5.337 | 7.698 |
| **151** | 45.722 | 18.257 | 1.345 | 34.628 | 13.095 | 2468557 | 2477490 | 5/22/1998 | 04:42:54.88 | 4.800 | 7.701 |
| **152** | 45.701 | 18.251 | 1.383 | 34.614 | 13.096 | 2528798 | 2476453 | 5/22/1998 | 04:48:55.68 | 5.214 | 7.697 |
| **153** | 45.671 | 18.217 | 1.396 | 34.617 | 13.095 | 2517556 | 2477030 | 5/22/1998 | 04:54:56.48 | 5.136 | 7.699 |
| **154** | 45.648 | 18.191 | 1.405 | 34.62 | 13.095 | 2519308 | 2477160 | 5/22/1998 | 05:00:57.28 | 5.148 | 7.700 |
| **155** | 45.627 | 18.166 | 1.428 | 34.623 | 13.094 | 2555662 | 2477278 | 5/22/1998 | 05:06:58.08 | 5.398 | 7.701 |
| **156** | 45.596 | 18.152 | 1.425 | 34.61 | 13.093 | 2513395 | 2476905 | 5/22/1998 | 05:12:58.88 | 5.108 | 7.699 |
| **157** | 45.577 | 18.116 | 1.464 | 34.623 | 13.093 | 2521306 | 2476796 | 5/22/1998 | 05:18:59.68 | 5.162 | 7.698 |
| **158** | 45.558 | 18.105 | 1.513 | 34.616 | 13.092 | 2555370 | 2477149 | 5/22/1998 | 05:25:00.48 | 5.396 | 7.700 |
| **159** | 45.542 | 18.092 | 1.526 | 34.614 | 13.093 | 2553861 | 2476514 | 5/22/1998 | 05:31:01.28 | 5.386 | 7.697 |
| **160** | 45.537 | 18.083 | 1.524 | 34.617 | 13.093 | 2550637 | 2476525 | 5/22/1998 | 05:37:02.08 | 5.363 | 7.697 |
| **161** | 45.524 | 18.069 | 1.559 | 34.618 | 13.092 | 2541907 | 2476470 | 5/22/1998 | 05:43:02.88 | 5.304 | 7.697 |
| **162** | 45.508 | 18.054 | 1.615 | 34.617 | 13.091 | 2523072 | 2477189 | 5/22/1998 | 05:49:03.68 | 5.174 | 7.700 |
| **163** | 45.472 | 18.024 | 1.665 | 34.612 | 13.091 | 2556613 | 2477205 | 5/22/1998 | 05:55:04.48 | 5.404 | 7.700 |
| **164** | 45.458 | 17.994 | 1.638 | 34.625 | 13.09 | 2484451 | 2476845 | 5/22/1998 | 06:01:05.28 | 4.909 | 7.699 |
| **165** | 45.432 | 17.967 | 1.667 | 34.625 | 13.089 | 2464945 | 2477186 | 5/22/1998 | 06:07:06.08 | 4.775 | 7.700 |
| **166** | 45.407 | 17.939 | 1.632 | 34.628 | 13.088 | 2531457 | 2476656 | 5/22/1998 | 06:13:06.88 | 5.232 | 7.698 |
| **167** | 45.386 | 17.918 | 1.659 | 34.628 | 13.088 | 2505329 | 2477277 | 5/22/1998 | 06:19:07.68 | 5.053 | 7.701 |
| **168** | 45.369 | 17.909 | 1.695 | 34.621 | 13.089 | 2498060 | 2477641 | 5/22/1998 | 06:25:08.48 | 5.003 | 7.702 |
| **169** | 45.348 | 17.876 | 1.674 | 34.631 | 13.089 | 2555347 | 2476938 | 5/22/1998 | 06:31:09.28 | 5.396 | 7.699 |
| **170** | 45.313 | 17.843 | 1.705 | 34.629 | 13.087 | 2538492 | 2476915 | 5/22/1998 | 06:37:10.08 | 5.280 | 7.699 |
| **171** | 45.281 | 17.812 | 1.735 | 34.629 | 13.086 | 2542194 | 2476964 | 5/22/1998 | 06:43:10.88 | 5.306 | 7.699 |
| **172** | 45.25 | 17.783 | 1.751 | 34.626 | 13.085 | 2376488 | 2477291 | 5/22/1998 | 06:49:11.68 | 4.168 | 7.701 |
| **173** | 45.209 | 17.716 | 1.712 | 34.649 | 13.085 | 2513666 | 2477088 | 5/22/1998 | 06:55:12.48 | 5.110 | 7.700 |
| **174** | 45.166 | 17.693 | 1.717 | 34.632 | 13.085 | 2480147 | 2476989 | 5/22/1998 | 07:01:13.28 | 4.880 | 7.699 |
| **175** | 45.13 | 17.66 | 1.679 | 34.628 | 13.084 | 2557294 | 2476859 | 5/22/1998 | 07:07:14.08 | 5.409 | 7.699 |
| **176** | 45.098 | 17.62 | 1.699 | 34.635 | 13.083 | 2529115 | 2477376 | 5/22/1998 | 07:13:14.88 | 5.216 | 7.701 |
| **177** | 45.057 | 17.587 | 1.684 | 34.628 | 13.082 | 2532466 | 2477867 | 5/22/1998 | 07:19:15.68 | 5.239 | 7.703 |
| **178** | 45.036 | 17.56 | 1.704 | 34.633 | 13.081 | 2486409 | 2477678 | 5/22/1998 | 07:25:16.48 | 4.923 | 7.702 |
| **179** | 45.011 | 17.527 | 1.7 | 34.639 | 13.082 | 2508540 | 2476940 | 5/22/1998 | 07:31:17.28 | 5.075 | 7.699 |
| **180** | 44.985 | 17.508 | 1.693 | 34.633 | 13.082 | 2521874 | 2476530 | 5/22/1998 | 07:37:18.08 | 5.166 | 7.697 |
| **181** | 44.962 | 17.475 | 1.653 | 34.641 | 13.08 | 2470629 | 2476918 | 5/22/1998 | 07:43:18.88 | 4.814 | 7.699 |
| **182** | 44.935 | 17.456 | 1.632 | 34.634 | 13.08 | 2530286 | 2477282 | 5/22/1998 | 07:49:19.68 | 5.224 | 7.701 |
| **183** | 44.911 | 17.436 | 1.638 | 34.63 | 13.08 | 2497136 | 2476602 | 5/22/1998 | 07:55:20.48 | 4.996 | 7.698 |
| **184** | 44.898 | 17.413 | 1.607 | 34.639 | 13.08 | 2499170 | 2476886 | 5/22/1998 | 08:01:21.28 | 5.010 | 7.699 |
| **185** | 44.885 | 17.399 | 1.589 | 34.64 | 13.078 | 2521135 | 2476775 | 5/22/1998 | 08:07:22.08 | 5.161 | 7.698 |
| **186** | 44.87 | 17.388 | 1.574 | 34.636 | 13.079 | 2520418 | 2476553 | 5/22/1998 | 08:13:22.88 | 5.156 | 7.697 |
| **187** | 44.856 | 17.368 | 1.555 | 34.641 | 13.079 | 2496176 | 2476810 | 5/22/1998 | 08:19:23.68 | 4.990 | 7.699 |
| **188** | 44.838 | 17.351 | 1.545 | 34.641 | 13.078 | 2495921 | 2476436 | 5/22/1998 | 08:25:24.48 | 4.988 | 7.697 |
| **189** | 44.827 | 17.338 | 1.525 | 34.642 | 13.076 | 2499587 | 2476681 | 5/22/1998 | 08:31:25.28 | 5.013 | 7.698 |
| **190** | 44.811 | 17.328 | 1.497 | 34.636 | 13.078 | 2456752 | 2476819 | 5/22/1998 | 08:37:26.08 | 4.719 | 7.699 |
| **191** | 44.799 | 17.326 | 1.459 | 34.628 | 13.078 | 2527192 | 2476673 | 5/22/1998 | 08:43:26.88 | 5.203 | 7.698 |
| **192** | 44.786 | 17.299 | 1.434 | 34.64 | 13.076 | 2544265 | 2476520 | 5/22/1998 | 08:49:27.68 | 5.320 | 7.697 |
| **193** | 44.773 | 17.287 | 1.378 | 34.64 | 13.074 | 2539162 | 2477420 | 5/22/1998 | 08:55:28.48 | 5.285 | 7.701 |
| **194** | 44.767 | 17.276 | 1.381 | 34.643 | 13.075 | 2530529 | 2476615 | 5/22/1998 | 09:01:29.28 | 5.225 | 7.698 |
| **195** | 44.76 | 17.276 | 1.358 | 34.637 | 13.074 | 2554847 | 2476194 | 5/22/1998 | 09:07:30.08 | 5.392 | 7.696 |
| **196** | 44.763 | 17.264 | 1.315 | 34.65 | 13.074 | 2394760 | 2476965 | 5/22/1998 | 09:13:30.88 | 4.294 | 7.699 |
| **197** | 44.752 | 17.261 | 1.284 | 34.643 | 13.074 | 2495131 | 2476273 | 5/22/1998 | 09:19:31.68 | 4.983 | 7.696 |
| **198** | 44.748 | 17.268 | 1.262 | 34.633 | 13.074 | 2522533 | 2476803 | 5/22/1998 | 09:25:32.48 | 5.171 | 7.698 |
| **199** | 44.752 | 17.262 | 1.209 | 34.643 | 13.073 | 2482657 | 2476080 | 5/22/1998 | 09:31:33.28 | 4.897 | 7.695 |
| **200** | 44.753 | 17.26 | 1.192 | 34.645 | 13.073 | 2531466 | 2476243 | 5/22/1998 | 09:37:34.08 | 5.232 | 7.696 |
| **201** | 44.763 | 17.272 | 1.135 | 34.644 | 13.072 | 2478414 | 2476247 | 5/22/1998 | 09:43:34.88 | 4.868 | 7.696 |
| **202** | 44.776 | 17.281 | 1.113 | 34.647 | 13.072 | 2512870 | 2476179 | 5/22/1998 | 09:49:35.68 | 5.104 | 7.696 |
| **203** | 44.782 | 17.3 | 1.069 | 34.636 | 13.072 | 2542990 | 2476101 | 5/22/1998 | 09:55:36.48 | 5.311 | 7.695 |
| **204** | 44.795 | 17.303 | 1.054 | 34.645 | 13.073 | 2514186 | 2476201 | 5/22/1998 | 10:01:37.28 | 5.113 | 7.696 |
| **205** | 44.815 | 17.328 | 1.03 | 34.64 | 13.072 | 2482869 | 2475749 | 5/22/1998 | 10:07:38.08 | 4.898 | 7.694 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **206** | 44.847 | 17.356 | 1.009 | 34.645 | 13.072 | 2521376 | 2476367 | 5/22/1998 | 10:13:38.88 | 5.163 | 7.697 |
| **207** | 44.879 | 17.389 | 0.99 | 34.644 | 13.072 | 2506430 | 2475594 | 5/22/1998 | 10:19:39.68 | 5.060 | 7.693 |
| **208** | 44.917 | 17.419 | 0.951 | 34.651 | 13.074 | 2501957 | 2475565 | 5/22/1998 | 10:25:40.48 | 5.029 | 7.693 |
| **209** | 44.951 | 17.46 | 0.973 | 34.646 | 13.073 | 2508257 | 2476163 | 5/22/1998 | 10:31:41.28 | 5.073 | 7.696 |
| **210** | 44.978 | 17.498 | 0.906 | 34.636 | 13.074 | 2527258 | 2476195 | 5/22/1998 | 10:37:42.08 | 5.203 | 7.696 |
| **211** | 45.01 | 17.53 | 0.841 | 34.636 | 13.074 | 2520040 | 2475221 | 5/22/1998 | 10:43:42.88 | 5.153 | 7.692 |
| **212** | 45.022 | 17.538 | 0.817 | 34.64 | 13.073 | 2511075 | 2476560 | 5/22/1998 | 10:50:24.90 | 5.092 | 7.697 |
| **213** | 45.043 | 17.565 | 0.761 | 34.634 | 13.072 | 2573094 | 2476536 | 5/22/1998 | 10:56:25.70 | 5.518 | 7.697 |
| **214** | 45.069 | 17.588 | 0.727 | 34.637 | 13.072 | 2553586 | 2477014 | 5/22/1998 | 11:02:26.50 | 5.384 | 7.699 |
| **215** | 45.095 | 17.611 | 0.737 | 34.64 | 13.071 | 2555903 | 2476480 | 5/22/1998 | 11:08:27.30 | 5.400 | 7.697 |
| **216** | 45.117 | 17.635 | 0.716 | 34.639 | 13.072 | 2484253 | 2475660 | 5/22/1998 | 11:14:28.10 | 4.908 | 7.694 |
| **217** | 45.157 | 17.669 | 0.678 | 34.644 | 13.07 | 2479726 | 2476035 | 5/22/1998 | 11:20:28.90 | 4.877 | 7.695 |
| **218** | 45.186 | 17.701 | 0.649 | 34.642 | 13.072 | 2419273 | 2476067 | 5/22/1998 | 11:26:29.70 | 4.462 | 7.695 |
| **219** | 45.2 | 17.717 | 0.647 | 34.64 | 13.072 | 2497828 | 2475766 | 5/22/1998 | 11:32:30.50 | 5.001 | 7.694 |
| **220** | 45.223 | 17.742 | 0.609 | 34.639 | 13.072 | 2519695 | 2475132 | 5/22/1998 | 11:38:31.30 | 5.151 | 7.691 |
| **221** | 45.242 | 17.764 | 0.579 | 34.636 | 13.072 | 2544067 | 2474886 | 5/22/1998 | 11:44:32.10 | 5.318 | 7.690 |
| **222** | 45.253 | 17.766 | 0.543 | 34.644 | 13.071 | 2432940 | 2475029 | 5/22/1998 | 11:50:32.90 | 4.556 | 7.691 |
| **223** | 45.283 | 17.8 | 0.534 | 34.641 | 13.071 | 2537971 | 2475207 | 5/22/1998 | 11:56:33.70 | 5.277 | 7.692 |
| **224** | 45.317 | 17.843 | 0.501 | 34.634 | 13.072 | 2562296 | 2475944 | 5/22/1998 | 12:02:34.50 | 5.443 | 7.695 |
| **225** | 45.348 | 17.875 | 0.495 | 34.633 | 13.073 | 2440713 | 2474609 | 5/22/1998 | 12:08:35.30 | 4.609 | 7.689 |
| **226** | 45.376 | 17.893 | 0.508 | 34.641 | 13.072 | 2602873 | 2474617 | 5/22/1998 | 12:14:36.10 | 5.722 | 7.689 |
| **227** | 45.41 | 17.927 | 0.487 | 34.641 | 13.073 | 2501132 | 2473855 | 5/22/1998 | 12:20:36.90 | 5.024 | 7.686 |
| **228** | 45.438 | 17.952 | 0.466 | 34.644 | 13.073 | 2524167 | 2474290 | 5/22/1998 | 12:26:37.70 | 5.182 | 7.688 |
| **229** | 45.469 | 17.987 | 0.465 | 34.641 | 13.073 | 2536048 | 2474344 | 5/22/1998 | 12:32:38.50 | 5.263 | 7.688 |
| **230** | 45.501 | 18.018 | 0.43 | 34.642 | 13.072 | 2545965 | 2474540 | 5/22/1998 | 12:38:39.30 | 5.331 | 7.689 |
| **231** | 45.532 | 18.061 | 0.458 | 34.632 | 13.072 | 2533242 | 2474607 | 5/22/1998 | 12:44:40.10 | 5.244 | 7.689 |
| **232** | 45.573 | 18.097 | 0.398 | 34.636 | 13.074 | 2542412 | 2474832 | 5/22/1998 | 12:50:40.90 | 5.307 | 7.690 |
| **233** | 45.607 | 18.132 | 0.424 | 34.635 | 13.072 | 2537286 | 2475282 | 5/22/1998 | 12:56:41.70 | 5.272 | 7.692 |
| **234** | 45.649 | 18.191 | 0.424 | 34.621 | 13.073 | 2557397 | 2474541 | 5/22/1998 | 13:02:42.50 | 5.410 | 7.689 |
| **235** | 45.682 | 18.208 | 0.426 | 34.635 | 13.075 | 2572214 | 2475073 | 5/22/1998 | 13:08:43.30 | 5.512 | 7.691 |
| **236** | 45.71 | 18.237 | 0.444 | 34.635 | 13.075 | 2601694 | 2475205 | 5/22/1998 | 13:14:44.10 | 5.714 | 7.692 |
| **237** | 45.738 | 18.261 | 0.434 | 34.638 | 13.073 | 2522882 | 2475577 | 5/22/1998 | 13:20:44.90 | 5.173 | 7.693 |
| **238** | 45.77 | 18.288 | 0.47 | 34.642 | 13.074 | 2566391 | 2475066 | 5/22/1998 | 13:26:45.70 | 5.472 | 7.691 |
| **239** | 45.795 | 18.328 | 0.452 | 34.629 | 13.073 | 2572739 | 2475476 | 5/22/1998 | 13:32:46.50 | 5.515 | 7.693 |
| **240** | 45.821 | 18.348 | 0.457 | 34.635 | 13.073 | 2469582 | 2475410 | 5/22/1998 | 13:38:47.30 | 4.807 | 7.692 |
| **241** | 45.855 | 18.386 | 0.44 | 34.631 | 13.072 | 2546359 | 2475661 | 5/22/1998 | 13:44:48.10 | 5.334 | 7.694 |
| **242** | 45.878 | 18.403 | 0.449 | 34.636 | 13.073 | 2562619 | 2475641 | 5/22/1998 | 13:50:48.90 | 5.446 | 7.693 |
| **243** | 45.896 | 18.429 | 0.512 | 34.63 | 13.072 | 2531384 | 2475645 | 5/22/1998 | 13:56:49.70 | 5.231 | 7.693 |
| **244** | 45.919 | 18.447 | 0.525 | 34.634 | 13.073 | 2586375 | 2475526 | 5/22/1998 | 14:02:50.50 | 5.609 | 7.693 |
| **245** | 45.936 | 18.463 | 0.523 | 34.635 | 13.072 | 2432841 | 2476249 | 5/22/1998 | 14:08:51.30 | 4.555 | 7.696 |
| **246** | 45.956 | 18.481 | 0.574 | 34.637 | 13.074 | 2596008 | 2475959 | 5/22/1998 | 14:14:52.10 | 5.675 | 7.695 |
| **247** | 45.972 | 18.506 | 0.598 | 34.629 | 13.074 | 2559090 | 2476459 | 5/22/1998 | 14:20:52.90 | 5.421 | 7.697 |
| **248** | 45.987 | 18.518 | 0.618 | 34.632 | 13.073 | 2567108 | 2475733 | 5/22/1998 | 14:26:53.70 | 5.477 | 7.694 |
| **249** | 46.011 | 18.548 | 0.631 | 34.627 | 13.072 | 2580755 | 2476464 | 5/22/1998 | 14:32:54.50 | 5.570 | 7.697 |
| **250** | 46.028 | 18.555 | 0.658 | 34.635 | 13.071 | 2590000 | 2476157 | 5/22/1998 | 14:38:55.30 | 5.634 | 7.696 |
| **251** | 46.038 | 18.564 | 0.668 | 34.636 | 13.071 | 2629935 | 2476675 | 5/22/1998 | 14:44:56.10 | 5.908 | 7.698 |
| **252** | 46.051 | 18.583 | 0.702 | 34.631 | 13.07 | 2587591 | 2476883 | 5/22/1998 | 14:50:56.90 | 5.617 | 7.699 |
| **253** | 46.061 | 18.593 | 0.709 | 34.631 | 13.071 | 2554636 | 2476962 | 5/22/1998 | 14:56:57.70 | 5.391 | 7.699 |
| **254** | 46.069 | 18.607 | 0.741 | 34.626 | 13.071 | 2549037 | 2477047 | 5/22/1998 | 15:02:58.50 | 5.352 | 7.700 |
| **255** | 46.083 | 18.615 | 0.8 | 34.631 | 13.07 | 2589924 | 2476830 | 5/22/1998 | 15:08:59.30 | 5.633 | 7.699 |
| **256** | 46.083 | 18.617 | 0.809 | 34.629 | 13.071 | 2532447 | 2476741 | 5/22/1998 | 15:15:00.10 | 5.239 | 7.698 |
| **257** | 46.097 | 18.624 | 0.848 | 34.636 | 13.069 | 2553231 | 2477012 | 5/22/1998 | 15:21:00.90 | 5.381 | 7.699 |
| **258** | 46.104 | 18.639 | 0.902 | 34.629 | 13.07 | 2565389 | 2477423 | 5/22/1998 | 15:27:01.70 | 5.465 | 7.701 |
| **259** | 46.098 | 18.63 | 0.946 | 34.631 | 13.07 | 2535611 | 2478286 | 5/22/1998 | 15:33:02.50 | 5.260 | 7.705 |
| **260** | 46.088 | 18.613 | 0.971 | 34.637 | 13.069 | 2590498 | 2478543 | 5/22/1998 | 15:39:03.30 | 5.637 | 7.706 |
| **261** | 46.065 | 18.595 | 0.985 | 34.632 | 13.069 | 2590037 | 2478087 | 5/22/1998 | 15:45:04.10 | 5.634 | 7.704 |
| **262** | 46.045 | 18.573 | 1.009 | 34.634 | 13.069 | 2567389 | 2478166 | 5/22/1998 | 15:51:04.90 | 5.478 | 7.704 |
| **263** | 46.024 | 18.551 | 1.03 | 34.636 | 13.066 | 2563393 | 2478502 | 5/22/1998 | 15:57:05.70 | 5.451 | 7.706 |
| **264** | 46.002 | 18.529 | 1.044 | 34.635 | 13.066 | 2615503 | 2477569 | 5/22/1998 | 16:03:06.50 | 5.809 | 7.702 |
| **265** | 45.98 | 18.504 | 1.101 | 34.637 | 13.066 | 2611635 | 2477929 | 5/22/1998 | 16:09:07.30 | 5.782 | 7.703 |
| **266** | 45.959 | 18.483 | 1.186 | 34.637 | 13.064 | 2531634 | 2478889 | 5/22/1998 | 16:15:08.10 | 5.233 | 7.707 |
| **267** | 45.935 | 18.458 | 1.236 | 34.639 | 13.064 | 2615934 | 2478497 | 5/22/1998 | 16:21:08.90 | 5.812 | 7.706 |
| **268** | 45.911 | 18.434 | 1.249 | 34.638 | 13.064 | 2617829 | 2478638 | 5/22/1998 | 16:27:09.70 | 5.825 | 7.706 |
| **269** | 45.882 | 18.407 | 1.26 | 34.636 | 13.062 | 2568530 | 2479045 | 5/22/1998 | 16:33:10.50 | 5.486 | 7.708 |
| **270** | 45.854 | 18.375 | 1.314 | 34.64 | 13.062 | 2598543 | 2478537 | 5/22/1998 | 16:39:11.30 | 5.692 | 7.706 |
| **271** | 45.819 | 18.346 | 1.34 | 34.634 | 13.062 | 2552557 | 2478703 | 5/22/1998 | 16:45:12.10 | 5.377 | 7.707 |
| **272** | 45.784 | 18.309 | 1.384 | 34.636 | 13.06 | 2549410 | 2478786 | 5/22/1998 | 16:51:12.90 | 5.355 | 7.707 |
| **273** | 45.753 | 18.274 | 1.421 | 34.64 | 13.061 | 2590254 | 2478743 | 5/22/1998 | 16:57:13.70 | 5.635 | 7.707 |
| **274** | 45.718 | 18.239 | 1.462 | 34.639 | 13.061 | 2545525 | 2479306 | 5/22/1998 | 17:03:14.50 | 5.328 | 7.709 |
| **275** | 45.687 | 18.202 | 1.505 | 34.644 | 13.059 | 2555879 | 2479001 | 5/22/1998 | 17:09:15.30 | 5.399 | 7.708 |
| **276** | 45.649 | 18.156 | 1.511 | 34.651 | 13.058 | 2579929 | 2478432 | 5/22/1998 | 17:15:16.10 | 5.565 | 7.706 |
| **277** | 45.622 | 18.129 | 1.547 | 34.65 | 13.057 | 2555170 | 2478719 | 5/22/1998 | 17:21:16.90 | 5.395 | 7.707 |
| **278** | 45.583 | 18.093 | 1.532 | 34.648 | 13.057 | 2577298 | 2479581 | 5/22/1998 | 17:27:17.70 | 5.546 | 7.710 |
| **279** | 45.554 | 18.063 | 1.618 | 34.648 | 13.057 | 2600785 | 2479058 | 5/22/1998 | 17:33:18.50 | 5.708 | 7.708 |
| **280** | 45.521 | 18.033 | 1.604 | 34.646 | 13.056 | 2555234 | 2479098 | 5/22/1998 | 17:39:19.30 | 5.395 | 7.708 |
| **281** | 45.491 | 18.005 | 1.644 | 34.644 | 13.056 | 2531467 | 2479407 | 5/22/1998 | 17:45:20.10 | 5.232 | 7.710 |
| **282** | 45.453 | 17.96 | 1.676 | 34.649 | 13.055 | 2547282 | 2479640 | 5/22/1998 | 17:52:02.15 | 5.340 | 7.711 |
| **283** | 45.421 | 17.91 | 1.711 | 34.665 | 13.055 | 2540432 | 2479686 | 5/22/1998 | 17:58:02.95 | 5.293 | 7.711 |
| **284** | 45.378 | 17.877 | 1.752 | 34.656 | 13.054 | 2560748 | 2479403 | 5/22/1998 | 18:04:03.75 | 5.433 | 7.710 |
| **285** | 45.333 | 17.833 | 1.743 | 34.656 | 13.053 | 2538473 | 2479535 | 5/22/1998 | 18:10:04.55 | 5.280 | 7.710 |
| **286** | 45.291 | 17.789 | 1.756 | 34.656 | 13.052 | 2541569 | 2479947 | 5/22/1998 | 18:16:05.35 | 5.301 | 7.712 |
| **287** | 45.255 | 17.758 | 1.784 | 34.652 | 13.051 | 2518730 | 2479962 | 5/22/1998 | 18:22:06.15 | 5.144 | 7.712 |
| **288** | 45.206 | 17.699 | 1.795 | 34.661 | 13.05 | 2581636 | 2480060 | 5/22/1998 | 18:28:06.95 | 5.576 | 7.713 |
| **289** | 45.156 | 17.645 | 1.831 | 34.664 | 13.048 | 2522983 | 2479464 | 5/22/1998 | 18:34:07.75 | 5.174 | 7.710 |
| **290** | 45.1 | 17.594 | 1.863 | 34.659 | 13.049 | 2551811 | 2479704 | 5/22/1998 | 18:40:08.55 | 5.372 | 7.711 |
| **291** | 45.057 | 17.553 | 1.832 | 34.657 | 13.048 | 2555795 | 2480717 | 5/22/1998 | 18:46:09.35 | 5.399 | 7.715 |
| **292** | 45.013 | 17.51 | 1.848 | 34.656 | 13.047 | 2572267 | 2479715 | 5/22/1998 | 18:52:10.15 | 5.512 | 7.711 |
| **293** | 44.968 | 17.463 | 1.819 | 34.656 | 13.047 | 2562524 | 2480199 | 5/22/1998 | 18:58:10.95 | 5.445 | 7.713 |
| **294** | 44.94 | 17.433 | 1.844 | 34.658 | 13.046 | 2527876 | 2480112 | 5/22/1998 | 19:04:11.75 | 5.207 | 7.713 |
| **295** | 44.907 | 17.377 | 1.85 | 34.678 | 13.047 | 2528236 | 2480174 | 5/22/1998 | 19:10:12.55 | 5.210 | 7.713 |
| **296** | 44.879 | 17.366 | 1.904 | 34.663 | 13.047 | 2536020 | 2480288 | 5/22/1998 | 19:16:13.35 | 5.263 | 7.714 |
| **297** | 44.858 | 17.339 | 1.915 | 34.668 | 13.047 | 2530089 | 2481096 | 5/22/1998 | 19:22:14.15 | 5.222 | 7.717 |
| **298** | 44.835 | 17.313 | 1.881 | 34.67 | 13.045 | 2501618 | 2480710 | 5/22/1998 | 19:28:14.95 | 5.027 | 7.715 |
| **299** | 44.804 | 17.292 | 1.841 | 34.662 | 13.044 | 2516179 | 2480394 | 5/22/1998 | 19:34:15.75 | 5.127 | 7.714 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **300** | 44.787 | 17.259 | 1.846 | 34.675 | 13.046 | 2494858 | 2480956 | 5/22/1998 | 19:40:16.55 | 4.981 | 7.716 |
| **301** | 44.756 | 17.239 | 1.801 | 34.666 | 13.047 | 2544731 | 2479916 | 5/22/1998 | 19:46:17.35 | 5.323 | 7.712 |
| **302** | 44.735 | 17.216 | 1.817 | 34.667 | 13.043 | 2517467 | 2480882 | 5/22/1998 | 19:52:18.15 | 5.136 | 7.716 |
| **303** | 44.716 | 17.205 | 1.779 | 34.66 | 13.045 | 2549646 | 2480589 | 5/22/1998 | 19:58:18.95 | 5.357 | 7.715 |
| **304** | 44.695 | 17.163 | 1.791 | 34.678 | 13.043 | 2521162 | 2480455 | 5/22/1998 | 20:04:19.75 | 5.161 | 7.714 |
| **305** | 44.676 | 17.143 | 1.777 | 34.679 | 13.042 | 2518000 | 2480039 | 5/22/1998 | 20:10:20.55 | 5.139 | 7.712 |
| **306** | 44.657 | 17.115 | 1.799 | 34.687 | 13.042 | 2574959 | 2479869 | 5/22/1998 | 20:16:21.35 | 5.530 | 7.712 |
| **307** | 44.636 | 17.103 | 1.73 | 34.678 | 13.041 | 2532930 | 2480393 | 5/22/1998 | 20:22:22.15 | 5.242 | 7.714 |
| **308** | 44.614 | 17.089 | 1.688 | 34.671 | 13.043 | 2532986 | 2479990 | 5/22/1998 | 20:28:22.95 | 5.242 | 7.712 |
| **309** | 44.595 | 17.058 | 1.643 | 34.682 | 13.04 | 2517637 | 2480252 | 5/22/1998 | 20:34:23.75 | 5.137 | 7.713 |
| **310** | 44.572 | 17.057 | 1.645 | 34.662 | 13.04 | 2465567 | 2480180 | 5/22/1998 | 20:40:24.55 | 4.780 | 7.713 |
| **311** | 44.563 | 17.021 | 1.581 | 34.686 | 13.039 | 2502866 | 2480502 | 5/22/1998 | 20:46:25.35 | 5.036 | 7.714 |
| **312** | 44.553 | 17.018 | 1.578 | 34.679 | 13.039 | 2543391 | 2480776 | 5/22/1998 | 20:52:26.15 | 5.314 | 7.716 |
| **313** | 44.534 | 16.996 | 1.56 | 34.682 | 13.039 | 2492834 | 2480874 | 5/22/1998 | 20:58:26.95 | 4.967 | 7.716 |
| **314** | 44.532 | 16.991 | 1.518 | 34.685 | 13.04 | 2484181 | 2480518 | 5/22/1998 | 21:04:27.75 | 4.907 | 7.715 |
| **315** | 44.519 | 16.989 | 1.472 | 34.674 | 13.041 | 2551100 | 2480860 | 5/22/1998 | 21:10:28.55 | 5.367 | 7.716 |
| **316** | 44.505 | 16.975 | 1.414 | 34.674 | 13.038 | 2534409 | 2480932 | 5/22/1998 | 21:16:29.35 | 5.252 | 7.716 |
| **317** | 44.494 | 16.962 | 1.39 | 34.676 | 13.038 | 2503673 | 2481790 | 5/22/1998 | 21:22:30.15 | 5.041 | 7.720 |
| **318** | 44.487 | 16.96 | 1.336 | 34.672 | 13.038 | 2505018 | 2480901 | 5/22/1998 | 21:28:30.95 | 5.050 | 7.716 |
| **319** | 44.476 | 16.944 | 1.304 | 34.676 | 13.037 | 2527721 | 2481551 | 5/22/1998 | 21:34:31.75 | 5.206 | 7.719 |
| **320** | 44.473 | 16.942 | 1.288 | 34.676 | 13.038 | 2497366 | 2482178 | 5/22/1998 | 21:40:32.55 | 4.998 | 7.722 |
| **321** | 44.471 | 16.933 | 1.222 | 34.681 | 13.037 | 2540504 | 2480869 | 5/22/1998 | 21:46:33.35 | 5.294 | 7.716 |
| **322** | 44.464 | 16.927 | 1.178 | 34.681 | 13.037 | 2500477 | 2481066 | 5/22/1998 | 21:52:34.15 | 5.019 | 7.717 |
| **323** | 44.472 | 16.933 | 1.132 | 34.683 | 13.037 | 2493677 | 2480772 | 5/22/1998 | 21:58:34.95 | 4.973 | 7.716 |
| **324** | 44.471 | 16.932 | 1.084 | 34.682 | 13.037 | 2555636 | 2481482 | 5/22/1998 | 22:04:35.75 | 5.398 | 7.719 |
| **325** | 44.475 | 16.937 | 1.059 | 34.681 | 13.036 | 2541651 | 2482014 | 5/22/1998 | 22:10:36.55 | 5.302 | 7.721 |
| **326** | 44.48 | 16.94 | 0.999 | 34.683 | 13.039 | 2510246 | 2481305 | 5/22/1998 | 22:16:37.35 | 5.086 | 7.718 |
| **327** | 44.486 | 16.947 | 0.937 | 34.683 | 13.035 | 2502953 | 2481824 | 5/22/1998 | 22:22:38.15 | 5.036 | 7.720 |
| **328** | 44.503 | 16.959 | 0.901 | 34.687 | 13.036 | 2551338 | 2481762 | 5/22/1998 | 22:28:38.95 | 5.368 | 7.720 |
| **329** | 44.518 | 16.966 | 0.866 | 34.693 | 13.036 | 2549862 | 2481929 | 5/22/1998 | 22:34:39.75 | 5.358 | 7.721 |
| **330** | 44.54 | 17.007 | 0.831 | 34.678 | 13.035 | 2565331 | 2481888 | 5/22/1998 | 22:40:40.55 | 5.464 | 7.720 |
| **331** | 44.567 | 17.032 | 0.778 | 34.68 | 13.036 | 2511606 | 2481505 | 5/22/1998 | 22:46:41.35 | 5.096 | 7.719 |
| **332** | 44.599 | 17.056 | 0.721 | 34.687 | 13.036 | 2563539 | 2481368 | 5/22/1998 | 22:52:42.15 | 5.452 | 7.718 |
| **333** | 44.617 | 17.088 | 0.671 | 34.675 | 13.036 | 2572075 | 2481500 | 5/22/1998 | 22:58:42.95 | 5.511 | 7.719 |
| **334** | 44.662 | 17.121 | 0.634 | 34.686 | 13.036 | 2522143 | 2481644 | 5/22/1998 | 23:04:43.75 | 5.168 | 7.719 |
| **335** | 44.694 | 17.157 | 0.625 | 34.683 | 13.036 | 2498086 | 2482211 | 5/22/1998 | 23:10:44.55 | 5.003 | 7.722 |
| **336** | 44.723 | 17.191 | 0.594 | 34.678 | 13.037 | 2529994 | 2481445 | 5/22/1998 | 23:16:45.35 | 5.222 | 7.719 |
| **337** | 44.756 | 17.212 | 0.533 | 34.689 | 13.036 | 2505395 | 2481385 | 5/22/1998 | 23:22:46.15 | 5.053 | 7.718 |
| **338** | 44.786 | 17.255 | 0.486 | 34.678 | 13.036 | 2516920 | 2481856 | 5/22/1998 | 23:28:46.95 | 5.132 | 7.720 |
| **339** | 44.812 | 17.279 | 0.439 | 34.681 | 13.036 | 2528784 | 2481838 | 5/22/1998 | 23:34:47.75 | 5.213 | 7.720 |
| **340** | 44.842 | 17.318 | 0.403 | 34.673 | 13.037 | 2541116 | 2481893 | 5/22/1998 | 23:40:48.55 | 5.298 | 7.720 |
| **341** | 44.886 | 17.352 | 0.364 | 34.682 | 13.037 | 2524601 | 2481596 | 5/22/1998 | 23:46:49.35 | 5.185 | 7.719 |
| **342** | 44.91 | 17.386 | 0.315 | 34.673 | 13.04 | 2480835 | 2481857 | 5/22/1998 | 23:52:50.15 | 4.884 | 7.720 |
| **343** | 44.917 | 17.392 | 0.296 | 34.674 | 13.037 | 2529532 | 2481861 | 5/22/1998 | 23:58:50.95 | 5.219 | 7.720 |
| **344** | 44.946 | 17.418 | 0.253 | 34.678 | 13.036 | 2512864 | 2481803 | 5/23/1998 | 00:04:51.75 | 5.104 | 7.720 |
| **345** | 44.989 | 17.47 | 0.239 | 34.669 | 13.036 | 2486088 | 2481248 | 5/23/1998 | 00:10:52.55 | 4.920 | 7.718 |
| **346** | 45.025 | 17.513 | 0.2 | 34.664 | 13.037 | 2530735 | 2482099 | 5/23/1998 | 00:16:53.35 | 5.227 | 7.721 |
| **347** | 45.072 | 17.544 | 0.171 | 34.678 | 13.038 | 2567634 | 2481896 | 5/23/1998 | 00:22:54.15 | 5.480 | 7.720 |
| **348** | 45.111 | 17.585 | 0.127 | 34.676 | 13.039 | 2596736 | 2481618 | 5/23/1998 | 00:28:54.95 | 5.680 | 7.719 |
| **349** | 45.138 | 17.614 | 0.102 | 34.675 | 13.039 | 2544673 | 2481384 | 5/23/1998 | 00:34:55.75 | 5.323 | 7.718 |
| **350** | 45.154 | 17.637 | 0.053 | 34.669 | 13.037 | 2516014 | 2481507 | 5/23/1998 | 00:40:56.55 | 5.126 | 7.719 |
| **351** | 45.188 | 17.661 | 0.039 | 34.677 | 13.038 | 2546135 | 2481698 | 5/23/1998 | 00:46:57.35 | 5.333 | 7.720 |
| **352** | 45.223 | 17.703 | 0.014 | 34.672 | 13.037 | 2526513 | 2481972 | 5/23/1998 | 00:53:39.39 | 5.198 | 7.721 |
| **353** | 45.269 | 17.741 | 0 | 34.68 | 13.037 | 2555885 | 2482028 | 5/23/1998 | 00:59:40.19 | 5.399 | 7.721 |
| **354** | 45.306 | 17.783 | -0.014 | 34.675 | 13.038 | 2590430 | 2481398 | 5/23/1998 | 01:05:40.99 | 5.637 | 7.718 |
| **355** | 45.333 | 17.823 | -0.037 | 34.665 | 13.038 | 2553058 | 2481499 | 5/23/1998 | 01:11:41.79 | 5.380 | 7.719 |
| **356** | 45.366 | 17.854 | -0.062 | 34.666 | 13.039 | 2526912 | 2481095 | 5/23/1998 | 01:17:42.59 | 5.201 | 7.717 |
| **357** | 45.404 | 17.884 | -0.071 | 34.673 | 13.038 | 2540613 | 2481352 | 5/23/1998 | 01:23:43.39 | 5.295 | 7.718 |
| **358** | 45.452 | 17.934 | -0.095 | 34.672 | 13.038 | 2556517 | 2482037 | 5/23/1998 | 01:29:44.19 | 5.404 | 7.721 |
| **359** | 45.495 | 17.976 | -0.105 | 34.673 | 13.038 | 2548104 | 2481425 | 5/23/1998 | 01:35:44.99 | 5.346 | 7.718 |
| **360** | 45.531 | 18.013 | -0.117 | 34.672 | 13.039 | 2592367 | 2481265 | 5/23/1998 | 01:41:45.79 | 5.650 | 7.718 |
| **361** | 45.565 | 18.058 | -0.109 | 34.662 | 13.038 | 2556901 | 2481470 | 5/23/1998 | 01:47:46.59 | 5.406 | 7.719 |
| **362** | 45.606 | 18.087 | -0.102 | 34.673 | 13.039 | 2498739 | 2481178 | 5/23/1998 | 01:53:47.39 | 5.007 | 7.717 |
| **363** | 45.638 | 18.128 | -0.099 | 34.665 | 13.04 | 2560534 | 2480973 | 5/23/1998 | 01:59:48.19 | 5.431 | 7.716 |
| **364** | 45.68 | 18.162 | -0.094 | 34.673 | 13.04 | 2512583 | 2481180 | 5/23/1998 | 02:05:48.99 | 5.102 | 7.717 |
| **365** | 45.709 | 18.19 | -0.12 | 34.674 | 13.04 | 2564208 | 2481543 | 5/23/1998 | 02:11:49.79 | 5.457 | 7.719 |
| **366** | 45.746 | 18.229 | -0.131 | 34.672 | 13.039 | 2543685 | 2480836 | 5/23/1998 | 02:17:50.59 | 5.316 | 7.716 |
| **367** | 45.778 | 18.264 | -0.101 | 34.67 | 13.038 | 2568551 | 2481195 | 5/23/1998 | 02:23:51.39 | 5.486 | 7.717 |
| **368** | 45.805 | 18.29 | -0.099 | 34.67 | 13.041 | 2560673 | 2480921 | 5/23/1998 | 02:29:52.19 | 5.432 | 7.716 |
| **369** | 45.836 | 18.326 | -0.105 | 34.666 | 13.038 | 2558218 | 2480783 | 5/23/1998 | 02:35:52.99 | 5.416 | 7.716 |
| **370** | 45.857 | 18.351 | -0.102 | 34.663 | 13.04 | 2545895 | 2481259 | 5/23/1998 | 02:41:53.79 | 5.331 | 7.718 |
| **371** | 45.876 | 18.374 | -0.055 | 34.659 | 13.04 | 2599323 | 2481012 | 5/23/1998 | 02:47:54.59 | 5.698 | 7.717 |
| **372** | 45.91 | 18.405 | -0.045 | 34.662 | 13.04 | 2545121 | 2480984 | 5/23/1998 | 02:53:55.39 | 5.326 | 7.717 |
| **373** | 45.934 | 18.43 | -0.026 | 34.661 | 13.038 | 2522353 | 2480654 | 5/23/1998 | 02:59:56.19 | 5.169 | 7.715 |
| **374** | 45.953 | 18.453 | -0.013 | 34.658 | 13.04 | 2590378 | 2481112 | 5/23/1998 | 03:05:56.99 | 5.636 | 7.717 |
| **375** | 45.973 | 18.47 | -0.011 | 34.66 | 13.04 | 2548980 | 2481494 | 5/23/1998 | 03:11:57.79 | 5.352 | 7.719 |
| **376** | 45.995 | 18.487 | 0.016 | 34.665 | 13.039 | 2479335 | 2481220 | 5/23/1998 | 03:17:58.59 | 4.874 | 7.718 |
| **377** | 46.02 | 18.506 | 0.075 | 34.67 | 13.04 | 2602047 | 2480708 | 5/23/1998 | 03:23:59.39 | 5.716 | 7.715 |
| **378** | 46.041 | 18.544 | 0.104 | 34.655 | 13.04 | 2540454 | 2481055 | 5/23/1998 | 03:30:00.19 | 5.294 | 7.717 |
| **379** | 46.061 | 18.567 | 0.104 | 34.653 | 13.038 | 2556218 | 2480031 | 5/23/1998 | 03:36:00.99 | 5.402 | 7.712 |
| **380** | 46.083 | 18.58 | 0.105 | 34.661 | 13.039 | 2550058 | 2480823 | 5/23/1998 | 03:42:01.79 | 5.359 | 7.716 |
| **381** | 46.1 | 18.601 | 0.158 | 34.657 | 13.04 | 2565084 | 2480477 | 5/23/1998 | 03:48:02.59 | 5.463 | 7.714 |
| **382** | 46.125 | 18.62 | 0.198 | 34.663 | 13.041 | 2541682 | 2480354 | 5/23/1998 | 03:54:03.39 | 5.302 | 7.714 |
| **383** | 46.144 | 18.639 | 0.229 | 34.662 | 13.04 | 2560697 | 2480492 | 5/23/1998 | 04:00:04.19 | 5.433 | 7.714 |
| **384** | 46.156 | 18.647 | 0.264 | 34.666 | 13.041 | 2593683 | 2480358 | 5/23/1998 | 04:06:04.99 | 5.659 | 7.714 |
| **385** | 46.168 | 18.667 | 0.274 | 34.659 | 13.039 | 2549187 | 2480180 | 5/23/1998 | 04:12:05.79 | 5.354 | 7.713 |
| **386** | 46.183 | 18.689 | 0.325 | 34.653 | 13.037 | 2614653 | 2479799 | 5/23/1998 | 04:18:06.59 | 5.803 | 7.711 |
| **387** | 46.199 | 18.697 | 0.367 | 34.66 | 13.041 | 2551814 | 2479998 | 5/23/1998 | 04:24:07.39 | 5.372 | 7.712 |
| **388** | 46.205 | 18.705 | 0.403 | 34.658 | 13.036 | 2572861 | 2480206 | 5/23/1998 | 04:30:08.19 | 5.516 | 7.713 |
| **389** | 46.206 | 18.702 | 0.426 | 34.662 | 13.037 | 2581931 | 2480111 | 5/23/1998 | 04:36:08.99 | 5.578 | 7.713 |
| **390** | 46.196 | 18.701 | 0.443 | 34.654 | 13.036 | 2566662 | 2479960 | 5/23/1998 | 04:42:09.79 | 5.473 | 7.712 |
| **391** | 46.181 | 18.681 | 0.466 | 34.658 | 13.041 | 2544687 | 2480039 | 5/23/1998 | 04:48:10.59 | 5.323 | 7.712 |
| **392** | 46.173 | 18.671 | 0.51 | 34.659 | 13.037 | 2605728 | 2480230 | 5/23/1998 | 04:54:11.39 | 5.742 | 7.713 |
| **393** | 46.152 | 18.655 | 0.554 | 34.656 | 13.037 | 2603563 | 2479793 | 5/23/1998 | 05:00:12.19 | 5.727 | 7.711 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **394** | 46.141 | 18.635 | 0.57 | 34.664 | 13.034 | 2567619 | 2480371 | 5/23/1998 | 05:06:12.99 | 5.480 | 7.714 |
| **395** | 46.12 | 18.621 | 0.622 | 34.657 | 13.034 | 2580806 | 2479782 | 5/23/1998 | 05:12:13.79 | 5.571 | 7.711 |
| **396** | 46.103 | 18.604 | 0.649 | 34.657 | 13.035 | 2556223 | 2480113 | 5/23/1998 | 05:18:14.59 | 5.402 | 7.713 |
| **397** | 46.087 | 18.584 | 0.708 | 34.66 | 13.034 | 2573353 | 2479766 | 5/23/1998 | 05:24:15.39 | 5.519 | 7.711 |
| **398** | 46.068 | 18.562 | 0.727 | 34.663 | 13.033 | 2546761 | 2479405 | 5/23/1998 | 05:30:16.19 | 5.337 | 7.710 |
| **399** | 46.053 | 18.553 | 0.747 | 34.657 | 13.033 | 2543820 | 2480263 | 5/23/1998 | 05:36:16.99 | 5.317 | 7.713 |
| **400** | 46.042 | 18.531 | 0.758 | 34.667 | 13.032 | 2560063 | 2478851 | 5/23/1998 | 05:42:17.79 | 5.428 | 7.707 |
| **401** | 46.025 | 18.518 | 0.807 | 34.664 | 13.032 | 2552301 | 2479747 | 5/23/1998 | 05:48:18.59 | 5.375 | 7.711 |
| **402** | 45.994 | 18.496 | 0.828 | 34.656 | 13.032 | 2570116 | 2479852 | 5/23/1998 | 05:54:19.39 | 5.497 | 7.712 |
| **403** | 45.97 | 18.469 | 0.86 | 34.659 | 13.032 | 2543335 | 2479850 | 5/23/1998 | 06:00:20.19 | 5.313 | 7.712 |
| **404** | 45.952 | 18.441 | 0.904 | 34.666 | 13.031 | 2525443 | 2479693 | 5/23/1998 | 06:06:20.99 | 5.191 | 7.711 |
| **405** | 45.93 | 18.418 | 0.93 | 34.667 | 13.031 | 2558889 | 2479306 | 5/23/1998 | 06:12:21.79 | 5.420 | 7.709 |
| **406** | 45.908 | 18.395 | 0.97 | 34.669 | 13.029 | 2553385 | 2479460 | 5/23/1998 | 06:18:22.59 | 5.382 | 7.710 |
| **407** | 45.881 | 18.376 | 0.974 | 34.662 | 13.029 | 2600458 | 2479745 | 5/23/1998 | 06:24:23.39 | 5.705 | 7.711 |
| **408** | 45.861 | 18.354 | 1.024 | 34.663 | 13.03 | 2569088 | 2479341 | 5/23/1998 | 06:30:24.19 | 5.490 | 7.709 |
| **409** | 45.843 | 18.337 | 1.019 | 34.663 | 13.029 | 2526933 | 2479083 | 5/23/1998 | 06:36:24.99 | 5.201 | 7.708 |
| **410** | 45.816 | 18.304 | 1.004 | 34.667 | 13.028 | 2537581 | 2479577 | 5/23/1998 | 06:42:25.79 | 5.274 | 7.710 |
| **411** | 45.799 | 18.277 | 1.03 | 34.676 | 13.031 | 2599347 | 2479143 | 5/23/1998 | 06:48:26.59 | 5.698 | 7.709 |
| **412** | 45.78 | 18.265 | 1.097 | 34.67 | 13.027 | 2554368 | 2479341 | 5/23/1998 | 06:54:27.39 | 5.389 | 7.709 |
| **413** | 45.749 | 18.235 | 1.118 | 34.668 | 13.025 | 2525123 | 2479203 | 5/23/1998 | 07:00:28.19 | 5.188 | 7.709 |
| **414** | 45.705 | 18.198 | 1.132 | 34.663 | 13.025 | 2519614 | 2479449 | 5/23/1998 | 07:06:28.99 | 5.151 | 7.710 |
| **415** | 45.682 | 18.167 | 1.151 | 34.669 | 13.025 | 2533448 | 2479207 | 5/23/1998 | 07:12:29.79 | 5.246 | 7.709 |
| **416** | 45.654 | 18.141 | 1.143 | 34.667 | 13.026 | 2555954 | 2479500 | 5/23/1998 | 07:18:30.59 | 5.400 | 7.710 |
| **417** | 45.633 | 18.115 | 1.157 | 34.672 | 13.025 | 2430381 | 2479267 | 5/23/1998 | 07:24:31.39 | 4.538 | 7.709 |
| **418** | 45.608 | 18.09 | 1.174 | 34.672 | 13.024 | 2501958 | 2478975 | 5/23/1998 | 07:30:32.19 | 5.029 | 7.708 |
| **419** | 45.584 | 18.07 | 1.17 | 34.668 | 13.023 | 2524197 | 2479309 | 5/23/1998 | 07:36:32.99 | 5.182 | 7.709 |
| **420** | 45.549 | 18.033 | 1.186 | 34.67 | 13.022 | 2517803 | 2478930 | 5/23/1998 | 07:42:33.79 | 5.138 | 7.708 |
| **421** | 45.526 | 17.996 | 1.168 | 34.682 | 13.021 | 2518339 | 2478972 | 5/23/1998 | 07:48:34.59 | 5.142 | 7.708 |
| **422** | 45.486 | 17.966 | 1.173 | 34.673 | 13.021 | 2552188 | 2478608 | 5/23/1998 | 07:55:16.65 | 5.374 | 7.706 |
| **423** | 45.457 | 17.929 | 1.192 | 34.679 | 13.021 | 2544192 | 2479825 | 5/23/1998 | 08:01:17.45 | 5.319 | 7.712 |
| **424** | 45.422 | 17.907 | 1.171 | 34.668 | 13.022 | 2536213 | 2479450 | 5/23/1998 | 08:07:18.25 | 5.264 | 7.710 |
| **425** | 45.399 | 17.872 | 1.178 | 34.678 | 13.019 | 2519791 | 2479019 | 5/23/1998 | 08:13:19.05 | 5.152 | 7.708 |
| **426** | 45.369 | 17.838 | 1.173 | 34.682 | 13.02 | 2557432 | 2478595 | 5/23/1998 | 08:19:19.85 | 5.410 | 7.706 |
| **427** | 45.345 | 17.817 | 1.189 | 34.68 | 13.02 | 2507943 | 2479244 | 5/23/1998 | 08:25:20.65 | 5.070 | 7.709 |
| **428** | 45.328 | 17.792 | 1.144 | 34.686 | 13.02 | 2501972 | 2478712 | 5/23/1998 | 08:31:21.45 | 5.029 | 7.707 |
| **429** | 45.312 | 17.785 | 1.122 | 34.678 | 13.018 | 2550992 | 2479040 | 5/23/1998 | 08:37:22.25 | 5.366 | 7.708 |
| **430** | 45.29 | 17.76 | 1.123 | 34.681 | 13.017 | 2534530 | 2478846 | 5/23/1998 | 08:43:23.05 | 5.253 | 7.707 |
| **431** | 45.274 | 17.738 | 1.118 | 34.686 | 13.019 | 2591470 | 2478496 | 5/23/1998 | 08:49:23.85 | 5.644 | 7.706 |
| **432** | 45.255 | 17.731 | 1.101 | 34.675 | 13.017 | 2521083 | 2478329 | 5/23/1998 | 08:55:24.65 | 5.161 | 7.705 |
| **433** | 45.239 | 17.706 | 1.057 | 34.684 | 13.017 | 2508457 | 2478320 | 5/23/1998 | 09:01:25.45 | 5.074 | 7.705 |
| **434** | 45.232 | 17.701 | 1.037 | 34.681 | 13.017 | 2506494 | 2478702 | 5/23/1998 | 09:07:26.25 | 5.061 | 7.707 |
| **435** | 45.219 | 17.691 | 1.023 | 34.679 | 13.019 | 2531824 | 2479250 | 5/23/1998 | 09:13:27.05 | 5.234 | 7.709 |
| **436** | 45.209 | 17.68 | 1.041 | 34.68 | 13.018 | 2517963 | 2478876 | 5/23/1998 | 09:19:27.85 | 5.139 | 7.707 |
| **437** | 45.196 | 17.671 | 1.002 | 34.676 | 13.016 | 2528560 | 2478525 | 5/23/1998 | 09:25:28.65 | 5.212 | 7.706 |
| **438** | 45.181 | 17.645 | 0.956 | 34.685 | 13.015 | 2565673 | 2478672 | 5/23/1998 | 09:31:29.45 | 5.467 | 7.707 |
| **439** | 45.164 | 17.633 | 0.911 | 34.681 | 13.017 | 2546406 | 2478298 | 5/23/1998 | 09:37:30.25 | 5.334 | 7.705 |
| **440** | 45.148 | 17.624 | 0.909 | 34.674 | 13.014 | 2517827 | 2479205 | 5/23/1998 | 09:43:31.05 | 5.138 | 7.709 |
| **441** | 45.132 | 17.594 | 0.92 | 34.686 | 13.014 | 2531457 | 2478239 | 5/23/1998 | 09:49:31.85 | 5.232 | 7.705 |
| **442** | 45.123 | 17.586 | 0.88 | 34.685 | 13.014 | 2512794 | 2478250 | 5/23/1998 | 09:55:32.65 | 5.104 | 7.705 |
| **443** | 45.11 | 17.578 | 0.822 | 34.681 | 13.016 | 2548249 | 2478050 | 5/23/1998 | 10:01:33.45 | 5.347 | 7.704 |
| **444** | 45.102 | 17.569 | 0.779 | 34.682 | 13.014 | 2534234 | 2478375 | 5/23/1998 | 10:07:34.25 | 5.251 | 7.705 |
| **445** | 45.089 | 17.56 | 0.737 | 34.679 | 13.014 | 2516836 | 2478096 | 5/23/1998 | 10:13:35.05 | 5.131 | 7.704 |
| **446** | 45.091 | 17.56 | 0.71 | 34.68 | 13.015 | 2518174 | 2477505 | 5/23/1998 | 10:19:35.85 | 5.141 | 7.702 |
| **447** | 45.081 | 17.547 | 0.68 | 34.683 | 13.013 | 2514741 | 2478221 | 5/23/1998 | 10:25:36.65 | 5.117 | 7.705 |
| **448** | 45.079 | 17.539 | 0.609 | 34.689 | 13.013 | 2500781 | 2477760 | 5/23/1998 | 10:31:37.45 | 5.021 | 7.703 |
| **449** | 45.072 | 17.536 | 0.548 | 34.685 | 13.012 | 2534647 | 2477540 | 5/23/1998 | 10:37:38.25 | 5.254 | 7.702 |
| **450** | 45.079 | 17.543 | 0.58 | 34.685 | 13.013 | 2563901 | 2477984 | 5/23/1998 | 10:43:39.05 | 5.455 | 7.704 |
| **451** | 45.093 | 17.551 | 0.558 | 34.69 | 13.013 | 2524513 | 2478610 | 5/23/1998 | 10:49:39.85 | 5.184 | 7.706 |
| **452** | 45.11 | 17.575 | 0.526 | 34.685 | 13.013 | 2478230 | 2478030 | 5/23/1998 | 10:55:40.65 | 4.867 | 7.704 |
| **453** | 45.128 | 17.593 | 0.549 | 34.684 | 13.013 | 2582847 | 2477865 | 5/23/1998 | 11:01:41.45 | 5.585 | 7.703 |
| **454** | 45.141 | 17.612 | 0.458 | 34.679 | 13.013 | 2525097 | 2477944 | 5/23/1998 | 11:07:42.25 | 5.188 | 7.703 |
| **455** | 45.17 | 17.637 | 0.44 | 34.683 | 13.013 | 2527647 | 2477413 | 5/23/1998 | 11:13:43.05 | 5.206 | 7.701 |
| **456** | 45.188 | 17.662 | 0.407 | 34.677 | 13.014 | 2557564 | 2477671 | 5/23/1998 | 11:19:43.85 | 5.411 | 7.702 |
| **457** | 45.217 | 17.691 | 0.357 | 34.678 | 13.015 | 2525942 | 2477373 | 5/23/1998 | 11:25:44.65 | 5.194 | 7.701 |
| **458** | 45.231 | 17.701 | 0.294 | 34.68 | 13.013 | 2556153 | 2477652 | 5/23/1998 | 11:31:45.45 | 5.401 | 7.702 |
| **459** | 45.248 | 17.713 | 0.292 | 34.685 | 13.014 | 2569279 | 2476591 | 5/23/1998 | 11:37:46.25 | 5.491 | 7.698 |
| **460** | 45.269 | 17.729 | 0.259 | 34.689 | 13.014 | 2509790 | 2477083 | 5/23/1998 | 11:43:47.05 | 5.083 | 7.700 |
| **461** | 45.292 | 17.767 | 0.257 | 34.677 | 13.013 | 2512965 | 2476853 | 5/23/1998 | 11:49:47.85 | 5.105 | 7.699 |
| **462** | 45.305 | 17.777 | 0.242 | 34.679 | 13.014 | 2566893 | 2476984 | 5/23/1998 | 11:55:48.65 | 5.475 | 7.699 |
| **463** | 45.313 | 17.782 | 0.142 | 34.681 | 13.012 | 2525979 | 2477031 | 5/23/1998 | 12:01:49.45 | 5.194 | 7.699 |
| **464** | 45.329 | 17.8 | 0.128 | 34.68 | 13.014 | 2525679 | 2476737 | 5/23/1998 | 12:07:50.25 | 5.192 | 7.698 |
| **465** | 45.348 | 17.825 | 0.134 | 34.676 | 13.013 | 2550772 | 2477175 | 5/23/1998 | 12:13:51.05 | 5.364 | 7.700 |
| **466** | 45.379 | 17.847 | 0.122 | 34.683 | 13.014 | 2547300 | 2476558 | 5/23/1998 | 12:19:51.85 | 5.341 | 7.697 |
| **467** | 45.405 | 17.873 | 0.097 | 34.683 | 13.016 | 2571228 | 2476897 | 5/23/1998 | 12:25:52.65 | 5.505 | 7.699 |
| **468** | 45.425 | 17.885 | 0.063 | 34.691 | 13.014 | 2547223 | 2476299 | 5/23/1998 | 12:31:53.45 | 5.340 | 7.696 |
| **469** | 45.445 | 17.919 | 0.069 | 34.678 | 13.014 | 2578308 | 2476455 | 5/23/1998 | 12:37:54.25 | 5.553 | 7.697 |
| **470** | 45.475 | 17.948 | 0.017 | 34.679 | 13.016 | 2559621 | 2476264 | 5/23/1998 | 12:43:55.05 | 5.425 | 7.696 |
| **471** | 45.505 | 17.976 | 0 | 34.681 | 13.015 | 2570899 | 2477794 | 5/23/1998 | 12:49:55.85 | 5.503 | 7.703 |
| **472** | 45.537 | 18.009 | 0.002 | 34.681 | 13.015 | 2545682 | 2476519 | 5/23/1998 | 12:55:56.65 | 5.329 | 7.697 |
| **473** | 45.553 | 18.036 | -0.023 | 34.671 | 13.016 | 2582263 | 2476201 | 5/23/1998 | 13:01:57.45 | 5.581 | 7.696 |
| **474** | 45.589 | 18.062 | -0.049 | 34.679 | 13.014 | 2531513 | 2476566 | 5/23/1998 | 13:07:58.25 | 5.232 | 7.697 |
| **475** | 45.624 | 18.097 | -0.037 | 34.68 | 13.014 | 2573840 | 2477014 | 5/23/1998 | 13:13:59.05 | 5.523 | 7.699 |
| **476** | 45.647 | 18.124 | -0.048 | 34.676 | 13.015 | 2583203 | 2476824 | 5/23/1998 | 13:19:59.85 | 5.587 | 7.699 |
| **477** | 45.675 | 18.148 | -0.068 | 34.68 | 13.015 | 2518249 | 2476829 | 5/23/1998 | 13:26:00.65 | 5.141 | 7.699 |
| **478** | 45.706 | 18.187 | -0.057 | 34.673 | 13.014 | 2553641 | 2477265 | 5/23/1998 | 13:32:01.45 | 5.384 | 7.700 |
| **479** | 45.745 | 18.223 | -0.059 | 34.676 | 13.017 | 2569545 | 2476364 | 5/23/1998 | 13:38:02.25 | 5.493 | 7.697 |
| **480** | 45.779 | 18.252 | -0.045 | 34.681 | 13.016 | 2481423 | 2476294 | 5/23/1998 | 13:44:03.05 | 4.888 | 7.696 |
| **481** | 45.808 | 18.287 | -0.065 | 34.676 | 13.016 | 2595313 | 2476444 | 5/23/1998 | 13:50:03.85 | 5.670 | 7.697 |
| **482** | 45.847 | 18.32 | -0.043 | 34.681 | 13.017 | 2582524 | 2477134 | 5/23/1998 | 13:56:04.65 | 5.582 | 7.700 |
| **483** | 45.886 | 18.365 | -0.057 | 34.675 | 13.018 | 2575951 | 2476881 | 5/23/1998 | 14:02:05.45 | 5.537 | 7.699 |
| **484** | 45.915 | 18.405 | -0.051 | 34.666 | 13.016 | 2563593 | 2477154 | 5/23/1998 | 14:08:06.25 | 5.452 | 7.700 |
| **485** | 45.93 | 18.42 | -0.059 | 34.666 | 13.016 | 2535607 | 2477318 | 5/23/1998 | 14:14:07.05 | 5.260 | 7.701 |
| **486** | 45.977 | 18.456 | -0.038 | 34.676 | 13.015 | 2637619 | 2477696 | 5/23/1998 | 14:20:07.85 | 5.960 | 7.702 |
| **487** | 46.01 | 18.493 | -0.002 | 34.673 | 13.016 | 2545646 | 2477409 | 5/23/1998 | 14:26:08.65 | 5.329 | 7.701 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **488** | 46.045 | 18.535 | 0.016 | 34.666 | 13.016 | 2557096 | 2477579 | 5/23/1998 | 14:32:09.45 | 5.408 | 7.702 |
| **489** | 46.081 | 18.572 | 0.034 | 34.666 | 13.017 | 2599859 | 2477999 | 5/23/1998 | 14:38:10.25 | 5.701 | 7.704 |
| **490** | 46.114 | 18.602 | 0.052 | 34.668 | 13.018 | 2561174 | 2477664 | 5/23/1998 | 14:44:11.05 | 5.436 | 7.702 |
| **491** | 46.149 | 18.63 | 0.096 | 34.675 | 13.016 | 2600665 | 2478497 | 5/23/1998 | 14:50:11.85 | 5.707 | 7.706 |
| **492** | 46.171 | 18.66 | 0.11 | 34.667 | 13.015 | 2615404 | 2478598 | 5/23/1998 | 14:56:53.91 | 5.808 | 7.706 |
| **493** | 46.203 | 18.688 | 0.1 | 34.67 | 13.016 | 2574101 | 2478563 | 5/23/1998 | 15:02:54.71 | 5.525 | 7.706 |
| **494** | 46.221 | 18.709 | 0.116 | 34.668 | 13.015 | 2588684 | 2479002 | 5/23/1998 | 15:08:55.51 | 5.625 | 7.708 |
| **495** | 46.244 | 18.737 | 0.14 | 34.664 | 13.017 | 2612098 | 2478674 | 5/23/1998 | 15:14:56.31 | 5.785 | 7.707 |
| **496** | 46.259 | 18.748 | 0.193 | 34.667 | 13.015 | 2611134 | 2478829 | 5/23/1998 | 15:20:57.11 | 5.779 | 7.707 |
| **497** | 46.272 | 18.753 | 0.224 | 34.674 | 13.014 | 2568264 | 2479249 | 5/23/1998 | 15:26:57.91 | 5.484 | 7.709 |
| **498** | 46.28 | 18.768 | 0.265 | 34.668 | 13.016 | 2608994 | 2478914 | 5/23/1998 | 15:32:58.71 | 5.764 | 7.708 |
| **499** | 46.29 | 18.774 | 0.275 | 34.672 | 13.015 | 2619546 | 2478946 | 5/23/1998 | 15:38:59.51 | 5.836 | 7.708 |
| **500** | 46.292 | 18.786 | 0.334 | 34.663 | 13.014 | 2614175 | 2479754 | 5/23/1998 | 15:45:00.31 | 5.800 | 7.711 |
| **501** | 46.309 | 18.791 | 0.381 | 34.673 | 13.015 | 2590866 | 2479348 | 5/23/1998 | 15:51:01.11 | 5.640 | 7.709 |
| **502** | 46.313 | 18.792 | 0.395 | 34.675 | 13.016 | 2585067 | 2480068 | 5/23/1998 | 15:57:01.91 | 5.600 | 7.713 |
| **503** | 46.309 | 18.796 | 0.412 | 34.669 | 13.015 | 2602026 | 2479585 | 5/23/1998 | 16:03:02.71 | 5.716 | 7.710 |
| **504** | 46.319 | 18.8 | 0.431 | 34.674 | 13.015 | 2613919 | 2479851 | 5/23/1998 | 16:09:03.51 | 5.798 | 7.712 |
| **505** | 46.32 | 18.797 | 0.487 | 34.678 | 13.014 | 2576471 | 2479816 | 5/23/1998 | 16:15:04.31 | 5.541 | 7.711 |
| **506** | 46.311 | 18.789 | 0.498 | 34.676 | 13.013 | 2618894 | 2480055 | 5/23/1998 | 16:21:05.11 | 5.832 | 7.713 |
| **507** | 46.286 | 18.777 | 0.559 | 34.666 | 13.013 | 2574140 | 2480093 | 5/23/1998 | 16:27:05.91 | 5.525 | 7.713 |
| **508** | 46.269 | 18.747 | 0.587 | 34.676 | 13.012 | 2615854 | 2480015 | 5/23/1998 | 16:33:06.71 | 5.811 | 7.712 |
| **509** | 46.245 | 18.723 | 0.636 | 34.677 | 13.013 | 2580148 | 2480444 | 5/23/1998 | 16:39:07.51 | 5.566 | 7.714 |
| **510** | 46.224 | 18.703 | 0.695 | 34.676 | 13.011 | 2573582 | 2480412 | 5/23/1998 | 16:45:08.31 | 5.521 | 7.714 |
| **511** | 46.195 | 18.677 | 0.724 | 34.673 | 13.01 | 2625040 | 2480393 | 5/23/1998 | 16:51:09.11 | 5.874 | 7.714 |
| **512** | 46.17 | 18.644 | 0.738 | 34.679 | 13.01 | 2541443 | 2480157 | 5/23/1998 | 16:57:09.91 | 5.300 | 7.713 |
| **513** | 46.142 | 18.628 | 0.786 | 34.67 | 13.009 | 2561447 | 2480584 | 5/23/1998 | 17:03:10.71 | 5.438 | 7.715 |
| **514** | 46.117 | 18.595 | 0.8 | 34.676 | 13.009 | 2583691 | 2480850 | 5/23/1998 | 17:09:11.51 | 5.590 | 7.716 |
| **515** | 46.091 | 18.564 | 0.863 | 34.681 | 13.008 | 2580512 | 2481397 | 5/23/1998 | 17:15:12.31 | 5.569 | 7.718 |
| **516** | 46.058 | 18.535 | 0.869 | 34.677 | 13.009 | 2597700 | 2481068 | 5/23/1998 | 17:21:13.11 | 5.686 | 7.717 |
| **517** | 46.018 | 18.51 | 0.931 | 34.665 | 13.008 | 2583527 | 2480458 | 5/23/1998 | 17:27:13.91 | 5.589 | 7.714 |
| **518** | 45.997 | 18.473 | 1.007 | 34.679 | 13.006 | 2583268 | 2481198 | 5/23/1998 | 17:33:14.71 | 5.587 | 7.717 |
| **519** | 45.968 | 18.438 | 1.004 | 34.683 | 13.006 | 2568334 | 2481410 | 5/23/1998 | 17:39:15.51 | 5.485 | 7.718 |
| **520** | 45.936 | 18.414 | 1.066 | 34.676 | 13.005 | 2557581 | 2480883 | 5/23/1998 | 17:45:16.31 | 5.411 | 7.716 |
| **521** | 45.906 | 18.378 | 1.088 | 34.681 | 13.006 | 2606974 | 2481370 | 5/23/1998 | 17:51:17.11 | 5.750 | 7.718 |
| **522** | 45.878 | 18.346 | 1.107 | 34.684 | 13.005 | 2573104 | 2481574 | 5/23/1998 | 17:57:17.91 | 5.518 | 7.719 |
| **523** | 45.851 | 18.322 | 1.128 | 34.682 | 13.005 | 2594137 | 2480791 | 5/23/1998 | 18:03:18.71 | 5.662 | 7.716 |
| **524** | 45.826 | 18.286 | 1.168 | 34.691 | 13.004 | 2583724 | 2481147 | 5/23/1998 | 18:09:19.51 | 5.591 | 7.717 |
| **525** | 45.799 | 18.272 | 1.214 | 34.68 | 13.003 | 2606361 | 2481657 | 5/23/1998 | 18:15:20.31 | 5.746 | 7.719 |
| **526** | 45.78 | 18.25 | 1.263 | 34.683 | 13.003 | 2588500 | 2481590 | 5/23/1998 | 18:21:21.11 | 5.623 | 7.719 |
| **527** | 45.758 | 18.226 | 1.285 | 34.685 | 13.004 | 2527076 | 2480819 | 5/23/1998 | 18:27:21.91 | 5.202 | 7.716 |
| **528** | 45.735 | 18.208 | 1.332 | 34.679 | 13.002 | 2575497 | 2481792 | 5/23/1998 | 18:33:22.71 | 5.534 | 7.720 |
| **529** | 45.714 | 18.179 | 1.341 | 34.687 | 13.002 | 2585060 | 2481844 | 5/23/1998 | 18:39:23.51 | 5.600 | 7.720 |
| **530** | 45.682 | 18.147 | 1.357 | 34.686 | 13.002 | 2549996 | 2481082 | 5/23/1998 | 18:45:24.31 | 5.359 | 7.717 |
| **531** | 45.652 | 18.12 | 1.384 | 34.683 | 13.001 | 2572520 | 2481750 | 5/23/1998 | 18:51:25.11 | 5.514 | 7.720 |
| **532** | 45.623 | 18.088 | 1.391 | 34.686 | 13.001 | 2568332 | 2481663 | 5/23/1998 | 18:57:25.91 | 5.485 | 7.719 |
| **533** | 45.596 | 18.056 | 1.411 | 34.69 | 13 | 2578605 | 2482370 | 5/23/1998 | 19:03:26.71 | 5.555 | 7.723 |
| **534** | 45.556 | 18.021 | 1.419 | 34.687 | 12.999 | 2538940 | 2481953 | 5/23/1998 | 19:09:27.51 | 5.283 | 7.721 |
| **535** | 45.527 | 17.994 | 1.468 | 34.684 | 13 | 2541101 | 2481752 | 5/23/1998 | 19:15:28.31 | 5.298 | 7.720 |
| **536** | 45.505 | 17.96 | 1.491 | 34.695 | 12.999 | 2549788 | 2482844 | 5/23/1998 | 19:21:29.11 | 5.358 | 7.725 |
| **537** | 45.473 | 17.931 | 1.49 | 34.692 | 13.001 | 2568552 | 2482291 | 5/23/1998 | 19:27:29.91 | 5.486 | 7.722 |
| **538** | 45.445 | 17.905 | 1.48 | 34.689 | 12.998 | 2536868 | 2481457 | 5/23/1998 | 19:33:30.71 | 5.269 | 7.719 |
| **539** | 45.417 | 17.872 | 1.482 | 34.694 | 12.998 | 2562550 | 2482398 | 5/23/1998 | 19:39:31.51 | 5.445 | 7.723 |
| **540** | 45.396 | 17.855 | 1.503 | 34.69 | 12.997 | 2545116 | 2481969 | 5/23/1998 | 19:45:32.31 | 5.326 | 7.721 |
| **541** | 45.373 | 17.832 | 1.541 | 34.69 | 12.996 | 2532734 | 2482432 | 5/23/1998 | 19:51:33.11 | 5.241 | 7.723 |
| **542** | 45.349 | 17.813 | 1.501 | 34.686 | 12.995 | 2573317 | 2481901 | 5/23/1998 | 19:57:33.91 | 5.519 | 7.721 |
| **543** | 45.334 | 17.782 | 1.504 | 34.699 | 12.995 | 2503493 | 2482177 | 5/23/1998 | 20:03:34.71 | 5.040 | 7.722 |
| **544** | 45.316 | 17.772 | 1.465 | 34.692 | 12.997 | 2541711 | 2482256 | 5/23/1998 | 20:09:35.51 | 5.302 | 7.722 |
| **545** | 45.301 | 17.746 | 1.485 | 34.702 | 12.995 | 2549164 | 2482774 | 5/23/1998 | 20:15:36.31 | 5.353 | 7.724 |
| **546** | 45.288 | 17.734 | 1.472 | 34.701 | 12.995 | 2573047 | 2482208 | 5/23/1998 | 20:21:37.11 | 5.517 | 7.722 |
| **547** | 45.271 | 17.719 | 1.425 | 34.699 | 12.996 | 2545708 | 2482614 | 5/23/1998 | 20:27:37.91 | 5.330 | 7.724 |
| **548** | 45.255 | 17.706 | 1.423 | 34.697 | 12.996 | 2542285 | 2481805 | 5/23/1998 | 20:33:38.71 | 5.306 | 7.720 |
| **549** | 45.242 | 17.686 | 1.428 | 34.702 | 12.993 | 2550228 | 2482247 | 5/23/1998 | 20:39:39.51 | 5.361 | 7.722 |
| **550** | 45.23 | 17.673 | 1.414 | 34.703 | 12.995 | 2581937 | 2482300 | 5/23/1998 | 20:45:40.31 | 5.578 | 7.722 |
| **551** | 45.211 | 17.66 | 1.399 | 34.698 | 12.993 | 2570273 | 2481932 | 5/23/1998 | 20:51:41.11 | 5.498 | 7.721 |
| **552** | 45.199 | 17.646 | 1.37 | 34.699 | 12.993 | 2549604 | 2482879 | 5/23/1998 | 20:57:41.91 | 5.356 | 7.725 |
| **553** | 45.187 | 17.626 | 1.305 | 34.707 | 12.993 | 2541774 | 2482251 | 5/23/1998 | 21:03:42.71 | 5.303 | 7.722 |
| **554** | 45.176 | 17.619 | 1.312 | 34.704 | 12.992 | 2572604 | 2481994 | 5/23/1998 | 21:09:43.51 | 5.514 | 7.721 |
| **555** | 45.163 | 17.621 | 1.295 | 34.69 | 12.992 | 2533328 | 2483003 | 5/23/1998 | 21:15:44.31 | 5.245 | 7.725 |
| **556** | 45.16 | 17.593 | 1.264 | 34.712 | 12.992 | 2553867 | 2482282 | 5/23/1998 | 21:21:45.11 | 5.386 | 7.722 |
| **557** | 45.145 | 17.589 | 1.224 | 34.702 | 12.991 | 2528496 | 2482018 | 5/23/1998 | 21:27:45.91 | 5.212 | 7.721 |
| **558** | 45.143 | 17.577 | 1.18 | 34.711 | 12.991 | 2573246 | 2482777 | 5/23/1998 | 21:33:46.71 | 5.519 | 7.724 |
| **559** | 45.136 | 17.58 | 1.162 | 34.701 | 12.99 | 2543755 | 2482861 | 5/23/1998 | 21:39:47.51 | 5.316 | 7.725 |
| **560** | 45.126 | 17.566 | 1.103 | 34.705 | 12.992 | 2524751 | 2482836 | 5/23/1998 | 21:45:48.31 | 5.186 | 7.725 |
| **561** | 45.117 | 17.563 | 1.052 | 34.701 | 12.991 | 2586559 | 2482209 | 5/23/1998 | 21:51:49.11 | 5.610 | 7.722 |
| **562** | 45.115 | 17.561 | 0.987 | 34.701 | 12.99 | 2567427 | 2482785 | 5/23/1998 | 21:58:31.19 | 5.479 | 7.724 |
| **563** | 45.107 | 17.553 | 0.969 | 34.7 | 12.99 | 2506946 | 2483473 | 5/23/1998 | 22:04:31.99 | 5.064 | 7.727 |
| **564** | 45.105 | 17.541 | 0.908 | 34.708 | 12.99 | 2570293 | 2482717 | 5/23/1998 | 22:10:32.79 | 5.498 | 7.724 |
| **565** | 45.101 | 17.544 | 0.87 | 34.703 | 12.989 | 2520401 | 2483099 | 5/23/1998 | 22:16:33.59 | 5.156 | 7.726 |
| **566** | 45.1 | 17.542 | 0.835 | 34.703 | 12.989 | 2560565 | 2483233 | 5/23/1998 | 22:22:34.39 | 5.432 | 7.726 |
| **567** | 45.092 | 17.531 | 0.776 | 34.706 | 12.988 | 2564660 | 2482768 | 5/23/1998 | 22:28:35.19 | 5.460 | 7.724 |
| **568** | 45.087 | 17.524 | 0.757 | 34.707 | 12.989 | 2591988 | 2482636 | 5/23/1998 | 22:34:35.99 | 5.647 | 7.724 |
| **569** | 45.089 | 17.524 | 0.681 | 34.709 | 12.99 | 2564991 | 2482864 | 5/23/1998 | 22:40:36.79 | 5.462 | 7.725 |
| **570** | 45.08 | 17.525 | 0.635 | 34.701 | 12.989 | 2563840 | 2482469 | 5/23/1998 | 22:46:37.59 | 5.454 | 7.723 |
| **571** | 45.087 | 17.531 | 0.563 | 34.701 | 12.989 | 2557546 | 2482790 | 5/23/1998 | 22:52:38.39 | 5.411 | 7.724 |
| **572** | 45.081 | 17.521 | 0.523 | 34.705 | 12.989 | 2554226 | 2482937 | 5/23/1998 | 22:58:39.19 | 5.388 | 7.725 |
| **573** | 45.086 | 17.519 | 0.499 | 34.711 | 12.989 | 2555007 | 2483189 | 5/23/1998 | 23:04:39.99 | 5.393 | 7.726 |
| **574** | 45.086 | 17.513 | 0.412 | 34.716 | 12.988 | 2556514 | 2483846 | 5/23/1998 | 23:10:40.79 | 5.404 | 7.729 |
| **575** | 45.079 | 17.52 | 0.366 | 34.705 | 12.989 | 2543696 | 2483116 | 5/23/1998 | 23:16:41.59 | 5.316 | 7.726 |
| **576** | 45.086 | 17.522 | 0.31 | 34.709 | 12.988 | 2558715 | 2482789 | 5/23/1998 | 23:22:42.39 | 5.419 | 7.724 |
| **577** | 45.093 | 17.527 | 0.286 | 34.71 | 12.989 | 2522378 | 2483076 | 5/23/1998 | 23:28:43.19 | 5.170 | 7.726 |
| **578** | 45.101 | 17.534 | 0.256 | 34.711 | 12.988 | 2547002 | 2483104 | 5/23/1998 | 23:34:43.99 | 5.339 | 7.726 |
| **579** | 45.108 | 17.543 | 0.198 | 34.71 | 12.988 | 2523847 | 2482955 | 5/23/1998 | 23:40:44.79 | 5.180 | 7.725 |
| **580** | 45.105 | 17.537 | 0.128 | 34.712 | 12.987 | 2558518 | 2483796 | 5/23/1998 | 23:46:45.59 | 5.418 | 7.729 |
| **581** | 45.115 | 17.556 | 0.086 | 34.705 | 12.986 | 2556187 | 2483044 | 5/23/1998 | 23:52:46.39 | 5.402 | 7.725 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **582** | 45.129 | 17.566 | 0.03 | 34.709 | 12.987 | 2500909 | 2483400 | 5/23/1998 | 23:58:47.19 | 5.022 | 7.727 |
| **583** | 45.137 | 17.573 | -0.008 | 34.709 | 12.987 | 2540087 | 2483205 | 5/24/1998 | 00:04:47.99 | 5.291 | 7.726 |
| **584** | 45.142 | 17.589 | -0.057 | 34.7 | 12.987 | 2557522 | 2482857 | 5/24/1998 | 00:10:48.79 | 5.411 | 7.725 |
| **585** | 45.156 | 17.586 | -0.112 | 34.715 | 12.988 | 2544295 | 2483388 | 5/24/1998 | 00:16:49.59 | 5.320 | 7.727 |
| **586** | 45.164 | 17.595 | -0.152 | 34.714 | 12.986 | 2512824 | 2483547 | 5/24/1998 | 00:22:50.39 | 5.104 | 7.728 |
| **587** | 45.172 | 17.609 | -0.208 | 34.709 | 12.986 | 2583169 | 2483441 | 5/24/1998 | 00:28:51.19 | 5.587 | 7.727 |
| **588** | 45.202 | 17.638 | -0.239 | 34.71 | 12.986 | 2545343 | 2483371 | 5/24/1998 | 00:34:51.99 | 5.327 | 7.727 |
| **589** | 45.221 | 17.66 | -0.313 | 34.707 | 12.986 | 2567448 | 2483139 | 5/24/1998 | 00:40:52.79 | 5.479 | 7.726 |
| **590** | 45.251 | 17.683 | -0.336 | 34.714 | 12.987 | 2542378 | 2483583 | 5/24/1998 | 00:46:53.59 | 5.307 | 7.728 |
| **591** | 45.279 | 17.717 | -0.372 | 34.708 | 12.988 | 2565647 | 2483039 | 5/24/1998 | 00:52:54.39 | 5.466 | 7.725 |
| **592** | 45.318 | 17.75 | -0.389 | 34.713 | 12.988 | 2528270 | 2483811 | 5/24/1998 | 00:58:55.19 | 5.210 | 7.729 |
| **593** | 45.352 | 17.784 | -0.422 | 34.714 | 12.989 | 2553815 | 2483501 | 5/24/1998 | 01:04:55.99 | 5.385 | 7.727 |
| **594** | 45.39 | 17.828 | -0.459 | 34.709 | 12.988 | 2547765 | 2483306 | 5/24/1998 | 01:10:56.79 | 5.344 | 7.727 |
| **595** | 45.436 | 17.887 | -0.478 | 34.698 | 12.988 | 2570320 | 2483246 | 5/24/1998 | 01:16:57.59 | 5.499 | 7.726 |
| **596** | 45.487 | 17.922 | -0.506 | 34.712 | 12.989 | 2580803 | 2483211 | 5/24/1998 | 01:22:58.39 | 5.571 | 7.726 |
| **597** | 45.529 | 17.966 | -0.523 | 34.71 | 12.99 | 2568912 | 2483041 | 5/24/1998 | 01:28:59.19 | 5.489 | 7.725 |
| **598** | 45.581 | 18.024 | -0.573 | 34.705 | 12.99 | 2533323 | 2482691 | 5/24/1998 | 01:34:59.99 | 5.245 | 7.724 |
| **599** | 45.616 | 18.063 | -0.605 | 34.702 | 12.99 | 2595121 | 2482810 | 5/24/1998 | 01:41:00.79 | 5.669 | 7.724 |
| **600** | 45.664 | 18.1 | -0.635 | 34.712 | 12.99 | 2546168 | 2482842 | 5/24/1998 | 01:47:01.59 | 5.333 | 7.725 |
| **601** | 45.711 | 18.159 | -0.648 | 34.702 | 12.991 | 2534781 | 2482967 | 5/24/1998 | 01:53:02.39 | 5.255 | 7.725 |
| **602** | 45.748 | 18.192 | -0.665 | 34.706 | 12.992 | 2552269 | 2483090 | 5/24/1998 | 01:59:03.19 | 5.375 | 7.726 |
| **603** | 45.786 | 18.235 | -0.701 | 34.701 | 12.99 | 2568990 | 2482724 | 5/24/1998 | 02:05:03.99 | 5.489 | 7.724 |
| **604** | 45.82 | 18.298 | -0.684 | 34.676 | 12.991 | 2525259 | 2482959 | 5/24/1998 | 02:11:04.79 | 5.189 | 7.725 |
| **605** | 45.854 | 18.311 | -0.714 | 34.694 | 12.991 | 2538785 | 2483365 | 5/24/1998 | 02:17:05.59 | 5.282 | 7.727 |
| **606** | 45.893 | 18.344 | -0.699 | 34.699 | 12.989 | 2567812 | 2483468 | 5/24/1998 | 02:23:06.39 | 5.481 | 7.727 |
| **607** | 45.935 | 18.391 | -0.725 | 34.695 | 12.99 | 2541899 | 2483093 | 5/24/1998 | 02:29:07.19 | 5.304 | 7.726 |
| **608** | 45.964 | 18.42 | -0.719 | 34.695 | 12.992 | 2540393 | 2482727 | 5/24/1998 | 02:35:07.99 | 5.293 | 7.724 |
| **609** | 45.992 | 18.449 | -0.739 | 34.695 | 12.991 | 2540277 | 2482763 | 5/24/1998 | 02:41:08.79 | 5.292 | 7.724 |
| **610** | 46.023 | 18.474 | -0.73 | 34.7 | 12.993 | 2537097 | 2482703 | 5/24/1998 | 02:47:09.59 | 5.271 | 7.724 |
| **611** | 46.043 | 18.493 | -0.754 | 34.701 | 12.992 | 2576601 | 2482464 | 5/24/1998 | 02:53:10.39 | 5.542 | 7.723 |
| **612** | 46.068 | 18.519 | -0.751 | 34.699 | 12.992 | 2558954 | 2482937 | 5/24/1998 | 02:59:11.19 | 5.421 | 7.725 |
| **613** | 46.088 | 18.542 | -0.737 | 34.697 | 12.991 | 2541793 | 2481986 | 5/24/1998 | 03:05:11.99 | 5.303 | 7.721 |
| **614** | 46.115 | 18.572 | -0.723 | 34.695 | 12.992 | 2587505 | 2482243 | 5/24/1998 | 03:11:12.79 | 5.616 | 7.722 |
| **615** | 46.146 | 18.592 | -0.715 | 34.704 | 12.993 | 2575389 | 2482031 | 5/24/1998 | 03:17:13.59 | 5.533 | 7.721 |
| **616** | 46.166 | 18.627 | -0.71 | 34.692 | 12.991 | 2563601 | 2483049 | 5/24/1998 | 03:23:14.39 | 5.452 | 7.725 |
| **617** | 46.191 | 18.654 | -0.686 | 34.689 | 12.991 | 2577697 | 2481794 | 5/24/1998 | 03:29:15.19 | 5.549 | 7.720 |
| **618** | 46.219 | 18.675 | -0.661 | 34.696 | 12.99 | 2537695 | 2482100 | 5/24/1998 | 03:35:15.99 | 5.275 | 7.721 |
| **619** | 46.245 | 18.706 | -0.645 | 34.692 | 12.992 | 2545402 | 2482519 | 5/24/1998 | 03:41:16.79 | 5.328 | 7.723 |
| **620** | 46.269 | 18.737 | -0.62 | 34.685 | 12.991 | 2536966 | 2482121 | 5/24/1998 | 03:47:17.59 | 5.270 | 7.721 |
| **621** | 46.296 | 18.754 | -0.594 | 34.694 | 12.99 | 2579232 | 2482448 | 5/24/1998 | 03:53:18.39 | 5.560 | 7.723 |
| **622** | 46.316 | 18.782 | -0.555 | 34.687 | 12.99 | 2520219 | 2482138 | 5/24/1998 | 03:59:19.19 | 5.155 | 7.722 |
| **623** | 46.346 | 18.798 | -0.519 | 34.699 | 12.991 | 2569504 | 2482001 | 5/24/1998 | 04:05:19.99 | 5.493 | 7.721 |
| **624** | 46.376 | 18.836 | -0.49 | 34.692 | 12.991 | 2581072 | 2481781 | 5/24/1998 | 04:11:20.79 | 5.572 | 7.720 |
| **625** | 46.397 | 18.861 | -0.465 | 34.688 | 12.991 | 2533552 | 2481614 | 5/24/1998 | 04:17:21.59 | 5.246 | 7.719 |
| **626** | 46.421 | 18.884 | -0.448 | 34.689 | 12.991 | 2596221 | 2481413 | 5/24/1998 | 04:23:22.39 | 5.676 | 7.718 |
| **627** | 46.437 | 18.902 | -0.44 | 34.687 | 12.991 | 2538500 | 2481251 | 5/24/1998 | 04:29:23.19 | 5.280 | 7.718 |
| **628** | 46.461 | 18.928 | -0.391 | 34.686 | 12.991 | 2604953 | 2481362 | 5/24/1998 | 04:35:23.99 | 5.736 | 7.718 |
| **629** | 46.476 | 18.945 | -0.366 | 34.685 | 12.991 | 2585740 | 2481356 | 5/24/1998 | 04:41:24.79 | 5.604 | 7.718 |
| **630** | 46.491 | 18.959 | -0.308 | 34.686 | 12.99 | 2567337 | 2481101 | 5/24/1998 | 04:47:25.59 | 5.478 | 7.717 |
| **631** | 46.513 | 18.978 | -0.275 | 34.687 | 12.99 | 2529637 | 2480978 | 5/24/1998 | 04:53:26.39 | 5.219 | 7.717 |
| **632** | 46.526 | 18.992 | -0.233 | 34.687 | 12.99 | 2543221 | 2480621 | 5/24/1998 | 05:00:08.47 | 5.313 | 7.715 |
| **633** | 46.538 | 19.008 | -0.19 | 34.684 | 12.989 | 2592995 | 2480589 | 5/24/1998 | 05:06:09.27 | 5.654 | 7.715 |
| **634** | 46.553 | 19.021 | -0.14 | 34.686 | 12.992 | 2569245 | 2481033 | 5/24/1998 | 05:12:10.07 | 5.491 | 7.717 |
| **635** | 46.562 | 19.033 | -0.097 | 34.683 | 12.989 | 2547902 | 2480931 | 5/24/1998 | 05:18:10.87 | 5.345 | 7.716 |
| **636** | 46.567 | 19.04 | -0.081 | 34.68 | 12.99 | 2574859 | 2481231 | 5/24/1998 | 05:24:11.67 | 5.530 | 7.718 |
| **637** | 46.572 | 19.043 | -0.044 | 34.683 | 12.989 | 2567125 | 2480746 | 5/24/1998 | 05:30:12.47 | 5.477 | 7.716 |
| **638** | 46.561 | 19.035 | 0 | 34.679 | 12.99 | 2540199 | 2480925 | 5/24/1998 | 05:36:13.27 | 5.292 | 7.716 |
| **639** | 46.555 | 19.02 | 0.045 | 34.687 | 12.989 | 2593297 | 2481167 | 5/24/1998 | 05:42:14.07 | 5.656 | 7.717 |
| **640** | 46.537 | 19.019 | 0.046 | 34.673 | 12.989 | 2541115 | 2481025 | 5/24/1998 | 05:48:14.87 | 5.298 | 7.717 |
| **641** | 46.535 | 18.995 | 0.088 | 34.692 | 12.99 | 2588694 | 2480306 | 5/24/1998 | 05:54:15.67 | 5.625 | 7.714 |
| **642** | 46.519 | 18.987 | 0.133 | 34.685 | 12.989 | 2581442 | 2480319 | 5/24/1998 | 06:00:16.47 | 5.575 | 7.714 |
| **643** | 46.495 | 18.971 | 0.179 | 34.679 | 12.988 | 2556843 | 2480428 | 5/24/1998 | 06:06:17.27 | 5.406 | 7.714 |
| **644** | 46.484 | 18.949 | 0.202 | 34.687 | 12.99 | 2623828 | 2480374 | 5/24/1998 | 06:12:18.07 | 5.866 | 7.714 |
| **645** | 46.463 | 18.928 | 0.247 | 34.687 | 12.988 | 2553731 | 2480736 | 5/24/1998 | 06:18:18.87 | 5.385 | 7.715 |
| **646** | 46.444 | 18.913 | 0.293 | 34.684 | 12.988 | 2598748 | 2480040 | 5/24/1998 | 06:24:19.67 | 5.694 | 7.712 |
| **647** | 46.422 | 18.889 | 0.331 | 34.686 | 12.989 | 2534929 | 2480518 | 5/24/1998 | 06:30:20.47 | 5.256 | 7.715 |
| **648** | 46.393 | 18.863 | 0.384 | 34.684 | 12.986 | 2568590 | 2480127 | 5/24/1998 | 06:36:21.27 | 5.487 | 7.713 |
| **649** | 46.37 | 18.836 | 0.396 | 34.686 | 12.984 | 2591569 | 2480807 | 5/24/1998 | 06:42:22.07 | 5.644 | 7.716 |
| **650** | 46.35 | 18.811 | 0.414 | 34.69 | 12.985 | 2518750 | 2480723 | 5/24/1998 | 06:48:22.87 | 5.145 | 7.715 |
| **651** | 46.326 | 18.788 | 0.445 | 34.69 | 12.986 | 2569182 | 2480286 | 5/24/1998 | 06:54:23.67 | 5.491 | 7.714 |
| **652** | 46.296 | 18.758 | 0.497 | 34.69 | 12.984 | 2589712 | 2479956 | 5/24/1998 | 07:00:24.47 | 5.632 | 7.712 |
| **653** | 46.264 | 18.727 | 0.528 | 34.69 | 12.985 | 2615226 | 2480044 | 5/24/1998 | 07:06:25.27 | 5.807 | 7.712 |
| **654** | 46.236 | 18.698 | 0.531 | 34.69 | 12.982 | 2577135 | 2481169 | 5/24/1998 | 07:12:26.07 | 5.545 | 7.717 |
| **655** | 46.212 | 18.67 | 0.545 | 34.693 | 12.982 | 2546537 | 2479903 | 5/24/1998 | 07:18:26.87 | 5.335 | 7.712 |
| **656** | 46.189 | 18.648 | 0.578 | 34.692 | 12.982 | 2577851 | 2479914 | 5/24/1998 | 07:24:27.67 | 5.550 | 7.712 |
| **657** | 46.163 | 18.623 | 0.64 | 34.692 | 12.981 | 2569404 | 2480390 | 5/24/1998 | 07:30:28.47 | 5.492 | 7.714 |
| **658** | 46.138 | 18.582 | 0.691 | 34.705 | 12.981 | 2548668 | 2479683 | 5/24/1998 | 07:36:29.27 | 5.350 | 7.711 |
| **659** | 46.114 | 18.568 | 0.676 | 34.696 | 12.981 | 2599476 | 2480805 | 5/24/1998 | 07:42:30.07 | 5.699 | 7.716 |
| **660** | 46.093 | 18.556 | 0.68 | 34.689 | 12.98 | 2584971 | 2480287 | 5/24/1998 | 07:48:30.87 | 5.599 | 7.714 |
| **661** | 46.075 | 18.535 | 0.735 | 34.692 | 12.981 | 2552176 | 2481159 | 5/24/1998 | 07:54:31.67 | 5.374 | 7.717 |
| **662** | 46.057 | 18.508 | 0.76 | 34.699 | 12.98 | 2577478 | 2479673 | 5/24/1998 | 08:00:32.47 | 5.548 | 7.711 |
| **663** | 46.037 | 18.492 | 0.73 | 34.696 | 12.981 | 2512271 | 2480312 | 5/24/1998 | 08:06:33.27 | 5.100 | 7.714 |
| **664** | 46.016 | 18.475 | 0.759 | 34.692 | 12.979 | 2561416 | 2480509 | 5/24/1998 | 08:12:34.07 | 5.437 | 7.714 |
| **665** | 45.983 | 18.437 | 0.784 | 34.696 | 12.978 | 2587310 | 2479662 | 5/24/1998 | 08:18:34.87 | 5.615 | 7.711 |
| **666** | 45.957 | 18.41 | 0.804 | 34.697 | 12.979 | 2524612 | 2480053 | 5/24/1998 | 08:24:35.67 | 5.185 | 7.713 |
| **667** | 45.93 | 18.384 | 0.833 | 34.697 | 12.977 | 2547238 | 2480214 | 5/24/1998 | 08:30:36.47 | 5.340 | 7.713 |
| **668** | 45.898 | 18.349 | 0.809 | 34.7 | 12.978 | 2509149 | 2479837 | 5/24/1998 | 08:36:37.27 | 5.079 | 7.712 |
| **669** | 45.873 | 18.317 | 0.808 | 34.704 | 12.977 | 2499807 | 2480035 | 5/24/1998 | 08:42:38.07 | 5.015 | 7.712 |
| **670** | 45.848 | 18.295 | 0.817 | 34.702 | 12.978 | 2586391 | 2479196 | 5/24/1998 | 08:48:38.87 | 5.609 | 7.709 |
| **671** | 45.813 | 18.271 | 0.821 | 34.693 | 12.976 | 2545989 | 2479758 | 5/24/1998 | 08:54:39.67 | 5.332 | 7.711 |
| **672** | 45.801 | 18.252 | 0.798 | 34.699 | 12.976 | 2531883 | 2479912 | 5/24/1998 | 09:00:40.47 | 5.235 | 7.712 |
| **673** | 45.774 | 18.224 | 0.81 | 34.7 | 12.975 | 2552643 | 2479717 | 5/24/1998 | 09:06:41.27 | 5.377 | 7.711 |
| **674** | 45.759 | 18.21 | 0.843 | 34.698 | 12.975 | 2570936 | 2479692 | 5/24/1998 | 09:12:42.07 | 5.503 | 7.711 |
| **675** | 45.744 | 18.187 | 0.814 | 34.706 | 12.977 | 2548121 | 2479790 | 5/24/1998 | 09:18:42.87 | 5.346 | 7.711 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **676** | 45.736 | 18.176 | 0.823 | 34.708 | 12.975 | 2528995 | 2479496 | 5/24/1998 | 09:24:43.67 | 5.215 | 7.710 |
| **677** | 45.718 | 18.159 | 0.81 | 34.707 | 12.974 | 2532611 | 2480202 | 5/24/1998 | 09:30:44.47 | 5.240 | 7.713 |
| **678** | 45.708 | 18.152 | 0.753 | 34.704 | 12.975 | 2540490 | 2479465 | 5/24/1998 | 09:36:45.27 | 5.294 | 7.710 |
| **679** | 45.696 | 18.149 | 0.708 | 34.697 | 12.974 | 2560060 | 2479524 | 5/24/1998 | 09:42:46.07 | 5.428 | 7.710 |
| **680** | 45.692 | 18.132 | 0.723 | 34.708 | 12.973 | 2560181 | 2480266 | 5/24/1998 | 09:48:46.87 | 5.429 | 7.713 |
| **681** | 45.68 | 18.116 | 0.698 | 34.711 | 12.974 | 2537599 | 2479712 | 5/24/1998 | 09:54:47.67 | 5.274 | 7.711 |
| **682** | 45.663 | 18.103 | 0.657 | 34.708 | 12.972 | 2538305 | 2479775 | 5/24/1998 | 10:00:48.47 | 5.279 | 7.711 |
| **683** | 45.65 | 18.086 | 0.651 | 34.711 | 12.972 | 2526122 | 2480495 | 5/24/1998 | 10:06:49.27 | 5.195 | 7.714 |
| **684** | 45.634 | 18.066 | 0.649 | 34.715 | 12.971 | 2537052 | 2480465 | 5/24/1998 | 10:12:50.07 | 5.270 | 7.714 |
| **685** | 45.621 | 18.07 | 0.662 | 34.7 | 12.971 | 2571463 | 2480276 | 5/24/1998 | 10:18:50.87 | 5.506 | 7.713 |
| **686** | 45.609 | 18.046 | 0.567 | 34.71 | 12.97 | 2570091 | 2479485 | 5/24/1998 | 10:24:51.67 | 5.497 | 7.710 |
| **687** | 45.594 | 18.032 | 0.55 | 34.709 | 12.97 | 2576956 | 2480144 | 5/24/1998 | 10:30:52.47 | 5.544 | 7.713 |
| **688** | 45.585 | 18.024 | 0.512 | 34.708 | 12.97 | 2549565 | 2479847 | 5/24/1998 | 10:36:53.27 | 5.356 | 7.712 |
| **689** | 45.581 | 18.02 | 0.509 | 34.709 | 12.969 | 2540772 | 2480086 | 5/24/1998 | 10:42:54.07 | 5.296 | 7.713 |
| **690** | 45.574 | 18.019 | 0.486 | 34.704 | 12.97 | 2560019 | 2479711 | 5/24/1998 | 10:48:54.87 | 5.428 | 7.711 |
| **691** | 45.568 | 18.008 | 0.424 | 34.708 | 12.968 | 2561840 | 2479781 | 5/24/1998 | 10:54:55.67 | 5.440 | 7.711 |
| **692** | 45.559 | 17.995 | 0.402 | 34.711 | 12.968 | 2553935 | 2479301 | 5/24/1998 | 11:00:56.47 | 5.386 | 7.709 |
| **693** | 45.553 | 17.997 | 0.371 | 34.704 | 12.966 | 2555828 | 2479552 | 5/24/1998 | 11:06:57.27 | 5.399 | 7.710 |
| **694** | 45.554 | 17.994 | 0.331 | 34.708 | 12.968 | 2525852 | 2479064 | 5/24/1998 | 11:12:58.07 | 5.193 | 7.708 |
| **695** | 45.542 | 17.984 | 0.284 | 34.706 | 12.969 | 2558633 | 2479656 | 5/24/1998 | 11:18:58.87 | 5.418 | 7.711 |
| **696** | 45.546 | 17.99 | 0.252 | 34.704 | 12.969 | 2534397 | 2478554 | 5/24/1998 | 11:24:59.67 | 5.252 | 7.706 |
| **697** | 45.534 | 17.988 | 0.244 | 34.696 | 12.969 | 2550951 | 2479299 | 5/24/1998 | 11:31:00.47 | 5.366 | 7.709 |
| **698** | 45.538 | 17.981 | 0.211 | 34.705 | 12.97 | 2564371 | 2478272 | 5/24/1998 | 11:37:01.27 | 5.458 | 7.705 |
| **699** | 45.552 | 17.989 | 0.191 | 34.71 | 12.969 | 2540574 | 2479039 | 5/24/1998 | 11:43:02.07 | 5.294 | 7.708 |
| **700** | 45.557 | 17.999 | 0.135 | 34.706 | 12.968 | 2549046 | 2479188 | 5/24/1998 | 11:49:02.87 | 5.353 | 7.709 |
| **701** | 45.573 | 18.008 | 0.124 | 34.711 | 12.969 | 2521176 | 2478542 | 5/24/1998 | 11:55:03.67 | 5.161 | 7.706 |

## Blank Test #3 Sensor Data

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 45.815 | 18.716 | 1.364 | 34.32 | 13.006 | 2290723 | 2452020 | 5/28/1998 | 09:28:05.56 | 3.580 | 7.591 |
| **2** | 45.925 | 18.688 | 1.382 | 34.436 | 13.015 | 2223053 | 2462045 | 5/28/1998 | 09:34:47.56 | 3.115 | 7.635 |
| **3** | 45.99 | 18.683 | 1.404 | 34.495 | 12.967 | 2293106 | 2465218 | 5/28/1998 | 09:40:48.37 | 3.596 | 7.648 |
| **4** | 46.056 | 18.669 | 1.456 | 34.563 | 13.001 | 2236476 | 2466725 | 5/28/1998 | 09:46:49.16 | 3.207 | 7.655 |
| **5** | 46.083 | 18.653 | 1.469 | 34.598 | 13.01 | 2238362 | 2467832 | 5/28/1998 | 09:52:49.96 | 3.220 | 7.660 |
| **6** | 46.096 | 18.634 | 1.486 | 34.626 | 13.016 | 2245414 | 2469430 | 5/28/1998 | 09:58:50.76 | 3.269 | 7.667 |
| **7** | 46.113 | 18.621 | 1.497 | 34.651 | 13.017 | 2206619 | 2469853 | 5/28/1998 | 10:04:51.56 | 3.002 | 7.668 |
| **8** | 46.12 | 18.609 | 1.537 | 34.667 | 13.02 | 2186797 | 2470326 | 5/28/1998 | 10:10:52.36 | 2.866 | 7.670 |
| **9** | 46.109 | 18.59 | 1.566 | 34.673 | 13.019 | 2213549 | 2470326 | 5/28/1998 | 10:16:53.16 | 3.050 | 7.670 |
| **10** | 46.093 | 18.569 | 1.616 | 34.678 | 13.02 | 2222627 | 2472133 | 5/28/1998 | 10:22:53.96 | 3.112 | 7.678 |
| **11** | 46.071 | 18.52 | 1.666 | 34.7 | 13.019 | 2158621 | 2472106 | 5/28/1998 | 10:28:54.76 | 2.673 | 7.678 |
| **12** | **46.028** | **18.485** | **1.627** | **34.694** | **13.018** | **2229338** | **2472252** | **5/28/1998** | **10:34:55.56** | **3.158** | **7.679** |
| **13** | 45.974 | 18.431 | 1.63 | 34.694 | 13.017 | 2273754 | 2472350 | 5/28/1998 | 10:40:56.36 | 3.463 | 7.679 |
| **14** | 45.909 | 18.363 | 1.691 | 34.696 | 13.016 | 2257372 | 2473658 | 5/28/1998 | 10:46:57.16 | 3.351 | 7.685 |
| **15** | 45.844 | 18.287 | 1.698 | 34.706 | 13.014 | 2232544 | 2473818 | 5/28/1998 | 10:52:57.96 | 3.180 | 7.686 |
| **16** | 45.787 | 18.235 | 1.734 | 34.702 | 13.014 | 2205787 | 2474933 | 5/28/1998 | 10:58:58.76 | 2.997 | 7.690 |
| **17** | 45.729 | 18.165 | 1.798 | 34.711 | 13.013 | 2207467 | 2474394 | 5/28/1998 | 11:04:59.56 | 3.008 | 7.688 |
| **18** | 45.668 | 18.097 | 1.792 | 34.717 | 13.011 | 2206701 | 2474872 | 5/28/1998 | 11:11:00.36 | 3.003 | 7.690 |
| **19** | 45.612 | 18.033 | 1.824 | 34.723 | 13.01 | 2154618 | 2474108 | 5/28/1998 | 11:17:01.16 | 2.646 | 7.687 |
| **20** | 45.552 | 17.966 | 1.816 | 34.729 | 13.008 | 2156546 | 2474537 | 5/28/1998 | 11:23:01.96 | 2.659 | 7.689 |
| **21** | 45.485 | 17.906 | 1.871 | 34.723 | 13.007 | 2302887 | 2474953 | 5/28/1998 | 11:29:02.76 | 3.663 | 7.690 |
| **22** | 45.426 | 17.855 | 1.867 | 34.716 | 13.007 | 2175133 | 2474923 | 5/28/1998 | 11:35:03.56 | 2.786 | 7.690 |
| **23** | 45.397 | 17.813 | 1.852 | 34.727 | 13.005 | 2151673 | 2475793 | 5/28/1998 | 11:41:04.36 | 2.625 | 7.694 |
| **24** | 45.341 | 17.76 | 1.816 | 34.724 | 13.005 | 2195048 | 2475315 | 5/28/1998 | 11:47:05.16 | 2.923 | 7.692 |
| **25** | 45.287 | 17.701 | 1.878 | 34.728 | 13.003 | 2170562 | 2475311 | 5/28/1998 | 11:53:05.96 | 2.755 | 7.692 |
| **26** | 45.254 | 17.669 | 1.904 | 34.727 | 13.002 | 2224754 | 2475966 | 5/28/1998 | 11:59:06.76 | 3.127 | 7.695 |
| **27** | 45.225 | 17.63 | 1.949 | 34.735 | 13.002 | 2236781 | 2476073 | 5/28/1998 | 12:05:07.56 | 3.209 | 7.695 |
| **28** | 45.188 | 17.592 | 1.943 | 34.736 | 13.001 | 2171152 | 2476342 | 5/28/1998 | 12:11:08.36 | 2.759 | 7.696 |
| **29** | 45.153 | 17.555 | 1.931 | 34.738 | 12.999 | 2205415 | 2476254 | 5/28/1998 | 12:17:09.16 | 2.994 | 7.696 |
| **30** | 45.123 | 17.529 | 1.964 | 34.734 | 12.999 | 2192285 | 2476613 | 5/28/1998 | 12:23:09.96 | 2.904 | 7.698 |
| **31** | 45.088 | 17.492 | 1.883 | 34.736 | 12.998 | 2176514 | 2476551 | 5/28/1998 | 12:29:10.76 | 2.796 | 7.697 |
| **32** | 45.061 | 17.464 | 1.939 | 34.736 | 12.998 | 2197530 | 2476934 | 5/28/1998 | 12:35:11.56 | 2.940 | 7.699 |
| **33** | 45.022 | 17.429 | 1.936 | 34.733 | 12.997 | 2210250 | 2477219 | 5/28/1998 | 12:41:12.36 | 3.027 | 7.700 |
| **34** | 44.997 | 17.399 | 1.902 | 34.737 | 12.997 | 2167761 | 2477830 | 5/28/1998 | 12:47:13.16 | 2.736 | 7.703 |
| **35** | 44.97 | 17.373 | 1.927 | 34.736 | 12.994 | 2240925 | 2477797 | 5/28/1998 | 12:53:13.96 | 3.238 | 7.703 |
| **36** | 44.932 | 17.331 | 1.882 | 34.739 | 12.994 | 2208959 | 2476901 | 5/28/1998 | 12:59:14.76 | 3.019 | 7.699 |
| **37** | 44.902 | 17.294 | 1.879 | 34.745 | 12.994 | 2183254 | 2477105 | 5/28/1998 | 13:05:15.56 | 2.842 | 7.700 |
| **38** | 44.863 | 17.275 | 1.85 | 34.728 | 12.991 | 2211296 | 2477412 | 5/28/1998 | 13:11:16.36 | 3.035 | 7.701 |
| **39** | 44.834 | 17.225 | 1.855 | 34.745 | 12.991 | 2191683 | 2477101 | 5/28/1998 | 13:17:17.16 | 2.900 | 7.700 |
| **40** | 44.786 | 17.171 | 1.821 | 34.75 | 12.99 | 2185387 | 2478957 | 5/28/1998 | 13:23:17.96 | 2.857 | 7.708 |
| **41** | 44.744 | 17.134 | 1.823 | 34.745 | 12.989 | 2270538 | 2478453 | 5/28/1998 | 13:29:18.76 | 3.441 | 7.706 |
| **42** | 44.717 | 17.112 | 1.785 | 34.741 | 12.989 | 2226386 | 2477935 | 5/28/1998 | 13:35:19.56 | 3.138 | 7.703 |
| **43** | 44.697 | 17.081 | 1.784 | 34.75 | 12.987 | 2287064 | 2478254 | 5/28/1998 | 13:41:20.36 | 3.555 | 7.705 |
| **44** | 44.679 | 17.066 | 1.803 | 34.747 | 12.99 | 2167817 | 2478587 | 5/28/1998 | 13:47:21.16 | 2.736 | 7.706 |
| **45** | 44.663 | 17.048 | 1.768 | 34.75 | 12.987 | 2231016 | 2478824 | 5/28/1998 | 13:53:21.96 | 3.170 | 7.707 |
| **46** | 44.658 | 17.034 | 1.769 | 34.756 | 12.987 | 2184851 | 2478275 | 5/28/1998 | 13:59:22.76 | 2.853 | 7.705 |
| **47** | 44.635 | 17.02 | 1.706 | 34.749 | 12.986 | 2225184 | 2478505 | 5/28/1998 | 14:05:23.56 | 3.130 | 7.706 |
| **48** | 44.616 | 16.991 | 1.698 | 34.758 | 12.985 | 2280386 | 2479179 | 5/28/1998 | 14:11:24.36 | 3.509 | 7.709 |
| **49** | 44.596 | 16.98 | 1.716 | 34.75 | 12.984 | 2169856 | 2478613 | 5/28/1998 | 14:17:25.16 | 2.750 | 7.706 |
| **50** | 44.576 | 16.963 | 1.652 | 34.747 | 12.984 | 2181731 | 2480505 | 5/28/1998 | 14:23:25.96 | 2.832 | 7.714 |
| **51** | 44.558 | 16.937 | 1.638 | 34.754 | 12.985 | 2296427 | 2478729 | 5/28/1998 | 14:29:26.76 | 3.619 | 7.707 |
| **52** | 44.535 | 16.933 | 1.61 | 34.738 | 12.983 | 2169892 | 2478429 | 5/28/1998 | 14:35:27.56 | 2.750 | 7.706 |
| **53** | 44.531 | 16.923 | 1.6 | 34.742 | 12.983 | 2253349 | 2479582 | 5/28/1998 | 14:41:28.36 | 3.323 | 7.710 |
| **54** | 44.533 | 16.918 | 1.581 | 34.748 | 12.982 | 2256639 | 2479462 | 5/28/1998 | 14:47:29.16 | 3.346 | 7.710 |
| **55** | 44.528 | 16.908 | 1.557 | 34.753 | 12.981 | 2226991 | 2480557 | 5/28/1998 | 14:53:29.96 | 3.142 | 7.715 |
| **56** | 44.518 | 16.899 | 1.571 | 34.752 | 12.983 | 2241897 | 2480650 | 5/28/1998 | 14:59:30.76 | 3.245 | 7.715 |
| **57** | 44.527 | 16.915 | 1.504 | 34.745 | 12.958 | 2316993 | 2480476 | 5/28/1998 | 15:05:31.56 | 3.760 | 7.714 |
| **58** | 44.549 | 16.925 | 1.489 | 34.756 | 12.969 | 2308439 | 2480391 | 5/28/1998 | 15:11:32.36 | 3.701 | 7.714 |
| **59** | 44.571 | 16.949 | 1.482 | 34.754 | 12.974 | 2298706 | 2479076 | 5/28/1998 | 15:17:33.16 | 3.634 | 7.708 |
| **60** | 44.584 | 16.968 | 1.454 | 34.75 | 12.975 | 2188520 | 2480158 | 5/28/1998 | 15:23:33.96 | 2.878 | 7.713 |
| **61** | 44.611 | 16.993 | 1.49 | 34.751 | 12.976 | 2281052 | 2480822 | 5/28/1998 | 15:29:34.76 | 3.513 | 7.716 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | 44.652 | 17.032 | 1.461 | 34.753 | 12.977 | 2232378 | 2480235 | 5/28/1998 | 15:35:35.56 | 3.179 | 7.713 |
| 63 | 44.698 | 17.07 | 1.431 | 34.76 | 12.977 | 2227837 | 2481468 | 5/28/1998 | 15:41:36.36 | 3.148 | 7.719 |
| 64 | 44.732 | 17.124 | 1.423 | 34.744 | 12.978 | 2310947 | 2481383 | 5/28/1998 | 15:47:37.16 | 3.718 | 7.718 |
| 65 | 44.76 | 17.135 | 1.393 | 34.759 | 12.978 | 2269562 | 2481657 | 5/28/1998 | 15:53:37.96 | 3.434 | 7.719 |
| 66 | 44.793 | 17.184 | 1.387 | 34.745 | 12.978 | 2142602 | 2481480 | 5/28/1998 | 15:59:38.76 | 2.563 | 7.719 |
| 67 | 44.836 | 17.218 | 1.397 | 34.753 | 12.978 | 2359776 | 2481416 | 5/28/1998 | 16:05:39.56 | 4.054 | 7.718 |
| 68 | 44.885 | 17.26 | 1.37 | 34.759 | 12.978 | 2187769 | 2481843 | 5/28/1998 | 16:11:40.36 | 2.873 | 7.720 |
| 69 | 44.938 | 17.327 | 1.325 | 34.748 | 12.98 | 2264049 | 2481391 | 5/28/1998 | 16:17:41.16 | 3.397 | 7.718 |
| 70 | 44.979 | 17.371 | 1.32 | 34.745 | 12.98 | 2257395 | 2483061 | 5/28/1998 | 16:23:41.96 | 3.351 | 7.726 |
| 71 | 45.027 | 17.412 | 1.361 | 34.752 | 12.979 | 2255995 | 2483105 | 5/28/1998 | 16:29:42.76 | 3.341 | 7.726 |
| 72 | 45.075 | 17.466 | 1.344 | 34.747 | 12.978 | 2179090 | 2482225 | 5/28/1998 | 16:36:24.77 | 2.814 | 7.722 |
| 73 | 45.12 | 17.505 | 1.357 | 34.752 | 12.979 | 2306360 | 2482959 | 5/28/1998 | 16:42:25.57 | 3.687 | 7.725 |
| 74 | 45.163 | 17.553 | 1.318 | 34.748 | 12.98 | 2216848 | 2482842 | 5/28/1998 | 16:48:26.37 | 3.073 | 7.725 |
| 75 | 45.206 | 17.602 | 1.312 | 34.743 | 12.982 | 2299811 | 2483179 | 5/28/1998 | 16:54:27.17 | 3.642 | 7.726 |
| 76 | 45.248 | 17.647 | 1.346 | 34.741 | 12.978 | 2347777 | 2482750 | 5/28/1998 | 17:00:27.97 | 3.971 | 7.724 |
| 77 | 45.294 | 17.686 | 1.295 | 34.747 | 12.979 | 2270299 | 2483758 | 5/28/1998 | 17:06:28.77 | 3.440 | 7.729 |
| 78 | 45.341 | 17.736 | 1.28 | 34.745 | 12.979 | 2326224 | 2483566 | 5/28/1998 | 17:12:29.57 | 3.823 | 7.728 |
| 79 | 45.379 | 17.773 | 1.276 | 34.746 | 12.978 | 2330116 | 2483555 | 5/28/1998 | 17:18:30.37 | 3.850 | 7.728 |
| 80 | 45.411 | 17.809 | 1.258 | 34.743 | 12.979 | 2194439 | 2484385 | 5/28/1998 | 17:24:31.17 | 2.919 | 7.731 |
| 81 | 45.44 | 17.832 | 1.294 | 34.748 | 12.977 | 2257972 | 2484310 | 5/28/1998 | 17:30:31.97 | 3.355 | 7.731 |
| 82 | 45.455 | 17.862 | 1.269 | 34.735 | 12.979 | 2273135 | 2484298 | 5/28/1998 | 17:36:32.77 | 3.459 | 7.731 |
| 83 | 45.47 | 17.867 | 1.276 | 34.744 | 12.977 | 2226056 | 2484261 | 5/28/1998 | 17:42:33.57 | 3.136 | 7.731 |
| 84 | 45.503 | 17.894 | 1.251 | 34.749 | 12.976 | 2264866 | 2484409 | 5/28/1998 | 17:48:34.37 | 3.402 | 7.731 |
| 85 | 45.524 | 17.918 | 1.303 | 34.746 | 12.974 | 2191887 | 2485034 | 5/28/1998 | 17:54:35.17 | 2.901 | 7.734 |
| 86 | 45.537 | 17.94 | 1.311 | 34.739 | 12.975 | 2206129 | 2484422 | 5/28/1998 | 18:00:35.97 | 2.999 | 7.731 |
| 87 | 45.551 | 17.949 | 1.279 | 34.743 | 12.974 | 2305341 | 2484806 | 5/28/1998 | 18:06:36.77 | 3.680 | 7.733 |
| 88 | 45.57 | 17.957 | 1.311 | 34.752 | 12.975 | 2331995 | 2485314 | 5/28/1998 | 18:12:37.57 | 3.863 | 7.735 |
| 89 | 45.578 | 17.982 | 1.308 | 34.738 | 12.976 | 2260783 | 2485226 | 5/28/1998 | 18:18:38.37 | 3.374 | 7.735 |
| 90 | 45.588 | 17.987 | 1.31 | 34.742 | 12.975 | 2344333 | 2485342 | 5/28/1998 | 18:24:39.17 | 3.948 | 7.735 |
| 91 | 45.599 | 17.997 | 1.345 | 34.743 | 12.975 | 2346424 | 2485206 | 5/28/1998 | 18:30:39.97 | 3.962 | 7.735 |
| 92 | 45.597 | 17.996 | 1.348 | 34.742 | 12.973 | 2196651 | 2485632 | 5/28/1998 | 18:36:40.77 | 2.934 | 7.737 |
| 93 | 45.598 | 17.996 | 1.324 | 34.744 | 12.972 | 2296295 | 2485061 | 5/28/1998 | 18:42:41.57 | 3.618 | 7.734 |
| 94 | 45.607 | 18.002 | 1.336 | 34.746 | 12.972 | 2319592 | 2485361 | 5/28/1998 | 18:48:42.37 | 3.778 | 7.735 |
| 95 | 45.613 | 17.996 | 1.325 | 34.756 | 12.97 | 2243620 | 2486595 | 5/28/1998 | 18:54:43.17 | 3.256 | 7.741 |
| 96 | 45.604 | 18 | 1.376 | 34.745 | 12.968 | 2275180 | 2486285 | 5/28/1998 | 19:00:43.97 | 3.473 | 7.739 |
| 97 | 45.592 | 17.994 | 1.381 | 34.74 | 12.969 | 2370584 | 2486850 | 5/28/1998 | 19:06:44.77 | 4.128 | 7.742 |
| 98 | 45.579 | 17.97 | 1.459 | 34.749 | 12.967 | 2337242 | 2487006 | 5/28/1998 | 19:12:45.57 | 3.899 | 7.743 |
| 99 | 45.571 | 17.962 | 1.459 | 34.749 | 12.969 | 2324875 | 2486095 | 5/28/1998 | 19:18:46.37 | 3.814 | 7.739 |
| 100 | 45.549 | 17.947 | 1.538 | 34.743 | 12.969 | 2238043 | 2486748 | 5/28/1998 | 19:24:47.17 | 3.218 | 7.741 |
| 101 | 45.53 | 17.929 | 1.519 | 34.742 | 12.962 | 2223320 | 2486805 | 5/28/1998 | 19:30:47.97 | 3.117 | 7.742 |
| 102 | 45.515 | 17.902 | 1.518 | 34.752 | 12.962 | 2278924 | 2486859 | 5/28/1998 | 19:36:48.77 | 3.499 | 7.742 |
| 103 | 45.5 | 17.888 | 1.515 | 34.751 | 12.964 | 2348339 | 2487286 | 5/28/1998 | 19:42:49.57 | 3.975 | 7.744 |
| 104 | 45.489 | 17.873 | 1.542 | 34.755 | 12.966 | 2312372 | 2487225 | 5/28/1998 | 19:48:50.37 | 3.728 | 7.744 |
| 105 | 45.478 | 17.865 | 1.587 | 34.752 | 12.967 | 2254922 | 2486864 | 5/28/1998 | 19:54:51.17 | 3.334 | 7.742 |
| 106 | 45.448 | 17.844 | 1.594 | 34.745 | 12.966 | 2314330 | 2486693 | 5/28/1998 | 20:00:51.97 | 3.742 | 7.741 |
| 107 | 45.425 | 17.817 | 1.618 | 34.748 | 12.967 | 2387819 | 2487259 | 5/28/1998 | 20:06:52.77 | 4.246 | 7.744 |
| 108 | 45.403 | 17.792 | 1.62 | 34.75 | 12.966 | 2296862 | 2486566 | 5/28/1998 | 20:12:53.57 | 3.622 | 7.741 |
| 109 | 45.37 | 17.763 | 1.68 | 34.747 | 12.965 | 2339111 | 2486866 | 5/28/1998 | 20:18:54.37 | 3.912 | 7.742 |
| 110 | 45.341 | 17.729 | 1.736 | 34.751 | 12.966 | 2329803 | 2486786 | 5/28/1998 | 20:24:55.17 | 3.848 | 7.742 |
| 111 | 45.294 | 17.679 | 1.705 | 34.753 | 12.964 | 2358646 | 2487401 | 5/28/1998 | 20:30:55.97 | 4.046 | 7.744 |
| 112 | 45.264 | 17.654 | 1.731 | 34.748 | 12.965 | 2330498 | 2487117 | 5/28/1998 | 20:36:56.77 | 3.853 | 7.743 |
| 113 | 45.214 | 17.594 | 1.786 | 34.757 | 12.963 | 2314874 | 2487420 | 5/28/1998 | 20:42:57.57 | 3.745 | 7.744 |
| 114 | 45.168 | 17.555 | 1.775 | 34.751 | 12.962 | 2308275 | 2487907 | 5/28/1998 | 20:48:58.37 | 3.700 | 7.746 |
| 115 | 45.116 | 17.505 | 1.811 | 34.748 | 12.962 | 2344272 | 2487680 | 5/28/1998 | 20:54:59.17 | 3.947 | 7.745 |
| 116 | 45.073 | 17.457 | 1.837 | 34.753 | 12.961 | 2317267 | 2487876 | 5/28/1998 | 21:00:59.97 | 3.762 | 7.746 |
| 117 | 45.029 | 17.413 | 1.858 | 34.752 | 12.963 | 2300178 | 2487405 | 5/28/1998 | 21:07:00.77 | 3.645 | 7.744 |
| 118 | 44.99 | 17.358 | 1.924 | 34.766 | 12.96 | 2331624 | 2488023 | 5/28/1998 | 21:13:01.57 | 3.860 | 7.747 |
| 119 | 44.958 | 17.33 | 1.878 | 34.762 | 12.96 | 2329359 | 2487137 | 5/28/1998 | 21:19:02.37 | 3.845 | 7.743 |
| 120 | 44.915 | 17.294 | 1.953 | 34.757 | 12.959 | 2262493 | 2488073 | 5/28/1998 | 21:25:03.17 | 3.386 | 7.747 |
| 121 | 44.881 | 17.258 | 1.938 | 34.757 | 12.959 | 2240792 | 2488232 | 5/28/1998 | 21:31:03.97 | 3.237 | 7.748 |
| 122 | 44.846 | 17.223 | 1.958 | 34.757 | 12.958 | 2298574 | 2488113 | 5/28/1998 | 21:37:04.77 | 3.634 | 7.747 |
| 123 | 44.809 | 17.183 | 1.98 | 34.76 | 12.957 | 2262848 | 2488095 | 5/28/1998 | 21:43:05.57 | 3.388 | 7.747 |
| 124 | 44.778 | 17.139 | 1.945 | 34.771 | 12.957 | 2331855 | 2487752 | 5/28/1998 | 21:49:06.37 | 3.862 | 7.746 |
| 125 | 44.744 | 17.119 | 2.03 | 34.758 | 12.956 | 2280193 | 2488258 | 5/28/1998 | 21:55:07.17 | 3.507 | 7.748 |
| 126 | 44.708 | 17.078 | 2.065 | 34.762 | 12.955 | 2294880 | 2487701 | 5/28/1998 | 22:01:07.97 | 3.608 | 7.746 |
| 127 | 44.681 | 17.045 | 2.079 | 34.768 | 12.955 | 2308214 | 2488757 | 5/28/1998 | 22:07:08.77 | 3.700 | 7.750 |
| 128 | 44.664 | 17.005 | 2.063 | 34.787 | 12.955 | 2315095 | 2487847 | 5/28/1998 | 22:13:09.57 | 3.747 | 7.746 |
| 129 | 44.651 | 17.013 | 2.068 | 34.769 | 12.955 | 2289608 | 2487275 | 5/28/1998 | 22:19:10.37 | 3.572 | 7.744 |
| 130 | 44.617 | 16.977 | 2.087 | 34.771 | 12.953 | 2297307 | 2488295 | 5/28/1998 | 22:25:11.17 | 3.625 | 7.748 |
| 131 | 44.597 | 16.964 | 2.123 | 34.764 | 12.952 | 2336293 | 2487711 | 5/28/1998 | 22:31:11.97 | 3.892 | 7.746 |
| 132 | 44.581 | 16.941 | 2.11 | 34.77 | 12.953 | 2304030 | 2487121 | 5/28/1998 | 22:37:12.77 | 3.671 | 7.743 |
| 133 | 44.558 | 16.922 | 2.155 | 34.767 | 12.951 | 2351956 | 2487332 | 5/28/1998 | 22:43:13.57 | 4.000 | 7.744 |
| 134 | 44.525 | 16.881 | 2.177 | 34.773 | 12.951 | 2328506 | 2488363 | 5/28/1998 | 22:49:14.37 | 3.839 | 7.748 |
| 135 | 44.519 | 16.867 | 2.184 | 34.78 | 12.952 | 2332990 | 2488786 | 5/28/1998 | 22:55:15.17 | 3.870 | 7.750 |
| 136 | 44.51 | 16.869 | 2.167 | 34.771 | 12.95 | 2325469 | 2487748 | 5/28/1998 | 23:01:15.97 | 3.818 | 7.746 |
| 137 | 44.492 | 16.837 | 2.093 | 34.782 | 12.95 | 2257370 | 2488290 | 5/28/1998 | 23:07:16.77 | 3.351 | 7.748 |
| 138 | 44.472 | 16.82 | 2.202 | 34.779 | 12.95 | 2319133 | 2487317 | 5/28/1998 | 23:13:17.57 | 3.775 | 7.744 |
| 139 | 44.455 | 16.818 | 2.154 | 34.766 | 12.951 | 2305456 | 2488250 | 5/28/1998 | 23:19:18.37 | 3.681 | 7.748 |
| 140 | 44.432 | 16.787 | 2.194 | 34.773 | 12.949 | 2309781 | 2487183 | 5/28/1998 | 23:25:19.17 | 3.710 | 7.743 |
| 141 | 44.415 | 16.776 | 2.247 | 34.768 | 12.949 | 2319015 | 2487101 | 5/28/1998 | 23:31:19.97 | 3.774 | 7.743 |
| 142 | 44.394 | 16.751 | 2.193 | 34.771 | 12.948 | 2289664 | 2487559 | 5/28/1998 | 23:38:01.99 | 3.572 | 7.745 |
| 143 | 44.37 | 16.717 | 2.19 | 34.78 | 12.948 | 2263307 | 2487832 | 5/28/1998 | 23:44:02.79 | 3.392 | 7.746 |
| 144 | 44.351 | 16.709 | 2.147 | 34.77 | 12.946 | 2311462 | 2487816 | 5/28/1998 | 23:50:03.59 | 3.722 | 7.746 |
| 145 | 44.331 | 16.673 | 2.127 | 34.783 | 12.947 | 2320541 | 2487357 | 5/28/1998 | 23:56:04.39 | 3.784 | 7.744 |
| 146 | 44.306 | 16.65 | 2.17 | 34.781 | 12.946 | 2294127 | 2487148 | 5/29/1998 | 00:02:05.19 | 3.603 | 7.743 |
| 147 | 44.273 | 16.621 | 2.141 | 34.778 | 12.947 | 2332644 | 2487030 | 5/29/1998 | 00:08:05.99 | 3.867 | 7.743 |
| 148 | 44.254 | 16.6 | 2.127 | 34.779 | 12.945 | 2323867 | 2487469 | 5/29/1998 | 00:14:06.79 | 3.807 | 7.745 |
| 149 | 44.211 | 16.558 | 2.099 | 34.778 | 12.944 | 2300681 | 2487058 | 5/29/1998 | 00:20:07.59 | 3.648 | 7.743 |
| 150 | 44.188 | 16.526 | 2.067 | 34.786 | 12.943 | 2278551 | 2487306 | 5/29/1998 | 00:26:08.39 | 3.496 | 7.744 |
| 151 | 44.165 | 16.503 | 2.034 | 34.786 | 12.942 | 2287298 | 2487392 | 5/29/1998 | 00:32:09.19 | 3.556 | 7.744 |
| 152 | 44.135 | 16.469 | 2.06 | 34.789 | 12.941 | 2331387 | 2487051 | 5/29/1998 | 00:38:09.99 | 3.859 | 7.743 |
| 153 | 44.105 | 16.452 | 2.018 | 34.777 | 12.942 | 2295985 | 2487200 | 5/29/1998 | 00:44:10.79 | 3.616 | 7.743 |
| 154 | 44.088 | 16.426 | 1.986 | 34.784 | 12.942 | 2316765 | 2487424 | 5/29/1998 | 00:50:11.59 | 3.758 | 7.744 |
| 155 | 44.081 | 16.409 | 1.998 | 34.793 | 12.939 | 2304255 | 287212 | 5/29/1998 | 00:56:12.39 | 3.673 | 7.743 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **156** | 44.068 | 16.398 | 1.903 | 34.791 | 12.94 | 2228353 | 2487888 | 5/29/1998 | 01:02:13.19 | 3.152 | 7.746 |
| **157** | 44.057 | 16.389 | 1.925 | 34.789 | 12.94 | 2314425 | 2487251 | 5/29/1998 | 01:08:13.99 | 3.742 | 7.744 |
| **158** | 44.051 | 16.381 | 1.876 | 34.791 | 12.939 | 2319702 | 2488199 | 5/29/1998 | 01:14:14.79 | 3.779 | 7.748 |
| **159** | 44.046 | 16.384 | 1.839 | 34.784 | 12.939 | 2336415 | 2487387 | 5/29/1998 | 01:20:15.59 | 3.893 | 7.744 |
| **160** | 44.045 | 16.383 | 1.79 | 34.785 | 12.938 | 2317515 | 2488181 | 5/29/1998 | 01:26:16.39 | 3.764 | 7.748 |
| **161** | 44.045 | 16.382 | 1.783 | 34.785 | 12.938 | 2298769 | 2487598 | 5/29/1998 | 01:32:17.19 | 3.635 | 7.745 |
| **162** | 44.051 | 16.378 | 1.777 | 34.793 | 12.94 | 2317622 | 2487845 | 5/29/1998 | 01:38:17.99 | 3.764 | 7.746 |
| **163** | 44.061 | 16.385 | 1.689 | 34.797 | 12.938 | 2309962 | 2488155 | 5/29/1998 | 01:44:18.79 | 3.712 | 7.748 |
| **164** | 44.069 | 16.401 | 1.641 | 34.79 | 12.938 | 2313037 | 2488007 | 5/29/1998 | 01:50:19.59 | 3.733 | 7.747 |
| **165** | 44.086 | 16.425 | 1.592 | 34.784 | 12.938 | 2291199 | 2487798 | 5/29/1998 | 01:56:20.39 | 3.583 | 7.746 |
| **166** | 44.099 | 16.429 | 1.587 | 34.792 | 12.937 | 2301553 | 2489464 | 5/29/1998 | 02:02:21.19 | 3.654 | 7.753 |
| **167** | 44.117 | 16.453 | 1.537 | 34.787 | 12.938 | 2285801 | 2488157 | 5/29/1998 | 02:08:21.99 | 3.546 | 7.748 |
| **168** | 44.137 | 16.47 | 1.532 | 34.79 | 12.938 | 2299845 | 2488837 | 5/29/1998 | 02:14:22.79 | 3.642 | 7.750 |
| **169** | 44.161 | 16.497 | 1.441 | 34.787 | 12.938 | 2330472 | 2488705 | 5/29/1998 | 02:20:23.59 | 3.852 | 7.750 |
| **170** | 44.189 | 16.521 | 1.404 | 34.79 | 12.938 | 2291325 | 2489317 | 5/29/1998 | 02:26:24.39 | 3.584 | 7.753 |
| **171** | 44.205 | 16.544 | 1.414 | 34.786 | 12.938 | 2313383 | 2488472 | 5/29/1998 | 02:32:25.19 | 3.735 | 7.749 |
| **172** | 44.224 | 16.561 | 1.335 | 34.787 | 12.938 | 2284055 | 2488580 | 5/29/1998 | 02:38:25.99 | 3.534 | 7.749 |
| **173** | 44.246 | 16.582 | 1.343 | 34.788 | 12.936 | 2302788 | 2489789 | 5/29/1998 | 02:44:26.79 | 3.662 | 7.755 |
| **174** | 44.261 | 16.599 | 1.257 | 34.787 | 12.937 | 2234953 | 2489218 | 5/29/1998 | 02:50:27.59 | 3.197 | 7.752 |
| **175** | 44.269 | 16.613 | 1.192 | 34.782 | 12.935 | 2320161 | 2489082 | 5/29/1998 | 02:56:28.39 | 3.782 | 7.752 |
| **176** | 44.285 | 16.618 | 1.218 | 34.791 | 12.937 | 2297834 | 2489306 | 5/29/1998 | 03:02:29.19 | 3.628 | 7.752 |
| **177** | 44.293 | 16.635 | 1.162 | 34.783 | 12.937 | 2314185 | 2489379 | 5/29/1998 | 03:08:29.99 | 3.741 | 7.753 |
| **178** | 44.305 | 16.64 | 1.103 | 34.789 | 12.935 | 2282847 | 2488953 | 5/29/1998 | 03:14:30.79 | 3.526 | 7.751 |
| **179** | 44.317 | 16.659 | 1.051 | 34.784 | 12.935 | 2313239 | 2489215 | 5/29/1998 | 03:20:31.59 | 3.734 | 7.752 |
| **180** | 44.334 | 16.658 | 1.045 | 34.8 | 12.934 | 2327753 | 2489356 | 5/29/1998 | 03:26:32.39 | 3.834 | 7.753 |
| **181** | 44.342 | 16.681 | 0.969 | 34.787 | 12.934 | 2323343 | 2488751 | 5/29/1998 | 03:32:33.19 | 3.804 | 7.750 |
| **182** | 44.372 | 16.713 | 0.928 | 34.785 | 12.937 | 2273363 | 2488426 | 5/29/1998 | 03:38:33.99 | 3.461 | 7.749 |
| **183** | 44.413 | 16.751 | 0.857 | 34.788 | 12.935 | 2298671 | 2489384 | 5/29/1998 | 03:44:34.79 | 3.634 | 7.753 |
| **184** | 44.451 | 16.797 | 0.837 | 34.782 | 12.936 | 2283134 | 2488974 | 5/29/1998 | 03:50:35.59 | 3.528 | 7.751 |
| **185** | 44.487 | 16.83 | 0.795 | 34.784 | 12.935 | 2299437 | 2488495 | 5/29/1998 | 03:56:36.39 | 3.639 | 7.749 |
| **186** | 44.516 | 16.855 | 0.766 | 34.788 | 12.935 | 2318111 | 2488873 | 5/29/1998 | 04:02:37.19 | 3.768 | 7.751 |
| **187** | 44.561 | 16.898 | 0.719 | 34.79 | 12.936 | 2285798 | 2489263 | 5/29/1998 | 04:08:37.99 | 3.546 | 7.752 |
| **188** | 44.604 | 16.947 | 0.684 | 34.785 | 12.935 | 2304356 | 2488959 | 5/29/1998 | 04:14:38.79 | 3.673 | 7.751 |
| **189** | 44.624 | 16.97 | 0.622 | 34.782 | 12.937 | 2333743 | 2488811 | 5/29/1998 | 04:20:39.59 | 3.875 | 7.750 |
| **190** | 44.646 | 16.999 | 0.599 | 34.778 | 12.935 | 2327689 | 2488726 | 5/29/1998 | 04:26:40.39 | 3.833 | 7.750 |
| **191** | 44.689 | 17.023 | 0.563 | 34.794 | 12.935 | 2326769 | 2489019 | 5/29/1998 | 04:32:41.19 | 3.827 | 7.751 |
| **192** | 44.735 | 17.089 | 0.538 | 34.777 | 12.936 | 2280251 | 2489107 | 5/29/1998 | 04:38:41.99 | 3.508 | 7.752 |
| **193** | 44.778 | 17.119 | 0.527 | 34.789 | 12.935 | 2288164 | 2488836 | 5/29/1998 | 04:44:42.79 | 3.562 | 7.750 |
| **194** | 44.815 | 17.162 | 0.453 | 34.784 | 12.936 | 2354815 | 2489096 | 5/29/1998 | 04:50:43.59 | 4.020 | 7.752 |
| **195** | 44.858 | 17.201 | 0.432 | 34.787 | 12.936 | 2327043 | 2489481 | 5/29/1998 | 04:56:44.39 | 3.829 | 7.753 |
| **196** | 44.901 | 17.252 | 0.405 | 34.78 | 12.937 | 2193583 | 2488516 | 5/29/1998 | 05:02:45.19 | 2.913 | 7.749 |
| **197** | 44.955 | 17.308 | 0.372 | 34.779 | 12.936 | 2283462 | 2489276 | 5/29/1998 | 05:08:45.99 | 3.530 | 7.752 |
| **198** | 44.983 | 17.337 | 0.347 | 34.779 | 12.936 | 2331071 | 2488929 | 5/29/1998 | 05:14:46.79 | 3.857 | 7.751 |
| **199** | 44.983 | 17.351 | 0.316 | 34.767 | 12.934 | 2326903 | 2488973 | 5/29/1998 | 05:20:47.59 | 3.828 | 7.751 |
| **200** | 45.026 | 17.391 | 0.317 | 34.769 | 12.935 | 2299905 | 2488970 | 5/29/1998 | 05:26:48.39 | 3.643 | 7.751 |
| **201** | 45.074 | 17.43 | 0.274 | 34.777 | 12.935 | 2297999 | 2489074 | 5/29/1998 | 05:32:49.19 | 3.630 | 7.751 |
| **202** | 45.111 | 17.468 | 0.274 | 34.777 | 12.936 | 2331391 | 2488920 | 5/29/1998 | 05:38:49.99 | 3.859 | 7.751 |
| **203** | 45.156 | 17.504 | 0.201 | 34.785 | 12.937 | 2296867 | 2489300 | 5/29/1998 | 05:44:50.79 | 3.622 | 7.752 |
| **204** | 45.195 | 17.561 | 0.209 | 34.769 | 12.939 | 2321373 | 2488326 | 5/29/1998 | 05:50:51.59 | 3.790 | 7.748 |
| **205** | 45.243 | 17.598 | 0.216 | 34.779 | 12.937 | 2322803 | 2488669 | 5/29/1998 | 05:56:52.39 | 3.800 | 7.750 |
| **206** | 45.28 | 17.64 | 0.201 | 34.775 | 12.938 | 2344243 | 2489041 | 5/29/1998 | 06:02:53.19 | 3.947 | 7.751 |
| **207** | 45.321 | 17.679 | 0.156 | 34.776 | 12.936 | 2378781 | 2487804 | 5/29/1998 | 06:08:53.99 | 4.184 | 7.746 |
| **208** | 45.348 | 17.705 | 0.179 | 34.778 | 12.938 | 2366713 | 2488640 | 5/29/1998 | 06:14:54.79 | 4.101 | 7.750 |
| **209** | 45.388 | 17.747 | 0.172 | 34.776 | 12.936 | 2334393 | 2488707 | 5/29/1998 | 06:20:55.59 | 3.879 | 7.750 |
| **210** | 45.422 | 17.791 | 0.159 | 34.767 | 12.937 | 2255886 | 2487790 | 5/29/1998 | 06:26:56.39 | 3.341 | 7.746 |
| **211** | 45.462 | 17.83 | 0.169 | 34.769 | 12.94 | 2349147 | 2487964 | 5/29/1998 | 06:32:57.19 | 3.981 | 7.747 |
| **212** | 45.51 | 17.866 | 0.145 | 34.779 | 12.937 | 2347306 | 2488192 | 5/29/1998 | 06:39:39.22 | 3.968 | 7.748 |
| **213** | 45.538 | 17.905 | 0.138 | 34.77 | 12.936 | 2291856 | 2487561 | 5/29/1998 | 06:45:40.02 | 3.587 | 7.745 |
| **214** | 45.576 | 17.945 | 0.143 | 34.768 | 12.936 | 2222965 | 2487628 | 5/29/1998 | 06:51:40.82 | 3.115 | 7.745 |
| **215** | 45.616 | 17.983 | 0.17 | 34.77 | 12.94 | 2330958 | 2487773 | 5/29/1998 | 06:57:41.62 | 3.856 | 7.746 |
| **216** | 45.654 | 18.03 | 0.152 | 34.763 | 12.937 | 2322395 | 2487670 | 5/29/1998 | 07:03:42.42 | 3.797 | 7.745 |
| **217** | 45.686 | 18.057 | 0.166 | 34.766 | 12.939 | 2297551 | 2487695 | 5/29/1998 | 07:09:43.22 | 3.627 | 7.746 |
| **218** | 45.721 | 18.102 | 0.156 | 34.758 | 12.936 | 2334395 | 2487626 | 5/29/1998 | 07:15:44.02 | 3.879 | 7.745 |
| **219** | 45.766 | 18.14 | 0.185 | 34.765 | 12.939 | 2357319 | 2487050 | 5/29/1998 | 07:21:44.82 | 4.037 | 7.743 |
| **220** | 45.802 | 18.177 | 0.195 | 34.764 | 12.939 | 2310795 | 2487153 | 5/29/1998 | 07:27:45.62 | 3.717 | 7.743 |
| **221** | 45.838 | 18.217 | 0.221 | 34.76 | 12.938 | 2304781 | 2486748 | 5/29/1998 | 07:33:46.42 | 3.676 | 7.741 |
| **222** | 45.881 | 18.255 | 0.237 | 34.765 | 12.937 | 2374486 | 2486894 | 5/29/1998 | 07:39:47.22 | 4.155 | 7.742 |
| **223** | 45.91 | 18.293 | 0.255 | 34.757 | 12.94 | 2358374 | 2486404 | 5/29/1998 | 07:45:48.02 | 4.044 | 7.740 |
| **224** | 45.943 | 18.326 | 0.254 | 34.758 | 12.939 | 2355086 | 2486334 | 5/29/1998 | 07:51:48.82 | 4.021 | 7.740 |
| **225** | 45.976 | 18.356 | 0.27 | 34.759 | 12.94 | 2289219 | 2486584 | 5/29/1998 | 07:57:49.62 | 3.569 | 7.741 |
| **226** | 46.006 | 18.39 | 0.296 | 34.756 | 12.937 | 2331209 | 2486612 | 5/29/1998 | 08:03:50.42 | 3.858 | 7.741 |
| **227** | 46.037 | 18.426 | 0.316 | 34.751 | 12.939 | 2348303 | 2486396 | 5/29/1998 | 08:09:51.22 | 3.975 | 7.740 |
| **228** | 46.055 | 18.446 | 0.312 | 34.75 | 12.937 | 2260793 | 2486816 | 5/29/1998 | 08:15:52.02 | 3.374 | 7.742 |
| **229** | 46.087 | 18.47 | 0.341 | 34.757 | 12.938 | 2361113 | 2486006 | 5/29/1998 | 08:21:52.82 | 4.063 | 7.738 |
| **230** | 46.116 | 18.501 | 0.397 | 34.755 | 12.937 | 2242313 | 2486667 | 5/29/1998 | 08:27:53.62 | 3.247 | 7.741 |
| **231** | 46.141 | 18.525 | 0.396 | 34.756 | 12.935 | 2325640 | 2486151 | 5/29/1998 | 08:33:54.42 | 3.819 | 7.739 |
| **232** | 46.16 | 18.543 | 0.402 | 34.756 | 12.937 | 2334223 | 2486496 | 5/29/1998 | 08:39:55.22 | 3.878 | 7.740 |
| **233** | 46.174 | 18.564 | 0.483 | 34.751 | 12.936 | 2352298 | 2486551 | 5/29/1998 | 08:45:56.02 | 4.002 | 7.741 |
| **234** | 46.194 | 18.577 | 0.461 | 34.757 | 12.936 | 2334808 | 2486328 | 5/29/1998 | 08:51:56.82 | 3.882 | 7.740 |
| **235** | 46.198 | 18.582 | 0.484 | 34.756 | 12.936 | 2320176 | 2485657 | 5/29/1998 | 08:57:57.62 | 3.782 | 7.737 |
| **236** | 46.196 | 18.577 | 0.515 | 34.758 | 12.935 | 2273956 | 2485540 | 5/29/1998 | 09:03:58.42 | 3.465 | 7.736 |
| **237** | 46.188 | 18.582 | 0.542 | 34.747 | 12.934 | 2371515 | 2485166 | 5/29/1998 | 09:09:59.22 | 4.134 | 7.735 |
| **238** | 46.179 | 18.563 | 0.528 | 34.755 | 12.934 | 2359711 | 2485938 | 5/29/1998 | 09:16:00.02 | 4.053 | 7.738 |
| **239** | 46.16 | 18.544 | 0.592 | 34.756 | 12.933 | 2390262 | 2485802 | 5/29/1998 | 09:22:00.82 | 4.263 | 7.737 |
| **240** | 46.146 | 18.524 | 0.607 | 34.761 | 12.936 | 2376076 | 2484909 | 5/29/1998 | 09:28:01.62 | 4.165 | 7.734 |
| **241** | 46.122 | 18.508 | 0.608 | 34.754 | 12.932 | 2346540 | 2485726 | 5/29/1998 | 09:34:02.42 | 3.963 | 7.737 |
| **242** | 46.11 | 18.494 | 0.679 | 34.756 | 12.931 | 2271082 | 2485496 | 5/29/1998 | 09:40:03.22 | 3.445 | 7.736 |
| **243** | 46.098 | 18.49 | 0.659 | 34.748 | 12.931 | 2342790 | 2484503 | 5/29/1998 | 09:46:04.02 | 3.937 | 7.732 |
| **244** | 46.083 | 18.473 | 0.689 | 34.751 | 12.932 | 2360399 | 2484808 | 5/29/1998 | 09:52:04.82 | 4.058 | 7.733 |
| **245** | 46.071 | 18.451 | 0.764 | 34.759 | 12.93 | 2359366 | 2485051 | 5/29/1998 | 09:58:05.62 | 4.051 | 7.734 |
| **246** | 46.057 | 18.44 | 0.802 | 34.757 | 12.93 | 2339065 | 2485960 | 5/29/1998 | 10:04:06.42 | 3.911 | 7.738 |
| **247** | 46.039 | 18.429 | 0.778 | 34.751 | 12.929 | 2374929 | 2485450 | 5/29/1998 | 10:10:07.22 | 4.158 | 7.736 |
| **248** | 46.033 | 18.419 | 0.823 | 34.755 | 12.931 | 2380206 | 2485436 | 5/29/1998 | 10:16:08.02 | 4.194 | 7.736 |
| **249** | 46.026 | 18.406 | 0.877 | 34.759 | 12.931 | 2347044 | 2484886 | 5/29/1998 | 10:22:08.82 | 3.966 | 7.733 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **250** | 46.012 | 18.396 | 0.896 | 34.756 | 12.928 | 2355055 | 2485252 | 5/29/1998 | 10:28:09.62 | 4.021 | 7.735 |
| **251** | 45.995 | 18.378 | 0.951 | 34.756 | 12.928 | 2327764 | 2485243 | 5/29/1998 | 10:34:10.42 | 3.834 | 7.735 |
| **252** | 45.973 | 18.355 | 0.923 | 34.757 | 12.927 | 2380058 | 2484446 | 5/29/1998 | 10:40:11.22 | 4.193 | 7.732 |
| **253** | 45.948 | 18.336 | 0.969 | 34.752 | 12.906 | 2359418 | 2483853 | 5/29/1998 | 10:46:12.02 | 4.051 | 7.729 |
| **254** | 45.93 | 18.307 | 0.962 | 34.762 | 12.919 | 2348663 | 2485031 | 5/29/1998 | 10:52:12.82 | 3.977 | 7.734 |
| **255** | 45.892 | 18.271 | 1.029 | 34.759 | 12.918 | 2350833 | 2484387 | 5/29/1998 | 10:58:13.62 | 3.992 | 7.731 |
| **256** | 45.858 | 18.234 | 1.051 | 34.762 | 12.919 | 2329614 | 2484429 | 5/29/1998 | 11:04:14.42 | 3.847 | 7.731 |
| **257** | 45.822 | 18.198 | 1.064 | 34.762 | 12.92 | 2372916 | 2484444 | 5/29/1998 | 11:10:15.22 | 4.144 | 7.731 |
| **258** | 45.801 | 18.173 | 1.079 | 34.765 | 12.919 | 2342223 | 2484663 | 5/29/1998 | 11:16:16.02 | 3.933 | 7.732 |
| **259** | 45.77 | 18.143 | 1.107 | 34.764 | 12.918 | 2350212 | 2484551 | 5/29/1998 | 11:22:16.82 | 3.988 | 7.732 |
| **260** | 45.725 | 18.102 | 1.137 | 34.762 | 12.918 | 2295768 | 2484156 | 5/29/1998 | 11:28:17.62 | 3.614 | 7.730 |
| **261** | 45.672 | 18.049 | 1.166 | 34.761 | 12.918 | 2360195 | 2484763 | 5/29/1998 | 11:34:18.42 | 4.056 | 7.733 |
| **262** | 45.623 | 17.988 | 1.152 | 34.772 | 12.918 | 2325052 | 2484259 | 5/29/1998 | 11:40:19.22 | 3.815 | 7.731 |
| **263** | 45.567 | 17.947 | 1.168 | 34.758 | 12.915 | 2360377 | 2484336 | 5/29/1998 | 11:46:20.02 | 4.058 | 7.731 |
| **264** | 45.498 | 17.867 | 1.2 | 34.768 | 12.915 | 2345574 | 2484232 | 5/29/1998 | 11:52:20.82 | 3.956 | 7.731 |
| **265** | 45.429 | 17.793 | 1.221 | 34.772 | 12.913 | 2335963 | 2484171 | 5/29/1998 | 11:58:21.62 | 3.890 | 7.730 |
| **266** | 45.386 | 17.752 | 1.233 | 34.77 | 12.914 | 2372696 | 2484228 | 5/29/1998 | 12:04:22.42 | 4.142 | 7.731 |
| **267** | 45.334 | 17.698 | 1.292 | 34.772 | 12.913 | 2228506 | 2483885 | 5/29/1998 | 12:10:23.22 | 3.153 | 7.729 |
| **268** | 45.285 | 17.653 | 1.265 | 34.768 | 12.912 | 2321059 | 2484050 | 5/29/1998 | 12:16:24.02 | 3.788 | 7.730 |
| **269** | 45.252 | 17.609 | 1.294 | 34.777 | 12.912 | 2344872 | 2484538 | 5/29/1998 | 12:22:24.82 | 3.951 | 7.732 |
| **270** | 45.214 | 17.566 | 1.278 | 34.781 | 12.911 | 2370115 | 2484017 | 5/29/1998 | 12:28:25.62 | 4.125 | 7.730 |
| **271** | 45.163 | 17.518 | 1.302 | 34.779 | 12.911 | 2323027 | 2484582 | 5/29/1998 | 12:34:26.42 | 3.801 | 7.732 |
| **272** | 45.115 | 17.482 | 1.279 | 34.768 | 12.909 | 2343015 | 2484452 | 5/29/1998 | 12:40:27.22 | 3.939 | 7.732 |
| **273** | 45.081 | 17.447 | 1.299 | 34.768 | 12.908 | 2339927 | 2484048 | 5/29/1998 | 12:46:28.02 | 3.917 | 7.730 |
| **274** | 45.049 | 17.416 | 1.3 | 34.767 | 12.909 | 2336933 | 2484086 | 5/29/1998 | 12:52:28.82 | 3.897 | 7.730 |
| **275** | 45.034 | 17.385 | 1.287 | 34.781 | 12.909 | 2342602 | 2484079 | 5/29/1998 | 12:58:29.62 | 3.936 | 7.730 |
| **276** | 45.007 | 17.356 | 1.356 | 34.782 | 12.908 | 2301207 | 2483829 | 5/29/1998 | 13:04:30.42 | 3.652 | 7.729 |
| **277** | 44.977 | 17.326 | 1.372 | 34.783 | 12.908 | 2319952 | 2483977 | 5/29/1998 | 13:10:31.22 | 3.780 | 7.729 |
| **278** | 44.946 | 17.296 | 1.333 | 34.782 | 12.907 | 2332314 | 2484063 | 5/29/1998 | 13:16:32.02 | 3.865 | 7.730 |
| **279** | 44.918 | 17.271 | 1.364 | 34.779 | 12.907 | 2338066 | 2483642 | 5/29/1998 | 13:22:32.82 | 3.905 | 7.728 |
| **280** | 44.89 | 17.239 | 1.328 | 34.782 | 12.905 | 2340330 | 2484771 | 5/29/1998 | 13:28:33.62 | 3.920 | 7.733 |
| **281** | 44.851 | 17.202 | 1.309 | 34.781 | 12.905 | 2297767 | 2484638 | 5/29/1998 | 13:34:34.42 | 3.628 | 7.732 |
| **282** | 44.811 | 17.158 | 1.289 | 34.784 | 12.902 | 2337772 | 2484419 | 5/29/1998 | 13:41:16.46 | 3.903 | 7.731 |
| **283** | 44.786 | 17.13 | 1.28 | 34.786 | 12.903 | 2332777 | 2483267 | 5/29/1998 | 13:47:17.26 | 3.868 | 7.726 |
| **284** | 44.761 | 17.117 | 1.305 | 34.775 | 12.903 | 2343545 | 2483895 | 5/29/1998 | 13:53:18.06 | 3.942 | 7.729 |
| **285** | 44.712 | 17.05 | 1.31 | 34.791 | 12.902 | 2339659 | 2483953 | 5/29/1998 | 13:59:18.86 | 3.916 | 7.729 |
| **286** | 44.673 | 17.009 | 1.298 | 34.792 | 12.901 | 2321547 | 2484309 | 5/29/1998 | 14:05:19.66 | 3.791 | 7.731 |
| **287** | 44.639 | 16.982 | 1.33 | 34.786 | 12.903 | 2327921 | 2483368 | 5/29/1998 | 14:11:20.46 | 3.835 | 7.727 |
| **288** | 44.607 | 16.95 | 1.256 | 34.785 | 12.9 | 2312211 | 2484264 | 5/29/1998 | 14:17:21.26 | 3.727 | 7.731 |
| **289** | 44.598 | 16.924 | 1.228 | 34.8 | 12.901 | 2327343 | 2484037 | 5/29/1998 | 14:23:22.06 | 3.831 | 7.730 |
| **290** | 44.564 | 16.908 | 1.224 | 34.784 | 12.901 | 2341677 | 2483301 | 5/29/1998 | 14:29:22.86 | 3.929 | 7.727 |
| **291** | 44.536 | 16.867 | 1.17 | 34.795 | 12.899 | 2315049 | 2483388 | 5/29/1998 | 14:35:23.66 | 3.747 | 7.727 |
| **292** | 44.513 | 16.851 | 1.198 | 34.789 | 12.898 | 2329209 | 2483680 | 5/29/1998 | 14:41:24.46 | 3.844 | 7.728 |
| **293** | 44.478 | 16.822 | 1.231 | 34.783 | 12.9 | 2335562 | 2483394 | 5/29/1998 | 14:47:25.26 | 3.887 | 7.727 |
| **294** | 44.451 | 16.792 | 1.222 | 34.786 | 12.897 | 2338998 | 2483843 | 5/29/1998 | 14:53:26.06 | 3.911 | 7.729 |
| **295** | 44.42 | 16.75 | 1.193 | 34.795 | 12.9 | 2324411 | 2483427 | 5/29/1998 | 14:59:26.86 | 3.811 | 7.727 |
| **296** | 44.399 | 16.732 | 1.145 | 34.793 | 12.898 | 2304612 | 2484513 | 5/29/1998 | 15:05:27.66 | 3.675 | 7.732 |
| **297** | 44.364 | 16.703 | 1.1 | 34.786 | 12.883 | 2292713 | 2484593 | 5/29/1998 | 15:11:28.46 | 3.593 | 7.732 |
| **298** | 44.357 | 16.668 | 1.042 | 34.811 | 12.888 | 2308925 | 2484349 | 5/29/1998 | 15:17:29.26 | 3.705 | 7.731 |
| **299** | 44.349 | 16.674 | 1.108 | 34.799 | 12.89 | 2327934 | 2484425 | 5/29/1998 | 15:23:30.06 | 3.835 | 7.731 |
| **300** | 44.34 | 16.665 | 1.097 | 34.798 | 12.891 | 2282372 | 2483891 | 5/29/1998 | 15:29:30.86 | 3.522 | 7.729 |
| **301** | 44.316 | 16.646 | 1.05 | 34.795 | 12.892 | 2315451 | 2483857 | 5/29/1998 | 15:35:31.66 | 3.749 | 7.729 |
| **302** | 44.3 | 16.619 | 1.033 | 34.804 | 12.893 | 2251383 | 2483779 | 5/29/1998 | 15:41:32.46 | 3.310 | 7.729 |
| **303** | 44.283 | 16.606 | 1.085 | 34.8 | 12.891 | 2307209 | 2484265 | 5/29/1998 | 15:47:33.26 | 3.693 | 7.731 |
| **304** | 44.272 | 16.592 | 1.042 | 34.803 | 12.891 | 2332659 | 2483848 | 5/29/1998 | 15:53:34.06 | 3.867 | 7.729 |
| **305** | 44.257 | 16.582 | 0.982 | 34.798 | 12.89 | 2341376 | 2484169 | 5/29/1998 | 15:59:34.86 | 3.927 | 7.730 |
| **306** | 44.228 | 16.553 | 0.977 | 34.798 | 12.89 | 2313749 | 2483931 | 5/29/1998 | 16:05:35.66 | 3.738 | 7.729 |
| **307** | 44.201 | 16.521 | 0.959 | 34.802 | 12.89 | 2330583 | 2484105 | 5/29/1998 | 16:11:36.46 | 3.853 | 7.730 |
| **308** | 44.187 | 16.509 | 0.923 | 34.8 | 12.889 | 2303860 | 2484190 | 5/29/1998 | 16:17:37.26 | 3.670 | 7.730 |
| **309** | 44.176 | 16.493 | 0.932 | 34.804 | 12.89 | 2343082 | 2484519 | 5/29/1998 | 16:23:38.06 | 3.939 | 7.732 |
| **310** | 44.151 | 16.467 | 0.888 | 34.805 | 12.888 | 2343922 | 2484486 | 5/29/1998 | 16:29:38.86 | 3.945 | 7.732 |
| **311** | 44.128 | 16.456 | 0.881 | 34.794 | 12.888 | 2312010 | 2485232 | 5/29/1998 | 16:35:39.66 | 3.726 | 7.735 |
| **312** | 44.127 | 16.449 | 0.912 | 34.799 | 12.887 | 2322480 | 2484327 | 5/29/1998 | 16:41:40.46 | 3.798 | 7.731 |
| **313** | 44.142 | 16.468 | 0.873 | 34.796 | 12.889 | 2315096 | 2485002 | 5/29/1998 | 16:47:41.26 | 3.747 | 7.734 |
| **314** | 44.173 | 16.499 | 0.837 | 34.796 | 12.889 | 2348395 | 2485131 | 5/29/1998 | 16:53:42.06 | 3.975 | 7.734 |
| **315** | 44.191 | 16.515 | 0.87 | 34.798 | 12.891 | 2335403 | 2485378 | 5/29/1998 | 16:59:42.86 | 3.886 | 7.736 |
| **316** | 44.208 | 16.533 | 0.83 | 34.798 | 12.891 | 2330302 | 2486136 | 5/29/1998 | 17:05:43.66 | 3.851 | 7.739 |
| **317** | 44.25 | 16.573 | 0.852 | 34.799 | 12.892 | 2307566 | 2486248 | 5/29/1998 | 17:11:44.46 | 3.695 | 7.739 |
| **318** | 44.286 | 16.61 | 0.825 | 34.8 | 12.891 | 2330960 | 2486217 | 5/29/1998 | 17:17:45.26 | 3.856 | 7.739 |
| **319** | 44.32 | 16.644 | 0.8 | 34.8 | 12.892 | 2332307 | 2486066 | 5/29/1998 | 17:23:46.06 | 3.865 | 7.738 |
| **320** | 44.359 | 16.685 | 0.741 | 34.798 | 12.892 | 2320140 | 2486059 | 5/29/1998 | 17:29:46.86 | 3.782 | 7.738 |
| **321** | 44.393 | 16.731 | 0.788 | 34.789 | 12.892 | 2257174 | 2486583 | 5/29/1998 | 17:35:47.66 | 3.349 | 7.741 |
| **322** | 44.446 | 16.761 | 0.774 | 34.808 | 12.891 | 2338630 | 2485621 | 5/29/1998 | 17:41:48.46 | 3.908 | 7.737 |
| **323** | 44.483 | 16.804 | 0.821 | 34.803 | 12.891 | 2327171 | 2486514 | 5/29/1998 | 17:47:49.26 | 3.830 | 7.740 |
| **324** | 44.519 | 16.85 | 0.808 | 34.796 | 12.893 | 2338304 | 2486065 | 5/29/1998 | 17:53:50.06 | 3.906 | 7.738 |
| **325** | 44.557 | 16.884 | 0.787 | 34.798 | 12.892 | 2343962 | 2486671 | 5/29/1998 | 17:59:50.86 | 3.945 | 7.741 |
| **326** | 44.604 | 16.923 | 0.815 | 34.807 | 12.892 | 2355998 | 2486419 | 5/29/1998 | 18:05:51.66 | 4.028 | 7.740 |
| **327** | 44.638 | 16.979 | 0.782 | 34.787 | 12.895 | 2341730 | 2486646 | 5/29/1998 | 18:11:52.46 | 3.930 | 7.741 |
| **328** | 44.674 | 17.01 | 0.787 | 34.793 | 12.893 | 2296214 | 2487235 | 5/29/1998 | 18:17:53.26 | 3.617 | 7.744 |
| **329** | 44.711 | 17.052 | 0.762 | 34.788 | 12.892 | 2331940 | 2487590 | 5/29/1998 | 18:23:54.06 | 3.863 | 7.745 |
| **330** | 44.742 | 17.087 | 0.794 | 34.785 | 12.892 | 2348959 | 2487156 | 5/29/1998 | 18:29:54.86 | 3.979 | 7.743 |
| **331** | 44.771 | 17.113 | 0.81 | 34.787 | 12.892 | 2320873 | 2487392 | 5/29/1998 | 18:35:55.66 | 3.787 | 7.744 |
| **332** | 44.783 | 17.12 | 0.776 | 34.792 | 12.892 | 2322974 | 2486786 | 5/29/1998 | 18:41:56.46 | 3.801 | 7.742 |
| **333** | 44.794 | 17.136 | 0.795 | 34.788 | 12.892 | 2336199 | 2486699 | 5/29/1998 | 18:47:57.26 | 3.892 | 7.741 |
| **334** | 44.809 | 17.151 | 0.777 | 34.787 | 12.892 | 2321517 | 2487226 | 5/29/1998 | 18:53:58.06 | 3.791 | 7.744 |
| **335** | 44.835 | 17.179 | 0.82 | 34.786 | 12.892 | 2204881 | 2487495 | 5/29/1998 | 18:59:58.86 | 2.991 | 7.745 |
| **336** | 44.849 | 17.205 | 0.796 | 34.776 | 12.892 | 2327373 | 2487420 | 5/29/1998 | 19:05:59.66 | 3.831 | 7.744 |
| **337** | 44.861 | 17.208 | 0.765 | 34.784 | 12.893 | 2343211 | 2487378 | 5/29/1998 | 19:12:00.46 | 3.940 | 7.744 |
| **338** | 44.869 | 17.225 | 0.749 | 34.776 | 12.893 | 2334512 | 2487949 | 5/29/1998 | 19:18:01.26 | 3.880 | 7.747 |
| **339** | 44.901 | 17.238 | 0.768 | 34.793 | 12.89 | 2301201 | 2488307 | 5/29/1998 | 19:24:02.06 | 3.652 | 7.748 |
| **340** | 44.929 | 17.266 | 0.828 | 34.793 | 12.891 | 2348669 | 2487450 | 5/29/1998 | 19:30:02.86 | 3.977 | 7.744 |
| **341** | 44.925 | 17.282 | 0.876 | 34.776 | 12.891 | 2337543 | 2488202 | 5/29/1998 | 19:36:03.66 | 3.901 | 7.748 |
| **342** | 44.923 | 17.27 | 0.874 | 34.784 | 12.889 | 2326310 | 2487967 | 5/29/1998 | 19:42:04.46 | 3.824 | 7.747 |
| **343** | 44.929 | 17.262 | 0.9 | 34.796 | 12.889 | 2313199 | 2487320 | 5/29/1998 | 19:48:05.26 | 3.734 | 7.744 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **344** | 44.934 | 17.277 | 0.838 | 34.788 | 12.89 | 2352186 | 2487869 | 5/29/1998 | 19:54:06.06 | 4.002 | 7.746 |
| **345** | 44.939 | 17.277 | 0.9 | 34.792 | 12.888 | 2315448 | 2487883 | 5/29/1998 | 20:00:06.86 | 3.749 | 7.746 |
| **346** | 44.919 | 17.267 | 0.909 | 34.783 | 12.889 | 2353717 | 2487396 | 5/29/1998 | 20:06:07.66 | 4.012 | 7.744 |
| **347** | 44.913 | 17.253 | 0.88 | 34.79 | 12.888 | 2346549 | 2488178 | 5/29/1998 | 20:12:08.46 | 3.963 | 7.748 |
| **348** | 44.919 | 17.255 | 0.869 | 34.793 | 12.888 | 2336872 | 2487929 | 5/29/1998 | 20:18:09.26 | 3.896 | 7.747 |
| **349** | 44.917 | 17.254 | 0.894 | 34.793 | 12.889 | 2325632 | 2488405 | 5/29/1998 | 20:24:10.06 | 3.819 | 7.749 |
| **350** | 44.896 | 17.244 | 0.95 | 34.783 | 12.889 | 2334058 | 2488291 | 5/29/1998 | 20:30:10.86 | 3.877 | 7.748 |
| **351** | 44.879 | 17.226 | 0.984 | 34.784 | 12.887 | 2311488 | 2488567 | 5/29/1998 | 20:36:11.66 | 3.722 | 7.749 |
| **352** | 44.859 | 17.194 | 1.012 | 34.794 | 12.886 | 2341039 | 2487927 | 5/29/1998 | 20:42:53.70 | 3.925 | 7.747 |
| **353** | 44.844 | 17.181 | 0.997 | 34.792 | 12.885 | 2344434 | 2487600 | 5/29/1998 | 20:48:54.50 | 3.948 | 7.745 |
| **354** | 44.831 | 17.16 | 1.025 | 34.799 | 12.886 | 2337312 | 2488011 | 5/29/1998 | 20:54:55.30 | 3.899 | 7.747 |
| **355** | 44.813 | 17.153 | 1.01 | 34.789 | 12.886 | 2338198 | 2487658 | 5/29/1998 | 21:00:56.10 | 3.906 | 7.745 |
| **356** | 44.794 | 17.127 | 1.052 | 34.796 | 12.884 | 2344105 | 2488237 | 5/29/1998 | 21:06:56.90 | 3.946 | 7.748 |
| **357** | 44.783 | 17.118 | 1.028 | 34.794 | 12.886 | 2325453 | 2487986 | 5/29/1998 | 21:12:57.70 | 3.818 | 7.747 |
| **358** | 44.77 | 17.102 | 1.037 | 34.796 | 12.884 | 2331893 | 2488251 | 5/29/1998 | 21:18:58.50 | 3.862 | 7.748 |
| **359** | 44.742 | 17.079 | 1.109 | 34.791 | 12.883 | 2340829 | 2488391 | 5/29/1998 | 21:24:59.30 | 3.924 | 7.749 |
| **360** | 44.712 | 17.041 | 1.096 | 34.798 | 12.883 | 2321772 | 2488392 | 5/29/1998 | 21:31:00.10 | 3.793 | 7.749 |
| **361** | 44.673 | 17.014 | 1.13 | 34.788 | 12.882 | 2309981 | 2487718 | 5/29/1998 | 21:37:00.90 | 3.712 | 7.746 |
| **362** | 44.657 | 16.995 | 1.073 | 34.79 | 12.881 | 2339121 | 2487849 | 5/29/1998 | 21:43:01.70 | 3.912 | 7.746 |
| **363** | 44.637 | 16.974 | 1.173 | 34.791 | 12.881 | 2342414 | 2488280 | 5/29/1998 | 21:49:02.50 | 3.934 | 7.748 |
| **364** | 44.597 | 16.914 | 1.143 | 34.808 | 12.882 | 2315806 | 2487417 | 5/29/1998 | 21:55:03.30 | 3.752 | 7.744 |
| **365** | 44.551 | 16.87 | 1.17 | 34.806 | 12.879 | 2307752 | 2487611 | 5/29/1998 | 22:01:04.10 | 3.697 | 7.745 |
| **366** | 44.518 | 16.842 | 1.205 | 34.801 | 12.88 | 2361652 | 2487055 | 5/29/1998 | 22:07:04.90 | 4.066 | 7.743 |
| **367** | 44.492 | 16.802 | 1.156 | 34.814 | 12.878 | 2303127 | 2487274 | 5/29/1998 | 22:13:05.70 | 3.665 | 7.744 |
| **368** | 44.449 | 16.774 | 1.224 | 34.8 | 12.88 | 2330282 | 2486967 | 5/29/1998 | 22:19:06.50 | 3.851 | 7.742 |
| **369** | 44.407 | 16.728 | 1.246 | 34.802 | 12.877 | 2314107 | 2486463 | 5/29/1998 | 22:25:07.30 | 3.740 | 7.740 |
| **370** | 44.371 | 16.693 | 1.24 | 34.802 | 12.878 | 2323078 | 2487037 | 5/29/1998 | 22:31:08.10 | 3.802 | 7.743 |
| **371** | 44.34 | 16.665 | 1.237 | 34.799 | 12.876 | 2336920 | 2487277 | 5/29/1998 | 22:37:08.90 | 3.897 | 7.744 |
| **372** | 44.317 | 16.632 | 1.307 | 34.807 | 12.877 | 2293848 | 2487169 | 5/29/1998 | 22:43:09.70 | 3.601 | 7.743 |
| **373** | 44.281 | 16.605 | 1.295 | 34.799 | 12.875 | 2322162 | 2486511 | 5/29/1998 | 22:49:10.50 | 3.795 | 7.740 |
| **374** | 44.237 | 16.564 | 1.335 | 34.796 | 12.878 | 2329379 | 2486668 | 5/29/1998 | 22:55:11.30 | 3.845 | 7.741 |
| **375** | 44.221 | 16.536 | 1.283 | 34.806 | 12.875 | 2342634 | 2486745 | 5/29/1998 | 23:01:12.10 | 3.936 | 7.741 |
| **376** | 44.209 | 16.522 | 1.326 | 34.808 | 12.876 | 2322352 | 2486988 | 5/29/1998 | 23:07:12.90 | 3.797 | 7.742 |
| **377** | 44.179 | 16.504 | 1.307 | 34.798 | 12.874 | 2328236 | 2486675 | 5/29/1998 | 23:13:13.70 | 3.837 | 7.741 |
| **378** | 44.162 | 16.468 | 1.334 | 34.813 | 12.873 | 2314743 | 2486843 | 5/29/1998 | 23:19:14.50 | 3.745 | 7.742 |
| **379** | 44.149 | 16.471 | 1.319 | 34.799 | 12.874 | 2332417 | 2487581 | 5/29/1998 | 23:25:15.30 | 3.866 | 7.745 |
| **380** | 44.145 | 16.456 | 1.334 | 34.809 | 12.873 | 2307129 | 2486943 | 5/29/1998 | 23:31:16.10 | 3.692 | 7.742 |
| **381** | 44.131 | 16.441 | 1.366 | 34.81 | 12.873 | 2318263 | 2486990 | 5/29/1998 | 23:37:16.90 | 3.769 | 7.742 |
| **382** | 44.113 | 16.423 | 1.386 | 34.809 | 12.873 | 2307490 | 2486819 | 5/29/1998 | 23:43:17.70 | 3.695 | 7.742 |
| **383** | 44.104 | 16.419 | 1.387 | 34.805 | 12.872 | 2313981 | 2486828 | 5/29/1998 | 23:49:18.50 | 3.739 | 7.742 |
| **384** | 44.094 | 16.409 | 1.371 | 34.805 | 12.873 | 2319829 | 2486829 | 5/29/1998 | 23:55:19.30 | 3.779 | 7.742 |
| **385** | 44.085 | 16.394 | 1.402 | 34.811 | 12.873 | 2305087 | 2486923 | 5/30/1998 | 00:01:20.10 | 3.678 | 7.742 |
| **386** | 44.086 | 16.395 | 1.377 | 34.81 | 12.874 | 2316024 | 2486774 | 5/30/1998 | 00:07:20.90 | 3.753 | 7.742 |
| **387** | 44.08 | 16.384 | 1.409 | 34.815 | 12.872 | 2319964 | 2486620 | 5/30/1998 | 00:13:21.70 | 3.780 | 7.741 |
| **388** | 44.068 | 16.385 | 1.369 | 34.803 | 12.87 | 2334457 | 2486747 | 5/30/1998 | 00:19:22.50 | 3.880 | 7.741 |
| **389** | 44.071 | 16.377 | 1.432 | 34.812 | 12.871 | 2312238 | 2487028 | 5/30/1998 | 00:25:23.30 | 3.727 | 7.743 |
| **390** | 44.064 | 16.376 | 1.384 | 34.807 | 12.871 | 2325207 | 2486925 | 5/30/1998 | 00:31:24.10 | 3.816 | 7.742 |
| **391** | 44.062 | 16.366 | 1.468 | 34.815 | 12.87 | 2326876 | 2486570 | 5/30/1998 | 00:37:24.90 | 3.828 | 7.741 |
| **392** | 44.042 | 16.339 | 1.408 | 34.82 | 12.869 | 2328580 | 2486519 | 5/30/1998 | 00:43:25.70 | 3.839 | 7.740 |
| **393** | 44.029 | 16.338 | 1.329 | 34.81 | 12.869 | 2310907 | 2486439 | 5/30/1998 | 00:49:26.50 | 3.718 | 7.740 |
| **394** | 44.016 | 16.322 | 1.368 | 34.812 | 12.868 | 2293417 | 2486540 | 5/30/1998 | 00:55:27.30 | 3.598 | 7.741 |
| **395** | 44.009 | 16.32 | 1.374 | 34.807 | 12.868 | 2333263 | 2486925 | 5/30/1998 | 01:01:28.10 | 3.872 | 7.742 |
| **396** | 44.002 | 16.306 | 1.333 | 34.814 | 12.867 | 2326284 | 2486499 | 5/30/1998 | 01:07:28.90 | 3.824 | 7.740 |
| **397** | 43.996 | 16.298 | 1.346 | 34.815 | 12.867 | 2293722 | 2486428 | 5/30/1998 | 01:13:29.70 | 3.600 | 7.740 |
| **398** | 43.977 | 16.281 | 1.36 | 34.814 | 12.866 | 2305563 | 2486510 | 5/30/1998 | 01:19:30.50 | 3.682 | 7.740 |
| **399** | 43.965 | 16.269 | 1.286 | 34.813 | 12.866 | 2315140 | 2486732 | 5/30/1998 | 01:25:31.30 | 3.747 | 7.741 |
| **400** | 43.965 | 16.264 | 1.314 | 34.818 | 12.865 | 2287957 | 2486861 | 5/30/1998 | 01:31:32.10 | 3.561 | 7.742 |
| **401** | 43.952 | 16.253 | 1.196 | 34.815 | 12.866 | 2324126 | 2486300 | 5/30/1998 | 01:37:32.90 | 3.809 | 7.740 |
| **402** | 43.94 | 16.248 | 1.21 | 34.81 | 12.865 | 2301704 | 2487269 | 5/30/1998 | 01:43:33.70 | 3.655 | 7.744 |
| **403** | 43.934 | 16.233 | 1.171 | 34.818 | 12.865 | 2332119 | 2486575 | 5/30/1998 | 01:49:34.50 | 3.864 | 7.741 |
| **404** | 43.923 | 16.222 | 1.166 | 34.817 | 12.865 | 2283408 | 2486310 | 5/30/1998 | 01:55:35.30 | 3.529 | 7.740 |
| **405** | 43.913 | 16.215 | 1.127 | 34.814 | 12.865 | 2307587 | 2486227 | 5/30/1998 | 02:01:36.10 | 3.695 | 7.739 |
| **406** | 43.904 | 16.201 | 1.14 | 34.818 | 12.866 | 2267912 | 2486592 | 5/30/1998 | 02:07:36.90 | 3.423 | 7.741 |
| **407** | 43.888 | 16.187 | 1.092 | 34.816 | 12.866 | 2313204 | 2486313 | 5/30/1998 | 02:13:37.70 | 3.734 | 7.740 |
| **408** | 43.886 | 16.185 | 1.067 | 34.816 | 12.863 | 2326112 | 2486193 | 5/30/1998 | 02:19:38.50 | 3.823 | 7.739 |
| **409** | 43.882 | 16.173 | 1.018 | 34.824 | 12.864 | 2325764 | 2486166 | 5/30/1998 | 02:25:39.30 | 3.820 | 7.739 |
| **410** | 43.875 | 16.165 | 1.034 | 34.825 | 12.863 | 2293219 | 2486536 | 5/30/1998 | 02:31:40.10 | 3.597 | 7.741 |
| **411** | 43.871 | 16.171 | 0.956 | 34.816 | 12.862 | 2296363 | 2486374 | 5/30/1998 | 02:37:40.90 | 3.618 | 7.740 |
| **412** | 43.867 | 16.168 | 0.914 | 34.814 | 12.864 | 2313071 | 2486533 | 5/30/1998 | 02:43:41.70 | 3.733 | 7.741 |
| **413** | 43.874 | 16.169 | 0.913 | 34.819 | 12.864 | 2312193 | 2486292 | 5/30/1998 | 02:49:42.50 | 3.727 | 7.739 |
| **414** | 43.881 | 16.176 | 0.883 | 34.821 | 12.864 | 2301838 | 2486400 | 5/30/1998 | 02:55:43.30 | 3.656 | 7.740 |
| **415** | 43.892 | 16.187 | 0.889 | 34.821 | 12.864 | 2321676 | 2486633 | 5/30/1998 | 03:01:44.10 | 3.792 | 7.741 |
| **416** | 43.9 | 16.2 | 0.794 | 34.816 | 12.863 | 2316388 | 2486546 | 5/30/1998 | 03:07:44.90 | 3.756 | 7.741 |
| **417** | 43.906 | 16.204 | 0.678 | 34.818 | 12.864 | 2293921 | 2486201 | 5/30/1998 | 03:13:45.70 | 3.602 | 7.739 |
| **418** | 43.917 | 16.223 | 0.677 | 34.812 | 12.861 | 2305287 | 2487239 | 5/30/1998 | 03:19:46.50 | 3.680 | 7.744 |
| **419** | 43.932 | 16.225 | 0.72 | 34.822 | 12.86 | 2298005 | 2486506 | 5/30/1998 | 03:25:47.30 | 3.630 | 7.740 |
| **420** | 43.962 | 16.262 | 0.666 | 34.817 | 12.862 | 2326747 | 2487258 | 5/30/1998 | 03:31:48.10 | 3.827 | 7.744 |
| **421** | 43.997 | 16.306 | 0.616 | 34.81 | 12.864 | 2302305 | 2486826 | 5/30/1998 | 03:37:48.90 | 3.659 | 7.742 |
| **422** | 44.009 | 16.319 | 0.564 | 34.809 | 12.861 | 2322062 | 2488345 | 5/30/1998 | 03:44:30.95 | 3.795 | 7.748 |
| **423** | 44.026 | 16.337 | 0.556 | 34.808 | 12.861 | 2306504 | 2486669 | 5/30/1998 | 03:50:31.75 | 3.688 | 7.741 |
| **424** | 44.061 | 16.362 | 0.572 | 34.817 | 12.862 | 2314844 | 2487926 | 5/30/1998 | 03:56:32.55 | 3.745 | 7.747 |
| **425** | 44.095 | 16.398 | 0.486 | 34.815 | 12.862 | 2310070 | 2487092 | 5/30/1998 | 04:02:33.35 | 3.712 | 7.743 |
| **426** | 44.116 | 16.423 | 0.442 | 34.813 | 12.861 | 2296476 | 2487592 | 5/30/1998 | 04:08:34.15 | 3.619 | 7.745 |
| **427** | 44.119 | 16.414 | 0.365 | 34.824 | 12.861 | 2318347 | 2487428 | 5/30/1998 | 04:14:34.95 | 3.769 | 7.744 |
| **428** | 44.145 | 16.434 | 0.397 | 34.829 | 12.861 | 2307337 | 2486583 | 5/30/1998 | 04:20:35.75 | 3.694 | 7.741 |
| **429** | 44.174 | 16.475 | 0.383 | 34.819 | 12.862 | 2294535 | 2487564 | 5/30/1998 | 04:26:36.55 | 3.606 | 7.745 |
| **430** | 44.191 | 16.491 | 0.36 | 34.819 | 12.862 | 2300837 | 2487137 | 5/30/1998 | 04:32:37.35 | 3.649 | 7.743 |
| **431** | 44.203 | 16.495 | 0.288 | 34.827 | 12.862 | 2318227 | 2487116 | 5/30/1998 | 04:38:38.15 | 3.768 | 7.743 |
| **432** | 44.212 | 16.517 | 0.237 | 34.815 | 12.862 | 2289925 | 2486807 | 5/30/1998 | 04:44:38.95 | 3.574 | 7.742 |
| **433** | 44.218 | 16.511 | 0.252 | 34.826 | 12.861 | 2304591 | 2487024 | 5/30/1998 | 04:50:39.75 | 3.675 | 7.743 |
| **434** | 44.245 | 16.555 | 0.206 | 34.811 | 12.862 | 2324413 | 2487383 | 5/30/1998 | 04:56:40.55 | 3.811 | 7.744 |
| **435** | 44.265 | 16.557 | 0.177 | 34.826 | 12.861 | 2317846 | 2486946 | 5/30/1998 | 05:02:41.35 | 3.766 | 7.742 |
| **436** | 44.277 | 16.588 | 0.15 | 34.811 | 12.861 | 2308299 | 2487312 | 5/30/1998 | 05:08:42.15 | 3.700 | 7.744 |
| **437** | 44.279 | 16.593 | 0.122 | 34.808 | 12.861 | 2314803 | 2487202 | 5/30/1998 | 05:14:42.95 | 3.745 | 7.743 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **438** | 44.305 | 16.613 | 0.072 | 34.813 | 12.86 | 2309705 | 2488027 | 5/30/1998 | 05:20:43.75 | 3.710 | 7.747 |
| **439** | 44.337 | 16.648 | 0.058 | 34.811 | 12.863 | 2312600 | 2486801 | 5/30/1998 | 05:26:44.55 | 3.730 | 7.742 |
| **440** | 44.37 | 16.683 | 0.013 | 34.81 | 12.862 | 2319516 | 2487222 | 5/30/1998 | 05:32:45.35 | 3.777 | 7.743 |
| **441** | 44.39 | 16.691 | 0.003 | 34.82 | 12.861 | 2330909 | 2487368 | 5/30/1998 | 05:38:46.15 | 3.855 | 7.744 |
| **442** | 44.417 | 16.727 | -0.102 | 34.813 | 12.861 | 2315582 | 2486676 | 5/30/1998 | 05:44:46.95 | 3.750 | 7.741 |
| **443** | 44.456 | 16.764 | -0.029 | 34.814 | 12.862 | 2328682 | 2487264 | 5/30/1998 | 05:50:47.75 | 3.840 | 7.744 |
| **444** | 44.491 | 16.812 | -0.061 | 34.804 | 12.861 | 2327159 | 2486847 | 5/30/1998 | 05:56:48.55 | 3.830 | 7.742 |
| **445** | 44.533 | 16.851 | -0.082 | 34.808 | 12.861 | 2319389 | 2486671 | 5/30/1998 | 06:02:49.35 | 3.776 | 7.741 |
| **446** | 44.579 | 16.904 | -0.11 | 34.802 | 12.862 | 2340800 | 2486539 | 5/30/1998 | 06:08:50.15 | 3.923 | 7.741 |
| **447** | 44.617 | 16.936 | -0.13 | 34.807 | 12.863 | 2246282 | 2486725 | 5/30/1998 | 06:14:50.95 | 3.275 | 7.741 |
| **448** | 44.657 | 16.974 | -0.157 | 34.809 | 12.862 | 2331076 | 2486679 | 5/30/1998 | 06:20:51.75 | 3.857 | 7.741 |
| **449** | 44.697 | 17.016 | -0.144 | 34.807 | 12.863 | 2307462 | 2486032 | 5/30/1998 | 06:26:52.55 | 3.695 | 7.738 |
| **450** | 44.733 | 17.06 | -0.206 | 34.801 | 12.863 | 2336385 | 2486240 | 5/30/1998 | 06:32:53.35 | 3.893 | 7.739 |
| **451** | 44.776 | 17.098 | -0.196 | 34.805 | 12.863 | 2335998 | 2486472 | 5/30/1998 | 06:38:54.15 | 3.890 | 7.740 |
| **452** | 44.811 | 17.13 | -0.192 | 34.808 | 12.864 | 2330003 | 2485547 | 5/30/1998 | 06:44:54.95 | 3.849 | 7.736 |
| **453** | 44.843 | 17.169 | -0.2 | 34.802 | 12.863 | 2326793 | 2485960 | 5/30/1998 | 06:50:55.75 | 3.827 | 7.738 |
| **454** | 44.882 | 17.208 | -0.233 | 34.802 | 12.862 | 2298696 | 2486696 | 5/30/1998 | 06:56:56.55 | 3.634 | 7.741 |
| **455** | 44.921 | 17.25 | -0.22 | 34.801 | 12.864 | 2316551 | 2485880 | 5/30/1998 | 07:02:57.35 | 3.757 | 7.738 |
| **456** | 44.957 | 17.295 | -0.223 | 34.793 | 12.864 | 2342717 | 2486263 | 5/30/1998 | 07:08:58.15 | 3.937 | 7.739 |
| **457** | 44.988 | 17.324 | -0.272 | 34.795 | 12.864 | 2330527 | 2485781 | 5/30/1998 | 07:14:58.95 | 3.853 | 7.737 |
| **458** | 45.027 | 17.362 | -0.259 | 34.796 | 12.864 | 2332861 | 2485152 | 5/30/1998 | 07:20:59.75 | 3.869 | 7.735 |
| **459** | 45.06 | 17.388 | -0.261 | 34.802 | 12.864 | 2341392 | 2484661 | 5/30/1998 | 07:27:00.55 | 3.927 | 7.732 |
| **460** | 45.081 | 17.419 | -0.244 | 34.793 | 12.864 | 2330915 | 2484858 | 5/30/1998 | 07:33:01.35 | 3.856 | 7.733 |
| **461** | 45.125 | 17.449 | -0.26 | 34.805 | 12.864 | 2343651 | 2484480 | 5/30/1998 | 07:39:02.15 | 3.943 | 7.732 |
| **462** | 45.164 | 17.494 | -0.278 | 34.801 | 12.865 | 2347319 | 2483959 | 5/30/1998 | 07:45:02.95 | 3.968 | 7.729 |
| **463** | 45.201 | 17.531 | -0.253 | 34.8 | 12.864 | 2345763 | 2484574 | 5/30/1998 | 07:51:03.75 | 3.957 | 7.732 |
| **464** | 45.229 | 17.567 | -0.213 | 34.794 | 12.865 | 2333827 | 2485000 | 5/30/1998 | 07:57:04.55 | 3.876 | 7.734 |
| **465** | 45.269 | 17.613 | -0.222 | 34.789 | 12.865 | 2330157 | 2484141 | 5/30/1998 | 08:03:05.35 | 3.850 | 7.730 |
| **466** | 45.3 | 17.641 | -0.229 | 34.791 | 12.864 | 2336285 | 2484280 | 5/30/1998 | 08:09:06.15 | 3.892 | 7.731 |
| **467** | 45.337 | 17.67 | -0.201 | 34.799 | 12.864 | 2331750 | 2484503 | 5/30/1998 | 08:15:06.95 | 3.861 | 7.732 |
| **468** | 45.354 | 17.691 | -0.207 | 34.795 | 12.865 | 2348329 | 2484304 | 5/30/1998 | 08:21:07.75 | 3.975 | 7.731 |
| **469** | 45.392 | 17.736 | -0.203 | 34.788 | 12.865 | 2360376 | 2483506 | 5/30/1998 | 08:27:08.55 | 4.058 | 7.727 |
| **470** | 45.421 | 17.764 | -0.168 | 34.79 | 12.865 | 2352150 | 2483437 | 5/30/1998 | 08:33:09.35 | 4.001 | 7.727 |
| **471** | 45.446 | 17.794 | -0.152 | 34.786 | 12.867 | 2343306 | 2483485 | 5/30/1998 | 08:39:10.15 | 3.941 | 7.727 |
| **472** | 45.48 | 17.821 | -0.144 | 34.792 | 12.865 | 2321326 | 2483656 | 5/30/1998 | 08:45:10.95 | 3.790 | 7.728 |
| **473** | 45.51 | 17.856 | -0.144 | 34.787 | 12.867 | 2372649 | 2483256 | 5/30/1998 | 08:51:11.75 | 4.142 | 7.726 |
| **474** | 45.537 | 17.877 | -0.081 | 34.793 | 12.865 | 2337480 | 2483380 | 5/30/1998 | 08:57:12.55 | 3.901 | 7.727 |
| **475** | 45.559 | 17.903 | -0.106 | 34.79 | 12.865 | 2356705 | 2482860 | 5/30/1998 | 09:03:13.35 | 4.033 | 7.725 |
| **476** | 45.584 | 17.93 | -0.075 | 34.788 | 12.865 | 2343080 | 2483003 | 5/30/1998 | 09:09:14.15 | 3.939 | 7.725 |
| **477** | 45.601 | 17.954 | -0.076 | 34.782 | 12.866 | 2357706 | 2483258 | 5/30/1998 | 09:15:14.95 | 4.039 | 7.726 |
| **478** | 45.621 | 17.97 | -0.035 | 34.785 | 12.866 | 2342494 | 2483321 | 5/30/1998 | 09:21:15.75 | 3.935 | 7.727 |
| **479** | 45.636 | 17.978 | -0.017 | 34.792 | 12.867 | 2343084 | 2483467 | 5/30/1998 | 09:27:16.55 | 3.939 | 7.727 |
| **480** | 45.642 | 17.989 | 0.008 | 34.787 | 12.866 | 2345917 | 2483405 | 5/30/1998 | 09:33:17.35 | 3.958 | 7.727 |
| **481** | 45.65 | 17.996 | 0.004 | 34.788 | 12.864 | 2324748 | 2483245 | 5/30/1998 | 09:39:18.15 | 3.813 | 7.726 |
| **482** | 45.652 | 18.004 | 0.014 | 34.783 | 12.868 | 2351747 | 2483031 | 5/30/1998 | 09:45:18.95 | 3.998 | 7.725 |
| **483** | 45.66 | 18.009 | 0.081 | 34.786 | 12.863 | 2345949 | 2483732 | 5/30/1998 | 09:51:19.75 | 3.959 | 7.728 |
| **484** | 45.662 | 18.018 | 0.08 | 34.779 | 12.864 | 2362031 | 2483083 | 5/30/1998 | 09:57:20.55 | 4.069 | 7.726 |
| **485** | 45.666 | 18.017 | 0.092 | 34.784 | 12.865 | 2374991 | 2483133 | 5/30/1998 | 10:03:21.35 | 4.158 | 7.726 |
| **486** | 45.684 | 18.029 | 0.115 | 34.789 | 12.864 | 2366854 | 2482706 | 5/30/1998 | 10:09:22.15 | 4.102 | 7.724 |
| **487** | 45.692 | 18.046 | 0.149 | 34.781 | 12.863 | 2338731 | 2482179 | 5/30/1998 | 10:15:22.95 | 3.909 | 7.722 |
| **488** | 45.703 | 18.051 | 0.176 | 34.786 | 12.865 | 2354646 | 2482331 | 5/30/1998 | 10:21:23.75 | 4.018 | 7.722 |
| **489** | 45.707 | 18.058 | 0.207 | 34.784 | 12.864 | 2353211 | 2482325 | 5/30/1998 | 10:27:24.55 | 4.009 | 7.722 |
| **490** | 45.714 | 18.063 | 0.236 | 34.785 | 12.863 | 2348101 | 2482263 | 5/30/1998 | 10:33:25.35 | 3.973 | 7.722 |
| **491** | 45.705 | 18.051 | 0.197 | 34.788 | 12.865 | 2359616 | 2481648 | 5/30/1998 | 10:39:26.15 | 4.052 | 7.719 |
| **492** | 45.684 | 18.035 | 0.25 | 34.783 | 12.865 | 2251659 | 2481928 | 5/30/1998 | 10:46:08.20 | 3.312 | 7.721 |
| **493** | 45.669 | 18.016 | 0.327 | 34.787 | 12.861 | 2356701 | 2482500 | 5/30/1998 | 10:52:09.00 | 4.032 | 7.723 |
| **494** | 45.643 | 17.987 | 0.339 | 34.79 | 12.861 | 2327437 | 2481881 | 5/30/1998 | 10:58:09.80 | 3.832 | 7.720 |
| **495** | 45.625 | 17.973 | 0.34 | 34.786 | 12.86 | 2344082 | 2482078 | 5/30/1998 | 11:04:10.60 | 3.946 | 7.721 |
| **496** | 45.608 | 17.952 | 0.372 | 34.789 | 12.859 | 2331848 | 2482260 | 5/30/1998 | 11:10:11.40 | 3.862 | 7.722 |
| **497** | 45.587 | 17.938 | 0.341 | 34.784 | 12.859 | 2280028 | 2482564 | 5/30/1998 | 11:16:12.20 | 3.506 | 7.723 |
| **498** | 45.57 | 17.914 | 0.4 | 34.789 | 12.859 | 2332656 | 2481978 | 5/30/1998 | 11:22:13.00 | 3.867 | 7.721 |
| **499** | 45.549 | 17.9 | 0.418 | 34.783 | 12.86 | 2357642 | 2481849 | 5/30/1998 | 11:28:13.80 | 4.039 | 7.720 |
| **500** | 45.538 | 17.882 | 0.444 | 34.789 | 12.859 | 2330851 | 2481623 | 5/30/1998 | 11:34:14.60 | 3.855 | 7.719 |
| **501** | 45.521 | 17.871 | 0.452 | 34.784 | 12.859 | 2344205 | 2481926 | 5/30/1998 | 11:40:15.40 | 3.947 | 7.721 |
| **502** | 45.5 | 17.84 | 0.488 | 34.793 | 12.857 | 2342044 | 2481678 | 5/30/1998 | 11:46:16.20 | 3.932 | 7.720 |
| **503** | 45.469 | 17.819 | 0.55 | 34.783 | 12.858 | 2353370 | 2481840 | 5/30/1998 | 11:52:17.00 | 4.010 | 7.720 |
| **504** | 45.444 | 17.789 | 0.534 | 34.788 | 12.857 | 2334722 | 2481668 | 5/30/1998 | 11:58:17.80 | 3.882 | 7.719 |
| **505** | 45.424 | 17.767 | 0.555 | 34.789 | 12.858 | 2341054 | 2481409 | 5/30/1998 | 12:04:18.60 | 3.925 | 7.718 |
| **506** | 45.4 | 17.738 | 0.568 | 34.795 | 12.856 | 2319566 | 2482194 | 5/30/1998 | 12:10:19.40 | 3.778 | 7.722 |
| **507** | 45.388 | 17.736 | 0.581 | 34.786 | 12.856 | 2368102 | 2482065 | 5/30/1998 | 12:16:20.20 | 4.111 | 7.721 |
| **508** | 45.374 | 17.713 | 0.63 | 34.793 | 12.856 | 2336151 | 2481421 | 5/30/1998 | 12:22:21.00 | 3.891 | 7.718 |
| **509** | 45.356 | 17.694 | 0.65 | 34.794 | 12.856 | 2330657 | 2481885 | 5/30/1998 | 12:28:21.80 | 3.854 | 7.720 |
| **510** | 45.334 | 17.675 | 0.635 | 34.791 | 12.855 | 2338667 | 2481710 | 5/30/1998 | 12:34:22.60 | 3.909 | 7.720 |
| **511** | 45.328 | 17.665 | 0.679 | 34.794 | 12.855 | 2338739 | 2481293 | 5/30/1998 | 12:40:23.40 | 3.909 | 7.718 |
| **512** | 45.322 | 17.668 | 0.678 | 34.787 | 12.854 | 2341819 | 2481339 | 5/30/1998 | 12:46:24.20 | 3.930 | 7.718 |
| **513** | 45.312 | 17.654 | 0.706 | 34.79 | 12.855 | 2305778 | 2481554 | 5/30/1998 | 12:52:25.00 | 3.683 | 7.719 |
| **514** | 45.306 | 17.651 | 0.719 | 34.787 | 12.854 | 2355741 | 2480928 | 5/30/1998 | 12:58:25.80 | 4.026 | 7.716 |
| **515** | 45.296 | 17.631 | 0.747 | 34.796 | 12.854 | 2352447 | 2481637 | 5/30/1998 | 13:04:26.60 | 4.003 | 7.719 |
| **516** | 45.276 | 17.613 | 0.785 | 34.795 | 12.853 | 2345655 | 2481495 | 5/30/1998 | 13:10:27.40 | 3.957 | 7.719 |
| **517** | 45.232 | 17.569 | 0.769 | 34.794 | 12.852 | 2343949 | 2481561 | 5/30/1998 | 13:16:28.20 | 3.945 | 7.719 |
| **518** | 45.194 | 17.536 | 0.767 | 34.789 | 12.852 | 2316763 | 2482495 | 5/30/1998 | 13:22:29.00 | 3.758 | 7.723 |
| **519** | 45.162 | 17.493 | 0.813 | 34.799 | 12.85 | 2339920 | 2481985 | 5/30/1998 | 13:28:29.80 | 3.917 | 7.721 |
| **520** | 45.135 | 17.474 | 0.769 | 34.793 | 12.851 | 2320630 | 2481709 | 5/30/1998 | 13:34:30.60 | 3.785 | 7.720 |
| **521** | 45.108 | 17.451 | 0.78 | 34.788 | 12.85 | 2338579 | 2481695 | 5/30/1998 | 13:40:31.40 | 3.908 | 7.720 |
| **522** | 45.085 | 17.417 | 0.789 | 34.798 | 12.851 | 2340791 | 2481806 | 5/30/1998 | 13:46:32.20 | 3.923 | 7.720 |
| **523** | 45.063 | 17.399 | 0.774 | 34.794 | 12.849 | 2338455 | 2481271 | 5/30/1998 | 13:52:33.00 | 3.907 | 7.718 |
| **524** | 45.043 | 17.381 | 0.796 | 34.793 | 12.85 | 2343934 | 2481408 | 5/30/1998 | 13:58:33.80 | 3.945 | 7.718 |
| **525** | 45.01 | 17.347 | 0.834 | 34.793 | 12.848 | 2324896 | 2482038 | 5/30/1998 | 14:04:34.60 | 3.814 | 7.721 |
| **526** | 44.972 | 17.313 | 0.861 | 34.79 | 12.848 | 2326023 | 2481267 | 5/30/1998 | 14:10:35.40 | 3.822 | 7.718 |
| **527** | 44.953 | 17.27 | 0.796 | 34.81 | 12.847 | 2349034 | 2481626 | 5/30/1998 | 14:16:36.20 | 3.980 | 7.719 |
| **528** | 44.901 | 17.236 | 0.847 | 34.794 | 12.847 | 2327044 | 2481361 | 5/30/1998 | 14:22:37.00 | 3.829 | 7.718 |
| **529** | 44.86 | 17.197 | 0.812 | 34.792 | 12.846 | 2291170 | 2481187 | 5/30/1998 | 14:28:37.80 | 3.583 | 7.717 |
| **530** | 44.829 | 17.152 | 0.797 | 34.804 | 12.844 | 2323168 | 2481856 | 5/30/1998 | 14:34:38.60 | 3.802 | 7.720 |
| **531** | 44.801 | 17.13 | 0.793 | 34.799 | 12.846 | 2316254 | 2481883 | 5/30/1998 | 14:40:39.40 | 3.755 | 7.720 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **532** | 44.788 | 17.111 | 0.79 | 34.804 | 12.846 | 2316198 | 2481208 | 5/30/1998 | 14:46:40.20 | 3.755 | 7.718 |
| **533** | 44.76 | 17.092 | 0.789 | 34.797 | 12.845 | 2328209 | 2480747 | 5/30/1998 | 14:52:41.00 | 3.837 | 7.716 |
| **534** | 44.723 | 17.059 | 0.761 | 34.792 | 12.843 | 2317699 | 2481637 | 5/30/1998 | 14:58:41.80 | 3.765 | 7.719 |
| **535** | 44.699 | 17.011 | 0.803 | 34.812 | 12.848 | 2338119 | 2480879 | 5/30/1998 | 15:04:42.60 | 3.905 | 7.716 |
| **536** | 44.661 | 16.977 | 0.737 | 34.809 | 12.846 | 2306482 | 2480838 | 5/30/1998 | 15:10:43.40 | 3.688 | 7.716 |
| **537** | 44.62 | 16.937 | 0.752 | 34.809 | 12.843 | 2335119 | 2481446 | 5/30/1998 | 15:16:44.20 | 3.884 | 7.719 |
| **538** | 44.589 | 16.908 | 0.706 | 34.806 | 12.841 | 2337976 | 2480970 | 5/30/1998 | 15:22:45.00 | 3.904 | 7.716 |
| **539** | 44.545 | 16.861 | 0.702 | 34.809 | 12.842 | 2326859 | 2480761 | 5/30/1998 | 15:28:45.80 | 3.828 | 7.716 |
| **540** | 44.522 | 16.833 | 0.71 | 34.813 | 12.841 | 2309443 | 2480819 | 5/30/1998 | 15:34:46.60 | 3.708 | 7.716 |
| **541** | 44.495 | 16.81 | 0.7 | 34.809 | 12.84 | 2308420 | 2480918 | 5/30/1998 | 15:40:47.40 | 3.701 | 7.716 |
| **542** | 44.465 | 16.785 | 0.68 | 34.804 | 12.84 | 2321747 | 2480805 | 5/30/1998 | 15:46:48.20 | 3.793 | 7.716 |
| **543** | 44.438 | 16.749 | 0.639 | 34.812 | 12.84 | 2325451 | 2481435 | 5/30/1998 | 15:52:49.00 | 3.818 | 7.718 |
| **544** | 44.415 | 16.717 | 0.648 | 34.82 | 12.843 | 2339895 | 2481379 | 5/30/1998 | 15:58:49.80 | 3.917 | 7.718 |
| **545** | 44.39 | 16.7 | 0.702 | 34.813 | 12.841 | 2310956 | 2481340 | 5/30/1998 | 16:04:50.60 | 3.719 | 7.718 |
| **546** | 44.365 | 16.675 | 0.667 | 34.813 | 12.839 | 2334141 | 2480805 | 5/30/1998 | 16:10:51.40 | 3.878 | 7.716 |
| **547** | 44.345 | 16.646 | 0.554 | 34.82 | 12.838 | 2345454 | 2481588 | 5/30/1998 | 16:16:52.20 | 3.955 | 7.719 |
| **548** | 44.321 | 16.628 | 0.616 | 34.815 | 12.838 | 2297626 | 2481229 | 5/30/1998 | 16:22:53.00 | 3.627 | 7.718 |
| **549** | 44.319 | 16.644 | 0.605 | 34.799 | 12.837 | 2300696 | 2481329 | 5/30/1998 | 16:28:53.80 | 3.648 | 7.718 |
| **550** | 44.339 | 16.647 | 0.628 | 34.814 | 12.844 | 2322034 | 2481895 | 5/30/1998 | 16:34:54.60 | 3.795 | 7.720 |
| **551** | 44.338 | 16.643 | 0.605 | 34.816 | 12.839 | 2328282 | 2481681 | 5/30/1998 | 16:40:55.40 | 3.837 | 7.720 |
| **552** | 44.328 | 16.634 | 0.553 | 34.815 | 12.84 | 2327137 | 2481625 | 5/30/1998 | 16:46:56.20 | 3.830 | 7.719 |
| **553** | 44.324 | 16.637 | 0.535 | 34.81 | 12.836 | 2297017 | 2482205 | 5/30/1998 | 16:52:57.00 | 3.623 | 7.722 |
| **554** | 44.333 | 16.645 | 0.54 | 34.811 | 12.837 | 2314413 | 2483107 | 5/30/1998 | 16:58:57.80 | 3.742 | 7.726 |
| **555** | 44.352 | 16.648 | 0.532 | 34.824 | 12.837 | 2320040 | 2482904 | 5/30/1998 | 17:04:58.60 | 3.781 | 7.725 |
| **556** | 44.365 | 16.663 | 0.505 | 34.823 | 12.837 | 2336185 | 2482267 | 5/30/1998 | 17:10:59.40 | 3.892 | 7.722 |
| **557** | 44.36 | 16.66 | 0.507 | 34.822 | 12.837 | 2319845 | 2483847 | 5/30/1998 | 17:17:00.20 | 3.780 | 7.729 |
| **558** | 44.371 | 16.687 | 0.504 | 34.807 | 12.837 | 2335070 | 2482923 | 5/30/1998 | 17:23:01.00 | 3.884 | 7.725 |
| **559** | 44.388 | 16.693 | 0.461 | 34.817 | 12.837 | 2309966 | 2483494 | 5/30/1998 | 17:29:01.80 | 3.712 | 7.727 |
| **560** | 44.408 | 16.709 | 0.504 | 34.821 | 12.837 | 2322082 | 2483483 | 5/30/1998 | 17:35:02.60 | 3.795 | 7.727 |
| **561** | 44.419 | 16.722 | 0.449 | 34.819 | 12.836 | 2327049 | 2483191 | 5/30/1998 | 17:41:03.40 | 3.829 | 7.726 |
| **562** | 44.423 | 16.737 | 0.424 | 34.81 | 12.836 | 2307450 | 2483219 | 5/30/1998 | 17:47:45.47 | 3.694 | 7.726 |
| **563** | 44.448 | 16.755 | 0.472 | 34.815 | 12.837 | 2316704 | 2483429 | 5/30/1998 | 17:53:46.27 | 3.758 | 7.727 |
| **564** | 44.467 | 16.776 | 0.439 | 34.814 | 12.837 | 2325010 | 2483311 | 5/30/1998 | 17:59:47.07 | 3.815 | 7.727 |
| **565** | 44.495 | 16.803 | 0.416 | 34.815 | 12.838 | 2313522 | 2483618 | 5/30/1998 | 18:05:47.87 | 3.736 | 7.728 |
| **566** | 44.517 | 16.829 | 0.412 | 34.812 | 12.838 | 2323538 | 2483754 | 5/30/1998 | 18:11:48.67 | 3.805 | 7.729 |
| **567** | 44.541 | 16.854 | 0.483 | 34.811 | 12.837 | 2331270 | 2483912 | 5/30/1998 | 18:17:49.47 | 3.858 | 7.729 |
| **568** | 44.573 | 16.885 | 0.424 | 34.812 | 12.838 | 2352604 | 2484172 | 5/30/1998 | 18:23:50.27 | 4.004 | 7.730 |
| **569** | 44.598 | 16.916 | 0.437 | 34.807 | 12.837 | 2313026 | 2483971 | 5/30/1998 | 18:29:51.07 | 3.733 | 7.729 |
| **570** | 44.634 | 16.943 | 0.357 | 34.815 | 12.836 | 2314830 | 2484002 | 5/30/1998 | 18:35:51.87 | 3.745 | 7.730 |
| **571** | 44.655 | 16.969 | 0.343 | 34.812 | 12.836 | 2316661 | 2483852 | 5/30/1998 | 18:41:52.67 | 3.758 | 7.729 |
| **572** | 44.682 | 16.991 | 0.411 | 34.816 | 12.838 | 2321050 | 2484249 | 5/30/1998 | 18:47:53.47 | 3.788 | 7.731 |
| **573** | 44.71 | 17.03 | 0.43 | 34.806 | 12.838 | 2305945 | 2484439 | 5/30/1998 | 18:53:54.27 | 3.684 | 7.731 |
| **574** | 44.734 | 17.052 | 0.379 | 34.808 | 12.838 | 2332542 | 2484144 | 5/30/1998 | 18:59:55.07 | 3.867 | 7.730 |
| **575** | 44.757 | 17.075 | 0.343 | 34.808 | 12.839 | 2332975 | 2484085 | 5/30/1998 | 19:05:55.87 | 3.870 | 7.730 |
| **576** | 44.769 | 17.084 | 0.357 | 34.811 | 12.836 | 2324107 | 2484439 | 5/30/1998 | 19:11:56.67 | 3.809 | 7.731 |
| **577** | 44.792 | 17.11 | 0.318 | 34.808 | 12.839 | 2331388 | 2484106 | 5/30/1998 | 19:17:57.47 | 3.859 | 7.730 |
| **578** | 44.81 | 17.127 | 0.313 | 34.809 | 12.839 | 2313910 | 2484145 | 5/30/1998 | 19:23:58.27 | 3.739 | 7.730 |
| **579** | 44.833 | 17.152 | 0.408 | 34.807 | 12.837 | 2328078 | 2484842 | 5/30/1998 | 19:29:59.07 | 3.836 | 7.733 |
| **580** | 44.855 | 17.171 | 0.355 | 34.811 | 12.838 | 2344090 | 2484449 | 5/30/1998 | 19:35:59.87 | 3.946 | 7.732 |
| **581** | 44.871 | 17.194 | 0.359 | 34.805 | 12.837 | 2339624 | 2484332 | 5/30/1998 | 19:42:00.67 | 3.915 | 7.731 |
| **582** | 44.888 | 17.21 | 0.38 | 34.805 | 12.837 | 2344343 | 2484705 | 5/30/1998 | 19:48:01.47 | 3.948 | 7.733 |
| **583** | 44.899 | 17.216 | 0.373 | 34.81 | 12.837 | 2310087 | 2484878 | 5/30/1998 | 19:54:02.27 | 3.713 | 7.733 |
| **584** | 44.904 | 17.222 | 0.337 | 34.809 | 12.839 | 2333516 | 2484756 | 5/30/1998 | 20:00:03.07 | 3.873 | 7.733 |
| **585** | 44.92 | 17.234 | 0.378 | 34.813 | 12.837 | 2316273 | 2485380 | 5/30/1998 | 20:06:03.87 | 3.755 | 7.736 |
| **586** | 44.93 | 17.252 | 0.355 | 34.806 | 12.837 | 2332862 | 2484519 | 5/30/1998 | 20:12:04.67 | 3.869 | 7.732 |
| **587** | 44.942 | 17.263 | 0.391 | 34.807 | 12.837 | 2304159 | 2484443 | 5/30/1998 | 20:18:05.47 | 3.672 | 7.731 |
| **588** | 44.949 | 17.269 | 0.347 | 34.808 | 12.838 | 2337755 | 2484307 | 5/30/1998 | 20:24:06.27 | 3.902 | 7.731 |
| **589** | 44.947 | 17.273 | 0.403 | 34.802 | 12.835 | 2324849 | 2484961 | 5/30/1998 | 20:30:07.07 | 3.814 | 7.734 |
| **590** | 44.957 | 17.286 | 0.375 | 34.8 | 12.837 | 2316579 | 2484758 | 5/30/1998 | 20:36:07.87 | 3.757 | 7.733 |
| **591** | 44.973 | 17.294 | 0.408 | 34.807 | 12.836 | 2340176 | 2484531 | 5/30/1998 | 20:42:08.67 | 3.919 | 7.732 |
| **592** | 44.974 | 17.294 | 0.409 | 34.807 | 12.836 | 2305631 | 2484242 | 5/30/1998 | 20:48:09.47 | 3.682 | 7.731 |
| **593** | 44.97 | 17.289 | 0.443 | 34.809 | 12.835 | 2350368 | 2484706 | 5/30/1998 | 20:54:10.27 | 3.989 | 7.733 |
| **594** | 44.978 | 17.31 | 0.368 | 34.797 | 12.835 | 2320151 | 2484715 | 5/30/1998 | 21:00:11.07 | 3.782 | 7.733 |
| **595** | 44.983 | 17.316 | 0.409 | 34.797 | 12.835 | 2374950 | 2484793 | 5/30/1998 | 21:06:11.87 | 4.158 | 7.733 |
| **596** | 44.992 | 17.316 | 0.498 | 34.805 | 12.835 | 2325091 | 2484815 | 5/30/1998 | 21:12:12.67 | 3.816 | 7.733 |
| **597** | 45 | 17.323 | 0.478 | 34.805 | 12.835 | 2330322 | 2484339 | 5/30/1998 | 21:18:13.47 | 3.851 | 7.731 |
| **598** | 44.999 | 17.321 | 0.49 | 34.806 | 12.835 | 2323568 | 2484905 | 5/30/1998 | 21:24:14.27 | 3.805 | 7.733 |
| **599** | 44.999 | 17.325 | 0.439 | 34.803 | 12.835 | 2312131 | 2484718 | 5/30/1998 | 21:30:15.07 | 3.727 | 7.733 |
| **600** | 44.999 | 17.325 | 0.504 | 34.803 | 12.833 | 2357488 | 2484551 | 5/30/1998 | 21:36:15.87 | 4.038 | 7.732 |
| **601** | 45.007 | 17.332 | 0.496 | 34.804 | 12.835 | 2356126 | 2484183 | 5/30/1998 | 21:42:16.67 | 4.029 | 7.730 |
| **602** | 45.008 | 17.336 | 0.5 | 34.8 | 12.834 | 2294992 | 2484451 | 5/30/1998 | 21:48:17.47 | 3.609 | 7.732 |
| **603** | 44.995 | 17.328 | 0.51 | 34.797 | 12.835 | 2344532 | 2484532 | 5/30/1998 | 21:54:18.27 | 3.949 | 7.732 |
| **604** | 44.995 | 17.318 | 0.464 | 34.805 | 12.833 | 2338993 | 2484706 | 5/30/1998 | 22:00:19.07 | 3.911 | 7.733 |
| **605** | 44.998 | 17.322 | 0.551 | 34.805 | 12.833 | 2336063 | 2484308 | 5/30/1998 | 22:06:19.87 | 3.891 | 7.731 |
| **606** | 44.988 | 17.324 | 0.485 | 34.794 | 12.833 | 2347245 | 2484718 | 5/30/1998 | 22:12:20.67 | 3.968 | 7.733 |
| **607** | 44.961 | 17.29 | 0.529 | 34.8 | 12.831 | 2327530 | 2484054 | 5/30/1998 | 22:18:21.47 | 3.832 | 7.730 |
| **608** | 44.942 | 17.261 | 0.601 | 34.809 | 12.831 | 2341420 | 2484308 | 5/30/1998 | 22:24:22.27 | 3.928 | 7.731 |
| **609** | 44.929 | 17.247 | 0.587 | 34.81 | 12.831 | 2320117 | 2484368 | 5/30/1998 | 22:30:23.07 | 3.781 | 7.731 |
| **610** | 44.897 | 17.211 | 0.624 | 34.813 | 12.832 | 2318803 | 2484852 | 5/30/1998 | 22:36:23.87 | 3.772 | 7.733 |
| **611** | 44.859 | 17.182 | 0.581 | 34.805 | 12.829 | 2300451 | 2484170 | 5/30/1998 | 22:42:24.67 | 3.646 | 7.730 |
| **612** | 44.842 | 17.159 | 0.673 | 34.81 | 12.829 | 2307613 | 2484224 | 5/30/1998 | 22:48:25.47 | 3.696 | 7.731 |
| **613** | 44.827 | 17.15 | 0.536 | 34.804 | 12.83 | 2342618 | 2484643 | 5/30/1998 | 22:54:26.27 | 3.936 | 7.732 |
| **614** | 44.815 | 17.131 | 0.656 | 34.811 | 12.83 | 2318363 | 2484742 | 5/30/1998 | 23:00:27.07 | 3.769 | 7.733 |
| **615** | 44.809 | 17.133 | 0.658 | 34.804 | 12.829 | 2327533 | 2484803 | 5/30/1998 | 23:06:27.87 | 3.832 | 7.733 |
| **616** | 44.78 | 17.102 | 0.651 | 34.805 | 12.828 | 2331690 | 2485428 | 5/30/1998 | 23:12:28.67 | 3.861 | 7.736 |
| **617** | 44.744 | 17.07 | 0.707 | 34.801 | 12.829 | 2302998 | 2484238 | 5/30/1998 | 23:18:29.47 | 3.664 | 7.731 |
| **618** | 44.72 | 17.046 | 0.725 | 34.801 | 12.827 | 2294114 | 2484737 | 5/30/1998 | 23:24:30.27 | 3.603 | 7.733 |
| **619** | 44.705 | 17.029 | 0.728 | 34.802 | 12.827 | 2331940 | 2484474 | 5/30/1998 | 23:30:31.07 | 3.863 | 7.732 |
| **620** | 44.684 | 16.994 | 0.73 | 34.814 | 12.827 | 2323665 | 2483807 | 5/30/1998 | 23:36:31.87 | 3.806 | 7.729 |
| **621** | 44.651 | 16.962 | 0.766 | 34.813 | 12.825 | 2307039 | 2483608 | 5/30/1998 | 23:42:32.67 | 3.692 | 7.728 |
| **622** | 44.628 | 16.949 | 0.732 | 34.804 | 12.825 | 2329842 | 2483527 | 5/30/1998 | 23:48:33.47 | 3.848 | 7.728 |
| **623** | 44.609 | 16.912 | 0.744 | 34.821 | 12.826 | 2310986 | 2484133 | 5/30/1998 | 23:54:34.27 | 3.719 | 7.730 |
| **624** | 44.583 | 16.889 | 0.662 | 34.817 | 12.826 | 2323973 | 2484025 | 5/31/1998 | 00:00:35.07 | 3.808 | 7.730 |
| **625** | 44.541 | 16.85 | 0.7 | 34.815 | 12.826 | 2314517 | 2483540 | 5/31/1998 | 00:06:35.87 | 3.743 | 7.728 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **626** | 44.514 | 16.81 | 0.718 | 34.826 | 12.825 | 2305950 | 2483341 | 5/31/1998 | 00:12:36.67 | 3.684 | 7.727 |
| **627** | 44.501 | 16.807 | 0.795 | 34.817 | 12.823 | 2318720 | 2484158 | 5/31/1998 | 00:18:37.47 | 3.772 | 7.730 |
| **628** | 44.482 | 16.791 | 0.716 | 34.814 | 12.823 | 2334235 | 2483380 | 5/31/1998 | 00:24:38.27 | 3.878 | 7.727 |
| **629** | 44.458 | 16.757 | 0.749 | 34.822 | 12.823 | 2303660 | 2482951 | 5/31/1998 | 00:30:39.07 | 3.668 | 7.725 |
| **630** | 44.449 | 16.762 | 0.773 | 34.81 | 12.823 | 2335158 | 2484032 | 5/31/1998 | 00:36:39.87 | 3.885 | 7.730 |
| **631** | 44.442 | 16.745 | 0.767 | 34.819 | 12.822 | 2317035 | 2483806 | 5/31/1998 | 00:42:40.67 | 3.760 | 7.729 |
| **632** | 44.411 | 16.72 | 0.716 | 34.814 | 12.822 | 2335917 | 2483119 | 5/31/1998 | 00:49:22.74 | 3.890 | 7.726 |
| **633** | 44.39 | 16.683 | 0.792 | 34.827 | 12.821 | 2300259 | 2483212 | 5/31/1998 | 00:55:23.54 | 3.645 | 7.726 |
| **634** | 44.382 | 16.683 | 0.748 | 34.819 | 12.821 | 2310443 | 2482885 | 5/31/1998 | 01:01:24.34 | 3.715 | 7.725 |
| **635** | 44.371 | 16.673 | 0.751 | 34.819 | 12.821 | 2310269 | 2483656 | 5/31/1998 | 01:07:25.14 | 3.714 | 7.728 |
| **636** | 44.357 | 16.656 | 0.692 | 34.822 | 12.82 | 2299976 | 2483270 | 5/31/1998 | 01:13:25.94 | 3.643 | 7.726 |
| **637** | 44.352 | 16.64 | 0.855 | 34.831 | 12.82 | 2303543 | 2483911 | 5/31/1998 | 01:19:26.74 | 3.668 | 7.729 |
| **638** | 44.35 | 16.65 | 0.689 | 34.821 | 12.819 | 2311595 | 2483846 | 5/31/1998 | 01:25:27.54 | 3.723 | 7.729 |
| **639** | 44.348 | 16.654 | 0.729 | 34.815 | 12.821 | 2286198 | 2482959 | 5/31/1998 | 01:31:28.34 | 3.549 | 7.725 |
| **640** | 44.335 | 16.644 | 0.741 | 34.813 | 12.819 | 2315982 | 2483572 | 5/31/1998 | 01:37:29.14 | 3.753 | 7.728 |
| **641** | 44.331 | 16.629 | 0.796 | 34.822 | 12.819 | 2308499 | 2483692 | 5/31/1998 | 01:43:29.94 | 3.702 | 7.728 |
| **642** | 44.32 | 16.607 | 0.786 | 34.833 | 12.819 | 2311654 | 2483279 | 5/31/1998 | 01:49:30.74 | 3.723 | 7.726 |
| **643** | 44.312 | 16.61 | 0.803 | 34.822 | 12.82 | 2323950 | 2484053 | 5/31/1998 | 01:55:31.54 | 3.808 | 7.730 |
| **644** | 44.299 | 16.592 | 0.811 | 34.826 | 12.819 | 2315010 | 2483069 | 5/31/1998 | 02:01:32.34 | 3.746 | 7.726 |
| **645** | 44.27 | 16.564 | 0.756 | 34.826 | 12.818 | 2325696 | 2482313 | 5/31/1998 | 02:07:33.14 | 3.820 | 7.722 |
| **646** | 44.238 | 16.531 | 0.67 | 34.826 | 12.818 | 2332486 | 2483377 | 5/31/1998 | 02:13:33.94 | 3.866 | 7.727 |
| **647** | 44.216 | 16.517 | 0.72 | 34.819 | 12.817 | 2304895 | 2483002 | 5/31/1998 | 02:19:34.74 | 3.677 | 7.725 |
| **648** | 44.201 | 16.497 | 0.666 | 34.822 | 12.819 | 2316913 | 2483223 | 5/31/1998 | 02:25:35.54 | 3.759 | 7.726 |
| **649** | 44.179 | 16.472 | 0.599 | 34.825 | 12.819 | 2300896 | 2483244 | 5/31/1998 | 02:31:36.34 | 3.649 | 7.726 |
| **650** | 44.164 | 16.461 | 0.591 | 34.822 | 12.818 | 2284959 | 2482831 | 5/31/1998 | 02:37:37.14 | 3.540 | 7.725 |
| **651** | 44.167 | 16.46 | 0.637 | 34.825 | 12.816 | 2300911 | 2482619 | 5/31/1998 | 02:43:37.94 | 3.650 | 7.724 |
| **652** | 44.166 | 16.459 | 0.65 | 34.825 | 12.816 | 2314387 | 2482802 | 5/31/1998 | 02:49:38.74 | 3.742 | 7.724 |
| **653** | 44.164 | 16.459 | 0.559 | 34.824 | 12.816 | 2299848 | 2482785 | 5/31/1998 | 02:55:39.54 | 3.642 | 7.724 |
| **654** | 44.177 | 16.45 | 0.539 | 34.843 | 12.817 | 2295863 | 2482534 | 5/31/1998 | 03:01:40.34 | 3.615 | 7.723 |
| **655** | 44.185 | 16.47 | 0.5 | 34.832 | 12.818 | 2295104 | 2484127 | 5/31/1998 | 03:07:41.14 | 3.610 | 7.730 |
| **656** | 44.19 | 16.487 | 0.563 | 34.822 | 12.815 | 2303198 | 2484003 | 5/31/1998 | 03:13:41.94 | 3.665 | 7.730 |
| **657** | 44.21 | 16.489 | 0.547 | 34.838 | 12.817 | 2302181 | 2484225 | 5/31/1998 | 03:19:42.74 | 3.658 | 7.731 |
| **658** | 44.218 | 16.519 | 0.514 | 34.818 | 12.815 | 2307547 | 2483527 | 5/31/1998 | 03:25:43.54 | 3.695 | 7.728 |
| **659** | 44.236 | 16.534 | 0.48 | 34.821 | 12.816 | 2302167 | 2483421 | 5/31/1998 | 03:31:44.34 | 3.658 | 7.727 |
| **660** | 44.252 | 16.544 | 0.422 | 34.826 | 12.816 | 2321940 | 2483373 | 5/31/1998 | 03:37:45.14 | 3.794 | 7.727 |
| **661** | 44.281 | 16.575 | 0.413 | 34.826 | 12.815 | 2286126 | 2483456 | 5/31/1998 | 03:43:45.94 | 3.548 | 7.727 |
| **662** | 44.302 | 16.603 | 0.435 | 34.82 | 12.818 | 2297277 | 2483741 | 5/31/1998 | 03:49:46.74 | 3.625 | 7.728 |
| **663** | 44.316 | 16.621 | 0.369 | 34.816 | 12.817 | 2301073 | 2483395 | 5/31/1998 | 03:55:47.54 | 3.651 | 7.727 |
| **664** | 44.336 | 16.631 | 0.395 | 34.825 | 12.816 | 2301366 | 2484162 | 5/31/1998 | 04:01:48.34 | 3.653 | 7.730 |
| **665** | 44.354 | 16.658 | 0.328 | 34.817 | 12.818 | 2308298 | 2483980 | 5/31/1998 | 04:07:49.14 | 3.700 | 7.729 |
| **666** | 44.386 | 16.676 | 0.344 | 34.83 | 12.817 | 2289449 | 2483188 | 5/31/1998 | 04:13:49.94 | 3.571 | 7.726 |
| **667** | 44.415 | 16.711 | 0.306 | 34.824 | 12.815 | 2293201 | 2483129 | 5/31/1998 | 04:19:50.74 | 3.597 | 7.726 |
| **668** | 44.441 | 16.736 | 0.275 | 34.827 | 12.816 | 2303105 | 2483821 | 5/31/1998 | 04:25:51.54 | 3.665 | 7.729 |
| **669** | 44.467 | 16.773 | 0.315 | 34.816 | 12.817 | 2327860 | 2483593 | 5/31/1998 | 04:31:52.34 | 3.835 | 7.728 |
| **670** | 44.492 | 16.797 | 0.179 | 34.818 | 12.817 | 2326132 | 2484109 | 5/31/1998 | 04:37:53.14 | 3.823 | 7.730 |
| **671** | 44.524 | 16.825 | 0.217 | 34.822 | 12.817 | 2306981 | 2483211 | 5/31/1998 | 04:43:53.94 | 3.691 | 7.726 |
| **672** | 44.56 | 16.865 | 0.18 | 34.819 | 12.816 | 2328597 | 2483898 | 5/31/1998 | 04:49:54.74 | 3.840 | 7.729 |
| **673** | 44.589 | 16.892 | 0.166 | 34.821 | 12.816 | 2336069 | 2483030 | 5/31/1998 | 04:55:55.54 | 3.891 | 7.725 |
| **674** | 44.618 | 16.924 | 0.098 | 34.818 | 12.816 | 2309710 | 2483795 | 5/31/1998 | 05:01:56.34 | 3.710 | 7.729 |
| **675** | 44.65 | 16.949 | 0.109 | 34.824 | 12.817 | 2302109 | 2483255 | 5/31/1998 | 05:07:57.14 | 3.658 | 7.726 |
| **676** | 44.68 | 16.986 | 0.072 | 34.818 | 12.817 | 2287068 | 2483245 | 5/31/1998 | 05:13:57.94 | 3.555 | 7.726 |
| **677** | 44.705 | 17.007 | 0.096 | 34.823 | 12.817 | 2315699 | 2483312 | 5/31/1998 | 05:19:58.74 | 3.751 | 7.727 |
| **678** | 44.73 | 17.034 | 0.003 | 34.82 | 12.817 | 2307496 | 2483303 | 5/31/1998 | 05:25:59.54 | 3.695 | 7.727 |
| **679** | 44.754 | 17.057 | 0.002 | 34.821 | 12.82 | 2322230 | 2483423 | 5/31/1998 | 05:32:00.34 | 3.796 | 7.727 |
| **680** | 44.765 | 17.066 | -0.034 | 34.823 | 12.817 | 2343106 | 2482430 | 5/31/1998 | 05:38:01.14 | 3.939 | 7.723 |
| **681** | 44.79 | 17.107 | -0.049 | 34.81 | 12.817 | 2322771 | 2482915 | 5/31/1998 | 05:44:01.94 | 3.800 | 7.725 |
| **682** | 44.822 | 17.131 | -0.092 | 34.817 | 12.818 | 2297749 | 2483116 | 5/31/1998 | 05:50:02.74 | 3.628 | 7.726 |
| **683** | 44.843 | 17.156 | -0.111 | 34.814 | 12.816 | 2326520 | 2482718 | 5/31/1998 | 05:56:03.54 | 3.825 | 7.724 |
| **684** | 44.874 | 17.183 | -0.094 | 34.817 | 12.817 | 2324705 | 2482674 | 5/31/1998 | 06:02:04.34 | 3.813 | 7.724 |
| **685** | 44.901 | 17.221 | -0.127 | 34.808 | 12.818 | 2329389 | 2482970 | 5/31/1998 | 06:08:05.14 | 3.845 | 7.725 |
| **686** | 44.934 | 17.248 | -0.181 | 34.814 | 12.819 | 2350961 | 2482526 | 5/31/1998 | 06:14:05.94 | 3.993 | 7.723 |
| **687** | 44.963 | 17.282 | -0.207 | 34.808 | 12.817 | 2322592 | 2483004 | 5/31/1998 | 06:20:06.74 | 3.798 | 7.725 |
| **688** | 44.994 | 17.31 | -0.186 | 34.812 | 12.817 | 2327741 | 2483266 | 5/31/1998 | 06:26:07.54 | 3.834 | 7.726 |
| **689** | 45.028 | 17.349 | -0.27 | 34.808 | 12.818 | 2311642 | 2482408 | 5/31/1998 | 06:32:08.34 | 3.723 | 7.723 |
| **690** | 45.059 | 17.375 | -0.296 | 34.812 | 12.818 | 2328969 | 2482993 | 5/31/1998 | 06:38:09.14 | 3.842 | 7.725 |
| **691** | 45.098 | 17.409 | -0.299 | 34.816 | 12.819 | 2312803 | 2482564 | 5/31/1998 | 06:44:09.94 | 3.731 | 7.723 |
| **692** | 45.122 | 17.431 | -0.313 | 34.818 | 12.82 | 2323874 | 2481855 | 5/31/1998 | 06:50:10.74 | 3.807 | 7.720 |
| **693** | 45.155 | 17.474 | -0.317 | 34.81 | 12.818 | 2315301 | 2482609 | 5/31/1998 | 06:56:11.54 | 3.748 | 7.724 |
| **694** | 45.188 | 17.509 | -0.296 | 34.808 | 12.818 | 2300552 | 2482936 | 5/31/1998 | 07:02:12.34 | 3.647 | 7.725 |
| **695** | 45.217 | 17.534 | -0.361 | 34.812 | 12.819 | 2316746 | 2481802 | 5/31/1998 | 07:08:13.14 | 3.758 | 7.720 |
| **696** | 45.245 | 17.565 | -0.345 | 34.81 | 12.819 | 2339566 | 2483458 | 5/31/1998 | 07:14:13.94 | 3.915 | 7.727 |
| **697** | 45.281 | 17.605 | -0.344 | 34.805 | 12.819 | 2328482 | 2481765 | 5/31/1998 | 07:20:14.74 | 3.839 | 7.720 |
| **698** | 45.318 | 17.649 | -0.374 | 34.8 | 12.821 | 2341276 | 2481853 | 5/31/1998 | 07:26:15.54 | 3.927 | 7.720 |
| **699** | 45.342 | 17.67 | -0.387 | 34.802 | 12.822 | 2331065 | 2481193 | 5/31/1998 | 07:32:16.34 | 3.857 | 7.717 |
| **700** | 45.354 | 17.68 | -0.423 | 34.804 | 12.82 | 2343198 | 2481314 | 5/31/1998 | 07:38:17.14 | 3.940 | 7.718 |
| **701** | 45.376 | 17.705 | -0.438 | 34.802 | 12.82 | 2342539 | 2481924 | 5/31/1998 | 07:44:17.94 | 3.935 | 7.721 |

## BFSD 2 Triplicate Blank Tests - PAHs
## Summary

| PAH | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| 1. Naphthalene | -243.5 | -448.1 | -629.3 | -440 | 218.4 | 193.0 |
| 2. Acenaphthene | -32.4 | ND | ND | -32.4 | n/a | n/a |
| 3. Acenaphthylene | -350.2 | 141.0 | 275.9 | 22.2 | 372.9 | 329.5 |
| 4. Fluorene | 125.5 | -69.3 | -84.2 | -9 | 132.4 | 117.0 |
| 5. Phenanthrene | 89.0 | -39.8 | -16.3 | 11 | 77.6 | 68.6 |
| 6. Anthracene | 182.3 | 53.1 | -324.8 | -30 | 298 | 263 |
| 7. Fluoranthene | -421.5 | -1539.0 | -1308.9 | -1089.8 | 667.8 | 590.1 |
| 8. Pyrene | 76.6 | -447.1 | -431.9 | -267.5 | 337.3 | 298.0 |
| 9. Benzo(a)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 10. Chrysene | 23.9 | -61.9 | ND | -19.0 | 84.2 | 60.7 |
| 11. Benzo(b)fluoranthene | ND | ND | -134.3 | -134.3 | n/a | n/a |
| 12. Benzo(k)fluoranthene | ND | ND | -9.8 | -9.8 | n/a | n/a |
| 13. Benzo(a)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 14.Indeno(1,2,3-c,d)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 15. Dibenz(a,h)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 16. Benzo(g,h,I)perylene | ND | 19.6 | ND | 19.6 | n/a | n/a |

## BFSD 2 Triplicate Blank Tests - PCBs
## Summary

| PCB | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| (8) 2,4'-Dichlorobiphenyl | -66.6 | ND | 47.8 | -9.4 | 112.2 | 80.9 |
| (18) 2,2',5-Trichlorobiphenyl | 205.2 | 23.3 | 27.0 | 85.2 | 117.6 | 104.0 |
| (28) 2,4,4'-Trichlorobiphenyl | -8.0 | ND | ND | -8.0 | n/a | n/a |
| (52) 2,2',5,5'-Tetrachlorobiphenyl | ND | 7.9 | 89.9 | 49 | 80.4 | 58.0 |
| (66) 2,3',4,4'-Tetrachlorobiphenyl | 53.6 | 16.6 | ND | 35 | 36.2 | 26.2 |
| (101) 2,2',4,5,5'-Pentachlorobiphenyl | 57.8 | 57.4 | -3.5 | 37 | 40 | 35 |
| (118) 2,3',4,4',5-Pentachlorobiphenyl | ND | 2.7 | 2.3 | 2.5 | 0.3 | 0.2 |
| (153) 2,2',4,4',5,5'-Hexachlorobiphenyl | ND | ND | 9.5 | 9.5 | n/a | n/a |
| (180) 2,2',3,4,4',5,5'-Heptachlorobiphenyl | ND | -9.6 | ND | -9.6 | n/a | n/a |
| (206) 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | -2.8 | 247.0 | -17.0 | 75.7 | 168.0 | 148.5 |
| (209) 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl | -18.5 | ND | ND | -18.5 | n/a | n/a |

## BFSD 2 Triplicate Blank Tests - Pesticides
## Summary

| Pesticide | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| alpha-Chlordane | 7.0 | ND | ND | 7.0 | n/a | n/a |
| 2,4'-DDD | 7.0 | ND | ND | 7.0 | n/a | n/a |
| Methoxychlor | 25.7 | ND | ND | 25.7 | n/a | n/a |
| Endosulfan I | 48.8 | ND | ND | 48.8 | n/a | n/a |
| hexachlorobutadiene | ND | ND | 22.0 | 22.0 | n/a | n/a |
| Heptachlor | 304.5 | ND | ND | 304.5 | n/a | n/a |
| Heptachlor Epoxide | ND | ND | 8.8 | 8.8 | n/a | n/a |
| alpha-hexachlorocyclohexane | 3.3 | ND | ND | 3.3 | n/a | n/a |
| beta-hexachlorocyclohexane | 61.0 | ND | ND | 61.0 | n/a | n/a |
| lindane | 35.2 | 132.3 | 33.8 | 67.1 | 63.9 | 56.5 |
| trans-Nonachlor | 40.8 | ND | ND | 40.8 | n/a | n/a |

## BFSD 2
## Paleta Creek Demonstration Summary

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -6.57 | 17.74 | 80.7% | 2.82 | 8.73 | 165 | 1.46 |
| Cadmium (Cd) | 7.02 | 3.87 | 100.0% | -0.52 | 0.75 | 1.16 | 0.06897 |
| Lead (Pb) | 4.32 | 12.39 | 65.6% | 3.16 | 1.59 | 98.9 | 0.07879 |
| Nickel (Ni) | 19.44 | 8.75 | 99.8% | 10.28 | 7.34 | 19.1 | 0.8378 |
| Manganese (Mn) | 103.94 | 957.14 | 73.3% | -264.85 | 7.49 | 405 | 24.02 |
| Manganese (Mn)[1] | 4194.24 | 101841.76 | 99.9% | -264.85 | 7.49 | 405 | 24.02 |
| Zinc (Zn) | 574.26 | 274.14 | 100% | -3.38 | -68.61 | 356 | 8.38 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1341.12 | 160.18 | na | na | na | na | 4.7 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 28.75 | 15.63 | 100% | -1.97 | 2.88 | na | 0.79 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

## BFSD 2
## Paleta Creek Pre-Demo Summary

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -1.75 | 19.71 | 38.1% | 2.82 | 8.73 | 165 | 1.54 |
| Cadmium (Cd) | 9.64 | 4.14 | 100.0% | -0.52 | 0.75 | 1.16 | 0.148 |
| Lead (Pb) | 11.06 | 7.94 | 100.0% | 3.16 | 1.59 | 98.9 | 0.1561 |
| Nickel (Ni) | 25.24 | 4.62 | 100.0% | 10.28 | 7.34 | 19.1 | 0.9262 |
| Manganese (Mn) | 71.33 | 701.54 | 80.7% | -264.85 | 7.49 | 405 | 28.12 |
| Manganese (Mn)[1] | 5763.99 | 23621.84 | 100.0% | -264.85 | 7.49 | 405 | 28.12 |
| Zinc (Zn) | 715.02 | 257.38 | 100.0% | -3.38 | 65.22 | 356 | 8.90 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1050.87 | 86.25 | na | na | na | na | 5.2 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 30.29 | 11.33 | 100% | -1.97 | 2.88 | na | 0.81 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

## BFSD 2
## Pearl Harbor Bishop Point Site Summary

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 112.46 | 17.60 | 100.0% | 2.82 | 8.73 | 241 | 0.36 |
| Cadmium (Cd) | 1.85 | 1.96 | 99.4% | -0.52 | 0.75 | 0.3 | 0.009 |
| Lead (Pb) | 0.71 | 1.11 | 78.7% | 3.16 | 1.59 | 93 | 0.06519 |
| Nickel (Ni) | 21.04 | 15.41 | 96.3% | 10.28 | 7.34 | 42.9 | 0.3934 |
| Manganese (Mn) | 223.33 | 284.79 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Manganese (Mn)[1] | 2177.45 | 192.60 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Zinc (Zn) | 191.18 | 54.07 | 100.0% | -3.38 | 65.22 | 304 | 1.43 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -567.12 | 54.96 | na | na | na | na | 6.5 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 118.61 | 27.62 | 100% | -1.97 | 2.88 | na | 0.31 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

## BFSD 2
## Pearl Harbor Middle Loch Summary

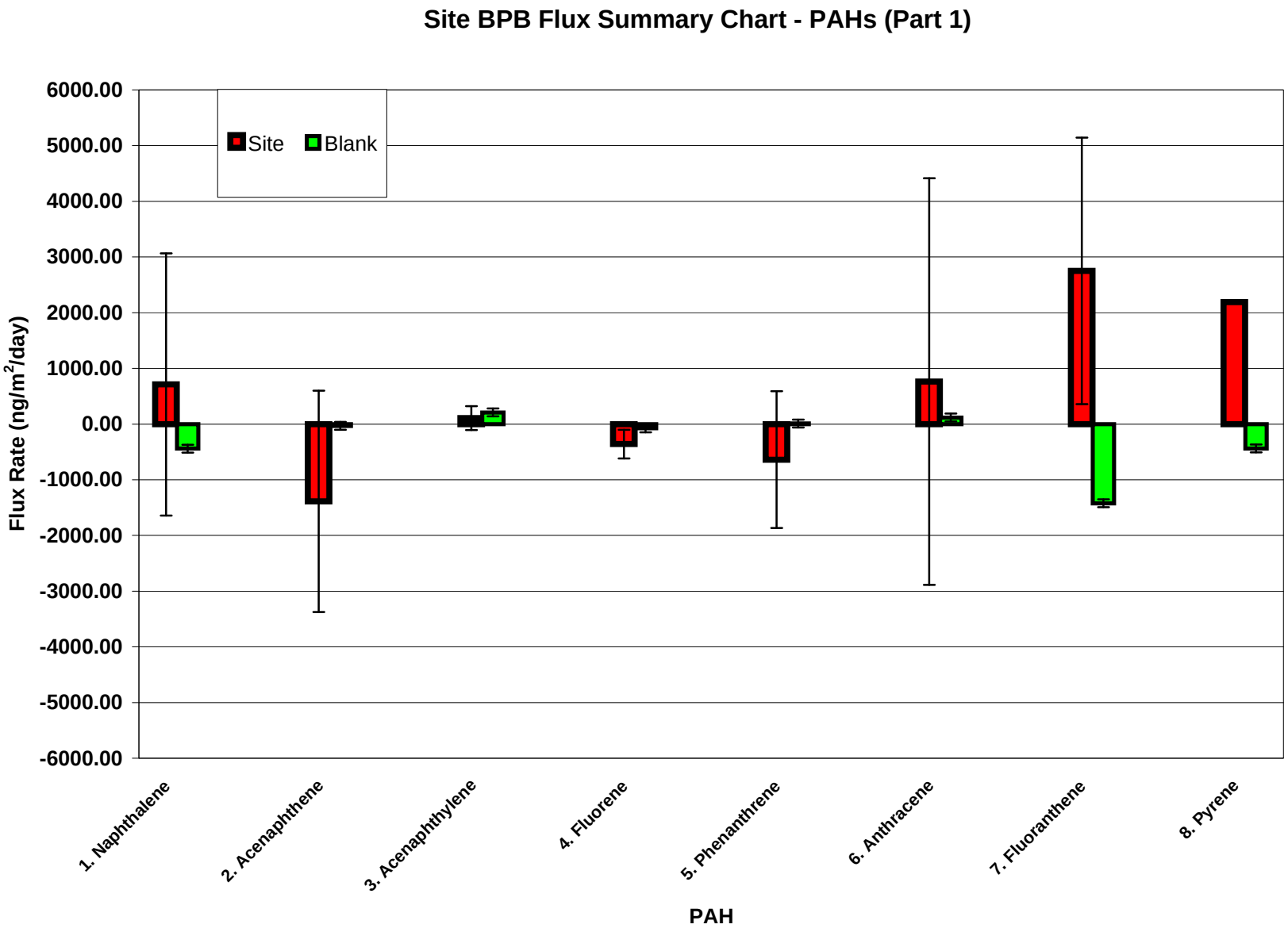
| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 14.79 | 3.46 | 99.9% | 2.82 | 8.73 | 195 | 0.80 |
| Cadmium (Cd) | 1.80 | 0.31 | 100.0% | -0.52 | 0.75 | 0.2 | 0.02277 |
| Lead (Pb) | -0.12 | 0.43 | 95.2% | 3.16 | 1.59 | 34 | 0.03879 |
| Nickel (Ni) | 27.17 | 15.91 | 100.0% | 10.28 | 7.34 | 214 | 0.9472 |
| Manganese (Mn) | -468.18 | 683.35 | 97.9% | -264.85 | 7.49 | 1180 | 52.19 |
| Manganese (Mn)[1] | 2131.59 | 904.57 | 100.0% | -264.85 | 7.49 | 1180 | 52.19 |
| Zinc (Zn) | 49.74 | 17.25 | 93.5% | -3.38 | 65.22 | 314 | 2.28 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1085.52 | 64.84 | na | na | na | na | 4.17 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 65.03 | 42.43 | 100% | -1.97 | 2.88 | na | 1.19 |

1. Mn flux calculated on the basis of first five samples due to non-linearity

## BFSD 2 12/9/2002
## BPB Site Summary

| Metal | Flux ($\mu g/m^2/day$)* | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Arsenic (As) | 23.48 | 6.94 | 100% | -5.16 | 2.10 | | |
| Copper (Cu) | -71.30 | 39.43 | 100.0% | 2.82 | 8.73 | | |
| Cadmium (Cd) | 1.31 | 1.63 | 98.1% | -0.52 | 0.75 | | |
| Lead (Pb) | 17.40 | 24.63 | 99.0% | 3.16 | 1.59 | | |
| Nickel (Ni) | 59.18 | 55.96 | 100.0% | 10.28 | 7.34 | | |
| Manganese (Mn) | 427.65 | 238.42 | 100.0% | -264.85 | 7.49 | | |
| Manganese (Mn)[1] | 1940.13 | 3853.41 | 100.0% | -264.85 | 7.49 | | |
| Silver (Ag) | -0.36 | 0.88 | 86.1% | 0.64 | 0.68 | | |
| Zinc (Zn) | 374.36 | 133.74 | 100.0% | -3.38 | 65.22 | | |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1457.09 | 48.92 | na | na | na | | |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 0.00 | 0.00 | 48% | -1.97 | 2.88 | | |

1. Mn flux calculated on the first three samples due to non-linearity and to compare with metals-only demonstration


Site BPB Flux Summary Chart - PAHs (Part 1)
Site
Blank
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
-1000.00
-2000.00
-3000.00
-4000.00
-5000.00
-6000.00
Flux Rate (ng/m2/day)
1. Naphthalene
2. Acenaphthene
3. Acenaphthylene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
PAH

**BFSD 2 - 12/9/2003**
**BPB Site Summary- PAHs (Part 2)**

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | 152.67 | 140.49 | NA | NA | NA | | |
| 10. CHRYSENE | 286.65 | 341.92 | 94.7% | 23.94 | 22.32 | | |
| 11. BENZO(B)FLUORANTHENE | 561.07 | 376.08 | 97.9% | -134.30 | 297.91 | | |
| 12. BENZO(K)FLUORANTHENE | 452.24 | 465.75 | 82.8% | -9.71 | 36.30 | | |
| 13. BENZO(A)PYRENE | 383.46 | 603.38 | NA | NA | NA | | |
| 14. INDENO(1,2,3-C,D)PYRENE | 8.68 | 10.98 | NA | NA | NA | | |
| 15. DIBENZ(A,H)ANTHRACENE | -1.97 | 7.69 | NA | NA | NA | | |
| 16. BENZO(G,H,I)PERYLENE | 8.77 | 10.59 | 12.9% | 20.15 | 65.15 | | |

## BFSD 2
## BPB Site Summary- PAHs (Part 1)

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. | Bulk Sediment (ng/g) | Overlying Water (ng/L) |
|---|---|---|---|---|---|---|---|
| 1. Naphthalene | 2456.72 | 13211.62 | 100.0% | -440.30 | 458.38 | | |
| 2. Acenaphthene | 9222.27 | 6867.34 | 100.0% | -32.40 | 50.34 | | |
| 3. Acenaphthylene | 778.37 | 880.29 | 100.0% | 208.47 | 112.60 | | |
| 4. Fluorene | 285.70 | 2021.66 | 100.0% | -76.74 | 28.38 | | |
| 5. Phenanthrene | -3555.98 | 7892.27 | 100.0% | 10.95 | 10.95 | | |
| 6. Anthracene | 2874.10 | 1330.22 | 100.0% | 117.68 | 64.62 | | |
| 7. Fluoranthene | 19696.65 | 3869.67 | 100.0% | -1423.95 | 178.41 | | |
| 8. Pyrene | 12101.21 | 3884.64 | 100.0% | -439.51 | 70.73 | | |

**Other**
(See Metals Analysis in combined deployments for these data)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*ml/m$^2$/day) | 0.00 | 0.00 | na | na | na | | |
| Silica ($SiO_2$)* (*mg/m$^2$/day) | 0.00 | 0.00 | 48% | -1.97 | 2.88 | | |

# BFSD2
## BPB Site - 12/9/2002
## PAH Flux Analysis

### BFSD 2 - Site BPB (12/9/2002) - PAHs (Part 2)
**First 4 samples only**

**Site:** Site BPB (21 19.815 N X 157 58.000W)
**Date:** 12/9/2003

**Start time:**
**Interval:** 7 hr
**End time:**

**Bottle Volume =** 0.25 liters
**Chamber Volume =** 30 liters
**Chamber Area =** 1701.4 $cm^2$

| Sample id | BFSD 2 Data: Measured Concentration (pptr)** | Sample No.* | Elapsed Time (hrs) | Dilution Correction: Measured Concentration (pptr)** | Corrected Concentration (pptr)** | # of Dilutions | Intercept Corrected Concentration (pptr) | From Regression Concentration (pptr)** | Lower 95% Conf. Int. | Upper 95% Conf. Int. |
|---|---|---|---|---|---|---|---|---|---|---|
| **BENZO(A)ANTHRACENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.72 | T-#0 | 0 | 2.720 | | n/a | | | | |
| BFSD2-BPB-2 | 4.50 | #1 | 0.3 | 4.500 | 4.5000 | 0 | 0.237 | 0.054 | -2.783 | 2.891 |
| BFSD2-BPB-3 | 5.62 | #2 | 7.3 | 5.620 | 5.6348 | 1 | 1.371 | 1.313 | -1.524 | 4.149 |
| BFSD2-BPB-4 | 6.13 | #3 | 14.3 | 6.130 | 6.1690 | 2 | 1.906 | 2.571 | -0.266 | 5.408 |
| BFSD2-BPB-5 | 8.45 | #4 | 21.3 | 8.450 | 8.5174 | 3 | 4.254 | 3.830 | 0.993 | 6.667 |
| BFSD2-BPB-6 | 6.77 | #5 | 28.3 | 6.770 | 6.8852 | 4 | 2.622 | 5.089 | 2.252 | 7.925 |
| BFSD2-BPB-7 | 6.99 | #6 | 35.3 | 6.990 | 7.1389 | 5 | 2.876 | 6.347 | 3.510 | 9.184 |
| BFSD2-BPB-8 | 7.56 | #7 | 42.3 | 7.560 | 7.745 | 6 | 3.481 | 7.606 | 4.769 | 10.443 |
| BFSD2-BPB-10 | 6.51 | #9 | 56.3 | 6.510 | 6.9162 | 8 | 2.653 | 10.123 | 7.286 | 12.960 |
| BFSD2-BPB-11 | 8.43 | #10 | 63.3 | 8.430 | 8.8904 | 9 | 4.627 | 11.382 | 8.545 | 14.219 |
| BFSD2-BPB-12 | 6.70 | #11 | 70.3 | 6.700 | 7.2307 | 10 | 2.967 | 12.640 | 9.803 | 15.477 |
| **CHRYSENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.18 | T-#0 | 0 | 1.180 | | n/a | | | | |
| BFSD2-BPB-2 | 7.90 | #1 | 0.3 | 7.900 | 7.9000 | 0 | 0.797 | 0.138 | -5.671 | 5.947 |
| BFSD2-BPB-3 | 10.0 | #2 | 7.3 | 10.000 | 10.0560 | 1 | 2.953 | 3.362 | -2.447 | 9.171 |
| BFSD2-BPB-4 | 12.4 | #3 | 14.3 | 12.400 | 12.5295 | 2 | 5.427 | 6.587 | 0.778 | 12.396 |
| BFSD2-BPB-5 | 17.6 | #4 | 21.3 | 17.600 | 17.8230 | 3 | 10.720 | 9.811 | 4.002 | 15.620 |
| BFSD2-BPB-6 | 11.5 | #5 | 28.3 | 11.500 | 11.8598 | 4 | 4.757 | 13.035 | 7.226 | 18.844 |
| BFSD2-BPB-7 | 12.8 | #6 | 35.3 | 12.800 | 13.2458 | 5 | 6.143 | 16.259 | 10.450 | 22.068 |
| BFSD2-BPB-8 | 13.2 | #7 | 42.3 | 13.200 | 13.743 | 6 | 6.640 | 19.484 | 13.675 | 25.293 |
| BFSD2-BPB-9 | 11 | #8 | 49.3 | 10.500 | 11.1428 | 7 | 4.040 | 22.708 | 16.899 | 28.517 |
| BFSD2-BPB-10 | 16.4 | #9 | 56.3 | 16.400 | 17.1205 | 8 | 10.018 | 25.932 | 20.123 | 31.741 |
| BFSD2-BPB-11 | 14.6 | #10 | 63.3 | 14.600 | 15.4473 | 9 | 8.345 | 29.156 | 23.347 | 34.965 |
| BFSD2-BPB-12 | 12.6 | #11 | 70.3 | 12.600 | 13.5592 | 10 | 6.457 | 32.381 | 26.572 | 38.190 |
| **BENZO(B)FLUORANTHENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.32 | T-#0 | 0 | 2.320 | | n/a | | | | |
| BFSD2-BPB-2 | 8.99 | #1 | 0.3 | 8.990 | 8.9900 | 0 | 0.706 | 0.133 | -12.291 | 12.558 |
| BFSD2-BPB-3 | 9.32 | #2 | 7.3 | 9.320 | 9.3756 | 1 | 1.092 | 3.241 | -9.183 | 15.665 |
| BFSD2-BPB-4 | 17.1 | #3 | 14.3 | 17.100 | 17.2139 | 2 | 8.930 | 6.349 | -6.075 | 18.773 |
| BFSD2-BPB-5 | 16.5 | #4 | 21.3 | 16.500 | 16.7371 | 3 | 8.453 | 9.457 | -2.967 | 21.881 |
| BFSD2-BPB-6 | 16.3 | #5 | 28.3 | 16.300 | 16.6553 | 4 | 8.371 | 12.565 | 0.141 | 24.989 |
| BFSD2-BPB-7 | 14.8 | #6 | 35.3 | 14.800 | 15.2718 | 5 | 6.988 | 15.673 | 3.249 | 28.097 |
| BFSD2-BPB-8 | 18.4 | #7 | 42.3 | 18.400 | 18.976 | 6 | 10.692 | 18.781 | 6.357 | 31.205 |
| BFSD2-BPB-11 | 18.7 | #10 | 63.3 | 18.700 | 19.5644 | 9 | 11.280 | 28.105 | 15.680 | 40.529 |
| BFSD2-BPB-12 | 18.1 | #11 | 70.3 | 18.100 | 19.1203 | 10 | 10.836 | 31.213 | 18.788 | 43.637 |
| **BENZO(K)FLUORANTHENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.62 | T-#0 | 0 | 2.620 | | n/a | | | | |
| BFSD2-BPB-2 | 7.42 | #1 | 0.3 | 7.420 | 7.4200 | 0 | 0.951 | 0.134 | -6.356 | 6.624 |
| BFSD2-BPB-3 | 8.15 | #2 | 7.3 | 8.150 | 8.1900 | 1 | 1.721 | 3.260 | -3.230 | 9.751 |
| BFSD2-BPB-4 | 13.4 | #3 | 14.3 | 13.400 | 13.4861 | 2 | 7.017 | 6.387 | -0.104 | 12.877 |
| BFSD2-BPB-5 | 15.9 | #4 | 21.3 | 15.900 | 16.0759 | 3 | 9.606 | 9.513 | 3.023 | 16.004 |
| BFSD2-BPB-6 | 10.9 | #5 | 28.3 | 10.900 | 11.1866 | 4 | 4.717 | 12.640 | 6.149 | 19.130 |
| BFSD2-BPB-7 | 12.9 | #6 | 35.3 | 12.900 | 13.2556 | 5 | 6.786 | 15.766 | 9.275 | 22.256 |
| BFSD2-BPB-8 | 17.9 | #7 | 42.3 | 17.900 | 18.341 | 6 | 11.872 | 18.892 | 12.402 | 25.383 |
| BFSD2-BPB-11 | 17.5 | #10 | 63.3 | 17.500 | 18.2433 | 9 | 11.774 | 28.271 | 21.781 | 34.762 |
| BFSD2-BPB-12 | 12.4 | #11 | 70.3 | 12.400 | 13.2891 | 10 | 6.820 | 31.398 | 24.907 | 37.888 |

**BENZO(A)ANTHRACENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.1798 | slope= | #REF! |
| intercept= | 4.2634 | | |
| St. Err of Slope= | 0.0367 | | |
| St Err of Int= | 0.4894 | | |
| R2= | 0.9231 | | |
| St Err of Y= | 0.5744 | St Err of Y= | #REF! |
| F= | 24.01044943 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 7.920894225 | | |
| ResSS= | 0.659787252 | ResSS= | #REF! |
| Sumx2= | 16666.5 | Sumx2= | #REF! |
| Average Conc. | 6.474 | | |
| Initial Conc | 4.500 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = #REF!
$S_{(y1-x2)}$ = #REF!
t = #REF!
p = #REF!

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **760.90** | **ng/m²/day** |
| **95% CI (low) =** | **92.77** | **ng/m²/day** |
| **95% CI (high) =** | **1429.04** | **ng/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **−134.29613** | **ng/m²/day** |
| **95% CI (low) =** | **−432.20593** | **ng/m²/day** |
| **95% CI (high) =** | **163.613683** | **ng/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.1798 | 4.2634 |
| 0.0367 | 0.4894 |
| 0.9231 | 0.5744 |
| 24.01044943 | 2 |
| 7.920894225 | 0.659787252 |

**Notes**

**CHRYSENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.4606 | slope= | 0.003950364 |
| intercept= | 7.1026 | | |
| St. Err of Slope= | 0.0752 | | |
| St Err of Int= | 1.0035 | | |
| R2= | 0.9493 | | |
| St Err of Y= | 1.1777 | St Err of Y= | 0.003681693 |
| F= | 37.47442787 | | |
| DF= | 2 | DF= | 7 |
| RegSS= | 51.97894031 | | |
| ResSS= | 2.774101875 | ResSS= | 0.511425087 |
| Sumx2= | 19096.99 | Sumx2= | 5390 |
| Average Conc. | 12.034 | | |
| Initial Conc | 7.900 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = 0.365058551
$S_{(y1-x2)}$ = 0.00931906
t = 49.00244917
p = 3.07797E-12

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1949.20** | **µg/m²/day** |
| **95% CI (low) =** | **579.19** | **µg/m²/day** |
| **95% CI (high) =** | **3319.22** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **100%** | |
| **Blank Flux=** | **−9.710954** | **µg/m²/day** |
| **95% CI (low) =** | **−46.008488** | **µg/m²/day** |
| **95% CI (high) =** | **26.5865797** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.4606 | 7.1026 |
| 0.0752 | 1.0035 |
| 0.9493 | 1.1777 |
| 37.47442787 | 2 |
| 51.97894031 | 2.774101875 |

**Notes**

**BENZO(B)FLUORANTHENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.4440 | slope= | -0.0221561 |
| intercept= | 8.2840 | | |
| St. Err of Slope= | 0.1605 | | |
| St Err of Int= | 2.1402 | | |
| R2= | 0.7929 | | |
| St Err of Y= | 2.5117 | St Err of Y= | 0.049148994 |
| F= | 7.655682812 | | |
| DF= | 2 | DF= | 4 |
| RegSS= | 48.29702501 | | |
| ResSS= | 12.61730043 | ResSS= | 19.88541378 |
| Sumx2= | 13496.81 | Sumx2= | 2058 |
| Average Conc. | 13.794 | | |
| Initial Conc | 8.990 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = 5.417119035
$S_{(y1-x2)}$ = 0.055078017
t = 8.463451966
p = 0.00014867

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1878.90** | **µg/m²/day** |
| **95% CI (low) =** | **-1042.88** | **µg/m²/day** |
| **95% CI (high) =** | **4800.68** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **100%** | |
| **Blank Flux=** | **#PB0!** | **µg/m²/day** |
| **95% CI (low) =** | **#PB0!** | **µg/m²/day** |
| **95% CI (high) =** | **#PB0!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.4440 | 8.2840 |
| 0.1605 | 2.1402 |
| 0.7929 | 2.5117 |
| 7.655682812 | 2 |
| 48.29702501 | 12.61730043 |

**Notes**

**BENZO(K)FLUORANTHENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.4466 | slope= | -0.001602108 |
| intercept= | 6.4694 | | |
| St. Err of Slope= | 0.0838 | | |
| St Err of Int= | 1.1181 | | |
| R2= | 0.9342 | | |
| St Err of Y= | 1.3121 | St Err of Y= | 0.005988347 |
| F= | 28.3865123 | | |
| DF= | 2 | DF= | 2 |
| RegSS= | 48.87136373 | | |
| ResSS= | 3.443280613 | ResSS= | 0.117143642 |
| Sumx2= | 13496.81 | Sumx2= | 1633.333333 |
| Average Conc. | 11.272 | | |
| Initial Conc | 7.420 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = 0.890106064
$S_{(y1-x2)}$ = 0.024716639
t = 18.13467808
p = 5.43699E-05

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1890.04** | **µg/m²/day** |
| **95% CI (low) =** | **363.70** | **µg/m²/day** |
| **95% CI (high) =** | **3416.37** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **100%** | |
| **Blank Flux=** | **#PB0!** | **µg/m²/day** |
| **95% CI (low) =** | **#PB0!** | **µg/m²/day** |
| **95% CI (high) =** | **#PB0!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.4466 | 6.4694 |
| 0.0838 | 1.1181 |
| 0.9342 | 1.3121 |
| 28.3865123 | 2 |
| 48.87136373 | 3.443280613 |

**Notes**

**BFSD2-SPL-10-1**
**BFSD2-SPL-10-2**
**BFSD2-SPL-10-3**
**BFSD2-SPL-10-4**
**BFSD2-SPL-10-5**
**BFSD2-SPL-10-6**
**BFSD2-SPL-10-7**
**BFSD2-SPL-10-8**
**BFSD2-SPL-10-10**
**BFSD2-SPL-10-11**

# BFSD2
## BPB Site - 12/9/2002
## PAH Flux Analysis

| Sample id | BFSD 2 Data: Measured Concentration (pptr)** | Sample No.* | Elapsed Time (hrs) | Dilution Correction: Measured Concentration (pptr)** | Corrected Concentration (pptr)** | # of Dilutions | Intercept Corrected Concentration (pptr) | From Regression Concentration (pptr)** | Lower 95% Conf. Int. | Upper 95% Conf. Int. |
|---|---|---|---|---|---|---|---|---|---|---|
| **BENZO(A)PYRENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.00 | T-#0 | 0 | 2.000 | | n/a | | | | |
| BFSD2-BPB-2 | 2.00 | #1 | 0.3 | 2.000 | 2.0000 | 0 | 0.794 | 0.100 | -7.469 | 7.669 |
| BFSD2-BPB-3 | 2.00 | #2 | 7.3 | 2.000 | 2.0000 | 1 | 0.794 | 2.438 | -5.131 | 10.007 |
| BFSD2-BPB-4 | 7.19 | #3 | 14.3 | 7.190 | 7.1900 | 2 | 5.984 | 4.776 | -2.793 | 12.345 |
| BFSD2-BPB-5 | 8.02 | #4 | 21.3 | 8.020 | 8.0633 | 3 | 6.857 | 7.114 | -0.455 | 14.683 |
| BFSD2-BPB-6 | 2.00 | #5 | 28.3 | 2.000 | 2.0934 | 4 | 0.887 | 9.452 | 1.883 | 17.021 |
| BFSD2-BPB-7 | 6.23 | #6 | 35.3 | 6.230 | 6.3234 | 5 | 5.117 | 11.790 | 4.221 | 19.359 |
| BFSD2-BPB-8 | 7.16 | #7 | 42.3 | 7.160 | 7.289 | 6 | 6.083 | 14.128 | 6.559 | 21.697 |
| BFSD2-BPB-9 | 18.3 | #8 | 49.3 | 18.300 | 18.4717 | 7 | 17.266 | 16.466 | 8.897 | 24.035 |
| BFSD2-BPB-10 | 2.00 | #9 | 56.3 | 2.000 | 2.3075 | 8 | 1.101 | 18.804 | 11.235 | 26.373 |
| BFSD2-BPB-11 | 9.68 | #10 | 63.3 | 9.680 | 9.9875 | 9 | 8.781 | 21.142 | 13.573 | 28.711 |
| BFSD2-BPB-12 | 6.92 | #11 | 70.3 | 6.920 | 7.2915 | 10 | 6.085 | 23.480 | 15.911 | 31.049 |
| **INDENO(1,2,3-C,D)PYRENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.98 | T-#0 | 0 | 1.98 | | n/a | | | | |
| BFSD2-BPB-2 | 1.98 | #1 | 0.3 | 1.98 | 1.9800 | 0 | 0.049 | 0.003 | -0.437 | 0.443 |
| BFSD2-BPB-3 | 1.98 | #2 | 7.3 | 1.98 | 1.9800 | 1 | 0.049 | 0.072 | -0.368 | 0.512 |
| BFSD2-BPB-4 | 1.98 | #3 | 14.3 | 1.98 | 1.9800 | 2 | 0.049 | 0.141 | -0.299 | 0.581 |
| BFSD2-BPB-5 | 2.21 | #4 | 21.3 | 2.21 | 2.2100 | 3 | 0.279 | 0.210 | -0.230 | 0.650 |
| BFSD2-BPB-6 | 1.98 | #5 | 28.3 | 1.98 | 1.9819 | 4 | 0.051 | 0.279 | -0.161 | 0.719 |
| BFSD2-BPB-7 | 1.98 | #6 | 35.3 | 1.98 | 1.9819 | 5 | 0.051 | 0.348 | -0.092 | 0.788 |
| BFSD2-BPB-8 | 1.98 | #7 | 42.3 | 1.980 | 1.982 | 6 | 0.051 | 0.417 | -0.023 | 0.857 |
| BFSD2-BPB-10 | 1.98 | #9 | 56.3 | 1.98 | 2.1139 | 8 | 0.183 | 0.555 | 0.115 | 0.995 |
| BFSD2-BPB-11 | 1.98 | #10 | 63.3 | 1.98 | 2.1304 | 9 | 0.199 | 0.624 | 0.184 | 1.064 |
| BFSD2-BPB-12 | 1.98 | #11 | 70.3 | 1.98 | 2.1469 | 10 | 0.216 | 0.693 | 0.253 | 1.133 |
| **DIBENZ(A,H)ANTHRACENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.67 | T-#0 | 0 | 1.67 | | n/a | | | | |
| BFSD2-BPB-2 | 1.67 | #1 | 0.3 | 1.67 | 1.6700 | 0 | 0.040 | 0.002 | -0.361 | 0.365 |
| BFSD2-BPB-3 | 1.67 | #2 | 7.3 | 1.67 | 1.6700 | 1 | 0.040 | 0.059 | -0.304 | 0.422 |
| BFSD2-BPB-4 | 1.67 | #3 | 14.3 | 1.67 | 1.6700 | 2 | 0.040 | 0.116 | -0.247 | 0.479 |
| BFSD2-BPB-5 | 1.86 | #4 | 21.3 | 1.86 | 1.8600 | 3 | 0.230 | 0.173 | -0.190 | 0.536 |
| BFSD2-BPB-6 | 1.67 | #5 | 28.3 | 1.67 | 1.6716 | 4 | 0.042 | 0.230 | -0.133 | 0.593 |
| BFSD2-BPB-7 | 1.67 | #6 | 35.3 | 1.67 | 1.6716 | 5 | 0.042 | 0.287 | -0.076 | 0.650 |
| BFSD2-BPB-8 | 1.67 | #7 | 42.3 | 1.670 | 1.672 | 6 | 0.042 | 0.344 | -0.019 | 0.707 |
| BFSD2-BPB-9 | 1.67 | #8 | 49.3 | 1.67 | 1.6716 | 7 | 0.042 | 0.401 | 0.038 | 0.764 |
| BFSD2-BPB-10 | 1.67 | #9 | 56.3 | 1.67 | 1.6716 | 8 | 0.042 | 0.458 | 0.095 | 0.821 |
| BFSD2-BPB-11 | 1.67 | #10 | 63.3 | 1.67 | 1.6716 | 9 | 0.042 | 0.515 | 0.152 | 0.878 |
| BFSD2-BPB-12 | 1.67 | #11 | 70.3 | 1.67 | 1.6716 | 10 | 0.042 | 0.572 | 0.209 | 0.935 |
| **BENZO(G,H,I)PERYLENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.98 | T-#0 | 0 | 1.9800 | | n/a | | | | |
| BFSD2-BPB-2 | 1.98 | #1 | 0.3 | 1.9800 | 1.9800 | 0 | 0.047 | 0.003 | -0.418 | 0.424 |
| BFSD2-BPB-3 | 1.98 | #2 | 7.3 | 1.9800 | 1.9800 | 1 | 0.047 | 0.069 | -0.352 | 0.490 |
| BFSD2-BPB-4 | 1.98 | #3 | 14.3 | 1.9800 | 1.9800 | 2 | 0.047 | 0.135 | -0.286 | 0.556 |
| BFSD2-BPB-5 | 2.20 | #4 | 21.3 | 2.2000 | 2.2000 | 3 | 0.267 | 0.201 | -0.220 | 0.622 |
| BFSD2-BPB-6 | 1.98 | #5 | 28.3 | 1.9800 | 1.9818 | 4 | 0.049 | 0.267 | -0.154 | 0.688 |
| BFSD2-BPB-7 | 1.98 | #6 | 35.3 | 1.9800 | 1.9818 | 5 | 0.049 | 0.333 | -0.088 | 0.754 |
| BFSD2-BPB-8 | 1.98 | #7 | 42.3 | 1.980 | 1.982 | 6 | 0.049 | 0.399 | -0.022 | 0.820 |
| BFSD2-BPB-10 | 1.98 | #9 | 56.3 | 1.9800 | 2.1138 | 8 | 0.181 | 0.531 | 0.110 | 0.952 |
| BFSD2-BPB-11 | 1.98 | #10 | 63.3 | 1.9800 | 2.1303 | 9 | 0.197 | 0.597 | 0.176 | 1.018 |
| BFSD2-BPB-12 | 1.98 | #11 | 70.3 | 1.9800 | 2.1468 | 10 | 0.214 | 0.663 | 0.242 | 1.084 |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.25 | liters |
| **Chamber Volume =** | 30 | liters |
| **Chamber Area =** | 1701.4 | $cm^2$ |

**BENZO(A)PYRENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.3340 | slope= | #REF! |
| intercept= | 1.2062 | | |
| St. Err of Slope= | 0.0980 | | |
| St Err of Int= | 1.3076 | | |
| R2= | 0.8530 | | |
| St Err of Y= | 1.5345 | St Err of Y= | #REF! |
| F= | 11.60645909 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 27.3306355 | | |
| ResSS= | 4.709556169 | ResSS= | #REF! |
| Sumx2= | 19096.99 | Sumx2= | #REF! |
| Average Conc. | 4.269 | | |
| Initial Conc | 2.000 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | #REF! |
| $S_{(b1-b2)}$ = | #REF! |
| t = | #REF! |
| p = | #REF! |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1413.41** | **µg/m²/day** |
| **95% CI (low) =** | **-371.66** | **µg/m²/day** |
| **95% CI (high) =** | **3198.48** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **#PBO!** | **µg/m²/day** |
| **95% CI (low) =** | **#PBO!** | **µg/m²/day** |
| **95% CI (high) =** | **#PBO!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.3340 | 1.2062 |
| 0.0980 | 1.3076 |
| 0.8530 | 1.5345 |
| 11.60645909 | 2 |
| 27.3306355 | 4.709556169 |

**Notes**

**INDENO(1,2,3-C,D)PYRENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.0099 | slope= | #REF! |
| intercept= | 1.9310 | | |
| St. Err of Slope= | 0.0057 | | |
| St Err of Int= | 0.0759 | | |
| R2= | 0.6000 | | |
| St Err of Y= | 0.0891 | St Err of Y= | #REF! |
| F= | 3 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 0.023805 | | |
| ResSS= | 0.01587 | ResSS= | #REF! |
| Sumx2= | 16666.5 | Sumx2= | #REF! |
| Average Conc. | 2.026 | | |
| Initial Conc | 1.980 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | #REF! |
| $S_{(b1-b2)}$ = | #REF! |
| t = | #REF! |
| p = | #REF! |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **41.71** | **µg/m²/day** |
| **95% CI (low) =** | **-61.91** | **µg/m²/day** |
| **95% CI (high) =** | **145.34** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **0** | **µg/m²/day** |
| **95% CI (low) =** | **0** | **µg/m²/day** |
| **95% CI (high) =** | **0** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.0099 | 1.9310 |
| 0.0057 | 0.0759 |
| 0.6000 | 0.0891 |
| 3 | 2 |
| 0.023805 | 0.01587 |

**Notes**

**DIBENZ(A,H)ANTHRACENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.0081 | slope= | #REF! |
| intercept= | 1.6296 | | |
| St. Err of Slope= | 0.0047 | | |
| St Err of Int= | 0.0627 | | |
| R2= | 0.6000 | | |
| St Err of Y= | 0.0736 | St Err of Y= | #REF! |
| F= | 3 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 0.016245 | | |
| ResSS= | 0.01083 | ResSS= | #REF! |
| Sumx2= | 19096.99 | Sumx2= | #REF! |
| Average Conc. | 1.708 | | |
| Initial Conc | 1.670 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | #REF! |
| $S_{(b1-b2)}$ = | #REF! |
| t = | #REF! |
| p = | #REF! |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **34.46** | **µg/m²/day** |
| **95% CI (low) =** | **-51.14** | **µg/m²/day** |
| **95% CI (high) =** | **120.06** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **23.9445835** | **µg/m²/day** |
| **95% CI (low) =** | **1.6285102** | **µg/m²/day** |
| **95% CI (high) =** | **46.2606567** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.0081 | 1.6296 |
| 0.0047 | 0.0627 |
| 0.6000 | 0.0736 |
| 3 | 2 |
| 0.016245 | 0.01083 |

**Notes**

**BENZO(G,H,I)PERYLENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.0094 | slope= | 0.003324437 |
| intercept= | 1.9332 | | |
| St. Err of Slope= | 0.0054 | | |
| St Err of Int= | 0.0726 | | |
| R2= | 0.6000 | | |
| St Err of Y= | 0.0852 | St Err of Y= | 0.01074885 |
| F= | 3 | | |
| DF= | 2 | DF= | 5 |
| RegSS= | 0.02178 | | |
| ResSS= | 0.01452 | ResSS= | 2.434381089 |
| Sumx2= | 16666.5 | Sumx2= | 4214 |
| Average Conc. | 2.024 | | |
| Initial Conc | 1.980 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | 0.349843013 |
| $S_{(b1-b2)}$ = | 0.01019853 |
| t = | 0.598530821 |
| p = | 0.568339569 |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **39.90** | **µg/m²/day** |
| **95% CI (low) =** | **-59.22** | **µg/m²/day** |
| **95% CI (high) =** | **139.02** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **43%** | |
| **Blank Flux=** | **#PBO!** | **µg/m²/day** |
| **95% CI (low) =** | **#PBO!** | **µg/m²/day** |
| **95% CI (high) =** | **#PBO!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.0094 | 1.9332 |
| 0.0054 | 0.0726 |
| 0.6000 | 0.0852 |
| 3 | 2 |
| 0.02178 | 0.01452 |

**Notes**

## BFSD 2
## Bishop Point Summary- PAHs (Part 1)

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. | Bulk Sediment (ng/g) | Overlying Water (ng/L) |
|---|---|---|---|---|---|---|---|
| 1. Naphthalene | -110.07 | 596.59 | 38.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 2680.41 | 10124.61 | 51.2% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 627.85 | 1483.64 | 82.7% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 75.17 | 1894.31 | 23.4% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | -552.72 | 1305.06 | 98.2% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 4053.72 | 3094.52 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 4435.81 | 10157.65 | 97.4% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 38.99 | 4132.12 | 28.5% | -439.51 | 70.73 | 150,000 | 20 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*ml/m$^2$/day) | -2518.63 | 152.07 | na | na | na | na | na |
| Silica ($SiO_2$)* (*mg/m$^2$/day) | na | na | na | -1.97 | 2.88 | na | na |

## BFSD 2
## Bishop Point Summary- PAHs (Part 1, First 4 Samples)

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 1,848 | 4,406 | 59.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 71,053 | 327,575 | 100.0% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 6,862 | 14,388 | 100.0% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 10,387 | 110,973 | 100.0% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | 3,031 | 106,690 | 99.4% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 26,955 | 27,293 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 69,812 | 380,981 | 100.0% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 24,512 | 190,723 | 100.0% | -439.51 | 70.73 | 150,000 | 20 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -2518.63 | 152.07 | na | na | na | na | na |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | na | na | na | -1.97 | 2.88 | na | na |

## BFSD 2
## Bishop Point Summary- PAHs (Part 1, Last 8 Samples)

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 27.23 | 1,194.31 | 58.0% | -440.30 | 458.38 | 44.00 | 13 |
| 2. Acenaphthene | -4,815.36 | 12,199.50 | 93.5% | -32.40 | 50.34 | 3,800.00 | 37 |
| 3. Acenaphthylene | -1,236.56 | 1,738.17 | 100.0% | 208.47 | 112.60 | 1,200.00 | 5.6 |
| 4. Fluorene | -175.37 | 2,790.40 | 29.9% | -76.74 | 28.38 | 4,800.00 | 19 |
| 5. Phenanthrene | 101.84 | 1,841.97 | 43.9% | 10.95 | 10.95 | 54,000.00 | 32 |
| 6. Anthracene | 803.06 | 2,237.54 | 99.0% | 117.68 | 64.62 | 10,000.00 | 13 |
| 7. Fluoranthene | -332.26 | 14,269.51 | 31.6% | -1423.95 | 178.41 | 270,000.00 | 52 |
| 8. Pyrene | -2,125.92 | 5,818.50 | 99.0% | -439.51 | 70.73 | 150,000.00 | 20 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -2518.63 | 152.07 | na | na | na | na | na |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | na | na | na | -1.97 | 2.88 | na | na |

## BFSD 2
## Bishop Point Site Summary- PAHs (Part 2)

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | 75.00 | 306.84 | NA | NA | NA | 16,000 | Non-Detect |
| 10. CHRYSENE | 1048.91 | 1012.24 | 98.5% | 23.94 | 22.32 | 48,000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 919.89 | 375.56 | 99.8% | -134.30 | 297.91 | 36,000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 234.99 | 156.43 | 93.3% | -9.71 | 36.30 | 10,000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12,000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 6.72 | 67.06 | NA | NA | NA | 7,400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1,500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 7.91 | 64.14 | 11.6% | 20.15 | 65.15 | 5,300 | 1.7 |

## BFSD 2
## Bishop Point Site Summary- PAHs (Part 2, First 4 Samples)

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 16000 | Non-Detect |
| 10. CHRYSENE | 8792.74 | 10650.21 | 100.0% | 23.94 | 22.32 | 48000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 3080.74 | 17862.28 | 99.4% | -134.30 | 297.91 | 36000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 977.52 | 3135.54 | 99.7% | -9.71 | 36.30 | 10000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 122.97 | 7142.02 | NA | NA | NA | 7400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 33.19 | 5249.50 | 7.0% | 20.15 | 65.15 | 5300 | 1.7 |

## BFSD 2
## Bishop Point Site Summary- PAHs (Part 2, Last 8 Samples)

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 16,000 | Non-Detect |
| 10. CHRYSENE | 75.45 | 780.02 | 29.4% | 23.94 | 22.32 | 48,000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 810.32 | 561.62 | 99.7% | -134.30 | 297.91 | 36,000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 155.56 | 270.41 | 81.2% | -9.71 | 36.30 | 10,000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12,000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 44.68 | 59.36 | NA | NA | NA | 7,400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1,500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 35.55 | 101.15 | 38.6% | 20.15 | 65.15 | 5,300 | 1.7 |

**BFSD 2**
**Bishop Point Demonstration Summary-PCBs**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | -2.62 | 93.70 | 4% | 57.59 | 31.49 | Non Detect | 2.1 |

**BFSD 2**
**Bishop Point Demonstration Summary-Pesticides**

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| Mirex | 61.81 | 110.60 | NA | NA | Non Detect | 1.00 |

## BFSD 2
## Paleta Creek Demonstration Summary- PAHs

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 459.20 | 429.58 | 94.5% | -440.30 | 458.38 | 13 | 6.7 |
| 2. Acenaphthene | 337.58 | 178.97 | 100.0% | -32.40 | 50.34 | 19 | 9.7 |
| 3. Acenaphthylene | 105.51 | 183.82 | 33.8% | 208.47 | 112.60 | 220 | 7.6 |
| 4. Fluorene | 173.17 | 149.76 | 100.0% | -76.74 | 28.38 | 34 | 2.3 |
| 5. Phenanthrene | 489.25 | 659.77 | 100.0% | 10.95 | 10.95 | 240 | 8.2 |
| 6. Anthracene | 569.42 | 260.29 | 100.0% | 117.68 | 64.62 | 470 | 5.3 |
| 7. Fluoranthene | 365.55 | 397.63 | 100.0% | -1423.95 | 178.41 | 890 | 37 |
| 8. Pyrene | 951.97 | 755.67 | 100.0% | -439.51 | 70.73 | 740 | 13 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -2193.62 | 146.52 | na | na | na | na | na |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | na | na | na | -1.97 | 2.88 | na | na |

**BFSD 2**
**Paleta Creek Demonstration Summary- PAHs (Part 2)**

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 500 | |
| 10. CHRYSENE | Non-Detect | NA | NA | 23.94 | 22.32 | 830 | |
| 11. BENZO(B)FLUORANTHENE | Non-Detect | NA | NA | -134.30 | 297.91 | 1400 | |
| 12. BENZO(K)FLUORANTHENE | Non-Detect | NA | NA | -9.71 | 36.30 | 470 | |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 790 | |
| 14. INDENO(1,2,3-C,D)PYRENE | -65.35 | 906.77 | NA | NA | NA | 470 | 1.40 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 120 | |
| 16. BENZO(G,H,I)PERYLENE | -46.63 | 263.97 | 67.7% | 20.15 | 65.15 | 400 | 1.40 |

**BFSD 2**
**Paleta Creek Demonstration Summary-PCBs**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 18 - 2,2',5-Trichlorobiphenyl | 52.21 | 103.93 | 4% | 76.82 | 36.49 | 2.6 | ND |
| 28 - 2,4,4'-Trichlorobiphenyl | 41.52 | 80.03 | 61% | -8.05 | 82.03 | 2.2 | 1.1 |
| 52 - 2,2',5,5'-Tetrachlorobiphenyl | 9.44 | 105.28 | 77% | 72.74 | 28.12 | 4.9 | 3 |
| 66 - 2,3',4,4'-Tetrachlorobiphenyl | -19.94 | 62.01 | 96% | 37.74 | 25.45 | 5.3 | ND |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | 45.99 | 84.58 | 17% | 57.59 | 31.49 | 13 | ND |
| 118 - 2,3',4,4',5-Pentachlorobiphenyl | -2.34 | 123.95 | 9% | 2.51 | 15.40 | 13 | ND |
| 153 - 2,2',4,4',5,5'-Hexachlorobiphenyl | 22.26 | 78.55 | 43% | 9.45 | 11.71 | 23 | 0.11 |

## BFSD 2
## Paleta Creek Demonstration Summary-Pesticides

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 2,4'-DDT | 57.49 | 95.75 | NA | NA | 3.6 | 0.88 |
| 4,4'-DDT | 31.23 | 55.47 | NA | NA | 14 | ND |
| Dieldrin | -23.48 | 45.68 | NA | NA | 2 | ND |
| Hexachlorobenzene | 23.76 | 35.20 | NA | NA | 0.61 | ND |
| Mirex | 36.23 | 154.93 | NA | NA | ND | ND |

# Appendix C

**Standard Procedures and Checklists**

**********

## BFSD 2
## ON DECK FINAL CHECKLIST

1. **Establish Laptop communications and verify "Sensor Check/$Br^-$ Injection" program file is loaded.**

2. **Oxygen Tank - Turn Valve ON**

3. **$Br^-$ Injection Valve OPEN (in-line position)**

4. **Sensor Caps - Slide CTD back and REMOVE $O_2$ & pH storage solution caps (reinstall CTD)**

5. **Vacuum Check - Assure bottles #2- #12 have >25 in-Hg**

6. **INSTALL Check Valve plugs in bottles #2 - #12 (hand tight + ½ turn)**

7. **Check each insertion lever movement and light function**

8. **Check Camera FOV – Coverage of Insertion lights, lid closure, collection chamber & $Br^-$ Injection vent bubbles**

9. **Open & latch lid - set rotary latch for ½ turn**

10. Evacuate Bottle #1 to >25 in-Hg and install check valve plug

11. Rig release hasp and proceed to <u>water entry</u>

## <u>BFSD 2</u>
## <u>IN WATER FINAL PROCEDURE/CHECKLIST</u>

1. Lift BFSD, remove wheels and suspend over water

2. Submerge fully, stop and inspect for evidence of leakage

3. Lower to within view of bottom and inspect surface for adequate landing and seal potential

4. Execute bottom landing/chamber insertion by either
   a. slowly descending and assuring insertion light function with minimum loss of visibility, or
   b. rapidly descending and assuring insertion light function with possible impaired visibility.

   <u>IMPORTANT</u> – Surface vessel must be able to hold position (+/- ~50 feet) for next 30 minutes (max). Overboard cables must not be allowed to tighten and disturb BFSD insertion.

5. Run "Sensor Check/$Br^-$ Injection" program and visually verify lid closure followed by vent bubbles ($Br^-$ Injection). Verify commands for CTD, pump and sensor operation by evidence of laptop computer data. After ~10 minutes, upload data, paste into Excel template and establish ambient $O_2$ level and control values.

6. Modify final test program with selected $O_2$ control limits and download to CTD - <u>verify</u> all loops

7. Run final test program and if surface vessel position hold allows, verify operation from laptop data.

8. Important – *First* close Laptop communications interface and *then* disconnect cables

9. Install and tape watertight connectors, bundle cables and cast overboard - clear of BFSD location

10. Record location, weather conditions, etc, and secure for departure

## BFSD 2
## SHORESIDE DEPLOYMENT PREPARATIONS

1. Batteries checked/replaced/refreshed:
   a. Gel cell charged to 24 Vdc @ 25 ma rate
   b. 14 new D-Cells - pump
   c. 6 new 9 Vdc batts - acoustic receiver
   d. 1 new D-Cell - landing lights
   e. CTD checked for 10+ Vdc

2. All components cleaned:
   a. Sample bottles cleaned, assembled and vacuum checked (with slow leakers identified for early positions)
   b. Pneumatic syringe cleaned and loaded w/52 ml $Br^-$ concentrate
   c. Valves/tubing fully rinsed and dried
   d. Chamber cleaned (and "bagged" if req'd)

3. Check loops confirm all subsystems operational

4. Rotary valves in "start" position

5. **Bottles installed and >25 in-Hg applied (any slow leakers in early positions).**

6. **$O_2$ pressure checked and adequate for deployment**

7. **Pneumatic syringe installed**

8. **Acoustic Receiver prepared:**
   **a. Ground plate sanded/buffed clean of deposits**
   **b. Switch in "ON" position**
   **c. Burn wire (with one wire removed) installed**
   **d. Function test performed**

8. **Sensors Calibrated**

9. **Laptop Status**
   a. **Loops designed & checked**
   b. **File structure set up (Operations: Loops Library/Data)**
   c. **Template functions adjusted for calibrations**

**BFSD 2**
**DEPLOYMENT EQUIPMENT LIST**

1. **Cables**
   - **one 75’ primary underwater 3-cable set (Comm, Video, light)**
   - **three Pigtail cables for Laptop comm, TV/VCR, Light**
   - **Underwater connector plugs**

2. **Computer Case**
   - **Laptop computer**
   - **AC Power supply**
   - **Log book**
   - **Check lists, cheat sheets, etc**
   - **Floppy drive w/data discs**
   - **Mouse w/pad**

3. **TV/VCR, controller, VHS Tape(s)**

4. **Video camera power supply**

5. **Tool box**

6. **Extension cord/power strip**

7. **Hand vacuum pump**

**BFSD 2**
**RETRIEVAL/RECOVERY CHECKLIST**

1. **Stand off from deployment location > 100' and transmit coded sonar pulse using EdgeTech deck unit (2 series of pulses). Allow 15 min (max) for buoy to deploy and reach surface.**

2. **Prepare deck hoist equipment and attach to buoy line**

3. **Raise to a visible depth and inspect/clear any fouling.**

4. **Raise above surface, open and secure lid, and washdown over water. Clear cables and haul onboard**

5. **Haul over deck, install pneumatic wheels and lower to deck**

6. **Turn Oxygen tank valve "off"**

7. **Verify system is shut down (ie, pump off). Inspect for damage, leakage and/or other abnormalities**

8. **Inspect and note bottle fill conditions, $Br^-$ syringe injection condition, and measure "scum" line location**

9. **Slide CTD back and install pH and $O_2$ storage caps**

10. **Disconnect "comm" cable plug and upload data to prepared file location. Record copy of data to floppy disc.**

11. **Remove and label sample bottles one at a time, capping inlet port immediately upon removal of teflon fill tube.**

12. **Disconnect cables and plug open connectors. Secure cables.**

13. **Thoroughly wash down with fresh water and flush valves/tubing with fresh/DI water without delay**

## BFSD 2

### Sample Bottle Cleaning and Preparation

1. **Disassembly for cleaning (After sample removed)**
   a. **By hand, unscrew and remove lid from bottle. Avoid gripping and turning filter holder. Set bottle aside.**
   b. **By hand, unscrew filter holder halves. Avoid gripping and turning bottle lid. Using tweezers, remove membrane filter and store in marked Petre dish (if required). Remove orange O-ring and, using blunt object, dislodge and remove black filter support. Set lid/lower filter holder, O-ring and support assembly aside.**
   c. **Using crescent wrench, unscrew and remove plug from top of check valve (if still there), then unscrew and remove spring retainer from top of check valve. Remove spring and valve plunger. Set parts aside.**
   d. **Using crescent wrench, unscrew and remove tubing plug from upper filter holder/tee assembly. Set parts aside.**

2. **Cleaning**
   a. **Rinse all parts in tap water to remove loose material.**
   b. **Rinse all parts thoroughly in deionized water.**
   c. **Soak all parts in 4% RBS solution for 4 hours minimum (24 hours preferred)**
   d. **Rinse all parts in deionized water**
   e. **Soak sample bottles and teflon tubing plugs in 25% nitric acid solution for 4 hours minimum (24 hours preferred)**
   f. **Soak Upper and lower filter holder assemblies, orange O-rings and black filter supports in 10% nitric acid for 4 hrs (24 hours is OK but NOT preferred).**
   g. **Rinse all parts in deionized water followed by thorough rinsing with 18meg-ohm water.**

h. **Set all parts in vented hood and allow to thoroughly air dry (overnight is preferred).**

3. **Assembly and preservation**
   a. **Assemble in the reverse the order of 1. above, with the following additions:**
      - **Apply a very thin layer of silicon grease to the check valve O-ring. Using the attached spring, lower the assembly into the check valve body and fully rotate it several times against the mating seat. Secure the spring with the retainer and tighten with a crescent wrench.**
      - **Snap a black filter support into the lower filter holder/lid assembly. Using tweezers, secure a membrane filter and position it on top of the filter support. Position an orange O-ring on top of the membrane filter and hand tighten the upper filter holder assembly in place. Securely tighten the assembly taking care not to grip and/or rotate the lid.**
      - **Assemble a tube plug and tighten with a crescent wrench.**
      - **Install a teflon gasket into the sample bottle lid (if used) and securely tighten the lid assembly to the sample bottle. Avoid gripping and/or turning the filter holder.**
      - **Using a hand vacuum pump, evacuate the finished assemble to 25 in-Hg and set aside for 4 hours minimum (24 hours is preferred).**
      - **If no leakage occurs, sample bottles may be used. If slight leakage occurs on a few, they may be labled and used early in sample sequence. Leakage may be resolved by further tightening of sample bottle lid. Any leakage resolution requiring disassembly shall include cleaning as above.**

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# Quantifying *In Situ* Metal and Organic Contaminant Mobility in Marine Sediments

# Space and Naval Warfare Systems Center San Diego, CA

# January 1, 2008

## 1. Introduction

### 1.1 Background Information

Contaminants enter shallow coastal waters from many sources, including ships, shoreside facilities, municipal outfalls, spills, and non point-source runoff. Sediments are typically considered a primary sink for these contaminants. Sediments in many bays, harbors and coastal waters used by DoD are contaminated with potentially harmful metal and organic compounds. The DoD is required by the Comprehensive Environmental Resource Conservation and Liability Act, as amended by the Superfund Amendment and Reauthorization Act of 1986 (CERCLA/SARA), to assess and if necessary remove and remediate these sites and discharges in order to protect the public health or welfare of the environment. To determine whether contaminants are moving into, out of, or remaining immobilized within the sediments, a determination of contaminant flux must be made. Variations in sediment chemical and physical properties make it impossible to rely on bulk sediment contaminant concentrations alone to predict contaminant flux, bioavailability, and therefore toxicity. Diagenetic reactions in surface sediments control contaminant pore water gradients, and the direction and magnitude of these gradients control the diffusive flux across the sediment-water interface. These fluxes can be calculated from measurements of contaminant pore water gradients and sediment physical properties. However, in some coastal areas pore water gradients are very steep and therefore difficult to measure. In addition, flux calculations based on pore water gradients only provide the diffusive component of a contaminant flux. An additional concern in coastal areas is that biological irrigation by infauna and wave or current induced flushing may provide a larger component of flux through advection of water through the sediments. To avoid these problems, a direct measurement of contaminant flux in coastal areas is often the best method to assess contaminant mobility across the sediment-water interface. This direct measurement can be made with a flux chamber that isolates a volume of seawater over the sediments to quantify contaminant flux across the sediment-water interface.

An instrument for measurement of contaminant fluxes from marine sediments called the Benthic Flux Sampling Device 2(BFSD2). The instrument is a commercialized version of the original prototype BFSD used during development and is adapted from benthic flux chamber technology developed in oceanography for studying the cycles of major elements and nutrients on the seafloor.

The BFSD2 is an autonomous instrument for *in-situ* measurement of toxicant flux rates from sediments. A flux out of or into the sediment is measured by isolating a volume of water above the sediment, drawing off samples from this volume over time, and analyzing these samples for increase or decrease in toxicant concentration. Increasing concentrations indicate that the toxicant is fluxing out of the sediment. Decreasing concentrations indicate that the toxicant is fluxing into the sediment.

Figure 1 shows the BFSD2, including its pyramid-shaped tubular frame, open-bottomed chamber, and associated sampling and control equipment. At the top of the frame is an acoustically released buoy for BFSD2 recovery. At the bottom of the frame is an open-bottomed chamber and associated sampling gear, flow-through sensors, a data acquisition and control unit, video camera system, power supply, and oxygen supply system.

**Figure 1. Benthic Flux Sampling Device 2.**

The BFSD2 provides a unique means of evaluating the significance of in-place sediment contamination. Knowledge of the degree to which contaminants remobilize is essential in defining the most cost effective remedial action at impacted sites. At present, there is no other viable method for direct quantification of sediments as sources. At sites where it can be demonstrated that remobilization of contaminants is limited, significant cost savings may be achieved through reduction of cleanup costs. This may often be the case because many contaminants are strongly sequestered within the sediment and not likely to leach out. Estimated disposal costs for contaminated sediments

range from $100-$1000/cubic yard. A recent survey of Navy shoreside facilities (NRaD, 1995) indicated that of the 31 facilities that responded, 29 reported the presence of contaminated sediment sites. The actual volume of contaminated sediment at these sites is not well-documented however even conservative estimates suggest that millions of cubic yards of material may exceed typical sediment quality guidelines.

## 1.2 Official DoD Requirement

This project addresses the DoD/Navy requirement for compliance, cleanup assessment, and remediation decisions using innovative technology to directly quantify the mobility and bioavailability of contaminants in marine sediments. Marine sediments serve as a repository for contamination from a wide variety of sources. The environmental risks posed by these contaminants are determined largely by the degree to which they remobilize into the environment.

### 1.2.1 How Requirements were Addressed

The technology demonstrated in this project provides a means of quantifying risks and supports the overall goal of cost-effective, risk-based environmental cleanup. This technology provides a basis for risk-based decision making and potential cost savings by

1. Improving methods for measuring bioavailability for contaminated sediment
2. Minimizing cleanup requirements at sites where contaminants are not remobilizing
3. Evaluating the integrity of natural and remedial sediment caps
4. Providing a direct measure of the time scale of natural attenuation
5. Documenting the actual contaminant contribution of sediments relative to other sources.

## 1.3 Objectives of the Demonstrations

The primary objective of the demonstrations of the BFSD2 was to perform deployments at contaminated sites in San Diego Bay, California and Pearl Harbor, Hawaii under the observation of California EPA certification evaluators. Other observers, including local, state and federal regulators, Remediation Program Managers, academic, industry and other DoD also attended. Each site offered different validation opportunities: San Diego Bay was used to show instrument repeatability and comparison with historical trends and Pearl Harbor was used to show site differences and geochemical trend analysis. Organics demonstrations were performed at the same sites. The specific planned objectives of the demonstrations were to:

(1) evaluate the quality of water samples collected using the BFSD2; specifically for use in determining if a statistically significant flux was occurring at the test locations in comparison to the blank flux results for the BFSD2.

(2) evaluate the BFSD2 for repeatability.

(3) evaluate the logistical and economic resources necessary to operate the BFSD2.

(4) evaluate the range of conditions in which the BFSD2 can be operated.

Other objectives included exposure of various user communities to the technology to encourage continued interest and applications.

### 1.4 Regulatory Issues

There were no regulatory permitting issues associated with deployment of the BFSD2. Collecting sediment samples in a marine environment is considered a nonhazardous activity (although personnel handling samples must follow all safety precautions and limit their exposure to potentially hazardous samples). No hazardous waste was generated during the demonstrations.

The BFSD2 is a sample collection instrument and its prototype was the first of its kind to collect sediment-water interface samples for contaminant flux analysis. Because this technology has no current equivalent, the BFSD2 is evaluated based on the internal quality assurance/quality control (QA/QC) for the laboratory analysis performed and on an analysis and interpretation of the data. Although some clean water standards have been set for seawater, only guidelines currently exist for sediments. And, whereas sample handling, preserving, analyzing and reporting is covered by a number of established methods and regulations, the primary regulatory issue for the BFSD2 involves the integrity of the collected samples to represent ambient conditions. Further, the heterogeneous nature of sediments combined with the complex chemistry of marine aquatic environments requires thoughtful evaluation of all data before arriving at conclusions. The BFSD2 system can routinely produce accurate, precise and repeatable results, however the application of these results to site specific conditions does not lend itself readily to standardized processes. In many cases, BFSD2 results may be used as an additional factor in a "weight of evidence" approach for risk-based decisions involving regulator concurrence.

### 1.5 Previous Testing of the Technology

Initial development program tests included *ex situ* (laboratory) and *in situ* (field) trials of critical components, subsystems, and systems. A number of system development tests were conducted at various locations within San Diego Bay during 1989-91.

Full-scale system trials of the prototype BFSD were conducted in Sinclair Inlet, offshore from Puget Sound Naval Shipyard, Bremerton WA, during June 1991 in support of an ongoing assessment. Ten deployments of the prototype BFSD were conducted to characterize flux rates of contaminants from seven shipyard sites and three reference sites (no blank test was conducted). Collected samples were analyzed for the trace metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). The tests were successful and results generally showed low release rates (or fluxes) compared to other contaminant sources. See general reference 12 for the complete report. Following review of the data, an active oxygen control subsystem with sensor feedback was developed and implemented along with several other changes to improve operation reliability.

During 1993 four systems tests of the upgraded prototype BFSD were conducted at sites within in San Diego Bay: one at Paleta Creek (at its entrance to the bay within Naval Station San Diego); two at a commercial yacht harbor (Shelter Island); and one at a industrial shipping terminal (PACO Industries). The deployments were preceded by a system blank test to determine the lower limits of flux that could be resolved with the prototype BFSD. Several experimental subsystems including a sensor for laser-induced fluorescence (LIF) investigation of polycyclic aromatic hydrocarbon (PAH) contaminants and an electrode for potentiometric stripping analysis (PSA) of trace metal (Cu and Zn) contaminants were also tested. Results from these deployments showed significant flux rates when compared to blank test results and clear differences between the sites as related to potential trace

metal sources. Paleta Creek results showed the highest flux levels for Cd, Cu, Ni and Zn. See reference 5 for the complete report.

Seven more prototype BFSD deployments in San Diego Bay in support of a sediment quality assessment at Naval Station San Diego were conducted during 1995. Paleta Creek was again included along with five other sites near piers and quay walls and one site outside the study area used as a reference. The work, preceded by a blank test, yielded results that were consistent with the previous study and showed Cd, Ni, Zn and Mn all to have positive fluxes. Paleta Creek again showed the highest trace metal fluxes with levels which were generally consistent with those measured two years prior. Correlations between measured trace metal flux levels and complex marine chemistry processes were studied and informative trends were identified. For example in the complex oxidation-reduction (redox) marine environment, it was found that trace metal fluxes are consistent with oxidation of solid metal sulfides as a sediment source. See key reference 7 for the complete report; an extract is included below to illustrate an initial interpretation of the Naval Station San Diego results:

> Some of these trace metal flux relationships may be better illustrated with bar charts showing the trends along a series of transects across the study area. Figures2 and 3 show the trace metal fluxes for the 1995 deployments along with data from the earlier 1993 deployments. The Zn fluxes in Figure 2 are so large that the other trace metal fluxes are barely visible, so the other metal fluxes are replotted in Figure 3 without Zn. This demonstrates that Zn is, by far, the trace metal with the largest flux out of the sediments. The first site displayed in both figures is the blank run, followed by the east-west transects near Pier 4 (Sites 3, 3r, 1r, and 2) and Paleta Creek (Sites 5, 4, and 6), and finally the 1993 data. Zn, Ni, and Cd fluxes in the 1995 data are high in the east (Sites 3 and 5) and decrease toward the west, and in the 1993 data higher in the central bay sites compared to north bay sites. The trends for Cu and Pb fluxes are less clear, with some sites showing fluxes into the sediments. Cu does, however, show the highest fluxes out of the sediments at Sites 3 and 5 where the sediment concentrations of most metals are high.

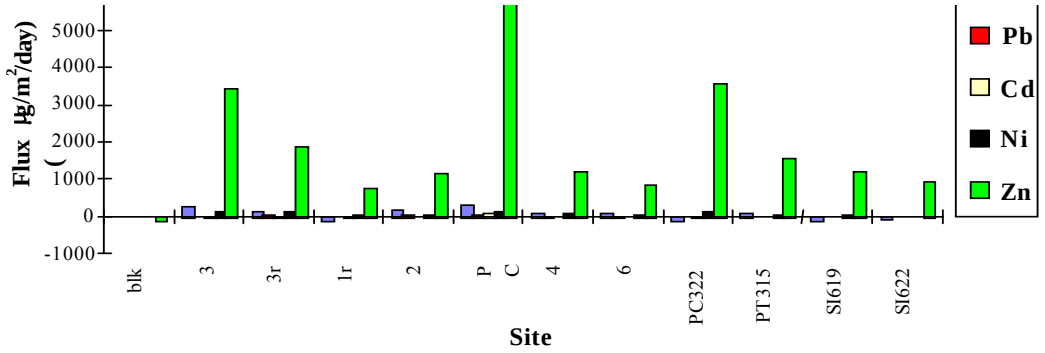



**Figure 2. Plot of Metal Fluxes Along East-west Transects**.

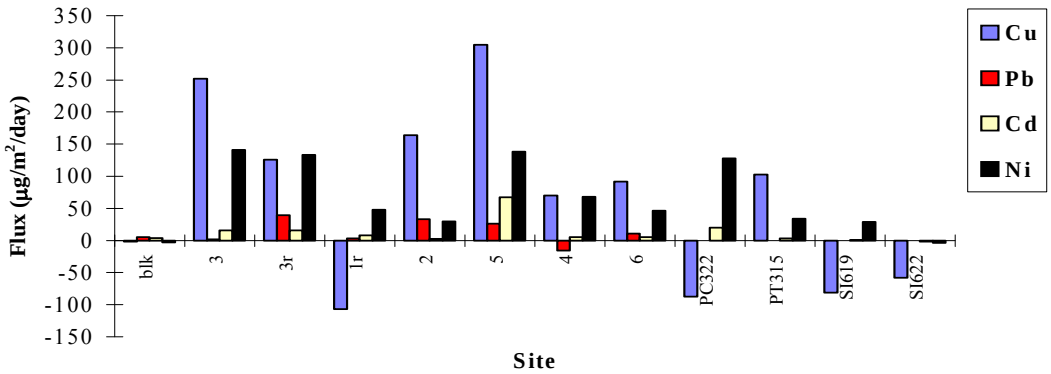



**Figure 3. Plot of Metal Fluxes Along East-west Transects, Excluding Zn.**

Looking at the NAVSTA area sediments out to the west side of the navigation channel, a surface area of approximately 3 million square meters (m2) is present. From the contour map of Zn concentrations in the sediment chemistry chapter, only approximately 500,000 m2 are above the ERM value of 410 ppm. The four Zn flux measurements from sediments with these high Zn levels (Sites 1R, 3, 3R, and 5) average 3100 + 2500 ug/ m2 / day. Sediments in the NAVSTA area with Zn levels below ERM values cover approximately 2.5 million m2 and three flux measurements from sediments with lower Zn levels average 1100 + 200 ug/ m2 / day. The overall flux of zinc directly from the sediments in the NAVSTA area is therefore 1500 + 600 kg Zn/ yr.

Finally, as mentioned above, blank tests of the prototype BFSD were conducted to determine the lowest levels of contaminants which could be resolved with the system. With the prototype BFSD prepared as it would be for a normal deployment, the test was conducted in seawater with the chamber sealed. A time-sequence for sample collection comparable to the planned deployments was used and the samples were analyzed identical to later site-collected samples. For the San Diego Bay tests discussed above the results were:

| Coumpound | flux ± S.E. (µg/m2/day) | |
|---|---|---|
| | 1993 | 1995 |
| Cadmium | 6 ± 7 | 5 ± 3 |
| Copper | -71 ± 62 | -2 ± 47 |
| Iron | -- | 160 ± 235 |
| Lead | -4 ± 8 | 7 ± 67 |
| Manganese | -- | -52 ± 26 |
| Nickle | 65 ± 69 | -4 ± 27 |
| Zinc | -227 ± 65 | -149 ± 267 |

Whereas the prototype BFSD performed successfully and was considered mature enough to begin technology transfer, the process of data analysis and interpretation revealed complexities requiring careful consideration prior to reaching conclusions. Technology transfer, to be fully discussed in section 8, began with a competitively awarded firm-fixed-priced contract for Benthic Flux Sampling Device 2 (BFSD2), which incorporated a number of changes from the prototype BFSD. A series of

*ex situ* and *in situ* tests and tests and checkouts assured that the instrument retained critical prototype BFSD performance attributes as well as establishing functionality of the changed features. A complete series of laboratory (e*x situ*) tests and checkouts were conducted. *Ex situ* tests included: the new rotary valve sampling system to assure reliable performance; the pump and diffuser system with dye-dispersion to assure adequate mixing; the flow-through sensor system to assure responsive and accurate readings; the vacuum-filled, *in situ*-filtered sample bottles to assure clog-free operation and adequate fill volume; and the data acquisition and control system to assure required performance.

# 2. Technology Description

## 2.1 Description

Contaminants enter shallow coastal waters from many sources, including ships, shoreside facilities, municipal outfalls, spills, and non point-source runoff. Sediments are typically considered a primary sink for these contaminants. Where previous shoreside practices have resulted in high concentrations of contaminants in the sediments, contaminants may flux out of the sediments. Also, in areas where pollution prevention and remediation practices have removed other contaminant sources, remaining contaminated sediments may serve as a primary contaminant source to the water column.

To determine whether contaminants are moving into, out of, or remaining immobilized within the sediments, a determination of contaminant flux must be made. Diagenetic reactions in surface sediments control contaminant pore water gradients, and the direction and magnitude of these gradients control the diffusive flux across the sediment-water interface. These fluxes can be calculated from measurements of contaminant pore water gradients and sediment physical properties. However, in some coastal areas pore water gradients are very steep and therefore difficult to measure. In addition, flux calculations based on pore water gradients provide only the diffusive component of a contaminant flux. An additional concern in coastal areas is that biological irrigation by infauna and wave or current induced flushing may provide a larger component of flux through advection of water through the sediments. To avoid these problems, a direct measurement of contaminant flux in coastal areas is required to assess contaminant mobility across the sediment-water interface. This direct measurement can be made with a flux chamber that isolates a volume of seawater over the sediments to quantify contaminant flux across the sediment-water interface.

The Navy-designed and developed, contractor-fabricated Benthic Flux Sampling Device 2 (BFSD2) is a flux chamber designed specifically for *in situ* measurement of contaminant fluxes in coastal areas. A chamber of known volume encloses a known surface area of sediment. Seawater samples are collected periodically at timed intervals. After a laboratory has analyzed the samples, and with knowledge of the time intervals between samples, a flux rate between the sediment and water in mass per surface area per unit time (micrograms per square meter per day [$\mu g/m^2/day$]) can be calculated.

The BFSD2, shown in Figure 4 with key components labeled, consists of an open-bottomed chamber mounted in a modified pyramid-shaped tubular framework with associated sampling gear, sensors, control system, power supply, and deployment and retrieval equipment. The entire device is approximately 1.2 by 1.2 meters from leg to leg and weighs approximately 175 pounds. The lower part of the framework contains the chamber, sampling valves, sampling bottles, and batteries. The upper frame includes a release that is acoustically burn-wire triggered. The BFSD2 is designed for use in coastal and inland waters to maximum depths of 50 meters. Maximum deployment time is approximately 4 days based on available battery capacity. Figures 5 and 6 illustrate the two basic configurations for landing and sampling events, respectively.

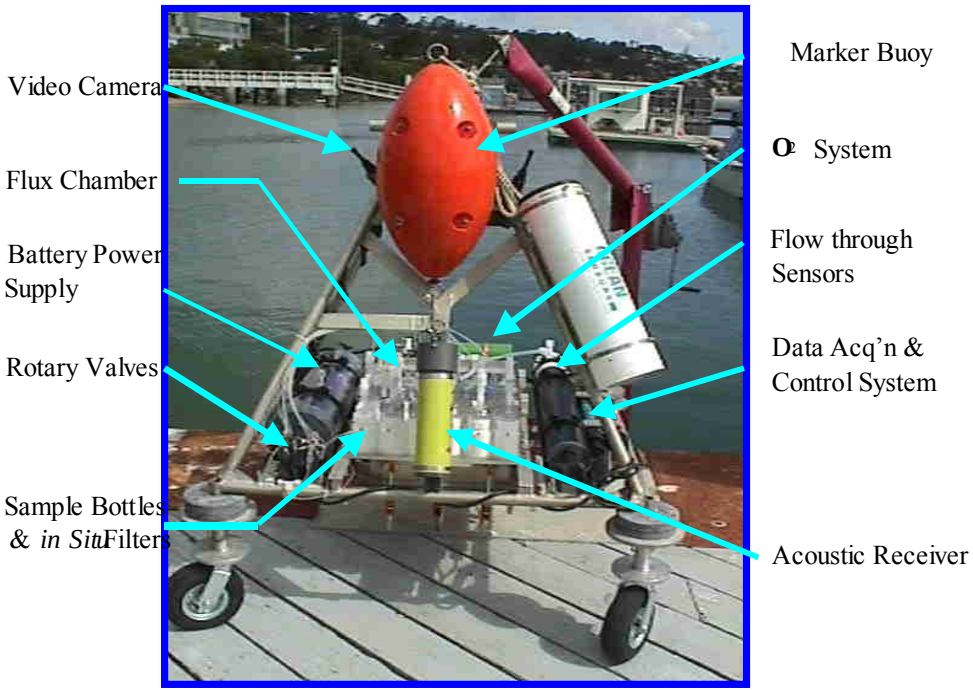
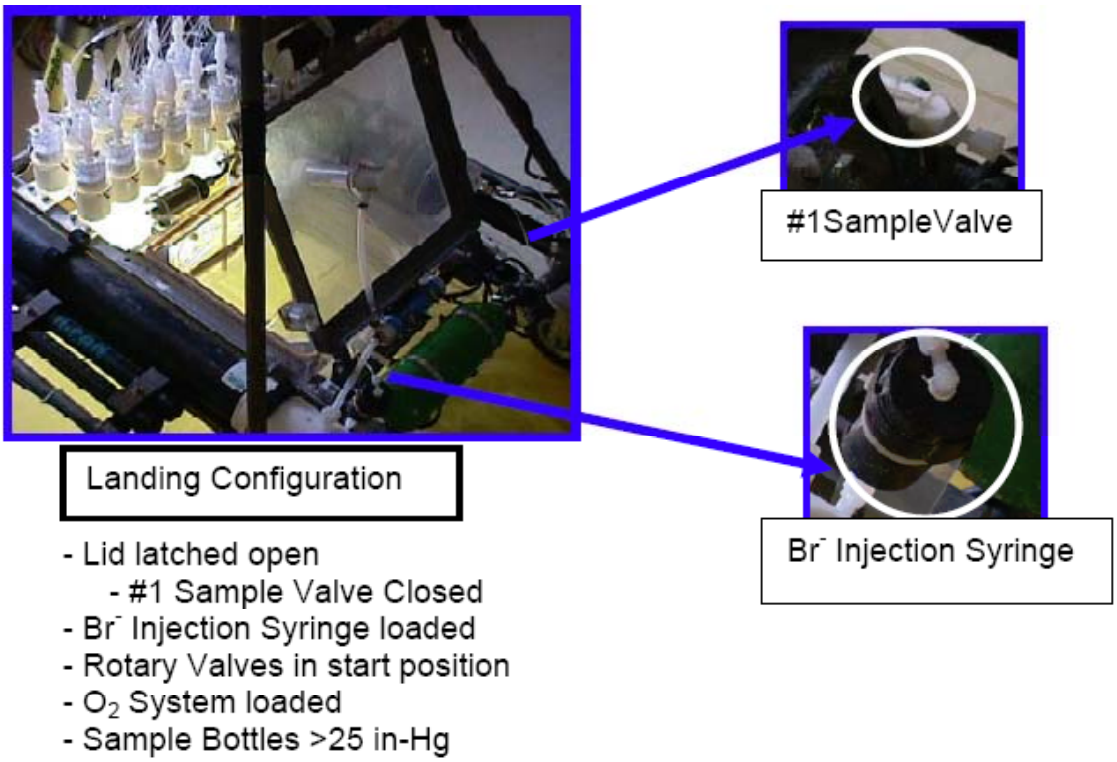



**Figure 4. Benthic Flux Sampling Device 2.**

**Figure 5. BFSD2 Sampling Events.**



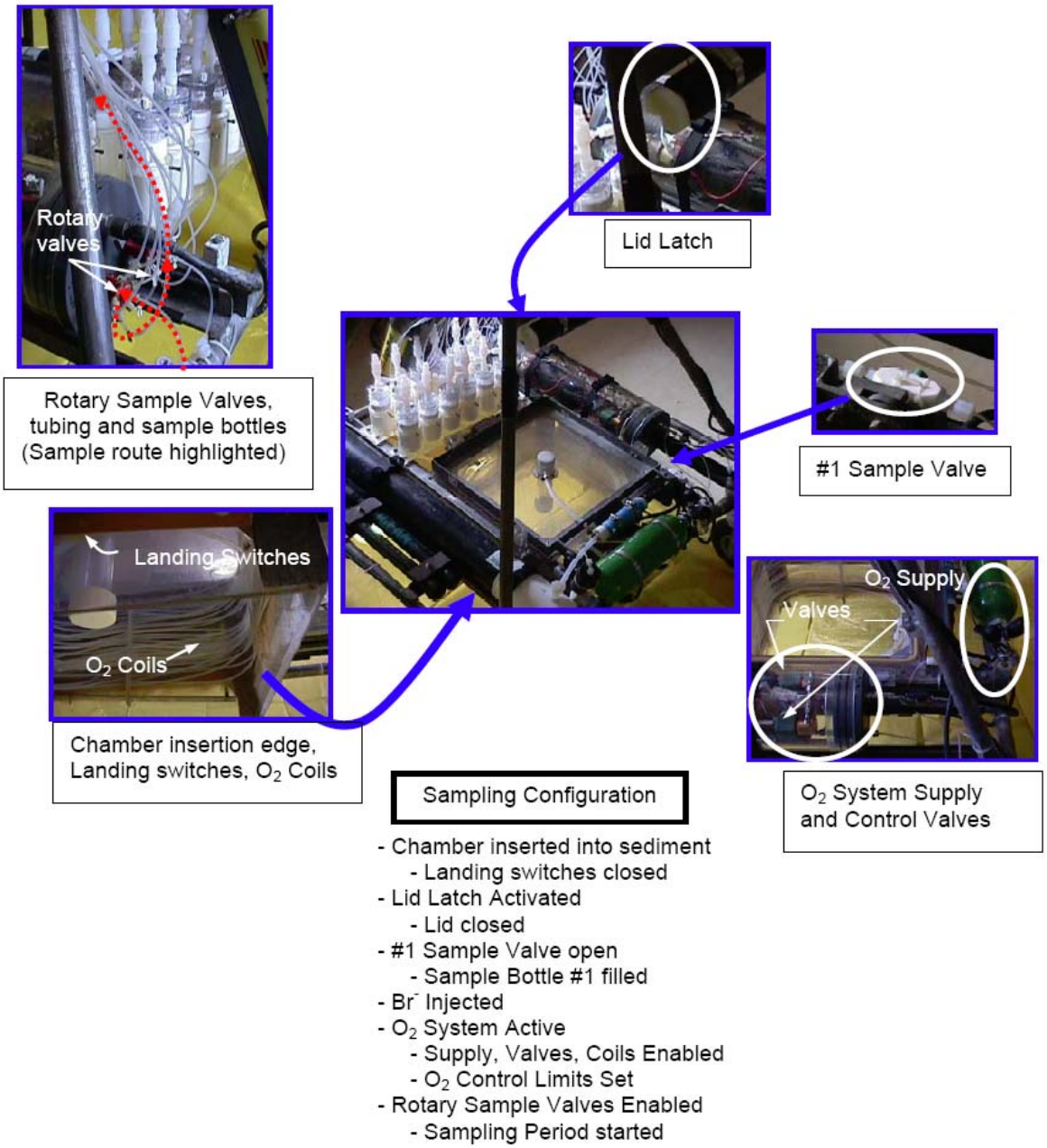



**Figure 6. BFSD2 Sampling Events.**

### 2.1.1 Sampling Chamber

The chamber is a bottomless box, approximately 40 centimeters (cm) square by 18 cm tall, with a volume of approximately 30.0 liters (Figure 7). The volume was chosen to allow for a maximum overall dilution of less than 10 percent due to sampling withdrawal into 11 samples of 250 milliliters (ml) each. For the combined demo, 11 combined samples were collected from within the chamber (100 mls for metals and 250 mls for PAH's) increasing the sample volume to 350 mls per sampling

event. This increased the dilution to about 13% for the combined sampling. The chamber is constructed of clear polycarbonate to avoid disrupting any exchanges that may be biologically driven and, thus, light sensitive. To prevent stagnation in the corners of the chamber, triangular blocks of polycarbonate occupy the 90-degree angles. The top of the chamber is hinged at one edge so that it may be left open during deployment to minimize sediment disturbance. Once the chamber is in place, the computer control system closes the lid. A gasket around the perimeter of the chamber ensures a positive seal between the chamber and the lid. Exact alignment is not required, because the lid is slightly larger than the sealing perimeter of the gasket and pivots on two sets of hinges. The lid is held closed by four permanent magnets situated along the chamber perimeter. The bottom of the chamber forms a knife-edge. Pressure-compensated switches mounted on the bottom surface of three sides of a flange circling the chamber at 7.6 cm above the base activate a series of three lights visible with a video camera mounted on the upper frame. Illumination of the lights indicate a uniform minimum sediment penetration depth has been achieved and a good probability that a positive seal between the chamber and the sediment has been achieved.

**Figure 7. Chamber Enclosure.**

Samples are drawn off through a 4-mm Teflon tube via synchronized parallel rotary valves and into evacuated 250 ml Teflon sampling bottles. For organics applications, standard precleaned 250 ml amber glass sample bottles with pre-combusted glass-fiber filter assemblies are used (Figure 8). For the combined demo, 100 ml Teflon bottles were used for metals and 250 ml amber glass bottles were used for PAH's.

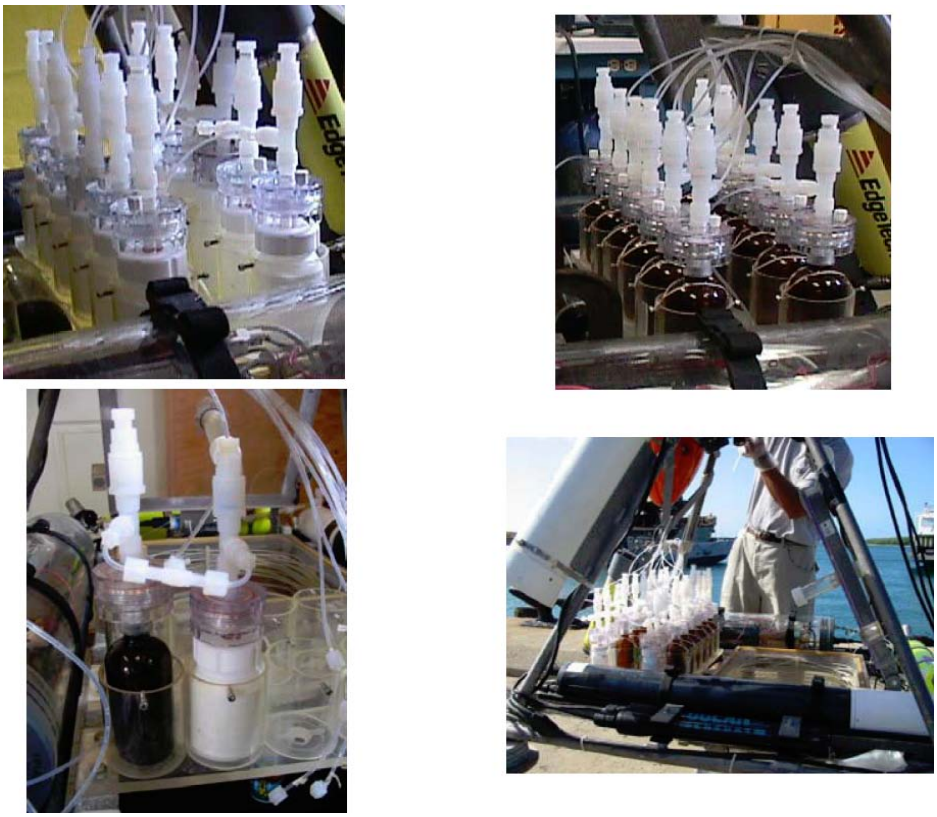


**Figure 8. Sample Bottles. Clockwise from Upper Left, metals Bottles; Organics Bottles; Combined Metals and Organics Configuration; and Paired Bottles for Combined Deployment.**

The first sample is drawn through a 0.45 micron-filter into the sample bottle upon closure of the lid at the start of the autonomous operation of the BFSD2; the remaining 11 samples are similarly collected as the synchronized parallel rotary valves are activated at preprogrammed intervals throughout the deployment. The bottles are evacuated to a minimum of 25 inches of mercury before deployment.

### 2.1.2 Acquisition and Control Subsystem

The acquisition and control unit is an Ocean Sensors Model OS200 conductivity temperature depth (CTD) instrument, modified to allow control of the BFSD2. It consists of a data logger that acquires and stores data from sensors, and a control unit that regulates sampling and other functions of the BFSD2. The data logger collects data from a suite of sensors housed in the CTD and connected to the chamber through a flow-through loop. A small constant-volume pump maintains circulation in the flow-through system to the sensors and is also used to maintain homogeneity of the contents of the chamber utilizing a helical diffuser mounted vertically on the central axis of the box. The control unit closes the lid, activates the flow-through/mixing pump, activates dissolved oxygen control valves, and controls activation the synchronized parallel rotary sampling valves. Commercial sensors, installed by Ocean Sensors, Inc., are mounted in the CTD instrument housing, and are connected to the chamber by means of a flow-through pump and circulation plumbing. Sensors are used for monitoring conditions within the chamber, including conductivity, temperature, pressure, salinity, pH, and dissolved oxygen, Figure 9. Circulation in the flow-through sensor system is maintained using a constant flow rate pump adjusted to approximately 15 milliliters per second (ml/sec).

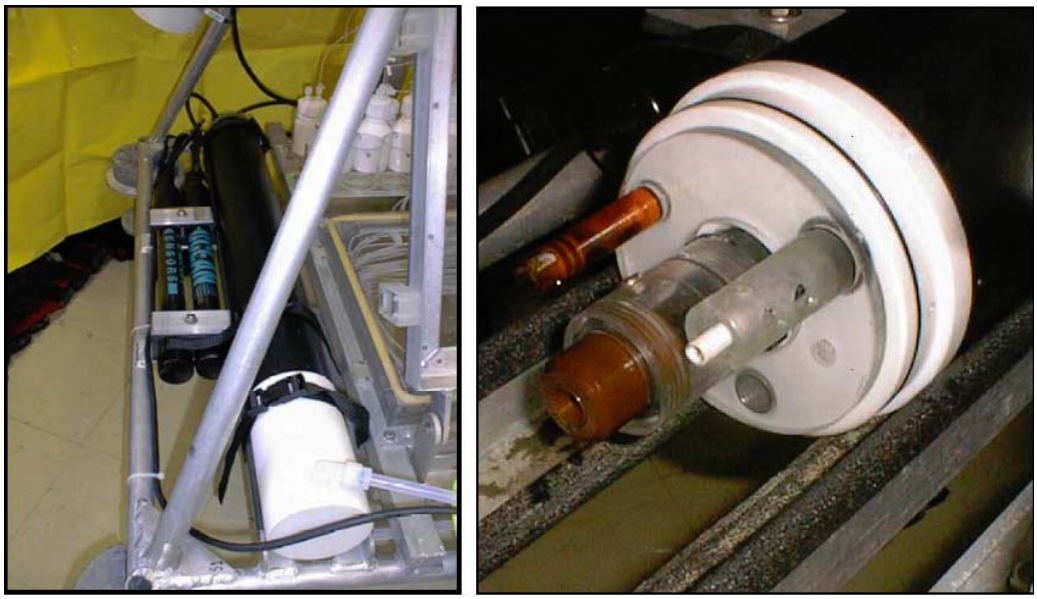


**Figure 9. Flow-Through Sensor System.**

### 2.1.3 Sampling Subsystem

Discrete samples are obtained using a vacuum collection approach consisting of sample containers, fill lines, in-line filters (with 0.45 micron membrane filters for metals or with 1.0 micron pre-combusted glass-fiber filters for organics), check valves, and synchronized parallel rotary valves connected to the chamber fill line. Off-the-shelf 250ml Teflon (metals) or amber-glass (organics) collection bottles are modified to allow filling through the cap. Sampling containers of any volume, material, or shape may be used, provided the cap can be modified to accept the fill line connection, the bottle wa lls are strong enough to withstand the pressure at the sampling depth, and the cap sea l is airtight and watertight at the sampling depth pressure. Glass, Teflon, and polycarbonate bottles have been tested and used successfully with the prototype BFSD. All valves, fittings, and tubes are made of Teflon or other nonmetallic materials to minimize potential metal contamination of samples and to facilitate cleaning. Samples are drawn from the chamber through a 4-mm Teflon tube connected to the rotary valves and into the sampling bottles. Sampling is initiated by the control system when it activates the valves at preprogrammed intervals. Seawater samples are drawn through the sampling system by a vacuum of 25 inches of mercury (minimum) which is applied to all sample bottles through check valves mounted in the bottle lids. The check valves are then sealed, and water enters each sample bottle when the rotary valves are activated (number 2 through 12) or when the lid closes and opens a valve attached to its hinge (number 1). Filtered seawater flows into each bottle until pressure is equalized, normally yielding at least 240ml.

### 2.1.4 Circulation Subsystem

The BFSD2 has a mixing area called the collection chamber and the process of interest is the exchange of chemical contaminants at the sediment-water interface sequestered within the chamber. The hydrodynamics inside the chamber must adequately simulate movement of water from near-bottom currents outside the chamber. For this purpose, a helical diffuser mounted vertically on the central axis of the chamber is used to mix the enclosed volume. Tests recorded on video verified that the helical diffuser provided a uniform, gentle mixing action that effectively dispersed dye injected into the chamber without disturbing the sediment layer on the chamber bottom.

The diffuser system includes a standard constant-volume submersible pump. The pump circulates water from an outlet in the chamber wall, into the sensor chamber and over the flow-through sensors, and back into the chamber via a rigid polycarbonate tube. The vertically mounted tube is capped at the discharge end and has 5mm holes drilled in a helix pattern along its length. The tests verified that this method visually dispersed a dye injection of Rhodamine in less than 120 seconds.

The acquisition and control unit, the oxygen supply bottle, a video camera and lighting system, circulation pumps, and the retrieval line canister are mounted on the frame members. The oxygen system is used to maintain aerobic conditions within the chamber by diffusing oxygen at a rate sufficient to maintain the initial dissolved oxygen levels through a coil of thin-walled, oxygen-permeable Teflon tubing.

### 2.1.5 Oxygen Control Subsystem

Over the course of an experiment, conditions in the isolated volume of seawater within the flux chamber begin to change from the initial conditions observed in the bottom water. Oxygen content is one factor that changes rapidly because isolated volumes of seawater in contact with the sediment surface will become anoxic without any resupply of oxygen. Since the fluxes of many contaminants, especially metals, are sensitive to redox conditions, the oxygen content is one of the most important factors that must b e monitored and regulated within the flux chamber. Most contaminant fluxes are not large enough to be measured in chambers without oxygen regulation because the isolated volume of seawater will become anoxic before significant contaminant fluxes have occurred. Because of this, an oxygen control system has been built into the BFSD2. This system maintains the oxygen levels in the chamber within a user-selected window about the measured bottom water oxygen level.

The oxygen regulating system consists of a supply tank, pressure regulator, control valves, diffusion coil, oxygen sensor, and control hardware and software. The supply tank is a 13-cubic foot aluminum diving tank equipped with a first-stage regulator that allows adjustment of output pressure to the system. The control valves are housed within a watertight pressure case with connections through bulkhead fittings on the end cap. The diffusion coil is thin-walled, 4-mm, oxygen-permeable, Teflon tubing approximately 15 meters (m) long. Oxygen is monitored using the oxygen sensor in the flow-through system described previously. The oxygen control valves (pressurize or vent) activation is incorporated into the control system of the BFSD2.

During a typical deployment, when the flux chamber is initially submerged, the ambient oxygen level in the water is measured with a control program which activates the circulation subsystem and sensors until a stable value of ambient oxygen concentration is obtained. This is performed with the BFSD2 either on the bottom or suspended less than 1 meter above the sediment (with the lid open). When oxygen stability is obtained, the user then establishes a maximum and a minimum oxygen control level, based on a userspecified range around the stable ambient level. Figure 10 is a typical set of data obtained from 15 minutes of operation. The control limits are entered into the operational control program and downloaded to the BFSD2 acquisition and control subsystem. When autonomous operations are started and the chamber is closed and sealed, the oxygen level inside the chamber is monitored by the control program. If the level drops below the allowable minimum, a control valve is momentarily opened, the diffusion coil is pressurized, and the oxygen level in the chamber begins to increase. When the oxygen level reaches the maximum allowable level, another control valve is activated and the pressurized tubing is vented. This sequence is repeated continuously during deployment, maintaining the oxygen level in the chamber near the ambient level. Figure 11 is a typical set of data obtained from a 72-hour deployment. Note that dissolved oxygen concentrations are reported in ml/l in this report. Dissolved oxygen concentrations in seawater can

be expressed in millimolar, uMoles/kg, mg-atoms/liter, mg/liter, ml/liter or percent saturation. Conversion from mg/l to ml/l is a linear computation (mg/l x 1.4276 = ml/l). It is true Standard Methods suggests re porting in mg/l, however different reporting units are found in the literature. We have historically used oxygen sensors obtained through Seabird Electronics, and their calibration procedures and software all use ml/l for dissolved oxygen concentrations.

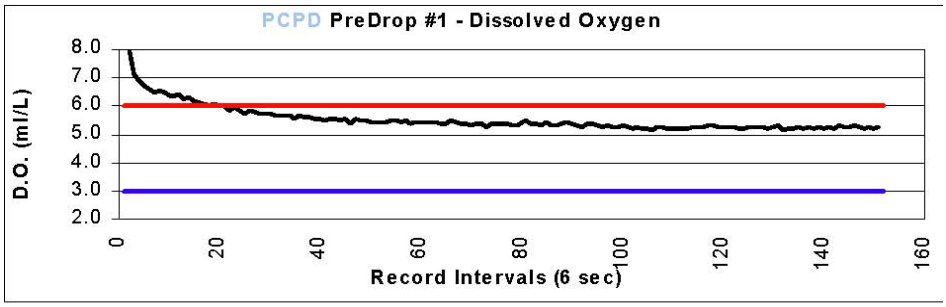



**Figure 10. Ambient Oxygen Data.**

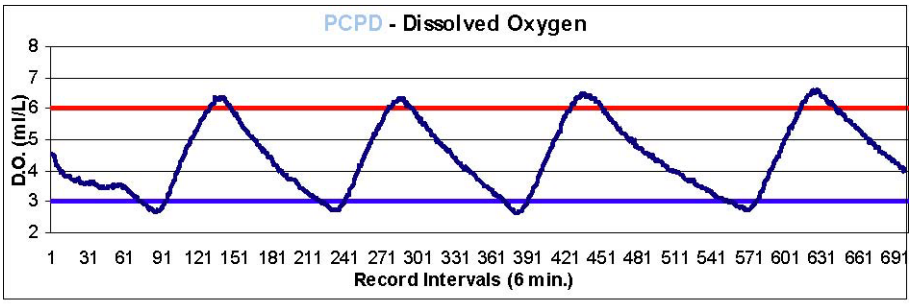



**Figure 11. Operational Oxygen Control Data.**

### 2.1.6 Deployment and Retrieval Subsystems

During deployment the test site is surveyed for obstacles with a light-aided video camera mounted on the upper frame of the BFSD2 using a on deck television monitor. As shown in Figure 12, a deployment cable and release line are used to lower the BFSD to its intended depth for the video inspection. Following either rapid or slow descent to the bottom, the minimum depth of collection chamber insertion is sensed by pressure-compensated switches, which activate lights mounted on the chamber frame. These lights are TV-monitored on deck.

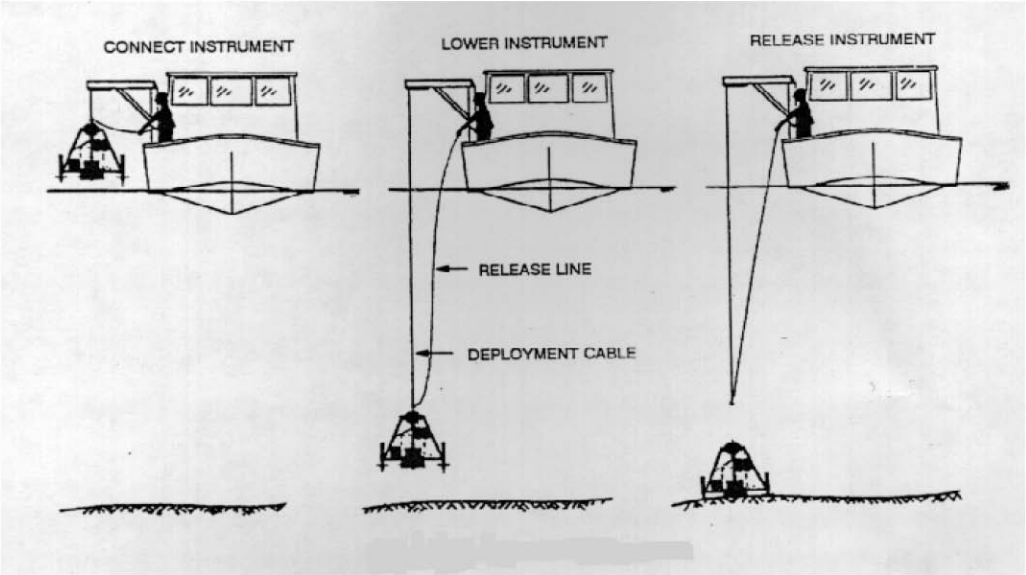



**Figure 12. BFSD Deployment.**

Recovery is accomplished by transmitting a coded acoustic signal to the frame-mounted receiver which in turn releases the marker buoy, Figure 13. As shown in Figure 14, the line attached to the buoy is used to lift the BFSD2 aboard the vessel. Stored sensor data is uploaded before the detaching cables.

**Figure 13. Acoustic Release and Retrieval Buoy.**

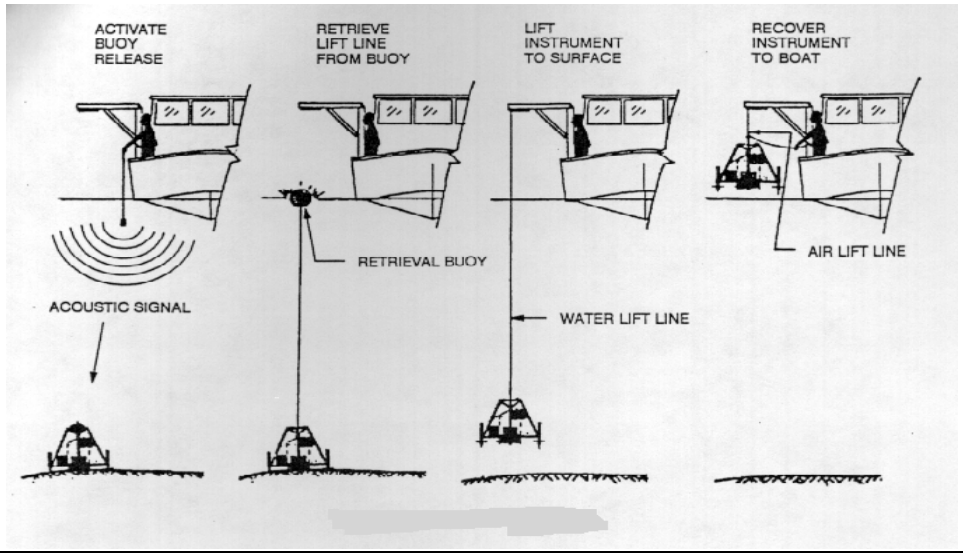



**Figure 14. BFSD Retrieval.**

### 2.1.7 Analytical Methods

#### 2.1.7.1 Cleaning

Prior to each deployment, the BFSD2 sample collection system is cleaned and decontaminated. A sequential process of flowing cleaning fluids through the sampling subsystem using vacuum; of soaking disassembled parts (collection bottles and other parts) in prepared solutions; of physically brushing and rinsing the collection and sensor chambers and the circulation subsystem with prepared solutions is followed. For metals, a nitric acid soak/rinse is used before a final rinse with 18 meg-ohm de-ionized water and for organics a methanol rinse with air dry is used prior to sealing/closing off all paths of contamination until deployment.

#### 2.1.7.2 Performance Indicators

A series of performance indicators are used to evaluate the data obtained during operational deployments. One performance indicator is the chemistry time-series data for silica. Silica, a common nutrient used in constructing the hard parts of some planktonic organisms, typically shows a continuous flux out of the sediments due to degradation processes. The linear increase in silica concentration with time in the collected sample bottles is therefore used as an internal check for problems such as a poor chamber seal at the lid or sediment surface. A field analytical test set (Hach Model DR2010) is used to assess the silica concentrations immediately following retrieval and before sending collected samples to the analytical laboratory. Figure 15 is an example of silica flux indicating an adequate chamber seal with the sediment. Also, with a good chamber seal the ongoing bacterial degradation of organic material in the sediment consumes oxygen (which must be regulated by the BFSD2) and also generates carbon dioxide. This gradually lowers the chamber pH and Figure 16 is an example of this data for a good chamber seal with the sediment.

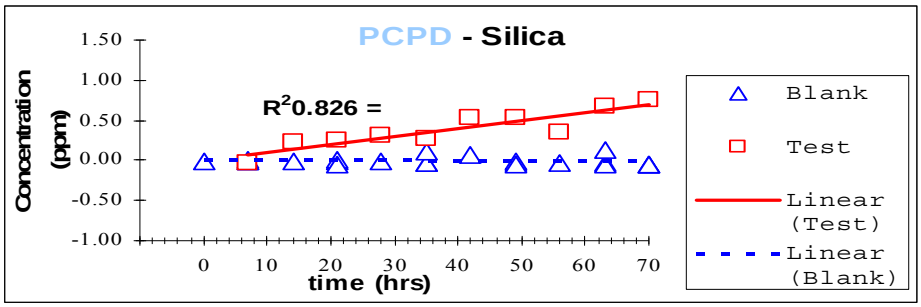



**Figure 15. Silica Flux for Good Chamber Seal.**

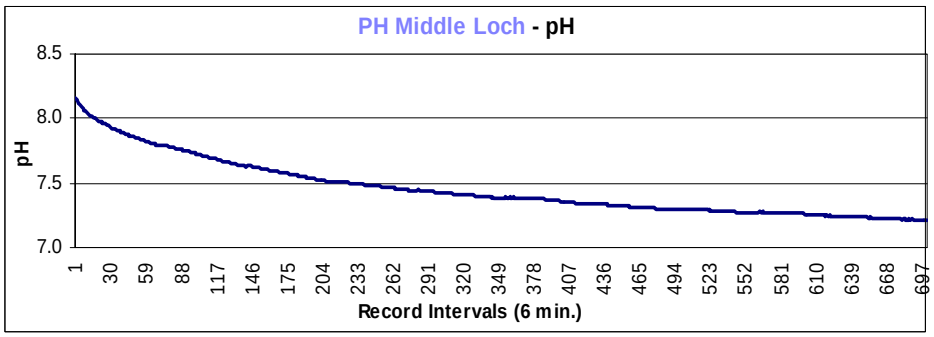



**Figure 16. pH Data for Good Chamber Seal.**

Although the expected relationships of these performance indictors aid in determining normal or successful deployments, natural variability is always present to cloud these relationships. Variations in the pore water reactions at the various sites lead to differences in the observed fluxes of oxygen, silica, and also the other contaminants. One major factor contributing to the large variations in fluxes may be burrowing activity. Enhanced biological irrigation (pumping of the overlying seawater through sediment burrows by infaunal organisms) increases the surface area of the sediment-water interface and flow rates across the interface, and may also increase the observed fluxes. The organisms responsible for this biological pumping will also affect oxygen uptake rates and may add to the complex interpretation of the analytical results.

#### 2.1.7.3 Blank Tests

Prior to the BFSD2 demonstrations, a triplicate blank test was performed to determine the lower limit of resolution for flux determinations of various metals. A polycarbonate panel was sealed across the bottom of the chamber and the BFSD2 was lowered to within several meters of the sediment surface. A standard operational program identical to the demonstration deployments was run for 70 hours. The results will be presented later in this report.

#### 2.1.7.4 Computations

Fluxes are computed from the trace metal concentrations in each sample bottle using a linear regression of concentration versus time after the concentrations are corrected for dilution effects. These dilution effects result from intake of bottom water from outside the chamber to replace the water removed for each collected sample. The corrected concentrations are obtained from the following equation:

$$[C_n] = [s_n] + \frac{v}{V}\left(\left(\sum_{i=1}^{n-1}[s_i]\right) - (n-1)[s_0]\right)$$

Where **[*C*]** is the corrected concentration, **[*s*]** is the measured sample concentration, ***n*** is the sample number (1 through 6), ***v*** is the sample volume, and ***V*** is the chamber volume. Fluxes are then calculated as follows:

$$Flux = \frac{mV}{A}$$

Where ***m*** is the slope of the regression of concentration versus time, ***V*** is the chamber volume, and ***A*** is the chamber area.

An interactive computational spreadsheet processes most data. Analytical laboratory results, sensor and other measured data, performance indicator results and blank test results are entered into the spreadsheet template and processed. A series of tables, charts and graphs are computed and displayed, including statistical confidence and other figures of merit. Appendix C provides a set of spreadsheet products for each demonstration.

## 2.2 Strengths, Advantages and Weaknesses

### 2.2.1 Strengths

The BFSD2 is an *in situ* technology. Benthic contaminant fluxes can provide a unique *in situ* measure of contaminated sediments as well as an indication of bioavailability. Many of the disadvantages cited for various approaches towards assessing sediment contamination relate to removal of the contaminated material to the laboratory for chemical and biological assays. In concert with traditional monitoring and assessment techniques, these flux measurements can lead to a better understanding of marine sediment contamination and transport mechanisms.

### 2.2.2 Advantages

The BFSD2 is an easily implemented technology, as it is readily deployed from a small boat, and all sampling, data logging, and control functions are carried out automatically based on preprogrammed parameters. The BFSD2 can be used to collect samples without diver assistance to minimize costs, time necessary for sampling, and safety issues associated with sampling activities. Furthermore, the system is able to collect a wide range of contaminants, nutrients, and dissolved gases and it is operational under a wide range of environmental conditions. All materials used in the system are suitable for use and prolonged exposure in the marine environment.

Results obtained using the BFSD2 can be used for the following purposes:

- Source quantification for comparison to other sources and input to models
- Indication of bioavailability since many studies indicate that resolubilized contaminants are more readily available for uptake
- Determination of the cleansing rate of a contaminated sediment site due to natural biogeochemical cycling of the in-place contaminants
- Provision of a nonintrusive monitoring tool for sites that have been capped or sealed to minimize biological exposure

- Testing and validation of hypotheses and models for predicting the response of marine sediments to various contaminants.

### 2.2.3 Weaknesses

One limitation is a lower limit on the flux rates that can be calculated from data collected using the BFSD2 system. Also, the BFSD2 may be deployed to a maximum depth of 50 meters and the maximum deployment is approximately 4 days, based on available battery capacity. The BFSD is stable in bottom currents up to 3 knots.

## 2.3 Factors Influencing Cost and Performance

### 2.3.1 Cost influences

The factors influencing cost include, in order:

1. Analytical laboratory costs: laboratory analysis of samples by highly specialized analytical laboratories accounts for approximately 50% of total BFSD2 project costs.

2. Blank tests: the larger the number of sites within a common bay, harbor or other defined location the smaller the proportional cost per site for blank tests. It may be possible to eliminate blank testing in some cases, but a cost approaching 50% could occur for only one deployment.

3. Remote location: Acquisition of local resources such as a surface vessel configured with a davit or A-frame and equipment shipping costs most influence total project costs. Transportation, per diem, materials and supplies are equivalent for all sites other than local. Labor costs are the same.

4. Work schedule: Limited site access or availability can influence cost. Without such restraints a work schedule taking advantage of *in situ* BFSD2 deployment periods over weekends and/or to accomplish cleaning, sample handling, and other turnaround preparations can be instituted. Extended work hours can be compensated with offsetting periods of inactivity.

### 2.3.2 Performance Influences

The factors influencing performance include:

1. Sediment physical conditions: The BFSD2 requires a collection chamber seal with the sediment to function properly. The primary cause for lack, or loss of seal is porosity of the sediment due to large grain size and distribution. An entire deployment can be lost under extreme conditions, however the use of performance indicators can avoid analytical laboratory costs by identifying such cases immediately after retrieval.

2. Sediment contamination levels: The lower limit for resolving significant flux levels is based on blank test results. Sites having contaminated sediment levels lower than blank test results cannot be resolved with a high degree of confidence. Such results are reported as statistical probabilities with confidence limits and are typically well below water quality limits and do not lead to cleanup issues.

3. Site marine conditions: As with 1. above (sediment-chamber seal), the BFSD2 also must also maintain a good chamber-lid seal. Surface vessel turbulence and/or prop wash, tidal and/or local currents, or even large fish disturbances can jar the magnetically held lid. A momentary loss of the lid seal can allow ambient seawater to enter the chamber and refresh sequestered sample water. Although such an event will be detected by the previously discussed performance indicators, some or all of the deployment can be negated by loss of lid seal.

# 3. Site/Facility Description

## 3.1 Background

Two locations were selected for BFSD2 demonstrations. The first was San Diego Bay, California (Paleta Creek area); and the second was Pearl Harbor, Hawaii (Middle Loch and Bishop Point). The locations/sites were selected based on the following criteria:

1. (metals) The sites were known to have metal-contaminated marine sediments, and had been at least partially characterized. The sediment contaminant levels were anticipated to be high enough to demonstrate statistically significant fluxes at the sediment-water interface.

2. (metals) Two deployments at the same San Diego Bay, Paleta Creek site would demonstrate repeatability; two deployments at geographically different Pearl Harbor sites would demonstrate characteristically different data and showcase analysis/interpretation results.

3. (metals) The contaminated sediments were located in shallow areas (less than 50 meters deep) and readily accessible.

4. (metals) Demonstration logistical support requirements would be demonstrated by deployments in Pearl Harbor.

5. (metals) Data from prototype BFSD deployments conducted at the Paleta Creek site were available for use as reference data and for comparison with demonstration results (See section 1.5).

6. (organics) Both sites were known to also have organics-contaminated sediments and other demonstration factors were already achieved.

## 3.2 Site/Facility Characteristics

### 3.2.1 San Diego Bay, California

With no major inputs of fresh water, the currents and residence time of water in San Diego Bay are tidally driven. The average depth of the bay is about 5 meters. The tidal range from mean lower-low water to mean higher-high water is about 1.7 meters. The maximum tidal velocity is about 0.05 to 0.1 meters per second. Sediment pore waters in San Diego Bay typically become anoxic several millimeters below the sediment surface. Dissolved oxygen concentrations range from 4 to 8 milliliters per liter; sea water pH varies from 7.9 to 8.1; and temperatures range from 14 to 25°C.

The sediments of San Diego Bay consist primarily of gray, brown, or black mud, silt, gravel, and sand. The sources of contamination in San Diego Bay have varied over time and include sewage, industrial wastes (commercial and military), ship discharges, urban runoff, and accidental spills. Current sources of pollution to San Diego Bay include underground dewatering, industries in the bay area, marinas and anchorages, Navy installations, underwater hull cleaning and vessel antifouling paints, and urban runoff. Known contaminants in the bay include arsenic, copper, chromium, lead,

cadmium, selenium, mercury, tin, manganese, silver, zinc, tributyltin, polynuclear aromatic hydrocarbons (PAH), petroleum hydrocarbons, polychlorinated biphenyls (PCB), chlordane, dieldrin, and DDT.

The Paleta Creek site, Figure 17, is located in San Diego Bay in San Diego County, California, adjacent to Naval Station San Diego. The Paleta Creek site is located on the western shore near Naval Station San Diego where Paleta Creek empties into the bay, slightly inland from the Navy Pier 8 and Mole Pier and north of Seventh Street. Naval Station San Diego began operations in 1919 as a docking/fleet repair base for the U.S. Shipping Board. In 1921, the Navy acquired the land for use as the San Diego Repair Base. From 1921 to the early 1940s, the station expanded as a result of land acquisitions and facilities development programs.

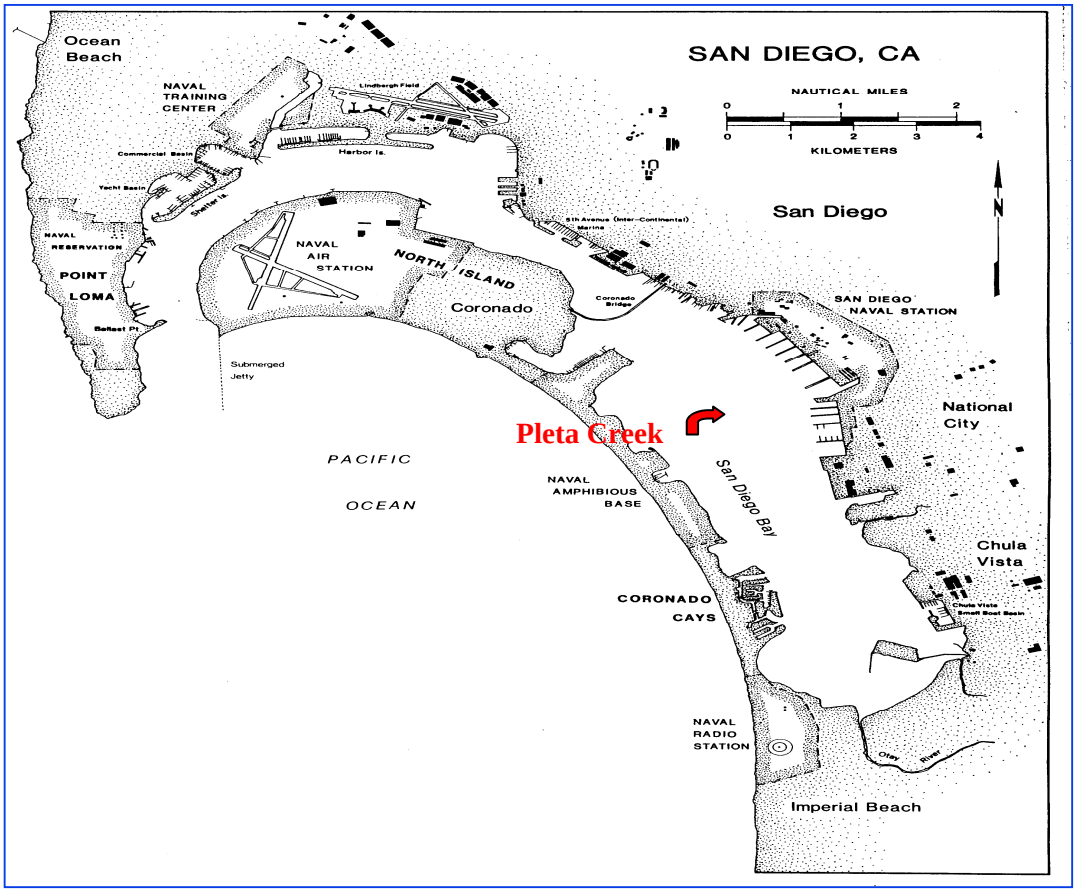



**Figure 17. San Diego Bay, Paleta Creek Site.**

### 3.2.2 Pearl Harbor, Hawaii

Pearl Harbor contains 21 square kilometers of surface water area; the mean depth is 9.1 meters. Tidal flow and circulation are weak and variable, with a mean tidal current velocity of 0.15 meter per second and a maximum ebb flow of 0.3 meters per second in the entrance channel. Salinity in Pearl Harbor ranges from 10 to 37.5 parts per thousand, with a yearly average of 32.8 parts per thousand. Harbor water temperatures annually range from 22.9 to 29.4°C, and dissolved oxygen values range from 2.8 to 11.0 milligrams per liter. Pearl Harbor is most appropriately described as a high-nutrient estuary.

Middle Loch is located in the northwestern end of Pearl Harbor, north and west of Ford Island, within the Pearl Harbor Naval Base, see Figure 18 below.

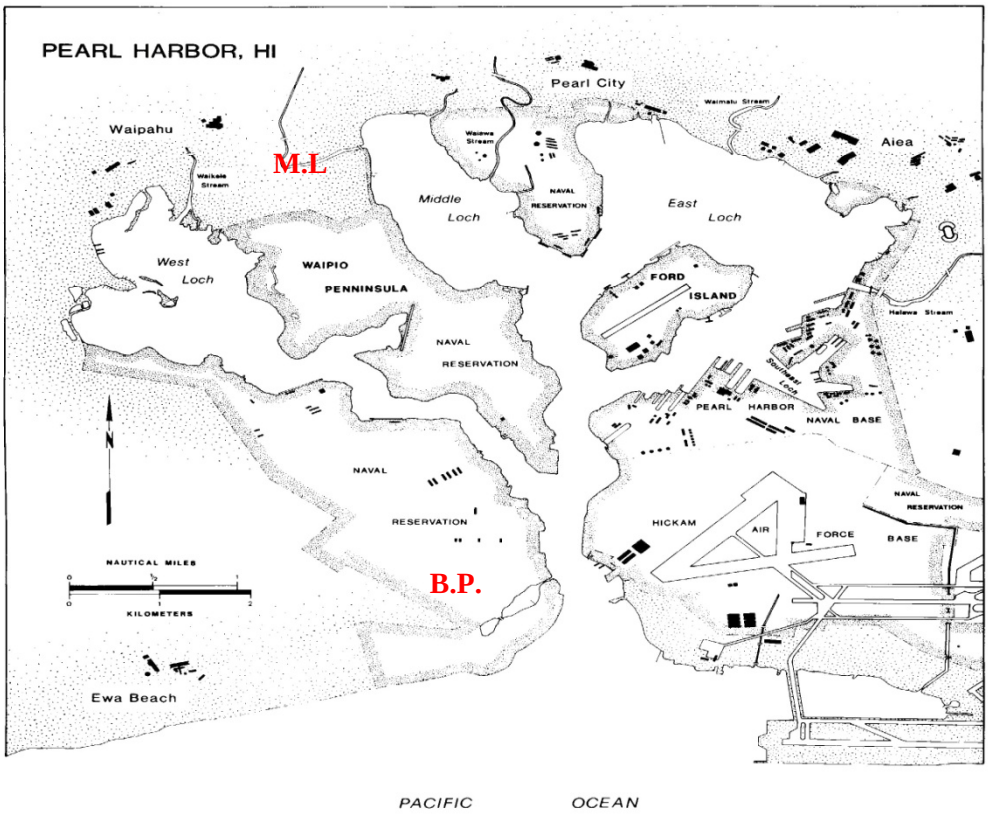



**Figure 18. Pearl Harbor, Hawaii Middle Loch Bishop and Point Sites.**

In 1901, the U.S. Navy acquired 800 acres of land to establish a naval station at Pearl Harbor. The Pearl Harbor Naval Base has existed since 1919. During World War I, about 12 warships were repaired and overhauled at the Navy Yard. In 1917, a temporary submarine base was relocated to the eastern shoreline of Southeast Loch. Industrial development in the vicinity of Pearl Harbor was greatly accelerated during the late 1930s and early 1940s. During the 1941 Japanese attack on Pearl Harbor during World War II, 21 of the U.S. ships in Pearl Harbor were sunk or severely damaged, and debris resulting from this attack remains buried in harbor sediments (despite initial cleanup efforts). Currently, Pearl Harbor is a major fleet homeport for nearly 40 warships, service-force vessels, submarines, and their associated support, training and repair facilities.

Middle Loch is moderately contaminated with heavy metals as well as with toxic organic compounds and hydrocarbons. Sediments contain various concentrations of metals such as silver, arsenic, cadmium, chromium, copper, iron, mercury, manganese, nickel, lead, and zinc. Toxic organic compounds include pollutants such as solvents, paints, pesticides, and PCBs. Hydrocarbon contaminants include all petroleum-based fuel products such as diesel, JP-5, JP-4, bunker fuel, gasoline, oils, sludges, and lubricants. Bishop Point is an active industrial area with ongoing salvage operations and related ship movements. Sediments contain similar contaminants as mentioned above but at higher levels.

# 4. Demonstration Approach

## 4.1 Performance Objectives

The demonstrations were intended to verify the performance of the BFSD2 by assessing whether chemicals are adsorbing to or desorbing from sediments at the sediment-water interface. Specifically, the objectives of the BFSD2 technology demonstrations were to:

(1) Evaluate the data quality of the water samples collected for use in determining if a statistically significant flux was occurring at the test locations.

(2) Evaluate the BFSD2 for repeatability.

(3) Evaluate the logistical and economic resources necessary to operate the BFSD2.

(4) Evaluate the range of conditions in which the BFSD2 can be operated.

In order to determine whether statistically significant fluxes were occurring at the test locations (Objective 1), 12 seawater samples were collected at 7-hour intervals using the BFSD2. For metals, the water samples were analyzed for cadmium, copper, manganese, nickel, lead, zinc and silica. For organics, the samples were analyzed for EPA priority PAHs, PCBs and pesticides. For metals, sediment samples, when collected, were analyzed for grain size, total solids, total organic carbon (TOC), acid volatile sulfide (AVS), simultaneously extracted metals (SEM), and total metals. Although the sediments may have been contaminated with other constituents, only the flux of the listed metals was evaluated during the demonstrations. For organics, sediment samples were analyzed for the same analytes as the associated water samples.

In addition, other metals including antimony, arsenic, selenium, silver, thallium, and iron were analyzed in the seawater samples collected during the three blank chamber tests. This data will be used at future dates when establishing baseline performance for these metals.

Sample concentrations were corrected for dilution introduced by the sampling process, and a regression curve was generated for each analyte based on the concentration data. Flux rates, with regression coefficients, were compared to the composite flux rate and standard deviation determined for each metal or organic during triplicate blank chamber tests. The measured flux rate for each metal or organic was then evaluated to assess if a statistically significant flux had been measured when compared to the blank chamber (background) test. The BFSD2 was evaluated for repeatability (Objective 2) by analyzing the metals results of repeat deployments, two weeks apart, at the same Paleta Creek site. Demonstration data was also compared to data from the site during previous prototype BFSD tests in the same approximate location. Finally, repeatability was evaluated by comparing the results from three blank chamber deployments for both metals and organics. The logistical and economic resources necessary (Objective 3) were evaluated by documenting costs associated with planning, scheduling and executing the demonstration deployments, laboratory analysis, data management, and report preparation. Lastly, the range of conditions for operating the BFSD2 were evaluated

(Objective 4) by describing the conditions under which the BFSD2 operated and the projected range of contaminants applicable to the technology.

The demonstration approach was to collect time series of water samples using the BFSD2 at two geographically different locations. For metals at the San Diego Bay location (Paleta Creek) two deployments at the same site were made; at the Pearl Harbor location, one deployment at each of two geologically different sites were made (Middle Loch and Bishop Point). Comparison of the results of the two Paleta Creek demonstrations to one another was intended to evaluate repeatability of the technology. Comparison of the results from the two geographically different sites in Pearl Harbor was intended to demonstrate data differences and analysis/interpretation approaches. Comparison of the Pearl Harbor data as a whole with that from San Diego also demonstrated geological differences between continental shelf and mid-Pacific riff measurements. For organics, one Paleta Creek deployment and one Bishop Point, Pearl Harbor deployment were performed to demonstrate the extended performance. For both metals and organics three "blank test" deployments were conducted, during which the BFSD2 was deployed in seawater with a sealed sampling chamber. Three time series of samples were collected and a baseline was established for each analyte, which provided a statistical estimate of the lower limit of flux detection measurable with the BFSD2. The data also served as another measure of precision and repeatability. Previous metals results obtained at the same location using the prototype BFSD also provided a general measure of trend repeatability. A rate of flux between the sediment and the water for each analyte for each deployment was calculated. The flux rate was calculated using knowledge of the volume of water enclosed within the BFSD2, the surface area of sediment isolated, the time the samples were collected, and the concentrations of the contaminants of interest in the individual sample. Because this technology has no current equivalent, the BFSD was evaluated based on the internal QA/QC of the laboratory analysis and an analysis of the data.

## 4.2 Physical Setup and Operation

### 4.2.1 Physical Setup

Deployment preparations included BFSD2 maintenance, decontamination and setup. Maintenance included inspection and repair due to leakage or corrosion, inspection of sealing surfaces, seals and o-rings, inspection and replacement of sacrificial zinc anodes, downloading and/or deleting unnecessary files in the memory-limited control and data acquisition subsystem, and inspection of any worn or other potentially failure prone areas.

Decontamination involves soaking and/or rinsing all surfaces contacting seawater samples in a series of fluids beginning with tap water, then de-ionized water, then a special detergent ("RBS"), then de-ionized water, then nitric acid for metals or Methanol for organics, then 18 meg-ohm de-ionized water (metals) and finally filtered air. For metals, the collection bottles are disassembled and all component parts are soaked, four-hours minimum, in each fluid. A 25% concentration of ultra-pure nitric acid is used to soak Teflon™ parts (bottles, lids, and sensor chamber) and a 10% concentration is used for all other parts (including acid-sensitive polycarbonate filter bodies). For organics, components are rinsed with Methanol and air-dried and precleaned amber-glass sample bottles are used. The synchronized rotary valves, tubes and fittings remain assembled to the BFSD2 and are cleaned in place by flowing the series of decontamination fluids through them. The acquisition and control subsystem is used to execute a special program which activates each valve position for specified time during which the decontamination fluids are forced through by positive pressure using a Teflon-coated pump. And finally, the collection chamber, lid, diffuser, circulation pump, tubes and fittings are physically scrubbed and rinsed in place with non-metallic brushes. All decontaminated surfaces are dried, reassembled or otherwise sealed to isolate them from ambient, air-borne contaminants.

BFSD2 setup includes various tasks to be performed prior to deployment using checklists. These include: charging the gel-cell 24Vdc battery; replacing the 14 circulation subsystem C-cell batteries; replacing the 6 acoustic release 9Vdc batteries; installing a new acoustic release subsystem burn wire, cleaning the plating anode and rigging the recovery float; checking and refilling (if required) the compressed-oxygen supply tank; checking the insertion light subsystem function and replacing its one battery (if required); installing the 12 sample collection bottles and evacuating them to less than 25 in-Hg; setting up laptop computer files for post-deployment data uploading; reviewing and modifying, as required, the deployment operational control programs and downloading the predrop program into the acquisition and control subsystem.

### 4.2.2 Deployment

Each BFSD deployment requires at least three personnel. One person is responsible for maneuvering, positioning and securing the surface vessel. Two additional persons are required to deploy and retrieve the BFSD. The checklists included in appendix D are the step-by-step procedures followed on deck to avoid oversights and mistakes. Ancillary tasks to be performed include collection of a sediment sample with a spring-loaded grab sampler and logging site GPS coordinates. Figures 19 through 22 illustrate typical deployment and recovery scenes.

### 4.2.3 Recovery

Recovery is initiated following an elapse time after the planned deployment greater than the operational program by at least two hours. This allows for accumulated processing delays which lengthen the overall autonomous time period. Once within approximately 100 yards of the deployment position a coded acoustic signal is transmitted to the BFSD2 acoustic receiver from the deck unit. A 15-minute function time begins during which the burn-wire is consumed and the recovery buoy is released. The line attached to the buoy is used to wench the BFSD2 and the attached coiled cables to the surface and aboard the vessel. Heavy sediment and other debris are washed off the BFSD2 before bringing it onboard. On deck an inspection of collection bottle status is made as an immediate indicator of deployment performance. Turning the compressed-oxygen cylinder valve off and installing storage caps on the pH and oxygen sensors is also done without delay. Other assessments that may be accomplished onboard include upload of logged data from the acquisition and control subsystem and processing of pH and oxygen sensor data as performance indicators. Spreadsheet templates are used to quickly generate graphs and charts of converted and processed data which display results for the entire operational deployment. Aboard a properly configured surface vessel such as SSC SD's R/V ECOS during the San Diego Bay demonstration sample handling such as acid preservation, labeling and sealing of 100 ml laboratory samples and 25 ml splits for measurement of silica concentration was accomplished. Once off loaded to shore, the BFSD2 must be thoroughly washed down with fresh water to remove all remaining debris, sediment and seawater and to minimize corrosion. As soon as practicable, a freshwater purge and forced-air dry of the synchronous rotary valves and associated tubes and fitting is accomplished.

**Figure 19. Deployment Equipment** (SSC SD Dock).

**Figure 20. Crane Loading Aboard Workboat** (Bishop Point, Pearl Harbor).

**Figure 21 Deployment** (Middle Loch, Pearl Harbor).

**Figure 22. Recovery** (Middle Loch, Pearl Harbor).

### 4.3 Sampling Procedures

The sampling procedures followed for the BFSD2 demonstrations provided assurance that the overall project goals and objectives were met. Careful adherence to the procedures ensured that data collected was useful in evaluating the effectiveness of the BFSD2 for benthic flux measurements.

#### 4.3.1 Overview of Sampling Operations

Sampling operations at each demonstration location consisted of site deployments during which the BFSD2 collected seawater samples at timed intervals and a sediment confirmation sample collected following each site deployment. Three additional identical blank (background) deployments with the BFSD2 collection chamber sealed using a polycarbonate bottom plate were used to statistically establish system blank performance as a baseline for comparison to the sediment flux data.

##### 4.3.1.1 BFSD2 Sampling

Samples were collected *in situ* in twelve 250-ml precleaned sampling bottles at preprogrammed time intervals. A description of the sampling technology can be found in Section 2.1. Sampling was initiated by starting the acquisition and control subsystem program, which activated synchronous rotary valves connected to the sample bottles. In-line filters passed only seawater with dissolved-phase contaminants at the time of collection. After each deployment, the samples for metals analysis

were transferred to appropriate sample containers and acidified, if necessary. Samples for organics analysis were collected in non-reusable bottles and shipped to the analytical lab without further disturbance. A baseline ambient water sample was collected as the number one BFSD2 sample during deployment. The sample was analyzed and used to establish the ambient concentration at time zero for each analyte. The total time required for the 12 sampling events including the time zero sample using 7-hour intervals was approximately 72 hours with consideration for accumulated data processing delays.

#### 4.3.1.2 Sediment Sampling

A sediment sample was collected at the end of each different site deployment using a spring-loaded grab sampler. The sediment was containerized, capped, labeled, and sealed. The sediment samples were used in various analyses, including digestion and extraction processes to measure trace metal and organic levels. Other measurements related to seawater data analysis and interpretation were conducted and are reported in a later section.

#### 4.3.1.3 System Blank Samples

With the BFSD2 configured as described in Section 2.1, three deployments using identical procedures were accomplished for both metals and for organics. The samples were collected and handled as in the demonstrations (see 4.3.1.1 above) and shipped to the analytical laboratory for the analyses discussed below.

#### 4.3.1.4 Quality Control

Demonstration samples and blank samples included equipment blanks, trip blanks and laboratory blanks to assess the performance of the equipment in the field.

#### 4.3.1.5 Communications and Documentation

The SSC SD program manager communicated regularly with demonstration participants to coordinate all field activities associated with the demonstrations and to resolve any logistical, technical, or QA issues that arose as the demonstrations progressed. Successful implementation of the demonstrations required detailed coordination and constant communication among all participants. Field documentation was included in field logbooks, field data sheets, chain-of-custody forms, and kept in a bound logbook. Each page was sequentially numbered and labeled with the project name and number. All photographs were logged by the digital camera and transferred to the computer file system. Those entries included the time, date, orientation, and subject of the photograph. Specific notes about each sample collected were written on sample field sheets and in the field logbook. Any deviations from the approved final demonstration plan were thoroughly documented in the field logbook and communicated to parties affected by the change. Original field sheets and chain-of-custody forms accompanied all samples shipped to the laboratory.

#### 4.3.1.6 Field Sample Collection

Sampling personnel collected and prepared samples using the procedures described below. All field activities conformed with the requirements of the Demonstration Plan and its attached Health and Safety Plan. Sampling operations at each site consisted of a deployment of the BFSD to collect seawater samples at timed intervals, and collection of a sediment grab sample after deployments. The series of samples collected during three blank test deployments with the chamber sealed with a polycarbonate bottom were used to assess the background level from which statistically significant fluxes can be derived.

#### 4.3.1.6.1 Field Blanks

One field blank for the San Diego Bay metals demonstration consisted of an additional 250-mL bottle filled with de-ionized water strapped to the flux chamber. This sample was to be used to assess the integrity of the sample bottle seals if anomalous data are obtained.

#### 4.3.1.6.2 Equipment Blanks

These samples consist of running 250 ml of de-ionized water through the BFSD2 sampling subsystem prior to deployment. One equipment blank was collected for each site demonstration. The equipment blank was used as a quality control measure to ensure that the BFSD2 was properly decontaminated between deployments.

#### 4.3.1.6.3 Trip Blank

**.** One trip blank for the San Diego Bay metals demonstration was collected by placing a closed 250-ml sample of de-ionized water in a sample cooler at the beginning of the demonstration. The trip blank was used as a quality control measure, if necessary, to ensure that samples are not contaminated during sample storage and shipment to the laboratory.

#### 4.3.1.6.4 Silica

Confirmatory silica analysis was used for metals tests to ensure that the BFSD2 is functioning properly, without any significant loss of collection chamber seal. Silica is a common component in constructing the hard parts of some planktonic organisms, and it typically fluxes out of sediments at a constant rate due to dissolution processes. By analyzing each of the samples collected using the BFSD for silica and plotting the concentration versus time data, a linear increase in silica concentration over time strongly suggests that there was a good seal of the chamber with the sediment. The first sample at time zero provides a value for silica in bottom waters at the start of the experiment. The silica analysis was performed using 25 ml of seawater removed from each sample collected prior to acid preservation. To maximize sample volume for organics analysis, measured pH data was used to ensure chamber seal integrity.

#### 4.3.1.6.5 BFSD2 System Blanks

Finally, for metals, a triple-duplicate deployment with the collection chamber sealed with a polycarbonate bottom ("blank test") was conducted as an experiment blank at the SSC SD dock in San Diego Bay. The data collected during those deployments provided a baseline with which to compare the site-specific flux rates, in order to document a statistically significant flux rate from both analytical and system variability in a seawater environment. For organics, a triplicate set of blank tests were conducted "*ex-situ*" using a single supply of ambient seawater. The data collected provided less variability due to the constant seawater supply, including sample makeup volumes.

### 4.3.1.7 Laboratory Blanks

Laboratory Blanks and Laboratory QC checks are designed to assess the precision and accuracy of the analysis, to demonstrate the absence of interferences and contamination from glassware and reagents, and to ensure the comparability of data. Laboratory QC checks consist of laboratory duplicates, surrogates, MS/MSDs, and method blanks. For organics, a Method Detection Limit study was performed to establish modified EPA standard procedures and controls for targeting specific PAHs, PCBs and pesticides with small sample volume. No comparable MDL study was performed for metals because adequate volumes were collected from the chamber for EPA standard procedures in which detection limits were adequate to measure anticipated metals concentrations.

#### 4.3.1.7.1 Method Blanks

Method blanks were used to verify that preparation of samples was contamination-free. Each batch of extracted and digested samples was accompanied by a blank that was analyzed in parallel with the rest of the samples, and carried through the entire preparation and analysis procedure. Method blanks may also be called calibration blanks. Calibration blanks are analyzed for seawater samples analyzed for metals, for seawater samples analyzed for silica, for sediment samples analyzed for metals, and for sediment samples analyzed for SEM.

#### 4.3.1.7.2 Precision

Analytical precision and method detection limits are determined by replicate storage, preparation, and analysis of standard seawater. Further verification of precision is achieved by splitting 1 in 20 field samples. Laboratory duplicates are analyzed during analysis of water samples analyzed for metals, water samples analyzed for alkalinity (if performed), sediment samples analyzed for metals, and sediment samples analyzed for SEM.

#### 4.3.1.7.3 Accuracy

Spiked replicates of field samples were processed with each analytical batch to validate method accuracy within the context of varying matrices. With water and extracted water samples that are analyzed by the method of standard additions, spiked samples are not used. MS and MSD samples were used for analysis of water samples analyzed for metals, sediment samples analyzed for metals, sediment samples for AVS, and sediment samples for SEM.

#### 4.3.1.8 Sample Storage, Packaging, and Shipping

The field team followed chain-of-custody procedures for each sample as it was collected following BFSD2 retrieval. An example chain-of-custody form can be found in Appendix E. The following information was completed on the chain-of-custody form: project number, project name, sampler's name, station number, date, time, station location, number of containers, and analysis parameters.

Following retrieval and removal of the samples from the BFSD at the end of each single deployment, and until shipment to Battelle (metals) or Aurther D. Little (organics), all samples were stored in refrigerators or coolers and maintained with ice at a temperature of approximately 4 $^{\circ}$C. The custody of samples was maintained in accordance with standard operation procedures (SOP). Samples to be shipped to the confirmatory laboratory were packaged and shipped according to the sample packaging and shipment requirements SOP. Copies of these SOPs are available upon request.

## 4.4 Analytical Procedures

### 4.4.1 Selection of metals Analytical Laboratory

The analytical laboratory selected to provide analytical services is Battelle Marine Sciences Laboratory (Battelle). Battelle was selected because of its experience with QA procedures, analytical result reporting requirements, and data quality parameters. Battelle is not affiliated with SSC SD or any of the demonstration team members.

### 4.4.2 Metals Analytical Methods

Sample and data analysis are key elements in the use of samples collected by the BFSD. Samples were analyzed for metals including cadmium, copper, lead, manganese, nickel, and zinc; and silica. The seawater samples collected by the BFSD2 and marine sediment samples were sent to Battelle for analysis. The analytical methods that were used are listed in Table 1. In addition, other metals

including antimony, arsenic, selenium, silver, thallium, and iron, were analyzed in the seawater samples collected during the three blank chamber tests. This data will be used in future projects to establish baseline data for the metals.

**Table 1. Analytical Methods.**

| ANALYTE | SEAWATER SAMPLE | SEDIMENT SAMPLE |
|---|---|---|
| | **Analytical Method** | **Analytical Method** |
| Cadmium | ICP-MS (Nakashima et al. 1988) | GFAA (Crecelius et al. 1993) |
| Copper | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Iron | GFAA (Crecelius et al. 1993) | XRF (Crecelius et al. 1993) |
| Manganese | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Nickel | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Lead | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Zinc | ICP-MS (Nakashima et al. 1988) | XRF (Crecelius et al. 1993) |
| Miscellaneous Metals - Antimony, Arsenic, Selenium, Silver, and Thallium | ICP-MS (Nakashima et al. 1988) GFAA or XRF (Crecelius et al. 1993) | N/A |
| Silica(1) | Strickland and Parsons 1968 | N/A |
| Alkalinity | Strickland and Parsons 1968 | N/A |
| Grain Size | N/A | (Plumb 1981) |

| | | |
|---|---|---|
| Total Solids | N/A | (Plumb 1981) |
| Total Organic Carbon | N/A | (Plumb 1981) |
| Acid Volatile Sulfide | N/A | (Lasorsa and Casas 1996) |
| Simultaneously Extracted Metals | N/A | ICP-MS (EPA Method 1638) |

N/A – Not Applicable
ICP-MS – Inductively coupled plasma mass spectroscopy
XRF – X-ray florescence
GFAA – Graphite furnace atomic absorbtion\
(1) Silica was analyzed in the field using a HACH DR 2010 instrument to assure sample integrity and to determine whether samples will be sent to the laboratory for full analysis.

#### 4.4.2.1 Preconcentration

The preconcentration method used for this project (Nakashima et al. 1988) was a tetrahydroborate reductive precipitation as a preconcentration technique. Samples were first acidified with nitric acid to pH 1.8 for storage. Samples were then adjusted to pH 8 to 9 with high-purity ammonia solution and iron and palladium were added. A sodium tetrahydroborate solution was added before the solution was filtered through a 25-millimeter (mm) -diameter acid-washed, acid-resistant cellulose nitrate 0.45-micrometer membrane filter. Concentrated nitric and hydrochloric acids are added to the empty bottle to dissolve any precipitate adhering to the walls; the acid mixture was subsequently transferred to the filter assembly. The filter is washed with water, and the solution was diluted to 25 ml. The filter and its holder were rinsed with 3-ml aliquots of the nitric and hydrochloric acids and water between samples, and were used repeatedly. The combination of iron and palladium brought about the rapid formation of a precipitate after the addition of sodium tetrahydroborate.

#### 4.4.2.2 Inductively Coupled Plasma Mass Spectrometry (Nakashima et al. 1988)

ICP-MS analysis allows the simultaneous, multi-elemental determination of metals by measuring the element-emitted light by optical spectrometry. Element-specific atomic-line emission spectra are dispersed by a grating spectrometer, and the intensities of the lines are monitored by photomultiplier tubes.

#### 4.4.2.3 Graphite Furnace Atomic Absorption (Nakashima et al. 1988)

GFAA allows the individual analysis of iron, arsenic, lead, selenium, and thallium to provide lower detection limits. In the furnace, the sample is evaporated to dryness, charred, and atomized. A light beam from a hollow cathode lamp or an electrode-less discharge lamp is directed through the tube into a monochromator and onto a detector that measures the amount of light. Because the wavelength of a light beam is characteristic of a single metal, the light energy absorbed is a measure of that metal's concentration.

#### 4.4.2.4 Silica (Strickland and Parsons 1968)

The sea water sample was allowed to react with molybdate under conditions which result in the formation of the silicomolybdate, phosphomolybdate, and arsenomolybdate complexes. A reducing solution, containing oxalic acid, is then added which reduces the silicomolybdate complex to give a blue reduction compound and simultaneously decomposes any phosphomolybdate or

arsenomolybdate, so that interference from phosphate and arsenate are eliminated. The extinction of the resulting solution was measured using 25centimeter (cm) cells. This method was performed using a Hach Model DR2010 Field Kit prior to sending samples to the laboratory.

#### 4.4.2.5 Sediment Samples

Sediment sample analysis included methods to determine grain size, TOC, AVS and total metals. The collected sediment samples were homogenized and split into subsamples before analysis. Sediment samples for total metals analysis were freeze-dried and ground prior to analysis. Total metals were then determined using X-ray fluorescence (XRF) or GFAA (Crecelius et al. 1993).

##### 4.4.2.5.1 Grain Size (Plumb 1981)

Grain size was measured by a combination of sieving, particle counters, and pipette analysis, as described in the above reference.

##### 4.4.2.5.2 TOC (Plumb 1981)

TOC was measured on an automated carbon analyzer by measuring total carbon and inorganic carbon contents, with the difference providing the TOC values. Inorganic carbon from carbonates and bicarbonates were removed by acid treatment. The organic compounds were decomposed by pyrolysis in the presence of oxygen or air.

##### 4.4.2.5.3 X-ray Fluorescence (Crecelius et al. 1993)

This procedure uses energy dispersive x-ray fluorescence spectroscopy to quantify elemental concentrations in sediment and tissue samples.

##### 4.4.2.5.4 AVS (Lasorsa and Casas 1996)

AVS is operationally defined as the fraction of sulfide present in the sediment that is extracted with cold hydrochloric acid. Analysis of AVS is an indicator of potential metal toxicity in sediments. AVS was determined by photoionization detection (PID) following a step that converted the sulfide in the sample to hydrogen sulfide. During the first step, the sample was allowed to react with 1 N hydrochloric acid, the system was purged with purified inert gas, and produced hydrogen sulfide was trapped using a column immersed in liquid nitrogen. The PID method used gas chromatographic separation and photoionization detection; the area under the curve of the chromatograph was used to calculate sulfide concentration from the linear regression of the standard curve.

### 4.4.3 Selection of Organics Analytical Laboratory

Arthur D. Little Analytical Laboratory, Cambridge, MA was selected for organics analysis as a result of a successful Method Detection Limit study to optimize detection limits for selected PAHs, PCBs and pesticides form 250 ml seawater samples. The resulting EPA-based procedures and controls were documented and used for all subsequent analyses.

### 4.4.4 Organics Analytical Methods

See Appendix C for a complete description of the Method Detection Limit study and organic sample analysis procedures and controls.

### 4.4.5 Data Reduction and Analysis

Correction of concentration for dilution, regression analysis, and flux rate concentrations were calculated using a custom spreadsheet template. See Appendix D for a complete set of spreadsheets for both metals and organics. Results from these complex computations require careful analysis and interpretation to reach valid conclusions. Various other sitespecific data and information must be used in combination with computed flux results to fully interpret the data. The approach taken and the conclusions reached for the demonstrations of this report are presented in the next section.

# 5. Performance Assessment

## 5.1 Performance Data

### 5.1.1 Metals Blank Tests

The primary purpose for performing system blank tests was to establish BFSD2 minimum performance levels, or detection limits, for assessment of flux data obtained during subsequent demonstration tests. Three replicate 70-hour blank tests were conducted using BFSD2 between May 14 and 31, 1998. The tests were conducted from the end of SSC, San Diego Pier 159 at approximately two feet off the bottom in seawater ranging from about 14 to 20 feet deep, depending on tidal flow.

As discussed earlier, the BFSD 2 collection chamber bottom was sealed with a polycarbonate plate and filled with ambient seawater at the start of each 70-hour test. Prior to each test routine procedures for decontamination of the sampling system were performed. Equipment and source blanks were taken. After each test the samples were handled in accordance with EPA Methods 1638 and 1669 and routine chain of custody procedures were used in preparation and shipment to Battelle Marine Sciences Laboratory for analysis. The Silica samples were sent to and analyzed by Scripps Institute of Oceanography.

Each test produced twelve 250ml sample bottles of seawater filtered *in situ* to 0.45 micron. Sample bottle one in each test was filled with ambient seawater taken from the water column as the BFSD 2 was lowered to its test depth at about 15 feet below the surface. Sample bottle two in each test was filled with seawater from the sealed chamber at 6 minutes after start of the 70-hour test. The remaining 10 sample bottles were filled from the chamber at 7-hour intervals. The data, analysis and graphs for each test were processed and compiled in Microsoft Excel spreadsheet, "BFSD2 Blank Tests.xls", provided with the electronic submission of this report. Appendix C provides copies of the spreadsheet results and includes data and graphs for the BFSD2 flow-through sensors. Table 2 below is a summary of the results of the blank tests

**Table 2. Metals Blank Test Results Summary.**

| Metal | Blank Flux ($\mu g/m^2/day$) | | | Repeatability ($\mu g/m^2/day$) | | |
|---|---|---|---|---|---|---|
| | Test 1(12) | Test 2 (6) | Test 3 (6) | Average Flux | +/- 95% C.L. | Std. Deviation |
| Copper (Cu) | 25 | -13 | 15 | 2.82 | 8.73 | 19.7 |
| Cadmium (Cd) | -5.3 | -0.8 | -0.09 | -0.52 | 0.75 | 2.8 |
| Lead (Pb) | 2.8 | 5 | 1 | 3.16 | 1.59 | 2.0 |
| Nickel (Ni) | 23 | 20 | -6.7 | 10.28 | 7.34 | 16.4 |
| Manganese (Mn) | -289 | -249 | -250 | -264.85 | 7.49 | 22.8 |
| Zinc (Zn) | -194 | -13 | 200 | -3.38 | -68.61 | 197 |
| Silica (SiO2)* (*mg/m2/day) | -4 | -3.3 | 1.4 | -1.97 | 2.88 | 2.9 |

#### 5.1.1.1 Discussion of Metals Blank Results

As expected, the blank results for most metals showed little or no time trend, indicating minimal source or loss of target analytes during the blank experiments. Figures 23 through 29 provide graphs of concentration versus time for each analyte for each blank test. With the exception of lead and manganese, replicate analysis indicates that none of the metal fluxes were significantly different from a zero flux condition at the 95% confidence level. Copper results for the three replicates showed both small positive and small negative flux rates. Replicate blanks for cadmium were all small and negative, however the variability was sufficient that the mean was still not significantly different than zero. Results for lead indicated small positive flux rates with a mean value of 2.9 □g/m$^2$/day which was different from the zero flux condition, suggesting a potential small source of lead in the experimental procedure. Nickel results indicated small positive and negative fluxes with no obvious uptake or sources of nickel from the system. Replicates for manganese all showed substantial negative flux rates indicating a significant loss of manganese due to some aspect of the experimental procedure. Results for zinc showed both positive and negative fluxes with no clear pattern of source or uptake.

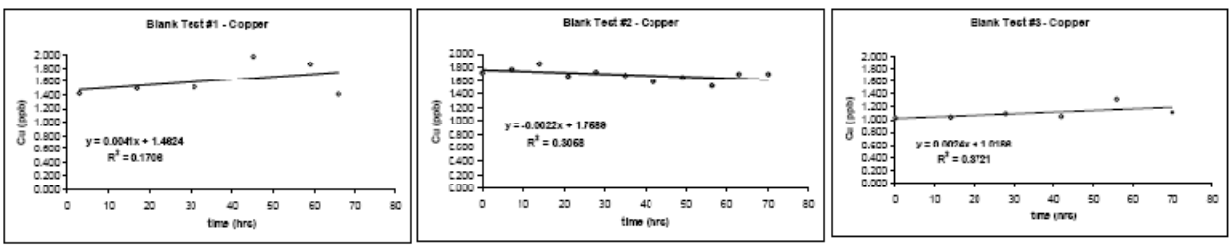



**Figure 23. Blank Performance for Copper (**Cu**).**

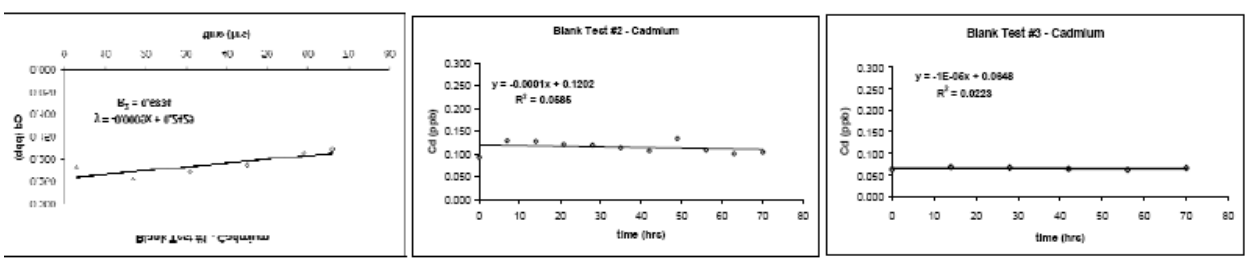



**Figure 24. Blank Performance for Cadmium (**Cd**).**

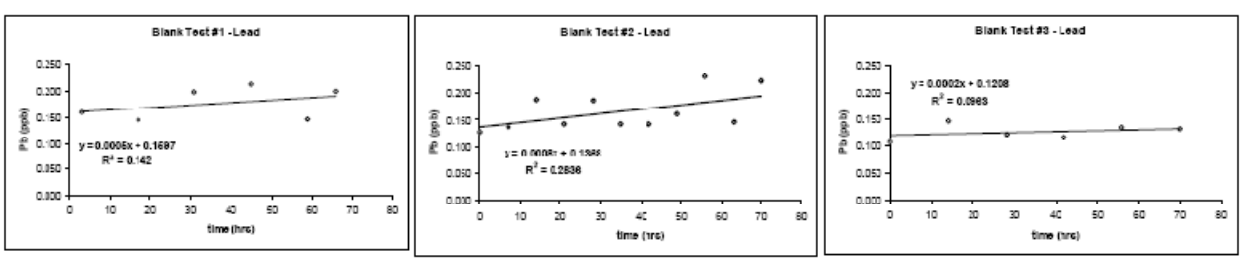



**Figure 25. Blank Performance for Lead (**Pb**).**

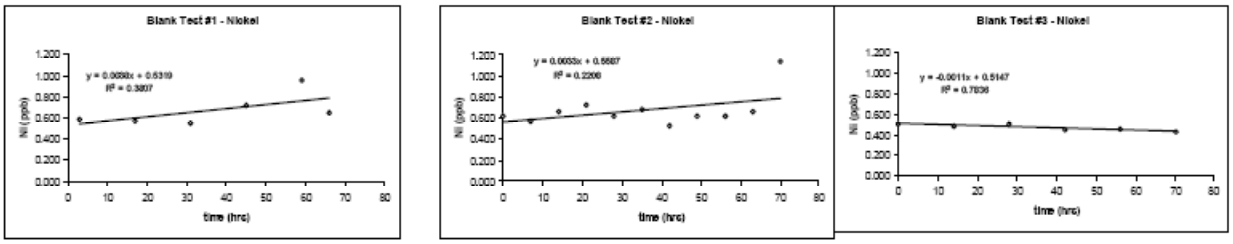



**Figure 26. Blank Performance for Nickel (**Ni**).**

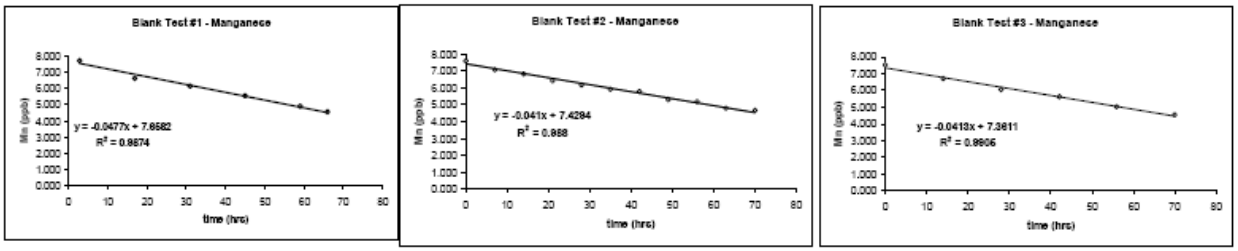



**Figure 27. Blank Performance for Manganese (**Mn**).**

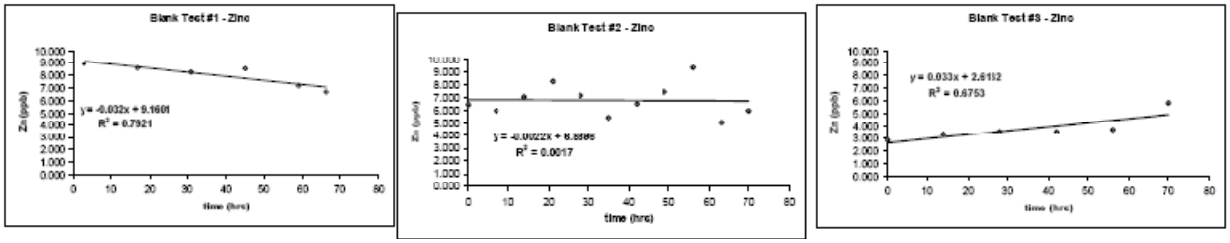



**Figure 28. Blank Performance for Zinc (**Zn**).**

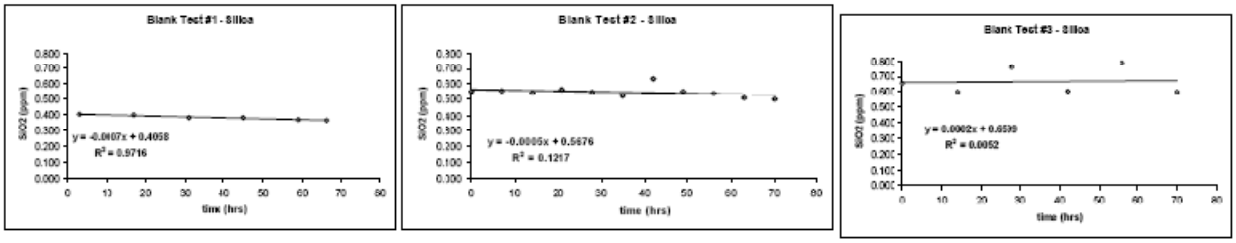



**Figure 29. Blank Performance for Silica (**$Sio_4$**).**

Scripps Institute of Oceanography analyzed silica concentrations, used to indicate chamber integrity and seal. The CA EPA request for an independent analysis of Silica could not be reasonably obtained from Battelle. Subsequent silica analyses were conducted on-site with field analytical systems (i.e., Hach Kit).

Results show a high, very repeatable level of Manganese uptake by the BFSD2. Results from earlier prototype BFSD blank tests were not consistent with this result and further investigation

is warranted. However, because manganese is not generally viewed as a toxic metal, the resolution of this issue is less critical than for other metals.
The somewhat higher blank fluxes observed for zinc are consistent with previous results and are attributed to the ubiquitous nature of zinc and associated contamination during sampling and analysis. Because previously measured flux rates for zinc generally lie outside the range of these blanks, and because of the higher toxicity thresholds for zinc relative to other metals, this is not considered as a serious problem. However, as with all trace metals, care must be taken to minimize zinc contamination during all phases of the experimental procedure. The higher variability between the zinc blank tests will make any results indicating small fluxes of zinc from sediments less conclusive.

#### 5.1.1.2 Discussion of Metals Blank Tests

Although the three blank tests were reasonably trouble free and produced generally high quality data there are a number of points deserving further discussion and explanation.

##### 5.1.1.2.1 Sensors

The flow-through sensors for dissolved oxygen and for pressure, Figures 30 and 31, produced data requiring explanation. The "noisy" dissolved oxygen data was discovered to be due to restricted flow over the sensing element. Flow improvements resolved the problem prior to the Paleta Creek demonstrations (see Figure 35). The oxygen measurements during the blank test are not critical because there is little oxygen depletion when no sediment is present. Drift of the pressure sensor readings was more problematic and resolution required trouble shooting at the factory, after the Paleta Creek demonstrations.

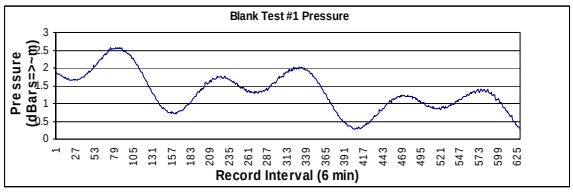



**Figure 30. Blank Test Dissolved Oxygen.**

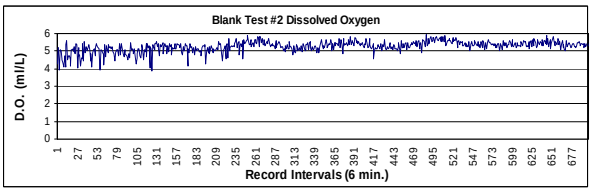



**Figure 31. Blank Test Pressure.**

##### 5.1.1.2.2 Ambient Seawater Sample

Sample bottle one was not used in blank test analyses, as well as subsequent Paleta Creek demonstration analyses. Analytical laboratory results clearly indicate that the metal concentrations in the water collected in bottle one as the BFSD2 descended to the test depth were not consistent with concentrations in the chamber after it was closed and sealed at the surface prior to descending to the test depth. CA EPA certification evaluators agreed that the sample taken at 6 minutes after the start of the test was a better representation of replacement water entering the chamber. The unused concentration value is still shown, in bold, in the spreadsheet. A sensitivity analysis of the affect of this change on dilution correction calculations and subsequent flux results show it to be insignificant. Consequently, an improved method to fill sample bottle one from more representative bottom water was implemented.

##### 5.1.1.2.3 Metals Sample Analysis

Not all samples were analyzed to minimize analytical costs. For Blank Test 1 only the six odd-numbered samples were analyzed (with further changes, see next paragraph); for Blank Test 2 all

twelve samples were analyzed; for Blank Test 3 only the six even-numbered samples were analyzed. Also, additional trace metals beyond those identified for CA EPA certification evaluation were analyzed for future applications.

Blank Test 1 suffered a "False Start" when an error in a software control loop shut the test down after six minutes, following sample bottle two filling. The error was corrected from the surface and the test was restarted three hours later without raising the BFSD2 from the test depth. Sample bottle three filled immediately upon restart and sample bottle two was retained as representative of ambient conditions. To complete the set of six samples, sample bottle twelve with a 7-hour interval was added to the other odd-numbered samples. Blank Test 1 was 66 hours total duration.

#### 5.1.1.3 Metals Blank Tests Assessment

It was concluded that the BFSD2 metals blank performance was statistically established and the values obtained were repeatable, precise and accurate enough to allow valid measurement of *in situ* sediment flux rates.

### 5.1.2 Organics Blank Tests

Three replicate 70-hour blank tests were conducted using BFSD2 between September 1, 2000 and November 27, 2000. The purpose of the tests was to establish system performance levels for selected polynuclear aromatic hydrocarbons (PAH) using standardized procedures as part of the demonstration project. Performance levels for selected polychlorinated biphenyl (PCB) congeners and pesticides were also measured for future potential applications. As shown in Figure 32, the tests were conducted *ex situ* at SSC San Diego using Naval Station San Diego (Paleta Creek) seawater.

**Figure 32. *Ex Situ* BFSD2 Organics Blank Test Physical Setup.**

The BFSD 2 collection chamber bottom was sealed with a polycarbonate plate and filled with seawater collected from the Paleta Creek industrial area within Naval Station San Diego, at the start of each 70-hour test. Paleta Creek has been designated as a "toxic hotspot" by the Regional Water Quality Control Board and has been selected for the initial demonstration of BFSD 2 for organics applications. Makeup seawater to replace collected sample volume and any leakage was likewise the same Paleta Creek source seawater. Prior to each test, routine procedures for decontamination of the sampling system were performed. The procedure differed from that used in metals applications only in that the Nitric acid rinse was omitted and a final Methanol rinse

was added. Samples were collected into 250ml precleaned amber glass sample bottles fitted with custom inline filter assemblies (Figure 6b). The filter element was a 47mm Gelman 1.0-micron binder-less borosilicate glass filter prepared by pre-combustion for 24 hours at 375 degrees Fahrenheit. The samples were collected, capped, labeled and shipped in the same commercially standard sample bottle. Routine chain of custody procedures were used for overnight shipment to Arthur D. Little, Inc. (ADL) analytical laboratory in Cambridge, MA. All samples were collected, shipped (chilled to 4 degrees), received and extracted within the EPA seven-day hold time requirement. Laboratory processing and analysis of the samples was in accordance with EPA SW-846 methods and procedures, including Methods 8270M and 8081A protocols modified based on results from a Method Detection Limit study performed under contract N66001-96-D-0050 by ADL for this project.

Each test produced twelve filtered 250ml (approximately) samples and one additional 500ml unfiltered source sample. Sample bottle one in each test was filled with source seawater passed through the chamber lid closure-activated valve at the initiation of the 70- hour test. Sample bottle two in each test was filled with seawater from the sealed chamber approximately 6 minutes after chamber lid closure. The remaining 10 sample bottles were filled from the sealed chamber at 7-hour intervals. The 500ml unfiltered sample was taken from the residual source seawater container at the conclusion of the test. Table 3, 4 and 5 are summaries of the results of the organics blank tests.

**Table 3. PAH Blank Tests Results Summary.**

| PAH | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| 1. Naphthalene | -243.5 | -448.1 | -629.3 | -440 | 218.4 | 193.0 |
| 2. Acenaphthene | -32.4 | ND | ND | -32.4 | n/a | n/a |
| 3. Acenaphthylene | -350.2 | 141.0 | 275.9 | 22.2 | 372.9 | 329.5 |
| 4. Fluorene | 125.5 | -69.3 | -84.2 | -9 | 132.4 | 117.0 |
| 5. Phenanthrene | 89.0 | -39.8 | -16.3 | 11 | 77.6 | 68.6 |
| 6. Anthracene | 182.3 | 53.1 | -324.8 | -30 | 298 | 263 |
| 7. Fluoranthene | -421.5 | -1539.0 | -1308.9 | -1089.8 | 667.8 | 590.1 |
| 8. Pyrene | 76.6 | -447.1 | -431.9 | -267.5 | 337.3 | 298.0 |
| 9. Benzo(a)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 10. Chrysene | 23.9 | -61.9 | ND | -19.0 | 84.2 | 60.7 |
| 11. Benzo(b)fluoranthene | ND | ND | -134.3 | -134.3 | n/a | n/a |
| 12. Benzo(k)fluoranthene | ND | ND | -9.0 | -9.0 | n/a | n/a |
| 13. Benzo(a)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 14.Indeno(1,2,3-c,d)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 15. Dibenz(a,h)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 16. Benzo(g,h,I)perylene | ND | 19.6 | ND | 19.6 | n/a | n/a |

**Table 4. PCB Blank Test Results Summary.**

| PCB | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| (8) 2,4'-Dichlorobiphenyl | -66.6 | ND | 47.8 | -9.4 | 112.2 | 80.9 |
| (18) 2,2',5-Trichlorobiphenyl | 205.2 | 23.3 | 27.0 | 85.2 | 117.6 | 104.0 |
| (28) 2,4,4'-Trichlorobiphenyl | -8.0 | ND | ND | -8.0 | n/a | n/a |
| (52) 2,2',5,5'-Tetrachlorobiphenyl | ND | 7.9 | 89.9 | 49 | 80.4 | 58.0 |
| (66) 2,3',4,4'-Tetrachlorobiphenyl | 53.6 | 16.6 | ND | 35 | 36.2 | 26.2 |
| (101) 2,2',4,5,5'-Pentachlorobiphenyl | 57.8 | 57.4 | -3.5 | 37 | 40 | 35 |
| (118) 2,3',4,4',5-Pentachlorobiphenyl | ND | 2.7 | 2.3 | 2.5 | 0.3 | 0.2 |
| (153) 2,2',4,4',5,5'-Hexachlorobiphenyl | ND | ND | 9.5 | 9.5 | n/a | n/a |
| (180) 2,2',3,4,4',5,5'-Heptachlorobiphenyl | ND | -9.6 | ND | -9.6 | n/a | n/a |
| (206) 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | -2.8 | 247.0 | -17.0 | 75.7 | 168.0 | 148.5 |
| (209) 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl | -18.5 | ND | ND | -18.5 | n/a | n/a |

**Table 5. Pesticide Blank Test Results Summary.**

| Pesticide | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| alpha-Chlordane | 7.0 | ND | ND | 7.0 | n/a | n/a |
| 2,4'-DDD | 7.0 | ND | ND | 7.0 | n/a | n/a |
| Methoxychlor | 25.7 | ND | ND | 25.7 | n/a | n/a |
| Endosulfan I | 48.8 | ND | ND | 48.8 | n/a | n/a |
| hexachlorobutadiene | ND | ND | 22.0 | 22.0 | n/a | n/a |
| Heptachlor | 304.5 | ND | ND | 304.5 | n/a | n/a |
| Heptachlor Epoxide | ND | ND | 8.8 | 8.8 | n/a | n/a |
| alpha-hexachlorocyclohexane | 3.3 | ND | ND | 3.3 | n/a | n/a |
| beta-hexachlorocyclohexane | 61.0 | ND | ND | 61.0 | n/a | n/a |
| lindane | 35.2 | 132.3 | 33.8 | 67.1 | 63.9 | 56.5 |
| trans-Nonachlor | 40.8 | ND | ND | 40.8 | n/a | n/a |

#### 5.1.2.1 Results of Organics Blank Tests

The Paleta Creek seawater collected for these tests contained a broad mixture of dissolved organic contaminants targeted by this study, but not all 63 of them. Of the 34 targeted organic contaminants that were detected, a number of them were not measurable in all three blank tests. Further, within a number of individual blank tests where a target contaminant was detected, one or more time-series samples fell below the detection limits. Notwithstanding such issues, analysis results plotted as time-series, with non-detects removed, show little if any, release or uptake of detected target contaminants by the BFSD2 with the exception of Naphthalene and Flouranthene. These two PAHs both consistently indicated an uptake trend likely due to sorption onto the many plastic surfaces of the collection chamber and recirculation system. Statistical analysis of the data for repeatability was applied to those tests with multiple measurements.

For the targeted EPA 16 Priority PAHs, the results were generally complete for the eight lowest molecular weight (through three Benzene rings) compounds. "Non detects" were much more prevalent with the eight heavier molecular weight PAHs (four-ring including Benzo(a)anthracene and higher) and four of the 16 targeted PAHs were not detected in all three blank tests although source seawater did indicate very low concentrations (less than 2 ng/L or parts/trillion) were present. Acenaphthene, a two-ring PAH, was the only low molecular weight compound not sufficiently detected in all three blank tests to establish repeatability statistics however a time-series flux trend (uptake or release) was established. Acenaphthene was detected in all three seawater source samples and in all 12 blank test 1 samples but dropped below detection limits in 10 of 12 blank test 2 samples and 9 of 12 blank test 3 samples. All remaining light-end PAHs (up to Pyrene) were detected in all 12 samples of all three blank tests and Table 3 provides full repeatability statistics for them. Time-series flux trends were also established for all of them. None of the heavier-end PAHs were detected sufficiently in all 12 samples of all three blank tests to yield full repeatability statistical results. Only Chrysene was detected sufficiently in two of the three blank tests to establish limited repeatability statistics. Benzo(b)fluoranthene, Benzo(k)fluoranthene and Benzo(g,h,I)perylene were detected sufficiently in only one blank test and repeatability statistics cannot be developed for them. Time-series flux trends were established for all four of these heavier-end PAHs. The remaining four PAHs (Benzo(a)anthracene, Benzo(a)pyrene, Indeno(1,2,3c,d)pyrene and Dibenz(a,h)anthracene) were not sufficiently detected in any of three blank tests to establish either repeatability statistics or time-series trends.

For the 20 targeted PCB congeners and 16 targeted pesticides, the results were somewhat less complete. Three PCB congeners (#18, #101, #206) and one pesticide (Lindane) were sufficiently detected in all three blank tests to establish full repeatability statistics and time-series flux trends. Two of the 20 PCBs and one of the 16 pesticides were detected sufficiently in two of the three blank tests to establish limited repeatability statistics and time-series flux trends. Four of 20 targeted PCBs and nine of the 16 targeted pesticides were detected in only one blank test with sufficient data to establish time-series flux trends, but not repeatability statistics. The remaining eleven PCB congeners and five pesticides were not detected sufficiently in any of the three blank tests to establish either repeatability statistics or time-series trends. Six of these remaining eleven PCB congeners and all five of these remaining pesticides were not detected in the unfiltered source seawater.

#### 5.1.2.2 Discussion of Organics Blank Tests

It was not unexpected to find very low levels of the heavier PAHs dissolved in the source seawater because of the known reduction in solubility of PAHs as the number of Benzene rings increase. This insolubility, combined with a low, but limited detection limit led to less complete and even non-detection of the heavier PAHs. However, the number of Benzene rings common within groupings of

PAHs allows a limited extension of the otherwise generally complete results. This applies for groupings of two and three-ring contaminants as well as the less complete and even missing results within the four, five and six-ring contaminant groupings. Within groups, time-series results for missing PAHs can be predicted to be consistent with those that were measured. This prediction can be made for both the complete lighter PAH results and the less complete heavier PAH results. Overall, the results establish that the various plastic and other materials of the BFSD2 which are in contact with the sampled seawater do not adversely adsorb or release the target PAHs within measurable limits, with the possible exceptions of Naphthalene and Flouranthene, as described in the Results section. Apparent adsorption of these two PAHs introduces a relatively small error to field measurements which are subsequently resolved by normalization during data processing. Furthermore, careful consideration was made when materials for the chamber, mixing mechanism and sample bottles were considered. Surfaces for minimal adsorption or release of the entire suite of contaminants analyzed were considered and practical decisions made. With polycarbonate chamber, Teflon flow lines and valves and glass sample bottles, the BFSDII has the most practical combination of materials for the minimal adsorption of release of these contaminants. Finally, although repeatability statistics requires more than a single data set, and three tests were conducted, those contaminants with only two data sets were analyzed albeit with lower confidence results. The repeatability of PAHs with a single data set can only be estimated, with no statistical confidence, and the four heavier PAHs with no data sets can only be predicted, as above. Thus, because of the common attributes of groups of PAHs and with the established results where data were available, it is estimated and predicted that field measurements of those PAHs with incomplete blank test results will be approximately similar to the other more complete PAHs measured. At sites where precise measurements are required for targeted PAHs which were not established with this series of blank tests an additional blank test using site-specific seawater or clean seawter or clean seawter spiked with the target PAH(s) may be necessary

Common features among PCB congeners allow much the same degree of extension of results discussed above for PAHs. Pesticides do not however support the same degree of extension because of the uncertainty of their composition and the limited results achieved. Pesticides were detected at much lower concentrations than the PAHs. For both PCBs and pesticides, blank test data sets that were sufficiently complete did establish acceptable repeatability considering such low levels (<1 ng/L). The remaining blank tests (with only one data set) established, as with PAHs, that the various plastic and other materials of the BFSD2 which are in contact with the sampled seawater do not adsorb or release the particular PCB congener or pesticide within measurable limits. The time-series flux trends for these contaminants show low and variable rates (slopes). It is noted that PCB congener 18 (2,2',5-Trichlorobiphenyl) showed a small release during the first blank test, but did not repeat in subsequent tests. In order to make the most from the available data, especially where only one of the three blank tests had sufficient detects (i.e., at least 6 measurements distributed evenly or grouped at one end), non-detects were removed and the remaining measurements used. This approach was used extensively for the PCB congeners and pesticides and much less for the heavier PAHs (only).

Ancillary data collected and recorded, including chamber temperature, pressure, salinity, pH and dissolved oxygen indicated chamber conditions remained stable throughout the tests. The pH sensor recorded a slight reduction in pH (<0.5) which occurred gradually over 70 hours in all three tests. The pressure sensor recorded changes in barometric conditions as well as the vacuum affect of each sample collection bottle being activated at 7-hour intervals during the tests.
Silica measurements used to confirm chamber integrity during BFSD2 metals applications will not be used for organics applications. The need to conserve sample volume to maximize detection levels

combined with experience in comparing onboard sensors with silica results in previous tests supports reliance on the sensors to identify any loss of chamber seal integrity. Dissolved oxygen an pH followed distinct trends when the silica test indicated a good seal. These two parameters show promise in interpreting seal integrity and will be used during organics applications.

#### 5.1.2.3 Organics Blank Tests Assessment

It was concluded that the BFSD2 organics blank performance was adequately established and the values obtained are sufficiently repeatable, precise and accurate to statistically distinguish differences from measured *in situ* sediment flux rates for a number of targeted PAHs. Measurement of *in situ* flux rates for selected PCB congeners and pesticides are also statistically distinguishable where blank test results are available.

### 5.1.3 San Diego Bay, Paleta Creek Metals Demonstrations

Two 70-hour metals demonstrations of BFSD 2 were conducted at the heavily industrialized Paleta Creek entrance to San Diego Bay (see Figure 33). The quiescent, marina-like area is used for mooring support craft and receives periodic stormwater inflow from the Paleta Creek drainage basin. The site was selected due to known levels of trace metals in the sediments, as established in two previous prototype BFSD tests, and because of its convenient location for an initial field test and first demonstration of BFSD2. Two demonstrations were conducted two weeks apart (June 6-8, 1998 and June 18-22, 1998) with the first demonstration being a full dress rehearsal for the second, formal demonstration. The locations for the tests were within 10 feet of one another and within the same proximity to two previous prototype BFSD deployments. The tests were conducted at about 18 +/- 3 feet depth, depending on tidal flow, and offshore about 30 feet from a quay wall. Deployment and retrieval was from the SSC SD research vessel R/V ECOS.

**Figure 33. BFSD2 Paleta Creek Metals Deployment.**

Prior to both tests, the BFSD 2 was cleaned and prepared using the same procedures used during the triplicate blank tests. Aboard R/V ECOS after loading and connecting various equipment (laptop computer, TV monitor and light, cabling) a standard pre-deployment checklist was followed. Once moored at the site with the GPS location logged, the BFSD 2 was lowered to within 2 feet of the bottom and a 15-minute test was started to stabilize the flow-through sensors and to measure the ambient dissolved oxygen level. This test was run twice during the first demonstration to assure repeatability. The ambient dissolved oxygen level is used to establish system control limits for maintaining a narrow range of dissolved oxygen in the collection chamber during the 70-hour test and for assessment of sediment oxygen uptake rates. As requested by CA EPA certification

evaluators, a second, independent dissolved oxygen measurement was made outside the collection chamber during the second demonstration by attaching an additional instrument to the BFSD 2 frame next to the collection chamber.

After entering the control limits into the 70-hour test program software and downloading it, the BFSD2 was raised for manual activation of the number one sample bottle valve. A new, higher mounting location for the valve was implemented following the blank tests to improve collection of representative ambient bottom water. With the BFSD2 partially submerged and the collection chamber approximately 3 feet below the surface, the valve was opened manually and the BFSD2 was immediately lowered back to approximately 2 feet from the bottom. After a short delay to arrange deck release lines, the BFSD2 was then allowed to free-fall to the bottom and insert its collection chamber into the sediment.

The landing and insertion were monitored using a video camera. Activation of the three insertion indicator lights was verified. The video camera, aided by a floodlight, also allowed a limited assessment of the site prior to initiating the 70-hour test. And, after starting the test, it also allowed confirmation of lid closure prior to complete detachment of lanyards and connections for autonomous operation. Both demonstration deployments were straightforward and without problems. The R/V ECOS returned to SSC SD and left the BFSD2 in its autonomous operation mode.

Retrieval of the BFSD2 after the tests was routine except for malfunction of the commercial acoustic recovery system. Recovery was with a separate line stowed at the site. Acoustic receiver burn-wire modification, latch modification, and most importantly, sandpaper cleaning of the ground electrode were subsequently implemented. Once BFSD2 was washed down and on deck, the twelve 250ml sample bottles were removed for processing using EPA handling and chain of custody procedures. During the first demonstration the samples were returned to SSC SD for splits (silica and metals). For the second demonstration splits were made aboard R/V ECOS using pre-acidified 125ml containers for metals samples and pre-cleaned 25ml beakers for silica measurements. Silica measurements were made aboard R/V ECOS using a field portable Hach model DR2010 Instrument. The metals samples were packaged and shipped to Battelle Marine Sciences Laboratory for analysis of the six metals selected for CA EPA certification evaluation. All data and results for the two demonstrations are compiled in Microsoft Excel spreadsheets “BFSD2 PCPD.xls” and “BFSD2 PCD.xls”, provided with the electronic submission of this report. Appendix C provides copies of the spreadsheet results and includes data and graphs for the BFSD2 flow-through sensors.

Tables 6 and 7 summarize the results of the two Paleta Creek metals demonstrations.

**Table 6. BFSD 2 Metals Results from the Paleta Creek Pre-Demonstration (**PCPD**).**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -1.75 | 19.71 | 38.1% | 2.82 | 8.73 | 165 | 1.54 |
| Cadmium (Cd) | 9.64 | 4.14 | 100.0% | -0.52 | 0.75 | 1.16 | 0.148 |
| Lead (Pb) | 11.06 | 7.94 | 100.0% | 3.16 | 1.59 | 98.9 | 0.1561 |
| Nickel (Ni) | 25.24 | 4.62 | 100.0% | 10.28 | 7.34 | 19.1 | 0.9262 |
| Manganese (Mn) | 71.33 | 701.54 | 80.7% | -264.85 | 7.49 | 405 | 28.12 |
| Manganese (Mn)[1] | 5763.99 | 23621.74 | 100.0% | -264.85 | 7.49 | 405 | 28.12 |
| Zinc (Zn) | 715.02 | 257.38 | 100.0% | -3.38 | 65.22 | 356 | 8.90 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1050.87 | 86.25 | na | na | na | na | 5.2 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 30.29 | 11.33 | 100% | -1.97 | 2.88 | na | 0.81 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

**Table 7. BFSD 2 Metals Results from the Paleta Creek Demonstration (**PCD**).**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -6.57 | 17.74 | 80.7% | 2.82 | 8.73 | 165 | 1.46 |
| Cadmium (Cd) | 7.02 | 3.87 | 100.0% | -0.52 | 0.75 | 1.16 | 0.06897 |
| Lead (Pb) | 4.32 | 12.39 | 65.6% | 3.16 | 1.59 | 98.9 | 0.07879 |
| Nickel (Ni) | 19.44 | 8.75 | 99.8% | 10.28 | 7.34 | 19.1 | 0.8378 |
| Manganese (Mn) | 103.94 | 957.14 | 73.3% | -264.85 | 7.49 | 405 | 24.02 |
| Manganese (Mn)[1] | 4194.24 | 101841.32 | 99.9% | -264.85 | 7.49 | 405 | 24.02 |
| Zinc (Zn) | 574.26 | 274.14 | 100% | -3.38 | -68.61 | 356 | 8.38 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1341.12 | 160.18 | na | na | na | na | 4.7 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 28.75 | 15.63 | 100% | -1.97 | 2.88 | na | 0.79 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

Numbers in the Flux Rate Confidence column indicate the statistical confidence that the measured flux rate is different than the blank flux rate. Results from the blank study, bulk sediment analysis, overlying water and oxygen uptake analysis are shown for comparison.

Figures 34 and 35 illustrate graphical comparison of the results.

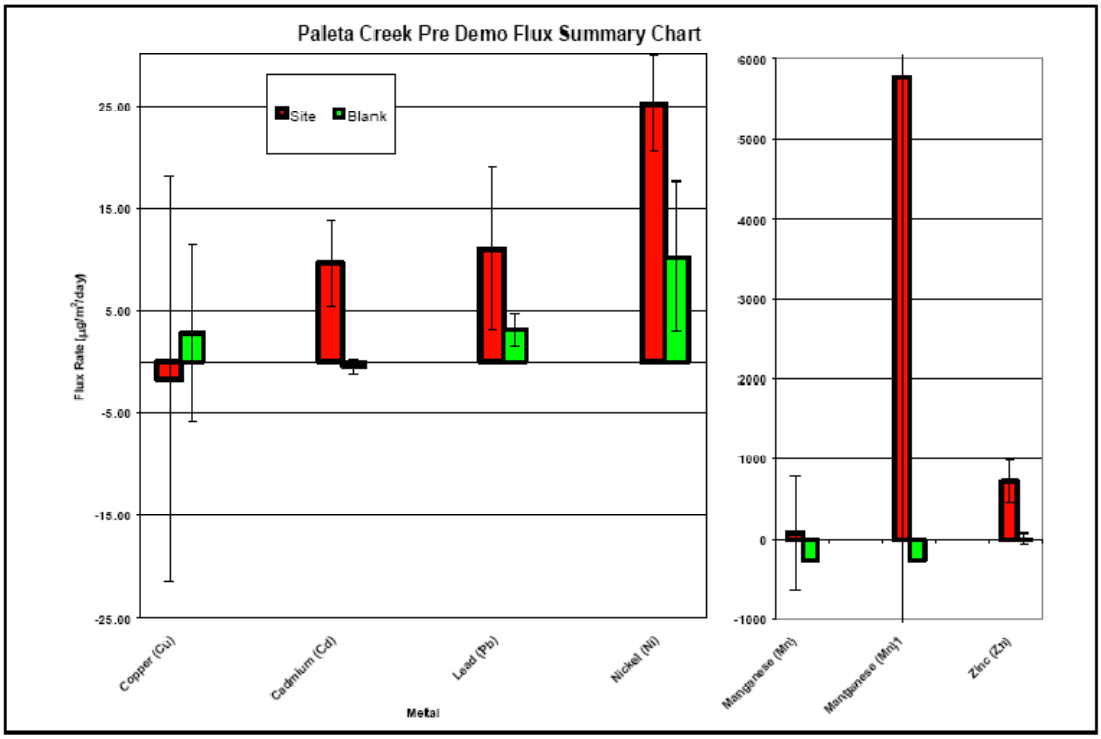



**Figure 34. Paleta Creek Metals Pre-Demonstration Results.**

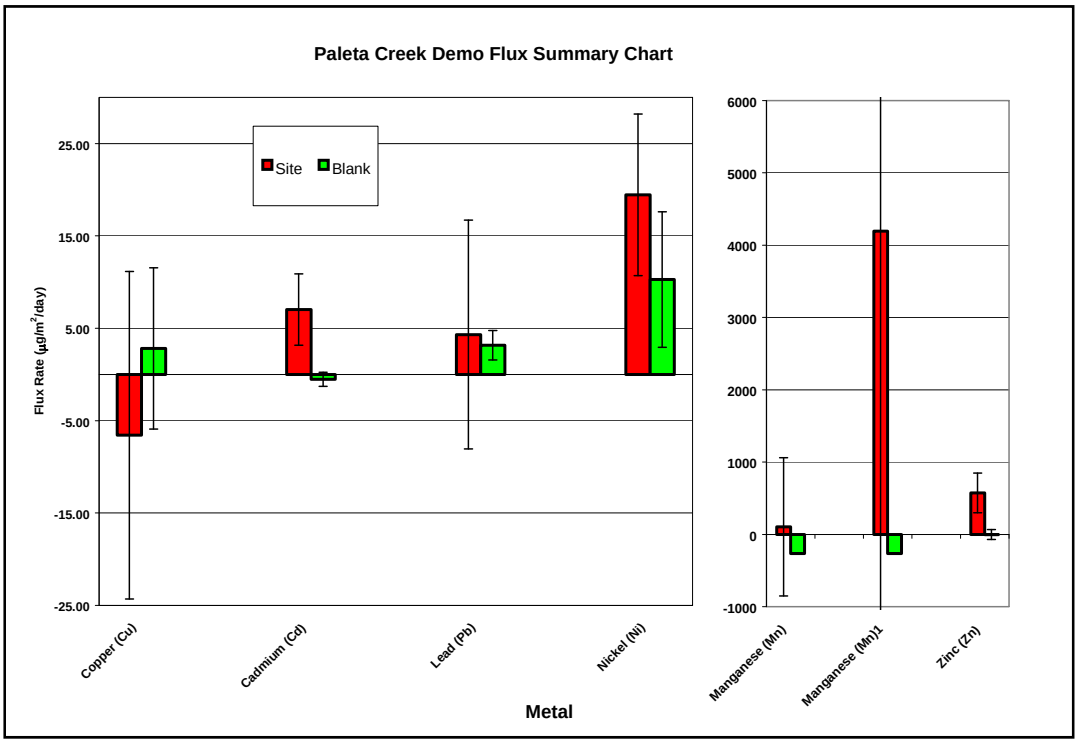



**Figure 35. Paleta Creek Metals Demonstration Results.**

#### 5.1.3.1 Discussion of Paleta Creek Demonstrations Results

In general, BFSD2 results from the two Paleta Creek demonstrations were similar and consistent with previous prototype deployments at this location. Figures 36 and 37 are the sets of graphs of concentration versus time for each analyte (red squares) in each of the demonstrations, compared with blank performance (blue triangles). The concentrations of analyte plotted on these graphs here and throughout this report are not the measured concentrations of each sample but concentrations that have been corrected for dilution effects from sampling water from the chamber and intercept corrected for the linear slope analysis. Therefore the concentrations shown could change depending on how many samples are included in the slope analysis. This is illustrated well in the manganese graphs where two slope analyses were performed with different numbers of samples. It appears concentrations for each sample are different. These graphs were generated in the process of calculation the slope or flux of each analyte, and it is the flux rate and not individual sample concentrations which are interpreted in these graphs.

The results for the Pre-Demonstration indicate that Cadmium, Lead, Nickel and Zinc had fluxes out of the sediment that were highly significant when compared to the blank chamber results. The flux of copper indicated a negative flux (sediment uptake) although the statistical confidence was only 65%.

Manganese fluxes showed a consistent trend or pattern here at Paleta as well as at subsequent deployments in Pearl Harbor. Flux curves would define a higher rate of flux in the first part of the test while becoming lower or negative in the later part. The reason for this drop is not known, but could be attributed to oxidation and subsequent precipitation or flocculation when the chamber water reached a high concentration which results in a “quenching”-like trend. Certainly some process was changing the flux rate of manganese as the test proceeded. So, in order to estimate actual flux rates of manganese from sediments as if the chamber were not present, the first three values obtained from the test was used for calculating a flux rate. This is similar to how dissolved oxygen demand is calculated before the system becomes anoxic and/or the oxygen feed system kicks in. This approach results in a more conservative estimate of flux rates for this metal, i.e. higher outward fluxes. We will use and discuss the flux values obtained from this later method of using the first three samples drawn from the chamber for manganese. However, flux curves and values from estimated from the entire test duration are also presented here for consideration. Therefore, manganese also had a positive outward flux as did cadmium, lead, nickel and zinc but the statistical confidence was somewhat lower.

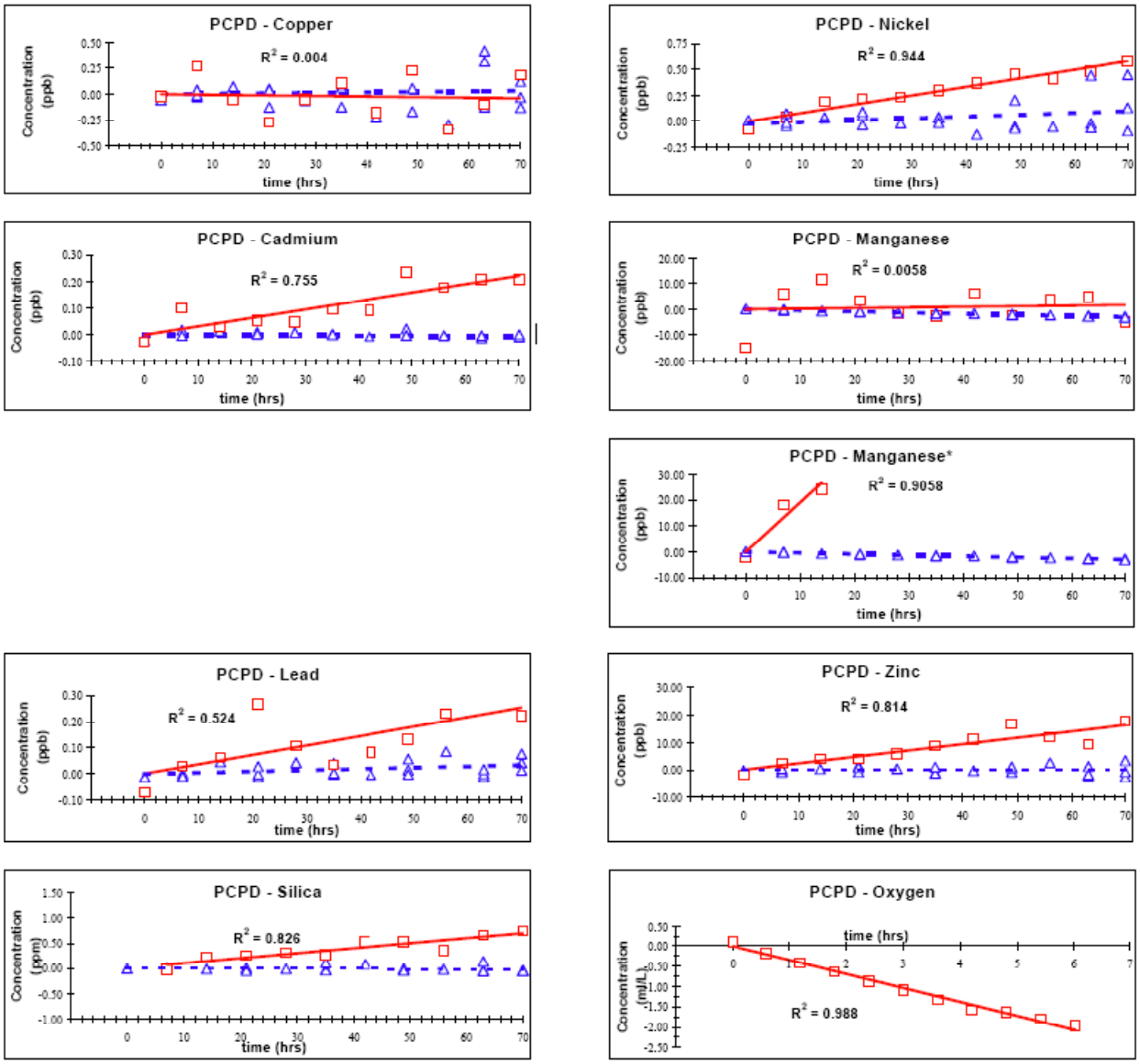



**Figure 36. Paleta Creek Metals Pre-Demonstration Concentration vs. Time.**

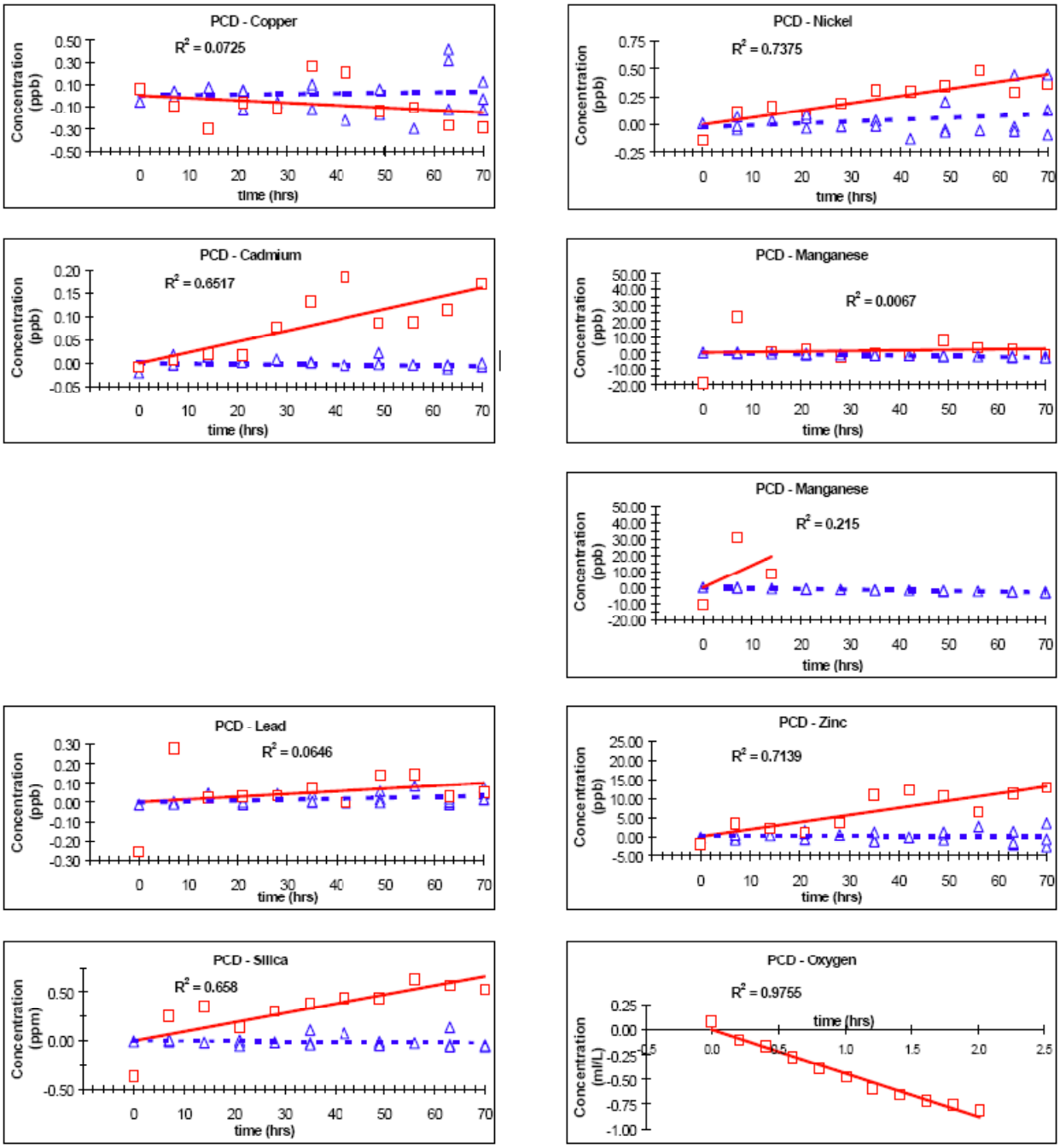



**Figure 37. Paleta Creek Metals Demonstration Concentration vs. Time.**

Results for the formal Demonstration were similar to those of the Pre-Demonstration with the exception of Lead. Cadmium, Nickel and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank results. The magnitude of the Cadmium, Nickel and Zinc fluxes for the Demo were similar, though slightly lower, than those observed for the Pre-Demonstration. Manganese again had a positive outward flux but a lower statistical confidence. As with the Pre-Demonstration, the flux of copper was negative (sediment uptake) although the statistical confidence was <0.1%.

#### 5.1.3.1.1 Flux Measurements

As shown in Tables 6 and 7, and illustrated in Figures 34 through 37, cadmium, lead, nickel, manganese and zinc all had positive flux rates which were statistically different from blank test results. Also, the relative magnitudes of the flux rates were consistent for both demonstrations and with earlier prototype work at the site. In other words, zinc had a larger flux rate than manganese; manganese was larger than nickel; nickel was larger than lead; lead and cadmium were very close to the same magnitude. The magnitude of the flux rates for the formal Demonstration were generally similar, though somewhat less (except manganese), than those of the Pre-Demonstration test two weeks earlier, however, the differences are not statistically significant. A correlation with sediment oxygen uptake is evident and may be an explanation for the slight downward shift of fluxes. The flux rate for manganese is likely more positive than measured when corrected by the large, very repeatable negative flux measured in the blank tests. Copper results indicate a slightly negative flux (sediment uptake) which has been observed in previous work. This may be attributed to pore water chemistry involving sulfide binding, complexation with organic matter, or elevated water column concentrations associated with hull leachate sources as discussed extensively in earlier reports. The oxygen uptake measured during both deployments is consistent and indicates continuous consumption of dissolved oxygen, which can be attributed to oxidation of organic matter and biological uptake at the sediment water interface.

### 5.1.3.2 Discussion of Paleta Creek Demonstrations Tests

Important aspects of the demonstrations including performance indicators and deployment problems are discussed below.

#### 5.1.3.2.1 Performance Indicators

Several methods were used to evaluate system performance of the BFSD2 during and after the demonstrations. To assure a proper seal of the chamber, the deployment was monitored with an underwater video camera, insertion light indicators connected to pressure sensors on the sealing flange were monitored, and silica, pH, and oxygen levels within the chamber were monitored for expected trends. Landing and insertion monitored with the video camera and landing lights indicated a good seal. After starting the test, the video camera also confirmed lid closure of the chamber.

A linear increase in silica during the deployments was used as another indicator of proper system performance and chamber seal. The results, shown on Figures 36 and 37, show that silica concentration increased linearly, and that the silica flux rates were consistent and repeatable for the two deployments, indicating proper system performance and chamber seal. Oxygen variations in the chamber were monitored to assure maintenance of ambient oxygen levels, proper chamber seal, and to evaluate sediment oxygen uptake. The rate of oxygen consumption (sediment uptake) during the deployments, also shown in

Figures 36 and 37, was sufficient to cause repeated cycling of the BFSD2 oxygen recharge subsystem. Figure 38 are graphs of the oxygen sensor data for the two deployments showing the operation of the control system. The control limits selected allowed the dissolved oxygen to remain within approximately 1 ml/L of the ambient level and still yield data to assess the sediment uptake rate. The multiple cycles for both recharge and uptake were consistent and repeatable.

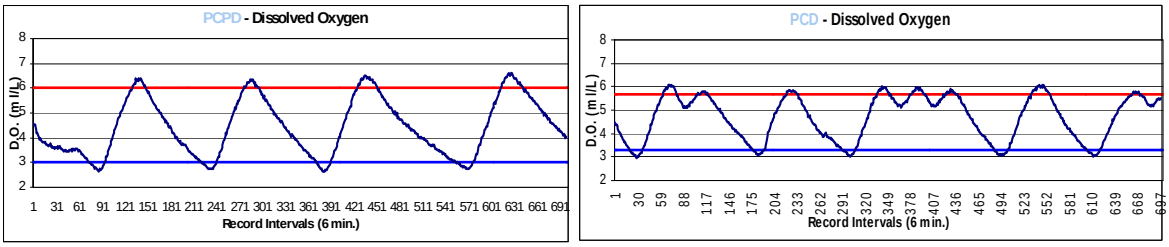



**Figure 38. Paleta Creek Metals Demonstrations Oxygen Control Results.**

As requested by CA EPA certification evaluators, an independent dissolved oxygen measurement of ambient bottom water at the BFSD2 test site was made during the formal Demonstration deployment. The measurement instrument was battery power-limited and operated for only the first 39 hours of the deployment. During that period, cyclic changes of approximately 0.5 ml/L occurred about the ambient level of approximately 5 ml/L. Thus oxygen results reconfirm that a proper chamber seal was achieved, and that oxygen levels within the chamber were maintained close to the ambient level and with similar, though slightly larger, variability to that observed outside the chamber.

In the properly sealed BFSD 2 chamber, the pH will generally show a decreasing trend as the breakdown of organic matter at the sediment water interface drives $CO_2$ into the chamber water. This decreasing trend was observed during both deployments as shown in Figure 39. Some small fluctuations from the expected steady decline in chamber pH were seen. While the exact cause of these fluctuations is not known, a number of factors including photosynthetic activity and sediment and pore water oxidation chemistry can account for the minor reversals. In the absence of other evidence of a breech in chamber seal, these small fluctuations were attributed to natural variations.

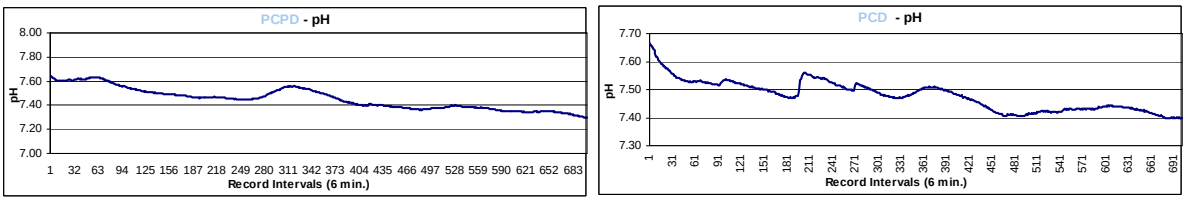



**Figure 39. Paleta Creek Metals Demonstrations pH Results.**

#### 5.1.3.2.2 Deployment and Recovery Problems

Two minor problems were encountered during the demonstrations. The first was failure of the commercial acoustic recovery system to function. During the Pre Demonstration the failure was attributed to one too many burn-wire strands which led to excessive time for functioning. One strand was removed for the next test, however the release latch mechanism was corroded and failed to release the buoy after the burn-wire had properly functioned. The latch was subsequently modified and is an inspection point as part of the pre-deployment checklist procedure. Most importantly it was determined that abrasive cleaning of the ground (plating) electrode with sandpaper must be performed after every use.

The second problem was the concentration of metals in the water collected from the open chamber, as it descended to the bottom was not consistent with concentrations in the chamber shortly after it reached the bottom. The values from laboratory analysis of the water in sample bottle one (which filled during descent, after manual operation of its valve near the surface) and from water in sample bottle number two (filled from the chamber 6 minutes after lid closure) were inconsistent. As with the blank tests, the concentration values from the second sample bottle were considered more representative of makeup water entering the chamber and were used in dilution correction calculations. And, as with the blank tests, a sensitivity analysis indicated an insignificant affect on flux results. A more acceptable method for collecting representative bottom water was subsequently implemented and test deployed prior to the Pearl Harbor demonstrations.

### 5.1.3.3 Discussion of Data Interpretation

In order to understand the significance of the measured flux rates in Paleta Creek from a water quality standpoint, it is necessary to estimate the potential loading and subsequent increase in metals concentrations within the overlying water. A simplified analysis is presented here in order to illustrate the utility of the BFSD2 data for this purpose.

The Paleta Creek study area where the demonstrations were performed is bordered by land on three sides, and open to San Diego Bay only to the southwest. The bounded area has a surface area of about 62400 $m^2$. The average depth of the area is about 7 m, and thus the overall volume is about 436800 $m^3$. The tidal range in San Diego Bay averages about 1.4 m. A simple estimate of the residence time can be obtained based on complete tidal flushing as

$$\tau_{res} = \frac{V_{pc}}{V_{tp}} = \frac{D_{pc}}{H_t N_t} = \frac{7}{1.4 \times 2} = 2.5\ days$$

Where $\tau_{res}$ is the residence time, $V_{pc}$ is the volume of the Paleta Creek study area, $V_{tp}$ is the tidal prism volume for the area, $D_{pc}$ is the depth of the study area, $H_t$ is the tidal range, and $N_t$ is the number of tides per day.

In steady state conditions, the residence time can be related to the overlying water concentration by the relation

$$\tau_{res} = \frac{m_{ow}}{\dot{m}_{sed}}$$

Where $m_{ow}$ is the mass of a given metal in the Paleta Creek study area overlying water, and $m_{sed}$ is the loading from the sediment.

The overlying water concentration can thus be estimated from the flux rates as

$$c_{ow} = \frac{m_{ow}}{V_{pc}} = \frac{\tau_{res}\dot{m}_{sed}}{V_{pc}} = \frac{\tau_{res}F_{sed}A_{pc}}{V_{pc}} = \frac{\tau_{res}F_{sed}}{D_{pc}}$$

Where $F_{sed}$ is the sediment flux rate measured by the BFSD, and $A_{pc}$ is the surface area of the sediment in the Paleta Creek study area. Using this relation, the estimated overlying water concentrations for each of the metals from each of the surveys can be estimated as shown in Table 8 below.

**Table 8. Estimated Sediment Flux Contribution to Overlying Water Concentrations for the Paleta Creek Study Area**.

| Metal | PCPD Flux | PCD Flux | $\tau_{res}$ | $D_{pc}$ | $C_{ow}$ PCPD | $C_{ow}$ PCD | $C_{ow}$ meas. | PCPD % of meas. | PCD % of meas. |
|---|---|---|---|---|---|---|---|---|---|
| | µg/m²/day | µg/m²/day | days | m | ug/l | ug/l | ug/l | | |
| Copper (Cu) | -2 | -7 | 2.5 | 7 | - | - | 2.41 | - | - |
| Cadmium (Cd) | 10 | 7 | 2.5 | 7 | 0.0036 | 0.0025 | 0.0786 | 4.54% | 3.2% |
| Lead (Pb) | 11 | 4 | 2.5 | 7 | 0.0039 | 0.0014 | 0.182 | 2.16% | 0.8% |
| Nickel (Ni) | 25 | 19 | 2.5 | 7 | 0.0089 | 0.0068 | 1.02 | 0.88% | 0.7% |
| Manganese (Mn) | 73 | 105 | 2.5 | 7 | 0.0261 | 0.0375 | 21.0 | 0.12% | 0.2% |
| Zinc (Zn) | 716 | 575 | 2.5 | 7 | 0.2557 | 0.2054 | 8.91 | 2.87% | 2.3% |
| Silica ($SiO_2$) | 30* | 30 | 2.5 | 7 | 0.011 ** | 0.011 ** | 0.79 ** | 1.35% | 1.4% |

*mg/m²/day **mg/l

Note: $C_{ow}$ measured is the overlying water concentration that was measured during the PCD study. The percent of measured column indicates the fraction of the overlying water concentration that can be explained by the sediment flux.

Comparing the estimated overlying water concentration to the measured concentration indicates that the contribution due to sediment fluxes ranges from a high of 4.5% for cadmium, to a low of about 0.2% for manganese. In practice, these estimates could be used to evaluate the potential benefit of a sediment removal or capping action compared to a no-action scenario. The simple model employed here neglects many factors such a s tidal flushing efficiency of the study area and scavenging of metals near the sediment-water interface that could influence the estimated concentrations. If the tidal flushing is not complete (which is realistic), then the residence time and estimated contribution from the sediments would increase. A typical flushing efficiency is about 50%, which wou ld increase the estimated Cow by a factor of 2. Colloid and particle scavenging near the sediment water interface would tend to reduce the s ediment flux contribution, although the magnitude of this process is not well known.

### 5.1.4 San Diego Bay, Paleta Creek Organics Demonstration

One 70-hour organics test using Benthic Flux Sampling Device 2 (BFSD2) was conducted March 2-5, 2001 at the heavily industrialized Paleta Creek entrance to San Diego Bay, within the borders Naval Station San Diego. Figure 40 is a picture o f the area which is used for mooring Navy industrial waste and sewage collection barges, emergency oil spill response vessels, and other transient industrial support vessels. The site was selected as one heavily studied over the years and likely to produce detectable and mobile organic contaminants. Also, the site was used for the BFSD2 *metals* flux demonstrations during June, 1998 and has subsequently been designated by the California Regional Water Quality Control Board as San Diego Bay's most "toxic hotspot". A sediment survey of the area conducted by SSC SD during December, 2000 using gravity core samples produced high levels of the US EPA's 16 priority Polynuclear Aromatic Hydrocarbons (PAH) expressed as Total Petroleum Hydrocarbons (TPH). The site was also a convenient location for this first organics field test. The tests were conducted at about 18 +/- 3 feet depth, depending on tidal flow, and offshore from a quay wall about 30 feet. Deployment and retrieval was from the SSC SD research vessel (R/V) Ecos.

**Figure 40. Paleta Creek, San Diego Bay.**

Prior to the test, the BFSD2 was cleaned and prepared using the same procedures used for the triplicate organics blank tests. Aboard R/V Ecos, after loading and connecting various equipment (laptop computer, TV monitor and light, cabling) a standard pre-deployment checklist was followed. Once moored at the site with the GPS location logged, the BFSD2 (shown in Figure 41) was lowered to near the bottom and the landing

**Figure 41. BFSD2 Paleta Creek Organics Deployment.**

site was surveyed by remote video for any obstructions or other features which could prevent successful insertion of the collection chamber into the sediment. The BFSD2 was then lowered to the bottom at the maximum rate allowed by the deck hoist (about 1ft/sec) and the landing and insertion were monitored using the video camera. Activation of three battery-powered lights by switches mounted on the chamber at the 3-inch level was verified and used to establish adequate sediment insertion. The landing produced a minimal amount of resuspension. The 15-minute "Sensor Check" program was then started to close the chamber lid, to stabilize the flow-through sensors and to measure the ambient dissolved oxygen level. Closing the chamber lid sealed the chamber and activated collection of an ambient water sample. Measurement of the ambient dissolved oxygen level was used to establish system control limits for maintaining a narrow range of dissolved oxygen in the collection chamber during the 70-hour test. Dissolved oxygen measurements data taken during the test are also used for assessment of sediment oxygen uptake rates.

After establishing and entering the dissolved oxygen control limits into the 70-hour test program and downloading it to the BFSD2, the flux test was started. The initial autonomous functions were monitored from R/V Ecos to assure proper operation of the BFSD2 prior to disconnecting the cables and dropping them overboard. Proper data recording and rotary sample valve commands were confirmed. R/V Ecos departed the site and left BFSD2 in place to perform the 70-hour autonomous sampling operation.

Retrieval of BFSD2 after completion of the test, shown in Figure 42, was routine except for malfunction of the commercial acoustic recovery system (the latch required subsequent modification). Recovery was aided by the clarity of the water and allowed a boat hook to be used to jar the recovery buoy loose from the BFSD2. Once BFSD2 was washed down and on deck, the twelve 250 ml sample bottles were removed for processing using EPA handling and chain of custody procedures. All bottles were full and inline filter elements were slightly discolored, indicating low turbidity within the chamber. Before moving location, a sediment sample was collected from the BFSD2 landing site. Onboard R/V Ecos, the sample bottle filter assemblies were removed and replaced with precleaned caps, preprinted labels were attached to the samples and packaging for overnight shipment was completed.

**Figure 42. BFSD 2 Paleta Creek Organics Demonstration Recovery.**

As the samples were being processed onboard R/V Ecos, the recorded data files from the 70-hour test were uploaded and entered into a standardized Excel spreadsheet template for data processing. The sensor data, plotted as time-series indicated a successful deployment. As can be seen in Figure 43, there was no sudden pH level shifts indicating loss of chamber seal and the oxygen control system maintained the dissolved oxygen level within the set limits. The slowly reducing trend for pH level was normal and is indicative of biological activity. The slight increases observed in pH near 28 hours and again near 50 hours correspond to midday periods and are most likely associated with benthic algal production and a corresponding consumption of $C0_2$ and increase in pH. Salinity, temperature and pressure were also normal.

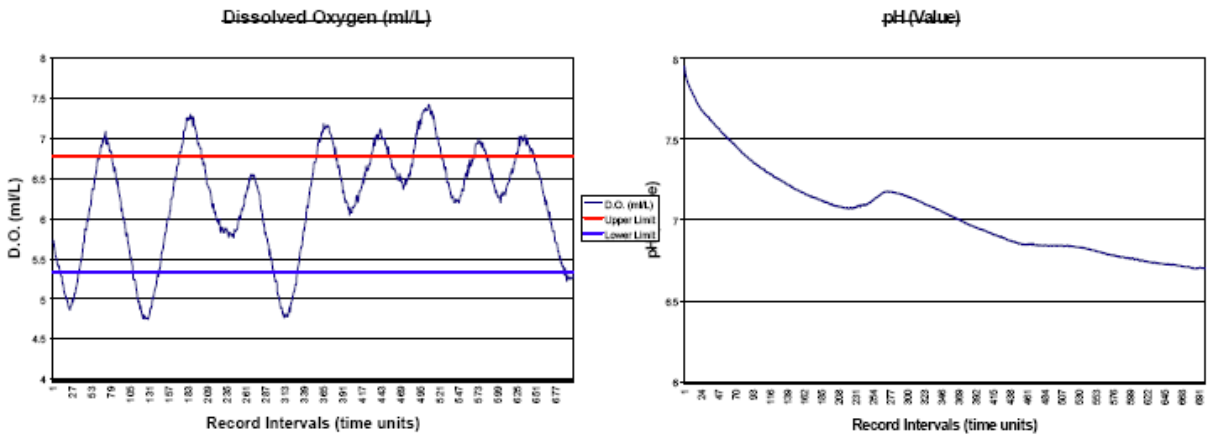



**Figure 43. BFSD 2 Paleta Creek Organics Demonstration Recovery.**

The samples were packaged and overnight air-shipped that afternoon to ADL for extraction and analysis in accordance with the processes, procedures and controls established under the Method Detection Limit study and used for the triplicate blank tests. All data and results for the demonstration are compiled in Microsoft Excel spreadsheets "PC Organics Demo - PAHs (Part1&2).xls", "PC Organics DemoPCBs.xls" and "PC Organics Demo-Pesticides.xls" provided with the electronic submission of this report. Appendix C provides copies of the spreadsheet results and includes data and graphs for the BFSD2 flow-through sensors.

Tables 9, 10 and 11 provide a summary of the flux results for selected PAHs, PCB congeners and pesticides for the Paleta Creek organics demonstration.

**Table 9. BFSD2 PAH Results Summary for Paleta Creek Demonstration.**

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 459.20 | 429.58 | 94.5% | -440.30 | 458.38 | 13 | 6.7 |
| 2. Acenaphthene | 337.58 | 178.97 | 100.0% | -32.40 | 50.34 | 19 | 9.7 |
| 3. Acenaphthylene | 105.51 | 183.82 | 33.8% | 208.47 | 112.60 | 220 | 7.6 |
| 4. Fluorene | 173.17 | 149.76 | 100.0% | -76.74 | 28.38 | 34 | 2.3 |
| 5. Phenanthrene | 489.25 | 659.77 | 100.0% | 10.95 | 10.95 | 240 | 8.2 |
| 6. Anthracene | 569.42 | 260.29 | 100.0% | 117.68 | 64.62 | 470 | 5.3 |
| 7. Fluoranthene | 365.55 | 397.63 | 100.0% | -1423.95 | 178.41 | 890 | 37 |
| 8. Pyrene | 951.97 | 755.67 | 100.0% | -439.51 | 70.73 | 740 | 13 |
| 14. Indeno(1,2,3-c,d)pyrene | -65.35 | 906.77 | NA | NA | NA | 470 | 1.4 |
| 16. Benzo(g,h,i)perylene | -46.63 | 263.97 | 67.7% | 20.15 | 65.15 | 400 | 1.4 |

**Table 10. BFSD2 PCB Results Summary for Paleta Creek Demonstration.**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 18 - 2,2',5-Trichlorobiphenyl | 52.21 | 103.93 | 4% | 76.82 | 36.49 | 2.6 | ND |
| 28 - 2,4,4'-Trichlorobiphenyl | 41.52 | 80.03 | 61% | -8.05 | 82.03 | 2.2 | 1.1 |
| 52 - 2,2',5,5'-Tetrachlorobiphenyl | 9.44 | 105.28 | 77% | 72.74 | 28.12 | 4.9 | 3 |
| 66 - 2,3',4,4'-Tetrachlorobiphenyl | -19.94 | 62.01 | 96% | 37.74 | 25.45 | 5.3 | ND |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | 45.99 | 84.57 | 17% | 57.59 | 31.49 | 13 | ND |
| 118 - 2,3',4,4',5-Pentachlorobiphenyl | -2.34 | 123.95 | 9% | 2.51 | 15.40 | 13 | ND |
| 153 - 2,2',4,4',5,5'-Hexachlorobiphenyl | 22.26 | 78.55 | 43% | 9.45 | 11.71 | 23 | 0.11 |

**Table 11. BFSD2 Pesticide Results Summary for Paleta Creek Demonstration.**

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 2,4'-DDT | 57.49 | 95.75 | NA | NA | 3.6 | 0.88 |
| 4,4'-DDT | 31.23 | 55.47 | NA | NA | 14 | ND |
| Dieldrin | -23.48 | 45.68 | NA | NA | 2 | ND |
| Hexachlorobenzene | 23.76 | 35.20 | NA | NA | 0.61 | ND |
| Mirex | 36.23 | 154.93 | NA | NA | ND | ND |

Numbers in the Flux Rate Confidence column indicate the statistical confidence that the measured flux rate is different than the blank flux rate. Results from the blank study, bulk sediment analysis and overlying water are shown for comparison.

Figures 44, 45 and 46 provide graphical comparison of the flux results with the blank tests results.

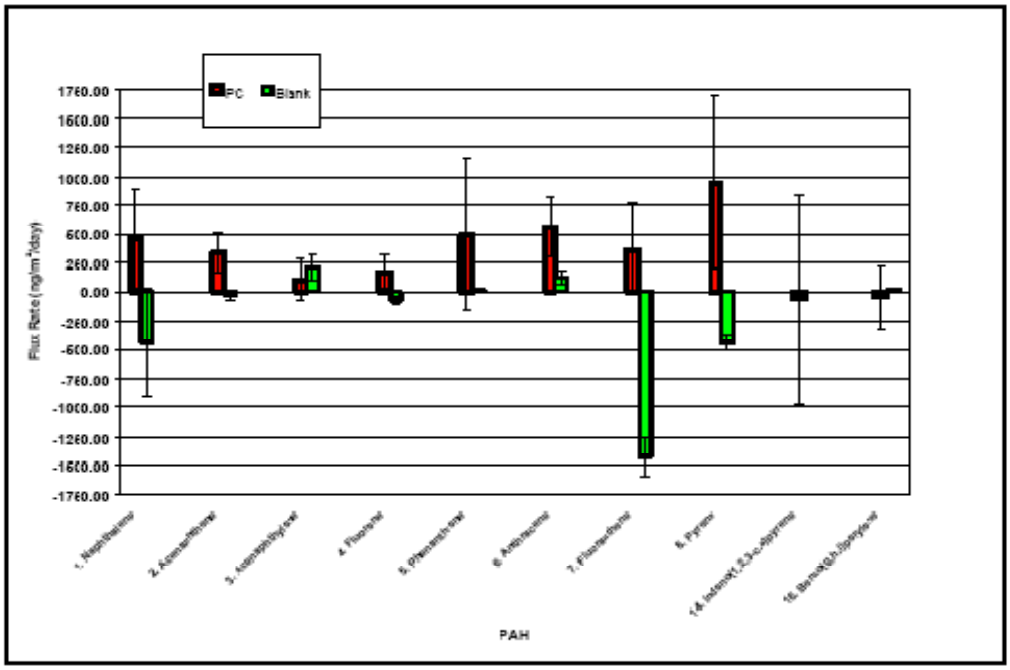



**Figure 44. Paleta Creek PAH Demonstration Results.**

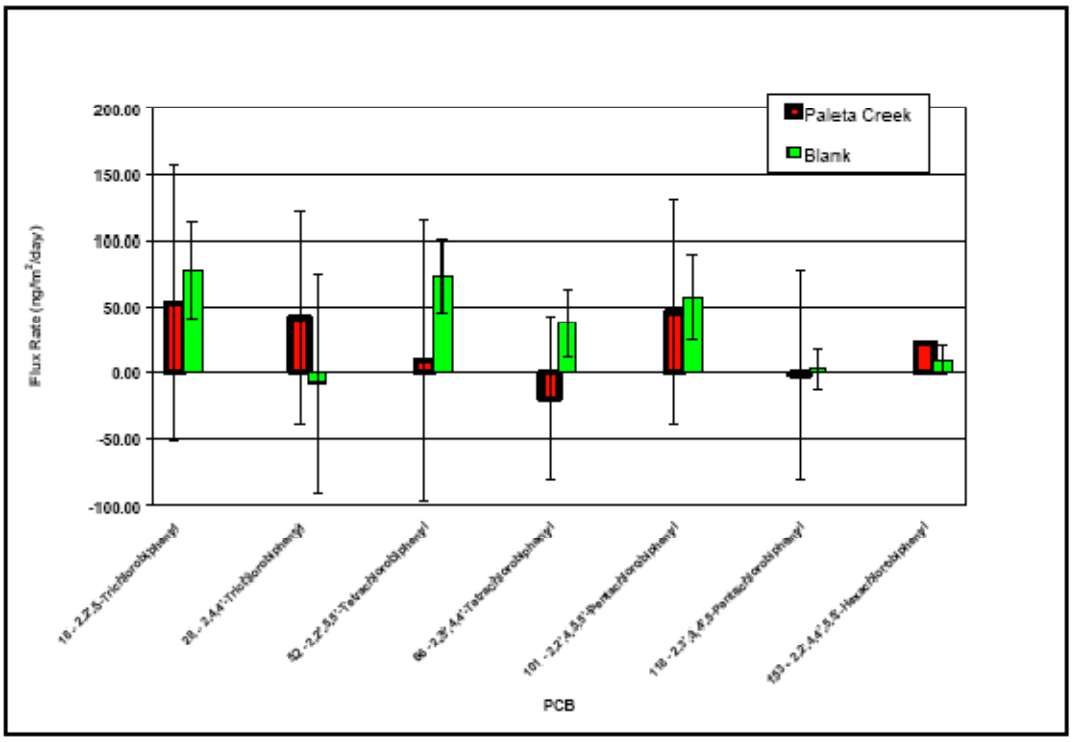



**Figure 45. Paleta Creek PCB Demonstration Results.**

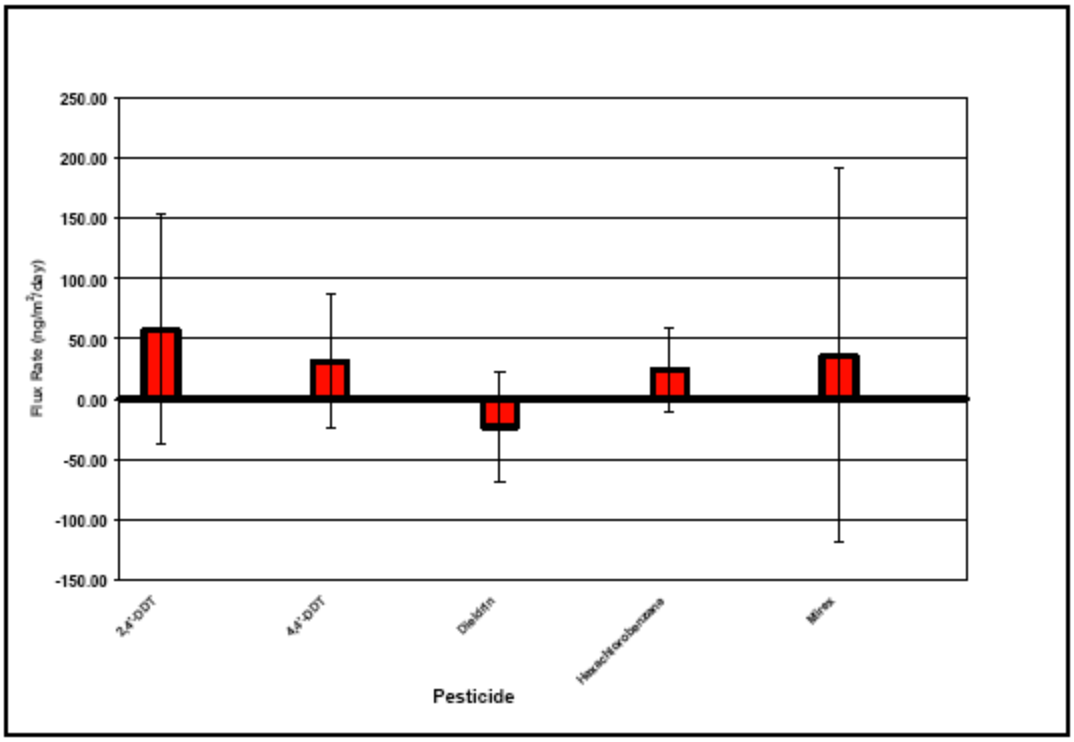



**Figure 46. Paleta Creek Pesticide Demonstration Results.**

### 5.1.4.1 Paleta Creek Organics Demonstrations Results

#### 5.1.4.1.1 Polynuclear Aromatic Hydrocarbons (PAHs) Results

Complete individual data sets were obtained for six of the first eight PAHs (Naphthalene, Acenaphthene, Acenaphthylene, Phenanthrene, Fluoranthene and Pyrene). For the two incomplete data sets, non-detects were reported in two samples for Fluorene (samples 4 and 6) and in one sample for Anthracene (sample 2). The non-detects were removed from the data series for flux computations. All trends in concentration change were positive over time (i.e. sediment *release*) and the largest change among the first eight PAHs during the 70-hour test, after correction for dilution, was 18.9 ng/L (parts per trillion) for Phenanthrene. Most of the other PAHs changed less than 10 ng/L. The resulting concentration trends, when compared to the statistically derived triplicate blank test trends showed significant flux for seven of the eight lightest molecular weight PAHs. The confidence that the flux was statistically different than the associated blank was 100% for six of the first eight PAHs and 94.5% for Naphthalene. Acenaphthylene was the only PAH in the first eight with a flux less than the associated blank tests and it had a resultant flux rate confidence of 33.8%. Appendix D ("PC Organics Demo-PAHs (Part 1).xls") includes time-series graphs showing flux and blank tests concentrations over time for the eight lightest molecular weight PAHs. These graphs show reasonable linearity of the time-series flux test data and allow intuitive comparison of the flux and blank test results.

Of the remaining eight targeted PAHs with the heaviest molecular weights all but two were non-detectable throughout the full set of 12 samples. For the two with detects, Indeno(1,2,3-c,d)pyrene yielded four (samples 1,3,5,and 12) and Benzo(g,h,i)perylene yielded five (samples 1,3,5,8,and12) detectable concentrations. Additionally, only Benzo(g,h,i)perylene had adequate blank test results during the earlier triplicate test series for comparison. The Benzo(g,h,i)perylene flux, adjusted for

dilution, was negative (i.e. sediment *uptake*) and in comparison to its blank results there was a 67.7% confidence that the flux is different than the blank results. Indeno(1,2,3-c,d)pyrene also indicated a negative flux and there is no blank results for comparison. The time-series graphs included in Appendix D ("PC Organics Demo-PAHs (Part 2).xls") show the slight negative slopes, or concentration changes over time, for these two heavier molecular weight PAHs.

#### 5.1.4.1.2 Polychlorinated Biphenyl (PCB) Congeners Results

Seven PCB congeners yielded sufficiently complete data sets for flux computations. PCB #28 (2,4,4'-Trichlorobiphenyl) yielded a complete set of 12 detectable concentration values. PCBs # 18 (2,2',5-Trichlorobipheny) yielded 9 samples with detectable concentration levels, #52 (2,2',5,5'-Tetrachlorobiphenyl) yielded 11 samples with detectable concentration levels, #66 (2,3',4,4'-Tetrachlorobiphenyl) yielded 10 samples with detectable concentration levels, #101 (2,2',4,5,5'-Pentachlorobiphenyl) yielded 8 samples with detectable concentration levels, #118 (2,3',4,4',5-Pentachlorobiphenyl) yielded 8 samples with detectable concentration levels, and #153 (2,2',4,4',5,5'-Hexachlorobiphenyl) yielded 11 samples with detectable concentration levels. In most cases, the partial data sets were composed of consecutive sample detects following initial non-detects in the series. As with PAHs, the non-detects were removed from the data series for flux computations. Five of the seven PCBs exhibited a positive trend in concentration over time (i.e. sediment *release*) and two exhibited a negative trend (i.e. sediment *uptake*). Three of the five PCBs indicating sediment release exhibited flux levels higher than the associated blank test levels and two were lower. The two PCBs indicating negative flux (sediment *uptake*) had positive blank test flux values. All changes in PCB concentration over the 70-hour test were less than 2 ng/L (parts per trillion) with the largest change (approximately 1.5 ng/L) exhibited by PCB #52. Statistical flux confidence is not high for six of the computed flux values when compared to associated blank test results. Statistical flux confidence for PCB#66 (2,3',4,4'-Tetrachlorobiphenyl) was 96%, however negative, or *uptake*, value introduces concern of validity and may be the result of the low concentrations measured. Appendix D ("PC Organics Demo-PCBs.xls") includes time-series graphs showing flux and blank tests concentrations over time for the seven PCBs with detectable concentrations. These graphs show marginal linearity of the time-series flux and blank test data resulting from the very low concentrations measured. Intuitive comparison of the flux and blank test results is illustrative of the low computed flux confidence levels reported in Table 10.

#### 5.1.4.1.3 Pesticide Results

Five pesticides yielded sufficiently complete data sets for flux computations. 2,4 DDT yielded 11 samples with detectable concentration levels, 4,4 DDT yielded 9 samples with detectable concentration levels, Dieldrin yielded 8 samples with detectable concentration levels, Hexachlorobenzene yielded 11 samples with detectable concentration levels and Mirex yielded 6 samples with detectable concentration levels. Again, as with PCBs, the partial data sets consisted of consecutive sample detects following initial non-detects in all series except for Mirex. Mirex had a one sample data gap in an otherwise consecutive series. And again, the non-detects were removed from the data series for flux computations. One additional measurement (sample 6) of the Hexachlorobenzene data set was removed because it exceeded all other data in the set by an order of magnitude and introduced a large trend offset. Four of the five pesticides exhibited a positive trend in concentration over time (i.e. sediment *release*) and one, Dieldrin, exhibited a negative trend (i.e. sediment *uptake*). There were insufficient blank test samples with detectable concentrations of these five pesticides to compute comparable blank flux performance. All changes in pesticide concentration over the 70hour test were less than 2 ng/L (parts per trillion) with the largest change (approximately 1.8 ng/L) exhibited by 2,4'-DDT. Appendix D ("PC Organics Demo-Pesticides.xls") includes time-series graphs showing flux and blank tests concentrations over time for the five

pesticides with detectable concentrations. These graphs show reasonable linearity of the time-series flux with consideration of the very low concentrations measured.

#### 5.1.4.2 Interpretation of Paleta Creek Organics Results

Whereas the flux results for the lighter molecular weight PAHs indicate greater mobility from the sediment into the overlying water than the heavier compounds, the measured concentration of the heavier molecular weight PAHs in samples extracted from the bulk sediment were generally higher than those of the lighter compounds. It appears that the heavier molecular weight PAHs are significantly less mobile, even with higher concentrations in the bulk sediment, than the lighter compounds. Comparison of this finding with solubility measurements of the targeted PAHs in seawater shows the same trend: the heavier molecular weight PAHs are far less soluble. A unilateral reduction in solubility of approximately five orders of magnitude occurs from lightest-to-heaviest for the 16 targeted PAHs. This relationship between PAH flux and PAH solubility does not appear to be exclusive of other factors however. For example, Pyrene (a four-ring compound with a molecular weight of 202) had a flux rate of 952ng/m$^2$/day which is more than twice that of Naphthalene (a two-ring compound with a molecular weight of 128) with a flux rate of 459ng/m$^2$/day. This result is likely driven by the bulk sediment concentration of Pyrene which was about of 57 times larger than Naphthalene (740ng/g vs 13ng/g). It appears that the flux of a PAH from the sediment into the overlying water remains dependant, in part, on the level of bulk concentration in the sediment. Thus even a low mobility, heavier molecular weight PAH with a high enough concentration in the sediment may flux into the overlying water at a higher rate than a lighter compound at lower concentrations. For the Paleta Creek test, it appears that the generally higher sediment concentrations of the heavier targeted PAHs were still too low to produce measurable concentrations. This then suggests that for PAHs in sediments, the PAH flux will vary in direct proportion to molecular weight and solubility leading to preferential removal of low molecular weight PAHs, and a relative increase in the bulk sediment fraction of the heavy molecular weight PAHs. Reduction of PAH concentrations at the sediment surface due to these diffusive fluxes will lessen, over time, the concentration levels of PAHs available for biological uptake. This reduction when combined with other natural attenuation factors such as infaunal irrigation and bacterially mediated degradation may be considered as a possible strategy for sediment remediation. Providing that risk levels are not exceeded, flux results for PAHs can be used to estimate the time required to reduce bulk sediment concentrations in the biologically active region of the sediment to acceptable levels.

The above discussion also generally applies to PCBs. The mobility of PCBs as indicated by the flux results was generally in direct proportion to solubility and in inverse proportion to molecular weight. The concentration values for the overlying water and bulk sediment were also generally consistent with trends identified with PAHs. The very low concentration levels of the PCBs in the Paleta Creek sediments introduced considerable uncertainty but a general trend is evident.

Pesticides may behave as above, however molecular weight relationships are difficult to establish with the wide range and complexity of such compounds. And, as with PCBs, the low concentration levels measured in this test introduce considerable uncertainty but still allow identification of a general trend.

#### 5.1.4.3 Conclusions for Paleta Creek Organics Demonstration Test

The measurement of the mobility of organic compounds from contaminated sediments at the Paleta Creek location within Naval Station San Diego was successfully achieved. The measurements, when compared to triplicate blank test results resulted in quantification of statistically significant values with high confidence primarily for Polynuclear Aromatic Hydrocarbons (PAHs) fluxing into

overlying water. The complete range of targeted PAHs, Polychlorinated Biphenyl (PCB) Congeners and pesticides were not measured either because they were not present or because they were below analytical detection limits. PCBs and pesticides, where present and measurable, had very low concentrations which introduced significant data scatter and low statistical confidence levels. Some flux measurements of PCBs and all pesticides did not have blank test results for comparison. Future site measurements of known or suspected contaminants for which blank test results are not available would benefit from blank tests using spiked concentrations of targeted contaminants.

### 5.1.5 Pearl Harbor, Hawaii Metals Demonstrations

70-hour metals demonstrations using BFSD2 were conducted at two different sites in Pearl Harbor, Oahu, Hawaii during February 1999. The BFSD2 deployments were conducted as part of a combined demonstration with integrated sediment investigation technologies and included site screening prior to both BFSD2 deployments.

The first test was conducted Feb. 5-8, 1999 within the Naval Inactive Ship Mooring Facility (NISMF) at Middle Loch where approximately 70 moored ships await disposition (disposal, sale, temporary storage, etc.). The area is quiescent and approximately 26 feet deep with murky water and fine-grained sediment overlain with an easily disturbed 1-2 foot flocculent layer. Reports of sediment depths over 100 feet were not confirmed but are believable. Some benthic organisms were found in the sediment during screening. All work at the site was accomplished from an open-deck, 35-foot Navy workboat operated by enlisted personnel, see Figure 47. A portable generator was used to power the video monitor, underwater light and laptop computer during deployment, however for recovery all electrical connections were made after reaching the shore facility.

**Figure 47. BFSD2 Pearl Harbor, Middle Loch Metals Demonstration.**

The second metals test was conducted Feb. 11-14, 1999 within the area known as Alpha Docks, Marine Diving and Salvage Unit One (MDSU-1) located at Bishop Point on the entrance channel to the harbor, Figure 48. Again, historical, RI and screening data indicated elevated levels of trace

metals present in the sediment. This area is an active industrial location and included several Navy housing barges, which are moved about by tugboats. The area has a depth of approximately 25 feet with generally clear water and medium- to fine-grained sediments. Tidal currents are enough to minimize any flocculent layer. Some benthic organisms were found during sediment screening. The Navy workboat was used as before for deployment but because of proximity to the quay wall recovery was accomplished from shore using an 80-foot crane.

**Figure 18. BFSD2 Pearl Harbor, Bishop Point Metals Demonstration.**

Prior to both tests, the BFSD2 was cleaned and prepared using the same procedures used during triplicate metals blank tests as well as other deployments and demonstrations. For the first deployment at NISMF, Middle Loch cleaning was accomplished at SSC SD prior to loading the BFSD2 into its re-usable shipping container, Figures 49 and 50. The shipping container, designed for compatibility with commercial air cargo carriers, includes compartments, shelving and storage bays sufficient for shipment of BFSD2 as well as all materials and supplies required for extended field operations. Shipping weight was approximately 1450 pounds. For safety reasons the compressed oxygen cylinder was vented to less than 250 psi and no hazardous materials (i.e. Nitric Acid for cleaning and sample preservation) were air-shipped. The container proved convenient for onsite access and minimized working space requirements. After arrival and unpacking, system checks and oxygen bottle refilling operations preceded. Nitric acid was secured from the local Navy environmental laboratory.

**Figure 49. BFSD2 Container, Front View.**

**Figure 50. BFSD2 Container, Back View.**

Aboard the Navy workboat, after loading and connecting various equipment (laptop computer, TV monitor and light, cabling) to the portable generator, a standard pre-deployment checklist was followed. At the site, after tying off, lowering the bow platform and logging the GPS location, the BFSD2 was lowered by hand wench to near the bottom and either slowly lowered into the sediment (to minimize disturbance and maintain video coverage: as at Middle Loch) or released from about 2 feet for free-fall (to assure insertion when video coverage can be maintained as at Bishop Point). Activation of the battery-powered insertion lights by switches mounted on the chamber at the 3- inch level was verified and used to establish adequate sediment insertion. Once on the bottom a 15-minute program was started to stabilize the flow-through sensors and to measure the ambient

dissolved oxygen level. After entering the dissolved oxygen control limits into the 70-hour test program, downloading and verifying it, the test was started after visibility conditions for lid closure were confirmed. After starting the program, lid closure (which also activates #1 sample bottle) was viewed and commands for circulation pump activation (at 10 minutes) and sample valve activation (at 16 minutes) for sample bottle number two was monitored before disconnecting for autonomous operations. The disconnected cables were plugged, coiled and cast overboard in a direction away from the BFSD2. Both demonstration deployments were straightforward and without problems. For both tests, the BFSD2 was returned to the shore facility for all data recovery. After freshwater washdown and cleanup the twelve 250 ml sample bottles were removed for processing using EPA handling and chain of custody procedures. Pre-acidified 125ml containers were filled and capped, labeled, logged and refrigerated for subsequent analytical laboratory metals analysis. The remaining sample volume was used to measure silica concentrations with the field portable Hach model DR2010 Instrument. The silica concentrations plotted against time and the BFSD2 pH and dissolved oxygen sensor data, also plotted against time were reviewed for any possible sample compromise prior to shipment to the analytical laboratory. Tables 12 and 13 summarize the results of the Pearl Harbor Middle Loch and Bishop Point metals demonstrations.

**Table 12. BFSD2 Results for Pearl Harbor Middle Loch (**PHML**) Metals Demonstration.**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 14.79 | 3.46 | 99.9% | 2.82 | 8.73 | 195 | 0.80 |
| Cadmium (Cd) | 1.80 | 0.31 | 100.0% | -0.52 | 0.75 | 0.2 | 0.02277 |
| Lead (Pb) | -0.12 | 0.43 | 95.2% | 3.16 | 1.59 | 34 | 0.03879 |
| Nickel (Ni) | 27.17 | 15.91 | 100.0% | 10.28 | 7.34 | 214 | 0.9472 |
| Manganese (Mn) | -468.18 | 683.35 | 97.9% | -264.85 | 7.49 | 1180 | 52.19 |
| Manganese (Mn)[1] | 2131.59 | 904.57 | 100.0% | -264.85 | 7.49 | 1180 | 52.19 |
| Zinc (Zn) | 49.74 | 17.25 | 93.5% | -3.38 | 65.22 | 314 | 2.28 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1085.52 | 64.84 | na | na | na | na | 4.17 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 65.03 | 42.43 | 100% | -1.97 | 2.88 | na | 1.19 |

1. Mn flux calculated on the basis of first five samples due to non-linearity

**Table 13. BFSD 2 Results for Pearl Harbor, Bishop Point (PHBP) Metals Demonstration.**

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 112.46 | 17.60 | 100.0% | 2.82 | 8.73 | 241 | 0.36 |
| Cadmium (Cd) | 1.85 | 1.96 | 99.4% | -0.52 | 0.75 | 0.3 | 0.009 |
| Lead (Pb) | 0.71 | 1.11 | 78.7% | 3.16 | 1.59 | 93 | 0.06519 |
| Nickel (Ni) | 21.04 | 15.41 | 96.3% | 10.28 | 7.34 | 42.9 | 0.3934 |
| Manganese (Mn) | 223.33 | 284.79 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Manganese (Mn)[1] | 2177.45 | 192.60 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Zinc (Zn) | 191.18 | 54.07 | 100.0% | -3.38 | 65.22 | 304 | 1.43 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -567.12 | 54.96 | na | na | na | na | 6.5 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 118.61 | 27.62 | 100% | -1.97 | 2.88 | na | 0.31 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

Numbers in the Flux Rate Confidence column indicate the statistical confidence that the measured flux rate is different than the blank flux rate. Results from the blank study, bulk sediment analysis, overlying water and oxygen uptake analysis are shown for comparison.

The results for Middle Loch indicate that Copper, Cadmium, and Nickel had fluxes out of the sediment that were highly significant when compared to the blank chamber results. Zinc also showed an outward flux but the statistical confidence was somewhat lower, and compared to blank results, any zinc flux is inconclusive. Lead had a negative flux (sediment uptake) but the statistical confidence was again somewhat lower. The flux of Manganese was negative when calculated using all the samples, but was positive when using only the first five samples. After the first five samples, the Manganese concentration in the chamber dropped dramatically. The reason for this drop is not known, and this effect and subsequent handling of the data are discussed in the Paleta Creek discussion in Section 5.1.3.1. The Silica flux was out of the sediment and was highly significant when compared to blank results. Dissolved Oxygen indicated a sediment uptake.

The results for Bishop Point were significantly different than those of Middle Loch with the exception of Cadmium, which was nearly identical. Copper, Cadmium, Manganese and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank chamber results and the magnitude of the Copper and Zinc fluxes were markedly higher than those observed for Middle Loch. The Nickel flux however was somewhat less and with a reduced confidence. Lead fluxed outward at Bishop Point, but confidence is only marginal when compared to blank chamber results. As with Middle Loch, the Manganese flux at Bishop Point was non-linear and the concentration in the chamber leveled off after the third sample. The Manganese flux calculated using only the first three samples is similar to the flux estimated using the first five samples at Middle Loch and similar to that measured at other sites. The flux calculated using all the samples is low but still positive. The Silica flux results were again highly significant compared to blank results and were

higher than Middle Loch. The Dissolved Oxygen sediment uptake was about half that of Middle Loch. Figures 50 and 51 belographically illustrate results

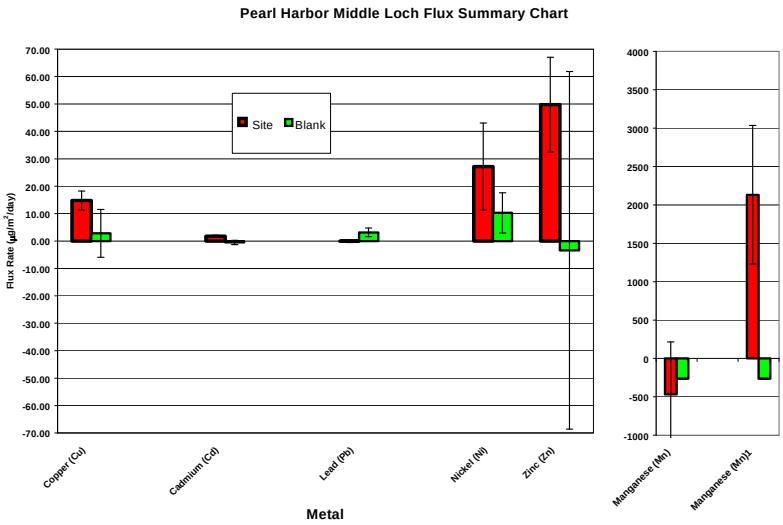



**Figure 51. Pearl Harbor Middle Loch Demonstration Results.**

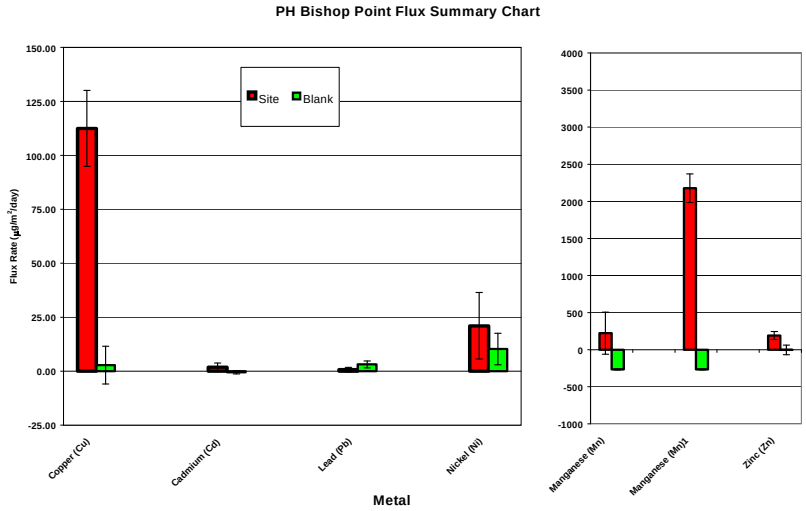



**Figure 52. Pearl Harbor Bishop Point Demonstration Results.**

#### 5.1.5.1 Discussion of Pearl Harbor Metals Demonstrations Results

In general, BFSD2 results from the two Pearl Harbor demonstration locations were significantly different than one another. Figures 53 and 54 are the sets of graphs of concentration versus time for each analyte in each of the demonstrations, compared with blank performance. The results for the Middle Loch demonstration indicate that Copper, Cadmium, and Nickel had fluxes out of the sediment that were highly significant when compared to the blank chamber results. Zinc also indicated an outward flux but the statistical confidence was low suggesting no conclusive flux rate. Zinc concentrations in Middle Loch were low compared to other sites and most likely not a problem

in this area. Lead had a negative flux (sediment uptake) but the statistical confidence was again somewhat lower. Manganese flux trends were similar to those observed in Paleta Creek and discussed in Section 5.1.3.1. The flux of Manganese was lower, even negative, when calculated using all the samples, but was positive when using only the first five samples. After the first five samples, the Manganese concentration in the chamber dropped dramatically. The Silica flux was out of the sediment and was highly significant when compared to blank results. Dissolved Oxygen indicated a sediment uptake.

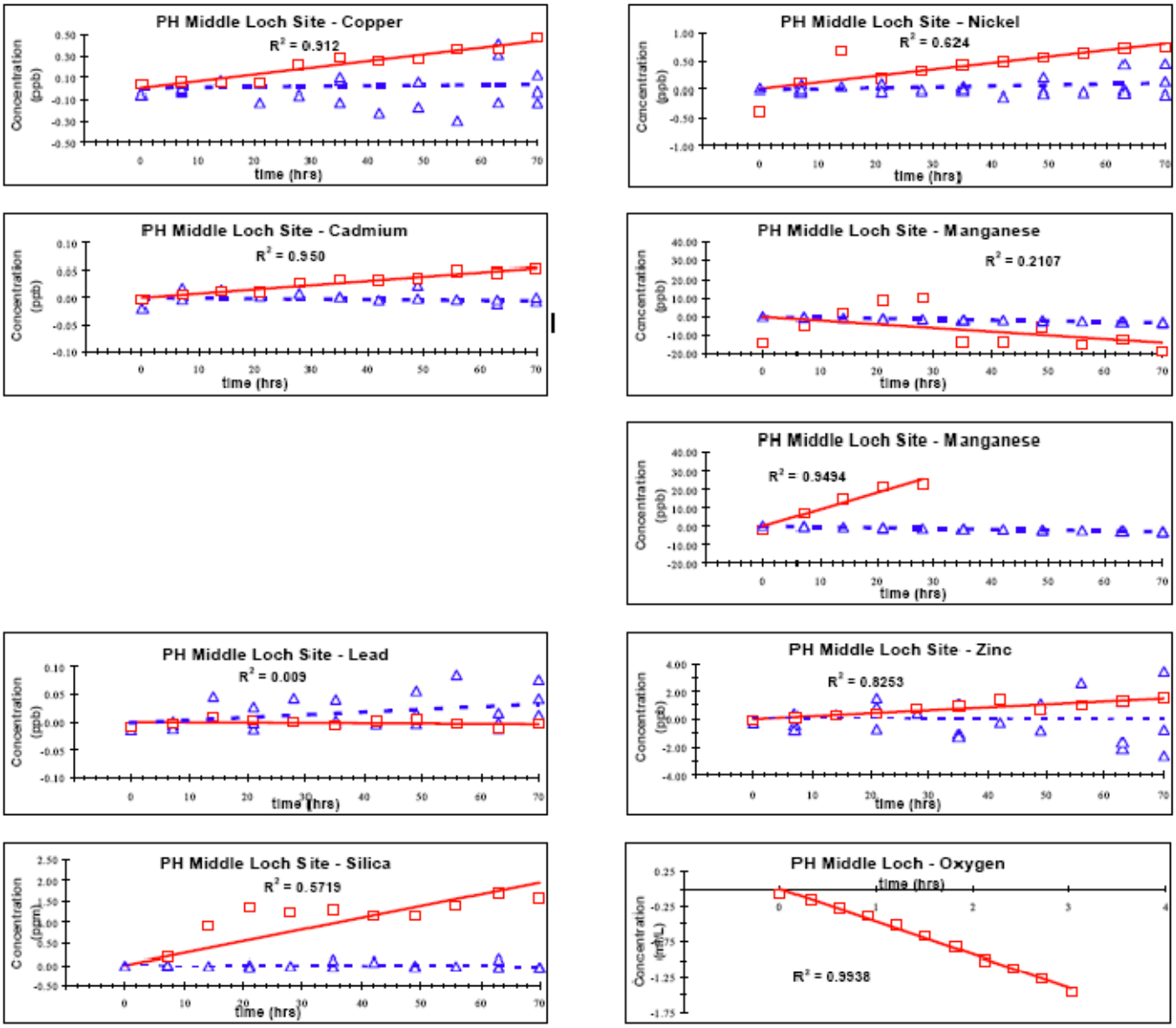



**Figure 53. Pearl Harbor Middle Loch Demonstration Concentration vs. Time.**

The results for Bishop Point were significantly different than those of Middle Loch with the exception of Cadmium, which was nearly identical. Copper, Cadmium, Manganese and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank chamber results and the magnitude of the Copper and Zinc fluxes were markedly higher than those observed for Middle Loch. The Nickel flux however was somewhat less and with a reduced confidence. Lead

fluxed outward at Bishop Point, but confidence is only marginal when compared to blank chamber results. As with Middle Loch, the Manganese flux at Bishop Point was non-linear and the concentration in the chamber leveled off after the third sample. The Manganese flux calculated using only the first three samples is similar to the flux estimated using the first five samples at Middle Loch and similar to that measured at other sites. The flux calculated using all the samples is low but still positive. The Silica flux results were again highly significant compared to blank results and were higher than Middle Loch. The Dissolved Oxygen sediment uptake was about half that of Middle Loch.

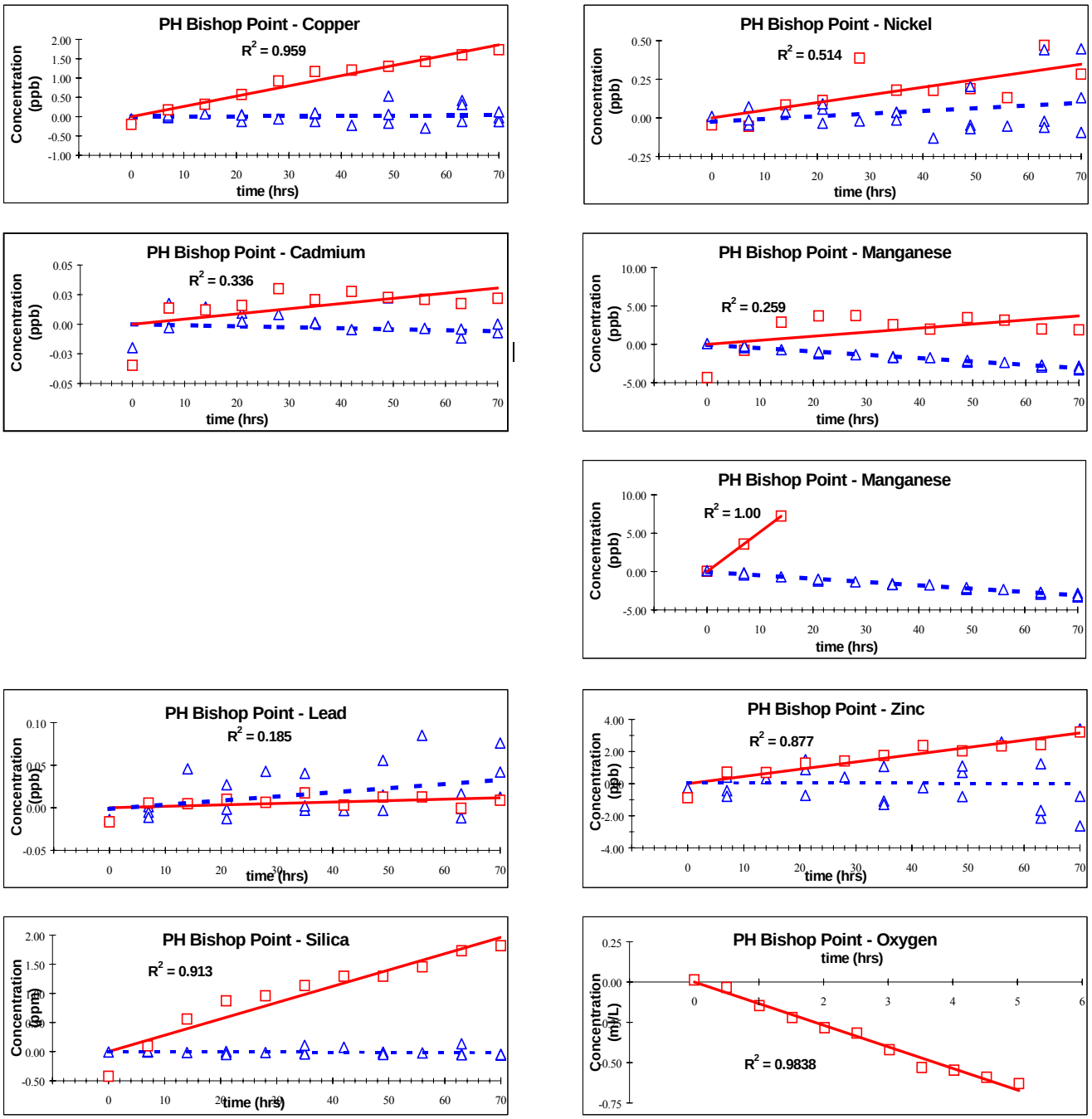



**Figure 54. Pearl Harbor Bishop Point demonstration Concentration vs. Time.**

#### 5.1.5.1.1 Metals Flux Measurements

Flux measurements were made for the metals cadmium, copper, lead, nickel, manganese and zinc. As shown in Tables 12 and 13, and illustrated in Figures 51 through 54, the BFSD2 results from the two Pearl Harbor demonstrations were significantly different from one another and from previous surveys.

Middle Loch fluxes were lower than those of Bishop Point, with the exception of Nickel (which was slightly higher). Of interest is that the Manganese flux at Middle Loch was initially almost the same (during the first 28 hours) as that at Bishop Point during the first 14 hours and then both exhibited an abrupt downward change. Possible explanations for this observation include complex reduction-oxidation interactions, sulfide binding, complexation with organic matter, or elevated water column concentrations associated with hull leachate sources at the sediment interface. The concentration-time graphs for both Manganese and Silica at Middle Loch show similar "quenching" trends, which are also apparent to a lesser degree in comparable data from Bishop Point.

Bishop Point fluxes were all outward and larger in magnitude than Middle Loch (except Nickel, as mentioned above). Copper, Cadmium, Manganese and Zinc all had fluxes out of the sediment that were highly significant when compared to the blank chamber results and the magnitude of the Copper and Zinc fluxes were markedly higher than those observed for Middle Loch. The Nickel flux however was somewhat less and with a reduced confidence. Lead fluxed outward at Bishop Point, but confidence is only marginal when compared to blank chamber results. With consideration for the more subtle Manganese and Silica "quenching" trends and the relatively lower oxygen uptake rate at Bishop Point, the fluxes appear to be less affected by possible interactions and are mobilizing from the sediment more linearly. The larger sediment grain sizes and size distribution at Bishop Point, as determined during site screening, may also be contributing to the apparent linear mobility of the outward fluxing metals.

As with Middle Loch, the Manganese flux at Bishop Point was non-linear and the concentration in the chamber leveled off after the third sample. The Manganese flux calculated using only the first three samples is similar to the flux estimated using the first five samples at Middle Loch and similar to that measured at other sites. The flux calculated using all the samples is low but still positive. The Silica flux results were again highly significant compared to blank results and were higher at Bishop Point than Middle Loch. The Dissolved Oxygen sediment uptake at Bishop Point was about half that of Middle Loch.

### 5.1.5.2 Discussion of Pearl Harbor Metals Demonstration Tests

Important aspects of the demonstrations including performance indicators and deployment problems are discussed below.

#### 5.1.5.2.1 Performance Indicators

As discussed in Section 5.1.2.2.1, several methods were used to assure system performance of the BFSD 2 during and after the demonstrations. In both deployments the landing and insertion, monitored with the video camera and landing lights, indicated a good penetration and after the test was started, the video camera also confirmed successful lid closure. At Middle Loch the "soft" landing approach was used to minimize disturbance of the flocculent layer and maintain maximum visibility in the already murky water. Penetration was about twice normal (approximately 6 inches) and all visibility was lost. Test start and lid activation was delayed (about 15 minutes) until the water cleared enough to confirm closure. At Bishop Point a "free fall" landing approach was used from

about one foot above the sediment without significant loss of visibility. The resulting outward-traveling small cloud of disturbed sediment clearly showed the "low bow-wave" design of the BFSD2 to function effectively. The color underwater video camera made viewing this performance possible.

A monotonic increase in silica during the demonstrations was used as another indicator of proper system performance and chamber seal. As shown in Figures 50 and 51, for both deployments the silica concentration increased over the duration of the test indicating proper system performance and chamber seal. The flux magnitudes were high compared to previous mainland surveys, and may be explained by the tropical conditions (i.e., calciferous-rich). Bishop Point Silica results were reasonably linear, but Middle Loch Silica flux was not. Following a rate of increase during the first 24 hours of almost twice that of Bishop Point, Middle Loch Silica flux slowed significantly for the remainder of the test. The non-linearity in both Silica and Manganese fluxes suggest that as the concentrations in the chamber build, the fluxes may be altered by the presence of the chamber itself. This could be attributed either to time/concentration dependent reactions within the chamber, or changes in fluxes due to changes in the gradient between the porewater and the overlying water trapped within the chamber.

The Dissolved Oxygen level in the chamber was monitored and recorded to assure maintenance of ambient oxygen levels, proper chamber seal, and to evaluate sediment oxygen uptake. The rate of oxygen consumption (sediment uptake) during the deployments, was shown in Figures 53 and 54, and was sufficient to cause repeated cycling of the BFSD2 oxygen control subsystem. Figure 55 are graphs of the oxygen sensor data for the two deployments showing the operation of the control system. The control limits selected allowed the dissolved oxygen to remain within approximately 1 ml/L of the ambient level and still yield data to assess the sediment uptake rate. Functioning of the system in this manner assured that chamber isolation of the water was maintained. The ambient oxygen level at Middle Loch was about one half that of Bishop Point and the sediment uptake rate was about twice that of Bishop Point. These conditions, when combined with the pH results discussed below indicate Middle Loch has a higher level of organic decomposition. Again, this is reasonable when considering the differences between the sites.

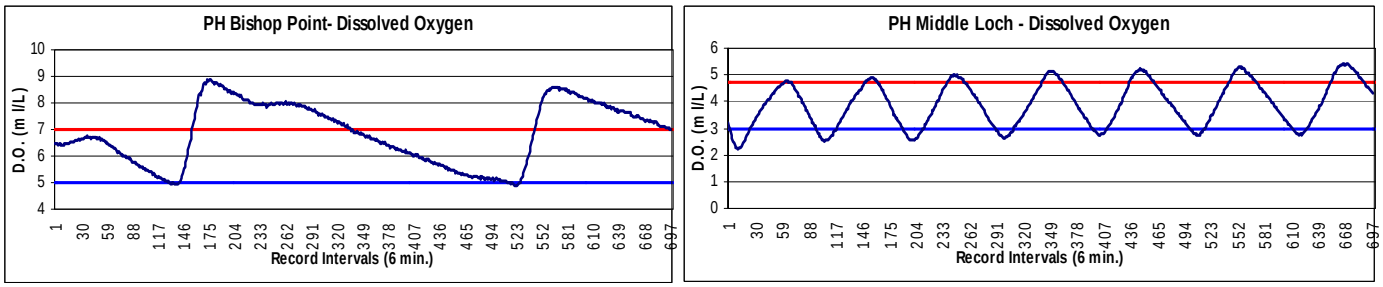



**Figure 55. Pearl Harbor Demonstrations Oxygen Control Results.**

The pH level in the chamber was monitored and recorded as another assurance indicator of seal integrity. In a sealed BFSD2 chamber, the pH will generally show a decreasing trend as the breakdown of organic matter at the sediment water interface drives $CO_2$ into the chamber water. This decreasing trend was observed during both deployments as shown in Figure 56. And, as would be expected from results of oxygen uptake discussed above, the pH level dropped at a higher rate throughout the entire 70-hour test duration at Middle Loch.

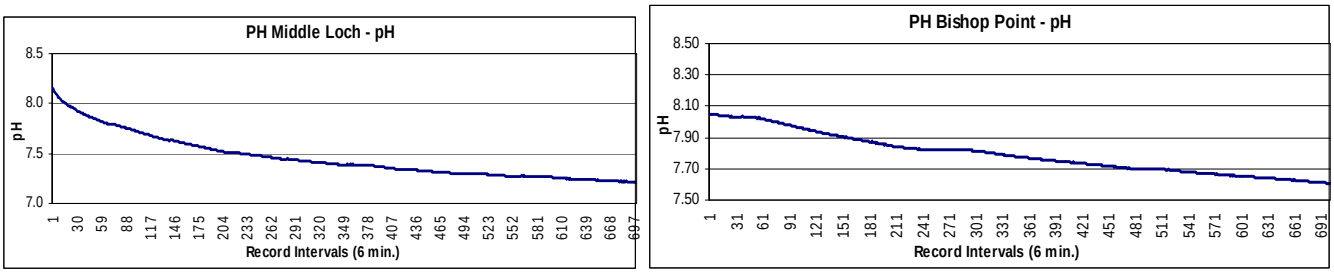



**Figure 56. Pearl Harbor Demonstrations pH Results.**

#### 5.1.5.2.2 Deployment and Recovery Problems

One minor problem was encountered during recovery at the Middle Loch demonstration and no deployment problems were encountered at either site and. At Middle Loch the commercial acoustic recovery system failed to function following several transmissions of the coded signal. Diver assistance was required to deploy the marker buoy and routine recovery operations were then followed. Subsequent analysis indicated absorption of the acoustic energy by the sediment due to the depth of BFSD2 insertion (almost covering the acoustic receiver window) and a near overhead aspect during transmission. Use of a standoff distance from the approximate location of the BFSD2 for future tests will minimize reoccurrence. Buoy activation was normal (within 8 minutes) after the Bishop Point deployment.

#### 5.1.5.3 Discussion of Metals Data Interpretation

Although the measurements from Pearl Harbor are limited to two locations, they provide significant insight into the importance of understanding contaminant mobility. One way to interpret the flux chamber measurements for Pearl Harbor is to evaluate them in the context of the exposure pathways defined in the RI study. In the RI study, sight-specific Biota-to-Sediment Accumulation Factors (BSAFs) were developed by comparing the tissue burdens of wild-caught organisms to the sediment concentrations found in the same region. In this approach, 100% of the tissue burden is attributed to sediment exposure. One of the primary pathways of sediment exposure is thought to be via remobilization of chemicals to the dissolved phase and subsequent uptake by the organism. The results from the flux chamber measurements allow us to quantify and examine this key pathway.

As an example, we can consider the potential exposure for copper in sediments at the two sites. A cursory examination of the bulk sediment data in Tables 7 and 8 indicate that the exposure levels at the two sites would be about the same, with a slightly lower level at Middle Loch than at Bishop Point. Thus the predicted bioaccumulation for the two sites would also be similar. However, examination of the flux rates for copper at the two sites suggests a much different scenario. The flux rate of copper at Middle Loch was much lower than the flux rate measured at Bishop Point. This indicates that the bulk sediment levels at the two sites do not necessarily reflect the exposure potential. This is further supported by evaluation of the bulk sediment data on a scale normalized for iron content. This analysis indicates that while the levels of copper at Middle Loch fall along the ambient trend, the copper levels at Bishop Point have sources of copper beyond that available from background weathering as shown in Figure 57. In addition, the high oxygen uptake rates at Middle Loch indicate presence of reducing sediments that are likely to contain strong copper binding phases such as sulfides.

These results suggest consideration of a refined exposure model for organisms where the primary exposure is thought to be via the dissolved phase. For example, using the measured flux rates for

copper, the contribution of the sediments to the water can be estimated. This would then be used to quantify the fraction of the biological exposure that could be attributed to this pathway. If this exposure mechanism cannot account for observed uptake or effects, then other pathways or sources must be considered.

Thus the flux rate measurements at the two Pearl Harbor sites illustrate the usefulness of the system in identifying and quantifying exposure pathways between sediments and organisms. The flux results are also consistent with existing knowledge of sediment geochemistry. The results suggest that incorporation of flux measurements on a broader scale will help to improve ecological risk assessments by providing stronger links between bulk sediment chemistry and biological exposure

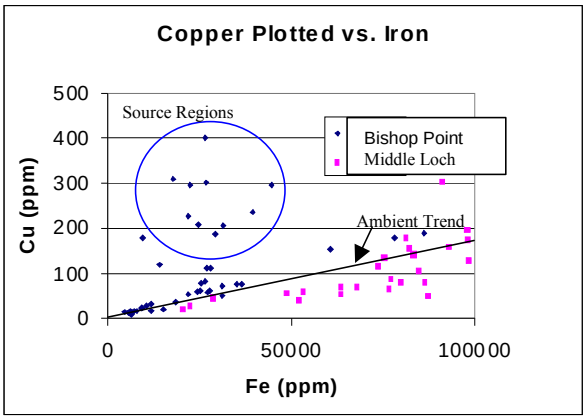



**Figure 57. Pearl Harbor Demonstration Data with Iron-Normalized Bulk Sediment Copper Concentrations.**

### 5.1.6 Pearl Harbor, Hawaii Organics Demonstration

One 72-hour test to demonstrate the application of the Benthic Flux Sampling Device 2 (BFSD 2) in *organics*-contaminated sediments was conducted September 7-10, 2001. The test was conducted at the Navy's Marine Diving and Salvage Unit 1 (MDSU-1) facility located at Bishop Point, Pearl Harbor, Hawaii. Pearl Harbor is identified on the National Priority List (Super Fund) for environmental cleanup and is currently completing a four-year Remediation Investigation (RI) study. The site was selected based on RI results and field screening results conducted in February 1999. It had also been previously used for BFSD2 metals-contaminated sediment studies and provided excellent test conditions (access, support, facilities). The MDSU-1 area is an active industrial location and includes several Navy housing barges, which are periodically moved by tugboats. The area has a depth of approximately 25 feet with generally clear water and medium- to fine-grained sediments. Tidal currents are enough to minimize any flocculent layer. The Alpha Dock site selected is near the site used for the metals test and was close enough to the quay wall to allow both deployment and recovery from shore using an 80-foot crane (See Figure 58).

**Figure 58. BFSD2 Pearl Harbor, Bishop Point Organics Demonstration.**

The BFSD2 was cleaned and prepared at Space and Naval Warfare Systems Center, San Diego (SSC SD) using the same procedures used during triplicate blank tests and the first organics demonstration. It was then loaded into its re-usable shipping container for air-shipment to Hawaii. The shipping container, designed for compatibility with commercial air cargo carriers, includes compartments, shelving and storage bays sufficient for shipment of BFSD2 as well as all materials and supplies required for extended field operations. Shipping weight was approximately 1450 pounds. For safety reasons the compressed oxygen cylinder was vented to less than 250 psi and no hazardous materials were air-shipped. The container is convenient for onsite storage and access and minimizes working space requirements. After arrival and unpacking, system checks were performed to assure no degradation during shipment had occurred. Oxygen bottle refilling was a problem in that compressed-gas suppliers were not willing to fill the small SCUBA-type cylinder and recreational dive shops would fill it but didn't carry pure oxygen. The problem was resolved when vandals stole the tank and refill fittings from
the rental car trunk. A new, air-filled small dive tank was purchased as a replacement. It was recognized that the lower oxygen content of the compressed air would be marginal in maintaining ambient chamber conditions, however it was generally believed that the diffusive flux component of organic compounds are not dependant on dissolved oxygen levels. Test results were not anticipated to be affected by the use of compressed air.

At the site near the quay wall the crane was positioned with its lift lines measured to allow placement of the BFSD2 at the desired location. An electrical extension cord was connected to a nearby building to provide power for the various deployment equipment (laptop computer, TV monitor and cabling) located in the trunk of the rental car (Figure 59). Preparations for the deployment followed a standard pre-deployment checklist (Figure 60).

**Figure 59. Deployment Equipment.**

**Figure 60. Pre-Deployment Checklist.**

After the BFSD2 was lowered to within view of the sediment surface it was established that no obstructions to chamber penetration were present and the decision to deploy was made. The crane lowered the BFSD2 at its maximum descent rate and a good landing was observed with the underwater video monitor. The bottom landing created a minimal amount of sediment resuspension and the water cleared within 15 seconds.

After video confirmation of sufficient sediment penetration to achieve a sea l the 10minute sensor check program was initiated. This program activated closure of the chamber lid which, while closing, simultaneously opened a hinge-mounted valve to collect the ambient-condition water sample (bottle #1). Following lid closure and activation of the recirculation subsystem, measurements of the enclosed water for dissolved oxygen, pH, temperature, pressure and salinity were made and recorded at 6second intervals for 10 minutes. Following completion of the 10-minute program t he sensor data was uploaded, processed and entered into a custom data template to confirm sensor functions and to establish initial ambient water conditions. The measurement for ambient dissolved oxygen was used to establish limits for the BFSD2 oxygen control subsystem. These values were entered into the 72-hour flux test program and downloaded to the submerged BFSD2. The limits selected reflected the use of compressed air in place of pure oxygen and allowed a near anoxic lower threshold to be reached before activating the oxygen (i.e. air) recharge valve. Figure 61 shows the ambient dissolved oxygen measurement with the upper and lower control limits superimposed and Figure 62 shows the ambient pH measurement.

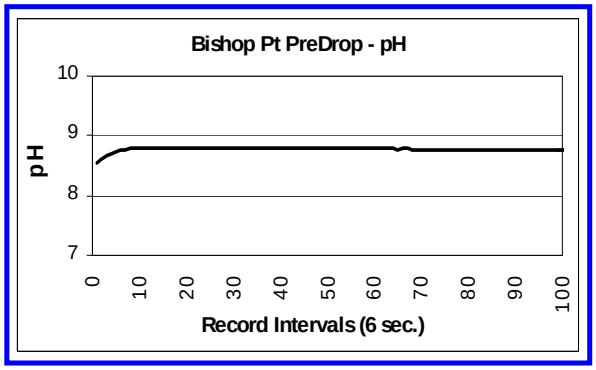



**Figure 61. Ambient Dissolved Oxygen.**

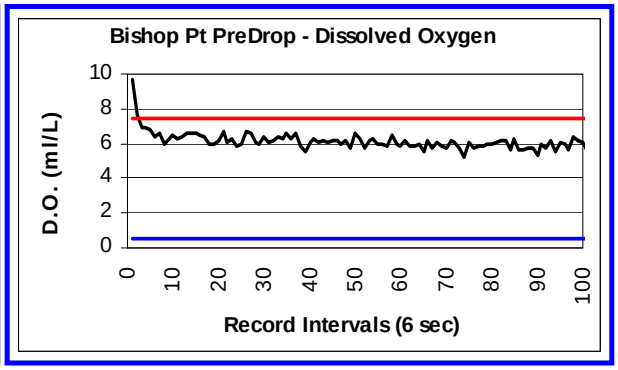



**Figure 62. Ambient pH.**

With the BFSD2 in place on the bottom, the downloaded 72-hour flux test program with the selected control limits was verified and the program was started. The BFSD2 connections were maintained to monitor and confirm collection of the first chamber sample (bottle #2) and sensor measurement recordings at 6-minute intervals. The crane tackle block was then disengaged from the deployment line and the crane was moved from the area. The deployment line and communication cables were stowed on the pier pilings to facilitate recovery at the completion of the 72-hour flux test.

At the conclusion of the 72-hour time period the BFSD2 communication cable was reconnected to the laptop computer to verify completion of the flux test program and to upload the recorded sensor data. The crane was then repositioned, rigged for recovery and the BFSD2 was lifted off the bottom and onto shore. Once secure on land an initial inspection indicated no damage, all components were intact and all twelve sample bottles were full. From a floating platform positioned over the deployment site a hand-held GPS location record was made and a 250-ml sediment sample was collected. The samples were then removed and transported to the field lab facility for filter removal, lid installation, labeling and preparation for shipment to the Arthur D. Little (ADL) analytical laboratory in Cambridge, MA. The BFSD2 was flushed and cleaned with freshwater, the gel-cell batteries were recharged and the sample collection subsystem was purged with deionized water and dried with forced-air in preparation for the return shipment to SSC SD.

As the samples were being processed, the recorded data files for the 72-hour test were uploaded and entered into a standardized Excel spreadsheet template for data processing. The sensor data, plotted as time-series indicated a successful deployment. As can be seen in Figure 63, there was no sudden pH level shifts indicating loss of chamber seal. The slowly reducing trend for pH level was normal and is indicative of biological activity. The dissolved oxygen level, Figure 64, shows the expected steady decline and control system activation as the level dropped below the lower limit. The decline was temporarily reversed, most likely due to residual pure oxygen in the system, however the recharge was not maintained due to the low oxygen content of the compressed air and the chamber eventually fell below the lower limit and remained at a near anoxic level until the test was completed. It is also noted that the slope of the declining pH became approximately level as the chamber approached anoxic conditions, indicating reduced biological activity. Salinity, temperature and pressure were normal.

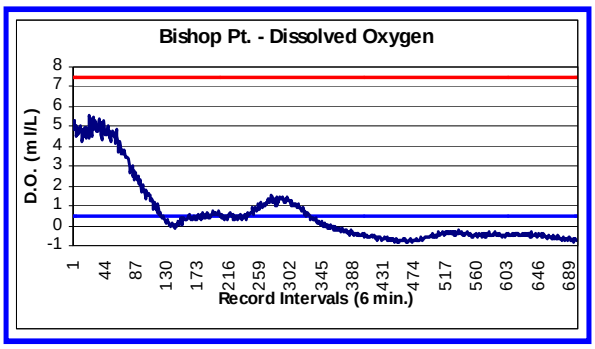



**Figure 63. Chamber pH.**

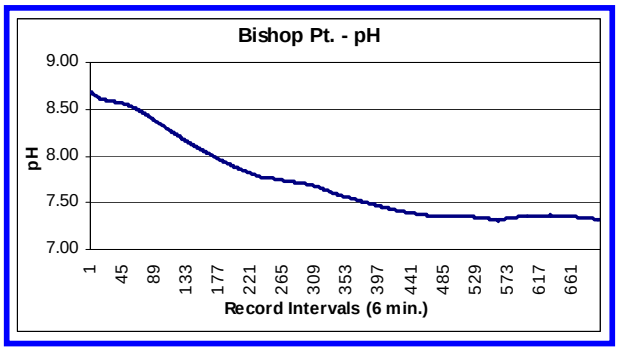



**Figure 64. Chamber Dissolved Oxygen.**

The samples were air-shipped from Honolulu International Airport by overnight express (FedEx) the afternoon of Sept 10, 2001. But the events of Sept 11, 2001 grounded all flights nation-wide and the samples were stopped and delayed in Oakland, CA until delivery to ADL on Sept 17, 2001. The samples were intact but exceeded the maximum extraction holding time (7 days) and maximum

storage temperature (4 degrees C.) when received. The conditions were noted and the decision to continue with processing and analysis was made.

#### 5.1.6.1 Pearl Harbor Organics Demonstration Results.

Tables 14, 15 and 16 below provide a summary of the flux results for selected PAHs, PCB congeners and pesticides, respectively. Figures 65, 66, and 67 provide graphical comparison of the flux results with the blank tests results.

**Table 14. Summary Results for PAHs.**

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | 75.00 | 306.84 | NA | NA | NA | 16,000 | Non-Detect |
| 10. CHRYSENE | 1048.91 | 1012.25 | 98.5% | 23.94 | 22.32 | 48,000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 919.89 | 375.56 | 99.8% | -134.30 | 297.91 | 36,000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 234.99 | 156.43 | 93.3% | -9.71 | 36.30 | 10,000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12,000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 6.72 | 67.06 | NA | NA | NA | 7,400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1,500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 7.91 | 64.14 | 11.6% | 20.15 | 65.15 | 5,300 | 1.7 |

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | -110.07 | 596.59 | 38.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 2680.41 | 10124.62 | 51.2% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 627.85 | 1483.64 | 82.7% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 75.17 | 1894.31 | 23.4% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | -552.72 | 1305.06 | 98.2% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 4053.72 | 3094.52 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 4435.81 | 10157.65 | 97.4% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 38.99 | 4132.13 | 28.5% | -439.51 | 70.73 | 150,000 | 20 |

**Table 15. Summary Results for PCBs.**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | -2.62 | 93.70 | 4% | 57.59 | 31.49 | Non Detect | 2.1 |

**Table 16. Summary Results for Pesticides.**

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| Mirex | 61.81 | 110.60 | NA | NA | Non Detect | 1.00 |

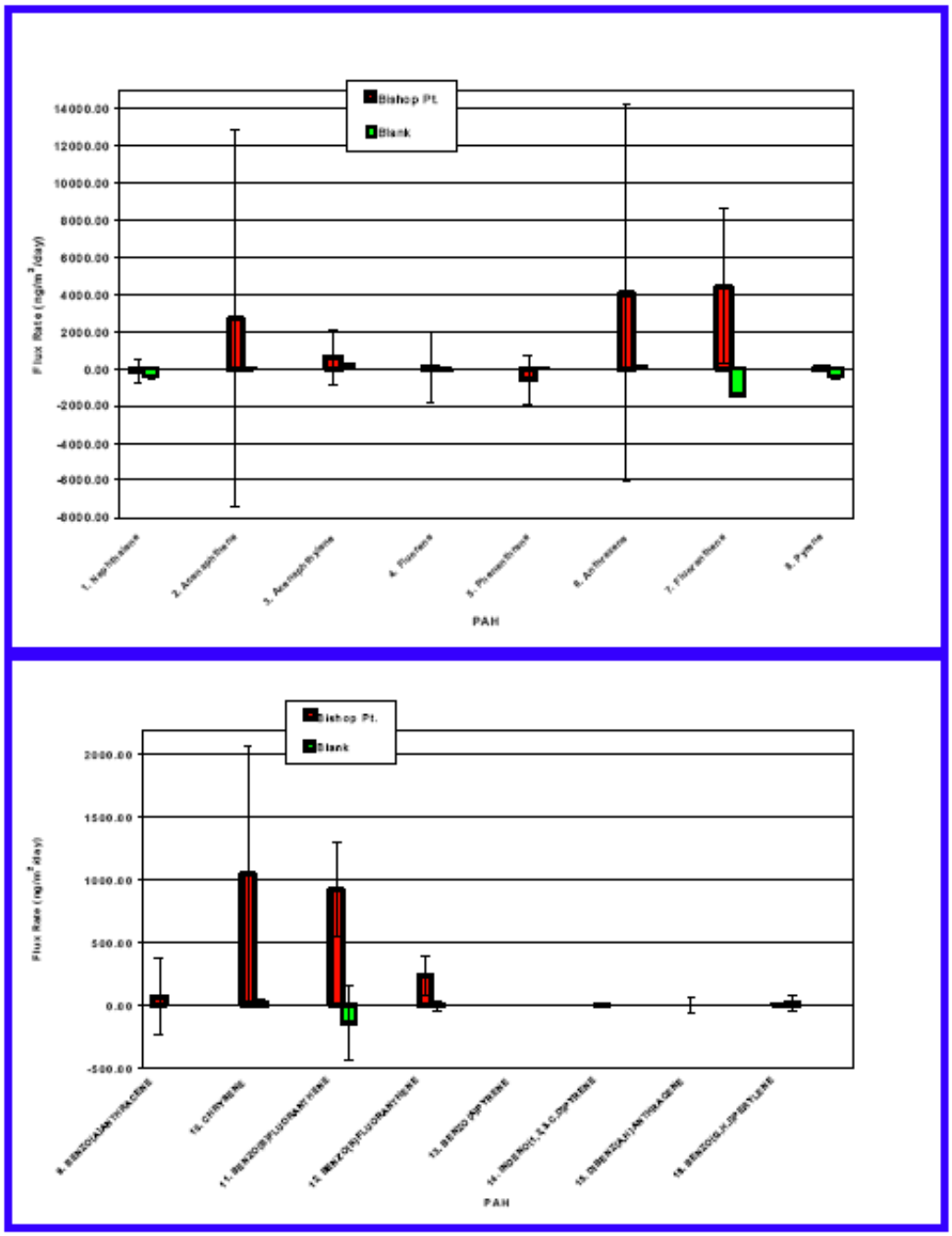



**Figure 65. Flux to Blank Comparison for PAHs.**

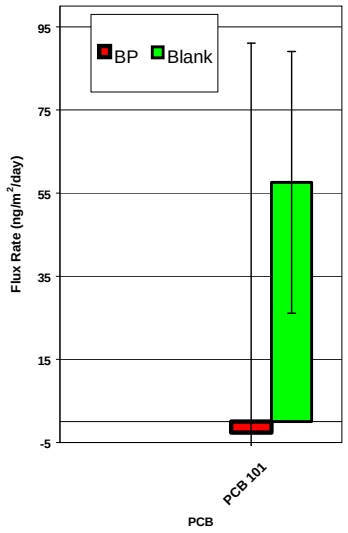



**Figure 66**. **Flux to Blank Comparison for PCBs.**

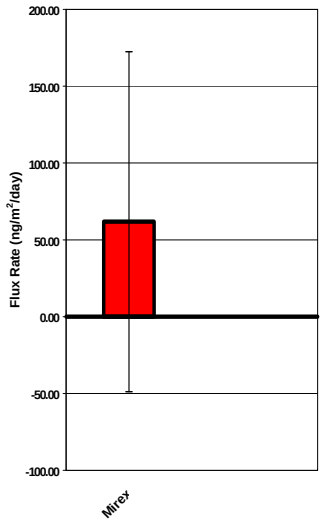



**Figure 67. Flux to Blank Comparison for Pesticides.**

**5.1.6.1.1 Polynuclear Aromatic Hydrocarbons (PAHs) Results**

Complete individual data sets were obtained for all of the first eight lighter molecular weight PAHs (Naphthalene, Acenaphthene, Acenaphthylene, Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene). Complete individual data sets were also obtained for five of the eight heavier molecular weight PAHs (Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-c,d)pyrene and Benzo(g,h,I)perylene). Partial data sets were obtained for Benzo[a]anthracene (9 of 12 detects) and Dibenzo[a,h]anthracene (4 of 12 detected). No detects were obtained for Benzo[a]pyrene. Flux analysis was accomplished for all complete data sets and the partial data set for Benzo[a]anthracene. However, the Benzo[a]anthracene analysis was abandoned since two of the

three non-detects occurred in the first four samples, as discussed below, and was compounded by a lack of blank test data for statistical comparison.

All trends in concentration change (i.e. flux) were strongly positive for the first four samples in each series of twelve. $R^2$ linearity factors for these initial trends were exceptionally high for all except Phenanthrene, Indeno(1,2,3-c,d)pyrene and Benzo(g,h,I)perylene. The concentration trends for the last eight samples in each series were generally flat or slightly negative with only Benzo(k)fluoranthene maintaining a lowered, but steady increase. $R^2$ linearity factors for these trends were correspondingly low. Due to this apparent change in concentration trends occurring after sample number four, coincident with the chamber dissolved oxygen level falling below the control limit at about 15 hours, separate analyses of the first four samples in each series and for the last eight samples in each series were accomplished. Also supporting this approach, the bulk sediment concentration levels for all the analyzed PAHs was directly related to the flux of the first four samples in the series and not for the last eight. And, whereas the relationship between bulk sediment concentrations and overlying water concentrations (measured in the number one sample) appear to be consistent with the solubility relationships discussed in the BFSD Paleta Creek demonstration report, the trend relationships identified for flux, bulk sediment concentrations and solubility appear to hold only for the first four samples. Table 17 shows these relationships for the first four PAH samples and Figure 68 shows the graphical comparison of the measured flux with the blank tests for the first four PAH samples.

**Table 17. Summary Results for First Four PAH Samples.**

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 1,848 | 4,406 | 59.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 71,053 | 327,574 | 100.0% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 6,862 | 14,388 | 100.0% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 10,387 | 110,972 | 100.0% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | 3,031 | 106,689 | 99.4% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 26,955 | 27,293 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 69,812 | 380,980 | 100.0% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 24,512 | 190,722 | 100.0% | -439.51 | 70.73 | 150,000 | 20 |

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 16000 | Non-Detect |
| 10. CHRYSENE | 8792.74 | 10650.17 | 100.0% | 23.94 | 22.32 | 48000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 3080.74 | 17862.21 | 99.4% | -134.30 | 297.91 | 36000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 977.52 | 3135.53 | 99.7% | -9.71 | 36.30 | 10000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 122.97 | 7141.99 | NA | NA | NA | 7400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 33.19 | 5249.47 | 7.0% | 20.15 | 35.15 | 5300 | 1.7 |

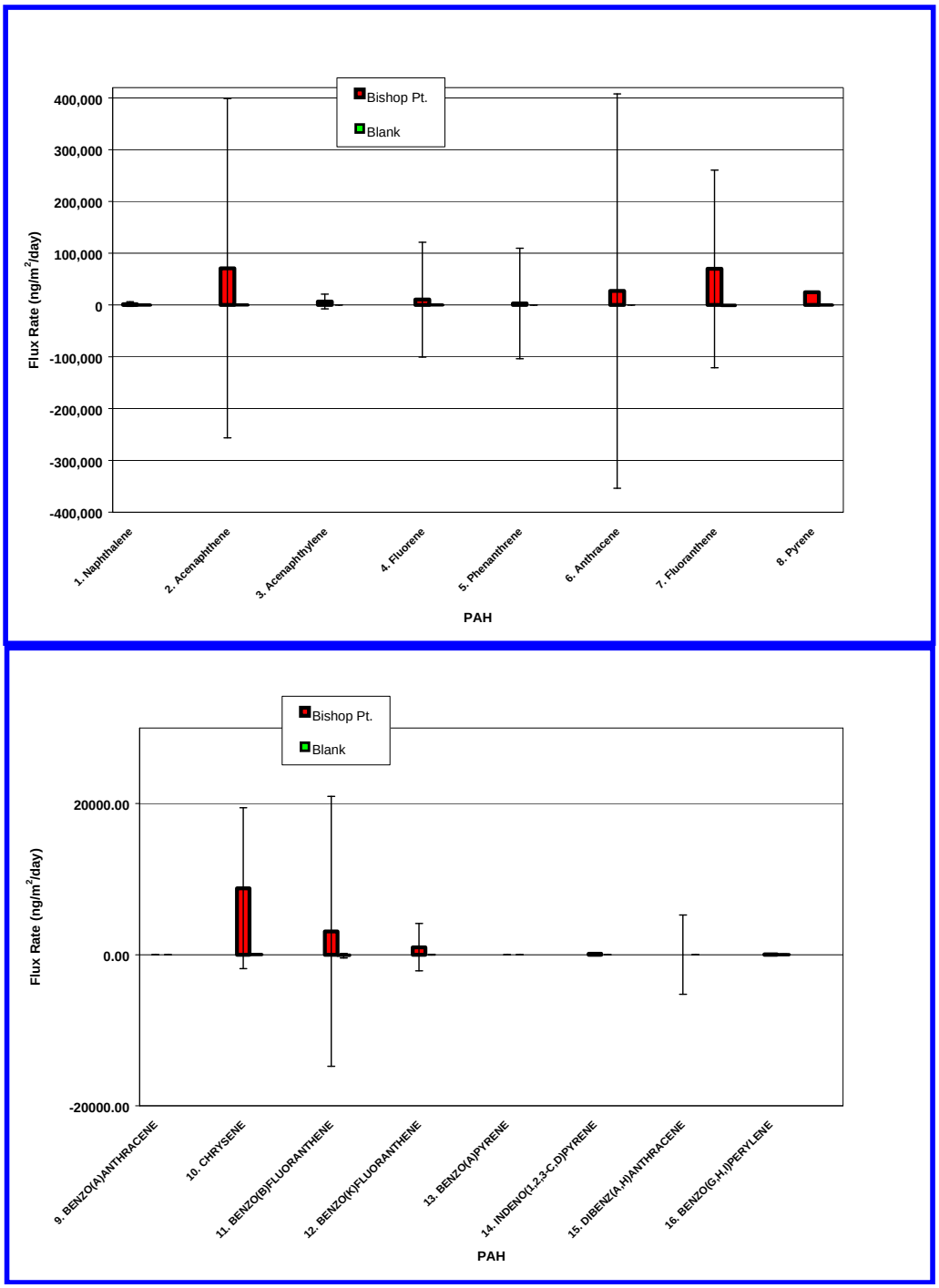



**Figure 68. Flux to Blank Comparison for First Four PAH Samples.**

The concentration trend (or flux) for the first four samples in the series, when compared to the statistically derived triplicate blank test trends showed large, significant flux for all of the eight lighter molecular weight PAHs. For seven of these eight PAHs the confidence that the flux was statistically different than the associated blank results was approximately 100%. The confidence for Naphthalene was 59.1%. For the five heavier molecular weight PAHs with complete data sets, the first four samples for Chrysene, Benzo(b)fluoranthene and Benzo(k)fluoranthene had high confidence (approximately 100%); Benzo(g,h,I)perylene had low confidence (7.0%); and

Indeno(1,2,3-c,d)pyrene had insufficient blank test data for comparison. For all the analyzed PAHs except Anthracene of the lighter molecular weight PAHs, and Benzo[b]fluoranthene and Benzo[k]fluoranthene of the heavier molecular weight PAHs, the last eight samples in the series exhibited concentration trends with low and/or negative trends as well as low confidence levels when compared to blank test results. Appendix D ("BP Organics Demo-PAHs.xls") includes time-series graphs showing flux and blank tests concentrations over time for the PAHs. Graphs for the complete data sets (12 samples), for the first four samples and for the last eight samples allow comparison of the flux and blank test results.

#### 5.1.6.1.2 Polychlorinated Biphenyl (PCB) Congeners Results

One complete individual data set was obtained for PCB Congener number 101 (2,2',3,4,4',5,5'-Heptachlorobiphenyl). Partial data sets were obtained for ten PCB Congeners: number 8 (2,4'-Dichlorobiphenyl) with 2 of 12 detections; number 44 (2,2',3,5'-Tetrachlorobiphenyl) with 5 of 12 detections; number 52 (2,2',5,5'-Tetrachlorobiphenyl) with 5 of 12 detections; number 66 (2,3',4,4'-Tetrachlorobiphenyl) with 2 of 12 detections; number 105 (2,3,3',4,4'-Pentachlorobiphenyl) with 5 of 12 detections; number 118 (2,3',4,4',5-Pentachlorobiphenyl) with 1 of 12 detections; number 153 (2,2',4,4',5,5'-Hexachlorobiphenyl) with 1 of 12 detections; number 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl) with 7 of 12 detections; number 206 (2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl) with 4 of 12 detections; and number 209 (2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl) with 1 of 12 detections. The remaining nine targeted PCB Congeners were not detected in the samples.

Flux analysis is reported for PCB Congener number 101 only, including statistical comparison with blank test data. The flux was small compared to the blank and it was negative (i.e. uptake). The 95% confidence limit values for the computed flux were large and the statistical confidence that the flux value was different than the corresponding blank was very small (4%). PCB Congener number 101 was not detected in the bulk sediment sample. The high flux rate trend noted in the first four samples for PAHs, prior to anoxic chamber conditions, was not evident for PCB Congener number 101 and separate analysis was not undertaken. Appendix D ("BP Organics Demo-PCBs.xls") includes a time-series graph showing flux and blank tests concentrations over time for PCB Congener number 101.

Flux analysis for the remaining PCBs having partial data sets was abandoned due to the degree of incomplete data and/or large intervals between data. Also, none of the PCB congeners with detections in seawater were reported in the bulk sediment analysis results.

#### 5.1.6.1.3 Pesticides

Partial data sets were obtained for six pesticides: 2,4'-DDT with 1 of 12 detections; 4,4'-DDT with 3 of 12 detections; 4,4'-DDD with 4 of 12 detections; Dieldrin with 1 of 12 detections; Endrin with 7 of 12 detections; Mirex with 10 of 12 detections. The remaining ten targeted pesticides were not detected in the samples.

Flux analysis was accomplished for the pesticide Mirex only. No blank test results were available for this pesticide and therefore statistical comparison cannot be made. The computed flux value for Mirex was small with large 95% confidence limit values. Mirex was also not detected in the bulk sediment sample. The high flux rate trend noted in the first four samples for PAHs, prior to anoxic chamber conditions, was not evident for Mirex and separate analysis was not undertaken. Appendix A, Excel spreadsheets(.xls"), includes a time-series graph showing flux and blank tests concentrations over time for the pesticide Mirex.

Flux analysis for the remaining pesticides having partial data sets was not accomplished due to the degree of incomplete data and/or large intervals between data. And again, none were reported in the bulk sediment analysis results.

#### 5.1.6.2 Discussion of Bishop Point Organics Results

Prior to data reduction and analysis, close inspection of the analytical laboratory results indicated a change or "knee" in sample concentration trends occurring after sample four for most PAHs, coincident with the dissolved oxygen level falling below control limits. The same change was not evident for the PCBs or pesticides, however the preponderance of "non detect" concentration levels in the seawater samples coincident with like results in the bulk sediment sample resulted in sufficient seawater data for only one PCB congener and one pesticide flux analysis. The PAHs on the other hand exhibited very large concentrations in the bulk sediment sample and 13 of sixteen yielded sufficient data for flux analysis. After correction for dilution and normalization for comparison to the blank tests the shift in concentration trends became even more evident for the PAHs and remained obscured by low concentration levels for the PCBs and pesticides. Thus separating the data sets into pre- and post-anoxic conditions for analysis allowed the affect of the low oxygen conditions on the PAH flux rates to be isolated to the last eight samples. The mechanism for this observed damping or stopping of the release of PAHs from the sediment is not known but may be related to reduction-oxidation chemistry changes causing soluble metals to precipitate and bind with organic compounds releasing from the sediment. Another possible explanation for the observed flux change may be loss of the irrigation component of the flux due to oxygen deprivation of the infaunal micro-organisms. Whatever the mechanism, it is clear that the large PAH concentrations in the sediment are the source of large flux levels entering the water column, albeit evidenced by only the first four samples. It is also clear that maintenance of at least a minimum level of dissolved oxygen (approximately 1.0 ml/L) in the chamber is required to achieve complete flux results for the full duration of the test. As a result of using compressed air in place of pure oxygen for maintenance of the chamber dissolved oxygen conditions, only the four samples collected during the first 14 hours of the test are considered valid for analysis. Of these four, only the last three were collected from the chamber at time intervals of 7 hours and thus the full value of the 12-sample, 70-hour test was not achieved. However, minimum statistical standards are met with the four samples and the following discussion and conclusions derived from them are considered valid.

As found in the Paleta Creek demonstration, the flux results for the lighter molecular weight PAHs indicate greater mobility from the sediment into the overlying water than the heavier compounds. Of interest is the measured concentration of the PAHs in the bulk sediment sample being higher for the mid-molecular weight compounds than for the lighter or the heavier compounds. This distribution of sediment concentrations resulting from the industrial and operational activity at the site, led to high flux levels for even the less soluble heavier molecular weight PAHs compared to the lighter molecular weight PAHs. Notwithstanding this result, it appears that the heavier molecular weight PAHs are significantly less mobile, even with higher concentrations in the bulk sediment, than the lighter compounds. For example, the flux value for Acenaphthene (molecular weight-154) was about the same as Fluoranthene (molecular weight-202), but the bulk sediment concentration is about 1.4% that of Fluoranthene. And, as before, comparison of this finding with solubility measurements of the targeted PAHs in seawater shows the same trend: the heavier molecular weight PAHs are far less soluble. In the example above, Acenaphthene is approximately 16.6 times more soluble than Fluoranthene. Thus even a low mobility, heavier molecular weight PAH with a high enough concentration in the sediment may flux into the overlying water at a higher rate than a lighter compound at lower concentrations.

Based on molecular weight and solubility, the above discussion also generally applies to PCBs and pesticides, i.e. their mobility as indicated by the flux results will be generally in direct proportion to solubility and in inverse proportion to molecular weight. This premise cannot be supported by the results of this demonstration due to the very low concentration levels of the PCBs and pesticides in the sediment. The one PCB and one pesticide detected with sufficient data to allow analysis yielded results with low confidence and no conclusions can be drawn from either the full set of data or the first four samples. It does appear however that both PCBs and pesticides are not a water quality issue for this site.

#### 5.1.6.3 Conclusions for Bishop Point Organics Demonstration Test

The BFSD2 demonstration at Bishop Point, Pearl Harbor was a qualified success. A single factor, use of compressed air in place of pure oxygen for chamber dissolved oxygen maintenance, was responsible for loss of valid data after approximately 14 hours into the 72-hour test. The affect of anoxic level conditions to stop, reduce or interfere with the release of organic compounds from contaminated sediment, previously not anticipated, was established. And, prior to this affect occurring, valid data was obtained.

The results from the first 14 hours of the 72-hour test show that measurement of the mobility of organic compounds from the highly contaminated sediments at the Bishop Point site within the Pearl Harbor Naval Complex was successfully achieved. The measurements, when compared to triplicate blank test results resulted in quantification of large, statistically significant values with high confidence for Polynuclear Aromatic Hydrocarbons (PAHs) fluxing into overlying water. Complete data sets for nearly all of the targeted US EPA priority PAHs were achieved and the flux results are consistent with bulk sediment concentrations, modified by the relative solubility of the compounds. Polychlorinated Biphenyl (PCB) Congeners and pesticides were not measured either because they were not present or because they were below analytical detection limits.

Ideally, a repeat of this test should be conducted to resolve potential questions regarding oxygen control during the measurement of organic contaminant fluxes. It could be conducted at the Bishop Point site or any other site where high levels of targeted organic compounds are present in the sediment. Whereas the first demonstration at Paleta Creek established the capability of the BFSD2 and the related data analysis process to extract meaningful results at a site with moderate levels of contaminants in the sediments, this demonstration only partially established the BFSD2 performance at a site with high levels of organic contaminants in the sediment. A full 72-hour test at such a site would help to demonstrate and establish BFSD2 performance as concentration levels become very large in a high flux level condition. However, even in lieu of this additional testing, it is clear that the BFSD2 can statistically resolve fluxes for a number of organic contaminants even when the number of samples is limited.

### 5.1.7 Pearl Harbor, Bishop Point, Combined Demonstration

One 72-hour test was conducted to demonstrate the ability of the Benthic Flux Sampling Device 2 to collect samples for both metals and PAH analysis in a single deployment. The The MUDSU-1 facility at Bishop Point, Pearl Harbor, Hawaii was selected because both a metals deployment and a deployment for PAH's were made in the area. The combined demonstration was successfully conducted on December 9-12, 2002. A previous attempt was made in October of 2003, but because of a technical malfunction and issues with the electronic control unit of the BFSD2, that deployment was unsuccessful.

The combined demo followed the metals demonstration by 3 years and 10 months and the PAH demonstration by 1 year and 3 months. Although all the deployments were made along the quay wall at the MUDSU-1 facility, deployment logistics made it impossible to sample the exact spot in all three deployments. Hence, the combined demo position was 20 meters west of the metals deployment and 34 meters east of the PAH deployment (Figure 69). These distances should not be significant in comparing overall operation of the BFSD between deployments at a general site, but some patchy contamination of sediments may be exhibited in the results with some contaminants. Also, the difference in time between deployments could conceivably show some variability in results.

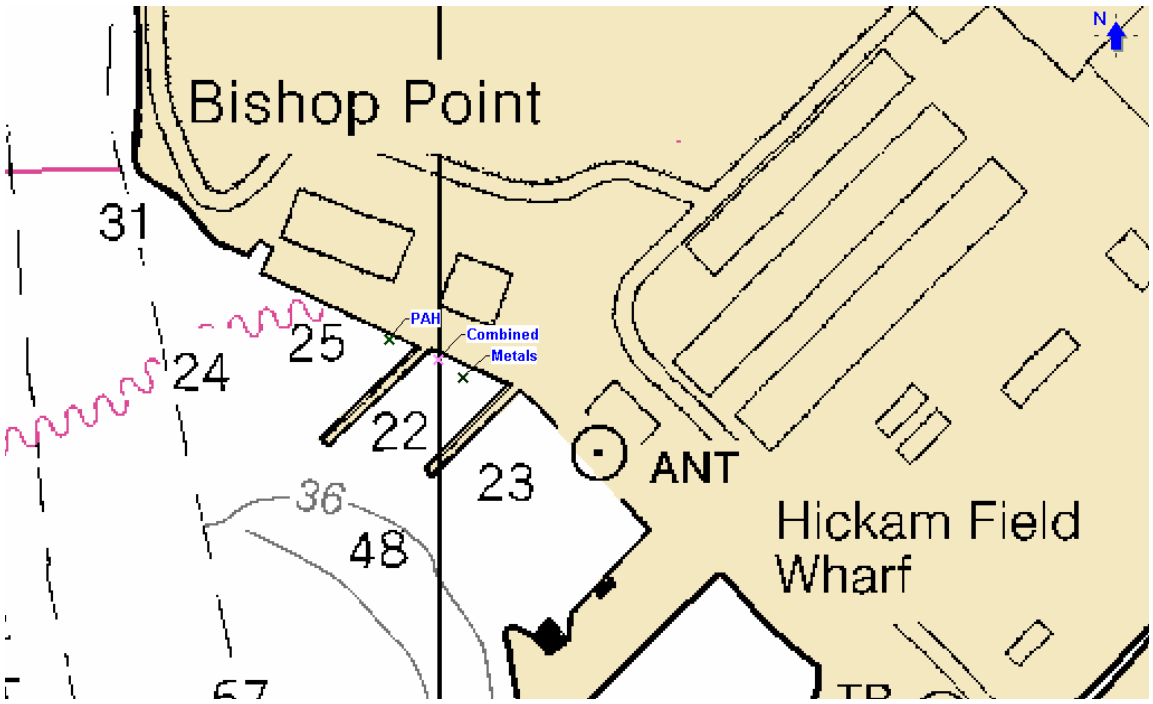



**Figure 69. Pearl Harbor, Bishop Point Demonstration Locations.**

The preparation and deployment for the combined demo followed very closely the procedures and events of the previous PAH demonstration deployment. The BFSD2 was cleaned, packed and shipped from SSC San Diego. When unpacked at Pearl Harbor, all systems were assembled, inspected and checked. The oxygen bottle was filled with $O_2$, and no problem with oxygen limitations was anticipated or encountered during the deployment as it was with the PAH deployment.

The BFSD2 was lowered into the water with a crane along the quay wall, and a pre- deployment checklist was followed. After the bottom was scanned with the onboard video camera and determined to be appropriate, the BFSD2 was landed and pre-deployment measurements taken. After the 10-minute pretest, sensors had stabilized and an oxygen range to be maintained could then be programmed for the 72-hour test from values taken during the pretest (Fig. 70). The 72-hour test was then started. Cables leading from the BFSD were disconnected from power, computers and video monitors and, together with a recovery line, were coiled and stored along the quay wall.

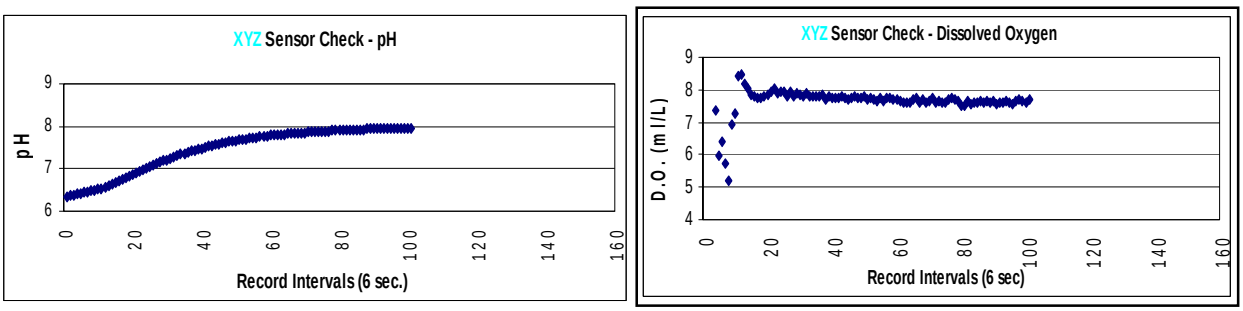



**Figure 70. Pearl Harbor, Bishop Point Combined Metals Pre-Deployment Sensor Graphs.**

Occasionally during the test, the cables were reconnected to the computer and video monitor and status was determined. All appeared normal during these checks and the cables resecured.

After 72 hours, the test was halted. Before the BFSD2 was raised from the bottom, data were uploaded via the stored cables on the quay wall. The BFSD2 was then raised from the bottom with the crane and deposited on the pier. The 24 sample bottles were briefly checked and found to be all full. They were then washed down, disconnected and removed from their racks. Samples were then taken to the field lab where filters were removed, labels added and they were shipped to Battelle labs for analysis.

Logged data were entered into Excel spreadsheets templates for processing. Oxygen and pH data show the deployment was successful in maintaining a tight seal and maintenance of the flux chamber integrity. Figure 71 shows a steady decline in pH which indicates no loss of seal or sudden contamination from outside the chamber. Figure 71 also shows the chamber was maintained oxic with the assistance of the $O_2$ feedback and injection system.

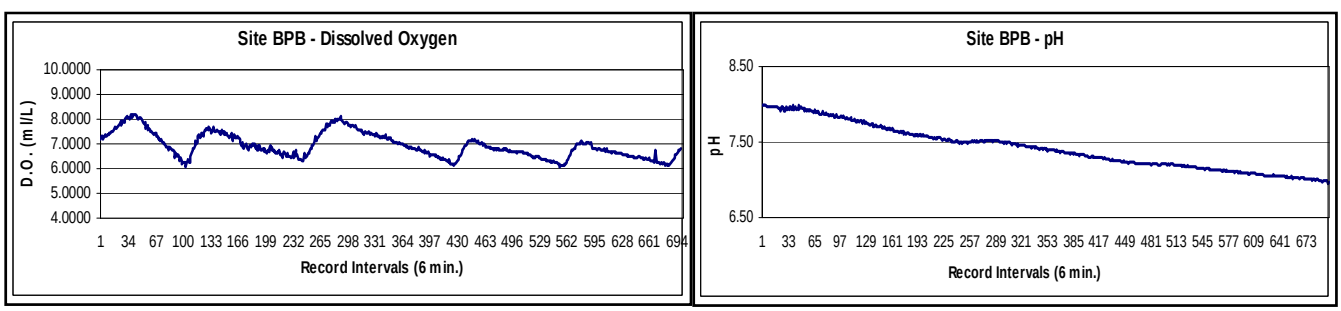



**Figure 71. Pearl Harbor, Bishop Point Combined Metals Full Test Sensor Graphs.**

#### 5.1.7.1 Pearl Harbor Combined Demonstration Results

Table 18 gives a summary of the flux results for metals and Figure 72 show these in graphical form. Flux of dissolved oxygen from the chamber, or the oxygen demand of the sediments, is also given in Table 18. This was calculated from the $O_2$ data logged from the chamber during the first decreasing slope in the 72-hour test before the $O_2$ feedback injection system raised the $O_2$ level.

Metals behaved similarly in this combined demonstration as they did in the original metals demonstration at the Bishop Point Site except for copper (Figure 73). Cadmium, lead, nickel, manganese and zinc all fluxed out of the sediments, a trend which is consistent with previous work,

while copper was adsorbed by the sediment. Copper fluxed out of the sediments during the initial study. Manganese behaved similarly in both studies in that it exhibited a higher flux rate during the first three samples of the test then leveled off for the remainder of the test period. This trend with Manganese is discussed in the Paleta Creek discussion section 5.1.3.1. Flux rates for manganese for the first 14 hours of the test as well as for the entire test are presented here. In general, flux rates were higher during this combined demonstration than during the metals-only demonstration.

PAH flux results are presented in two ways. First, the entire 72-hour test results with all twelve samples are presented. These data are presented in Figures 74 and 75 and Table 19. Then, secondly, results from the first four samples of the test, those up to 21.3 hours into the test, are shown. This is for comparison to the original organics-only demonstration where flux rates showed an initial slope then plateaued. In the original test, oxygen depletion in the chamber was theorized as the cause for this plateau, but oxygen levels were successfully maintained in the chamber during the second test. For whatever reasons this plateauing occurs, the trend seemed to repeat itself during the combined demonstration. For comparison purposes, the "first four" data are used to calculate flux rates.

**Table 18. Pearl Harbor, Bishop Point Combined Metals Summary of Metals.**

| Metal | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux (□g/m$^2$/day) | |
|---|---|---|---|---|---|
| | (□g/m$^2$/day)* | (□g/m$^2$/day) | (%) | Average | +/- 95% C.L. |
| Arsenic (As) | 23.48 | 6.94 | 100% | -5.16 | 2.10 |
| Copper (Cu) | -71.30 | 39.43 | 100.0% | 2.82 | 8.73 |
| Cadmium (Cd) | 1.31 | 1.63 | 98.1% | -0.52 | 0.75 |
| Lead (Pb) | 17.40 | 24.63 | 99.0% | 3.16 | 1.59 |
| Nickel (Ni) | 59.18 | 55.96 | 100.0% | 10.28 | 7.34 |
| Manganese (Mn) | 427.65 | 238.42 | 100.0% | -264.85 | 7.49 |
| Manganese (Mn)[1] | 1940.13 | 3853.39 | 100.0% | -264.85 | 7.49 |
| Silver (Ag) | -0.36 | 0.88 | 86.1% | 0.64 | 0.68 |
| Zinc (Zn) | 374.36 | 133.74 | 100.0% | -3.38 | 65.22 |
| **Other** | | | | | |
| Oxygen ($O_2$)* (*ml/m$^2$/day) | -1457.09 | 48.92 | na | na | na |
| Silica ($SiO_2$)* (*mg/m$^2$/day) | 0.00 | 0.00 | 48% | -1.97 | 2.88 |

1. Mn flux calculated on the first three samples due to non-linearity and to compare with metals-only demonstration

Flux rates for PAH's were similar in this combined test as it was in the original test. All PAH's that were measured fluxed out of the sediments except for phenanthrene. The largest flux rate measurement was for fluoranthene which also showed a large presence in the original test. This was followed by anthracene, acenaphthene and naphthalene, again similar to the original test. Similarities from the first test were also seen in the heavier molecular weight PAH's as benzo(a)pyrene,

benzo(k)flouranthene and chrysene showed large presence. Benzo(a)pyrene also showed a spike in this test but wasn't detected in the original test.

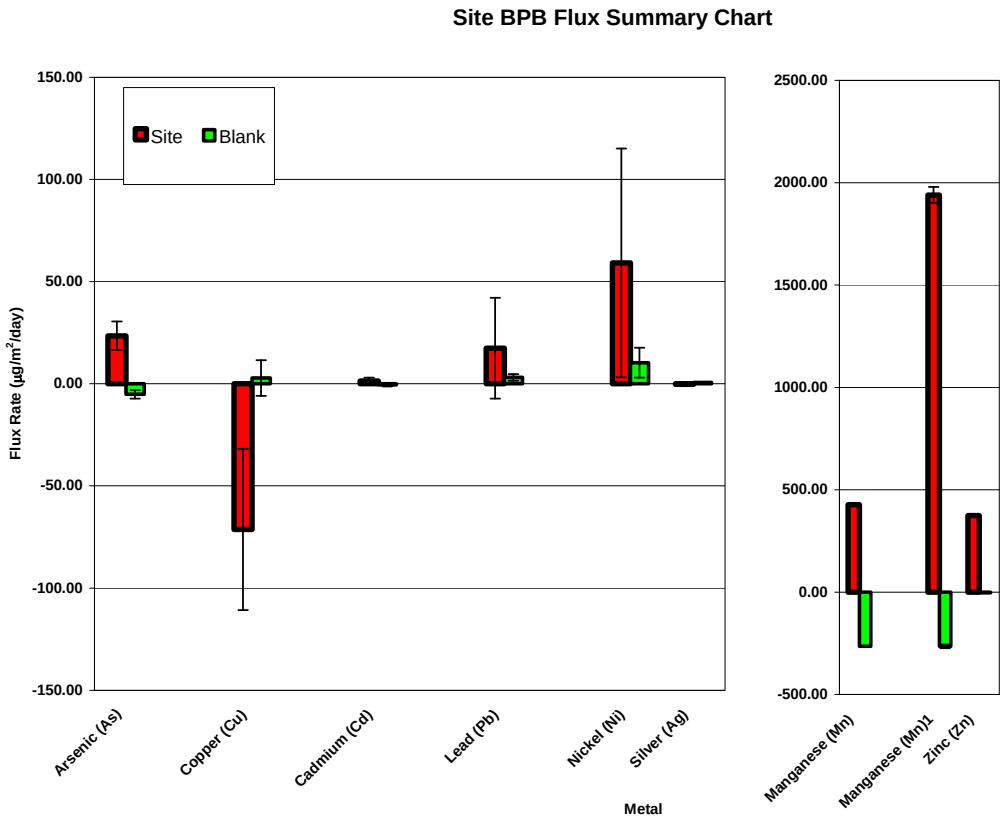



**Figure 72. Pearl Harbor, Bishop Point Combined Metals Comparison of Flux and Blanks.**

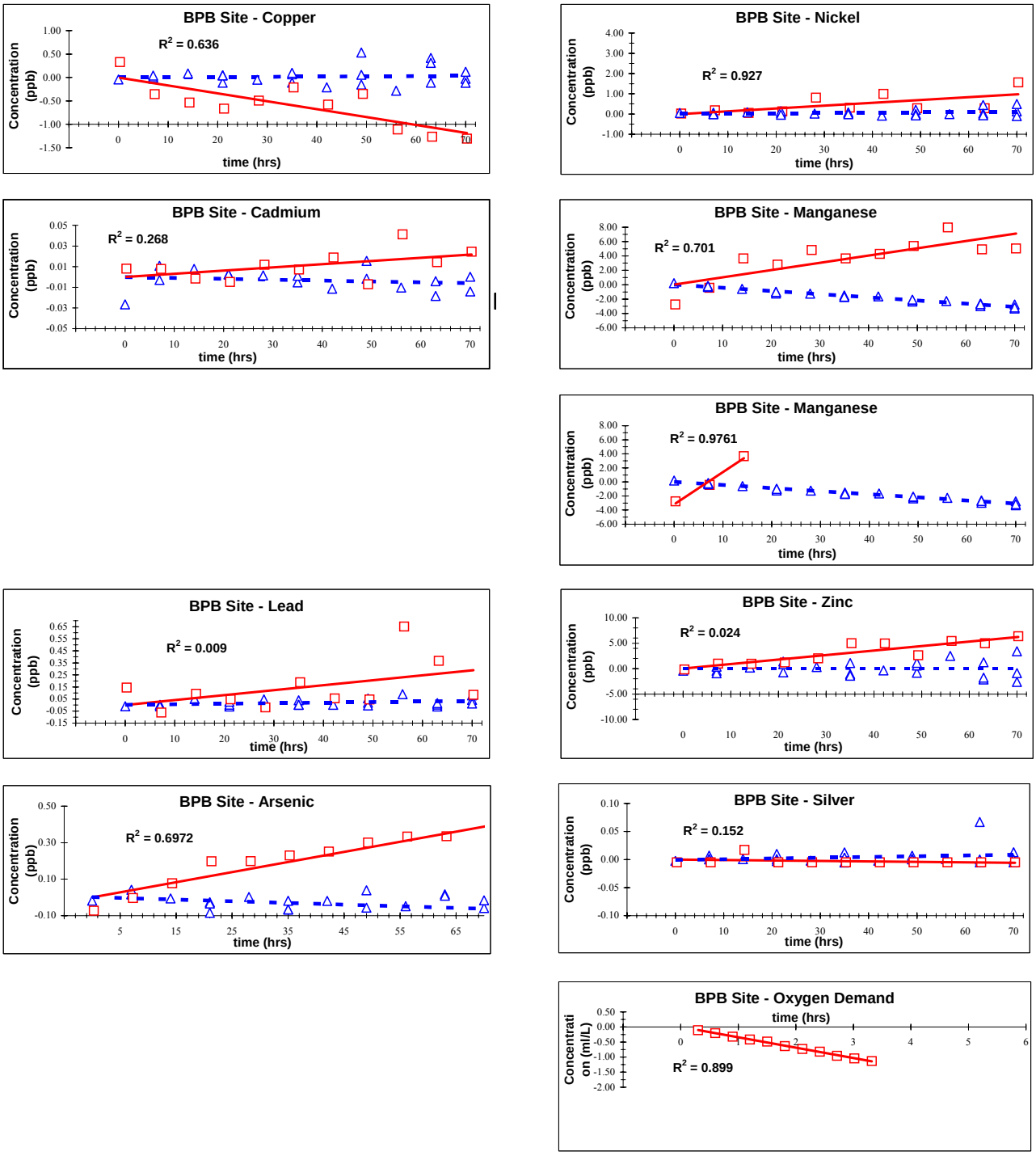
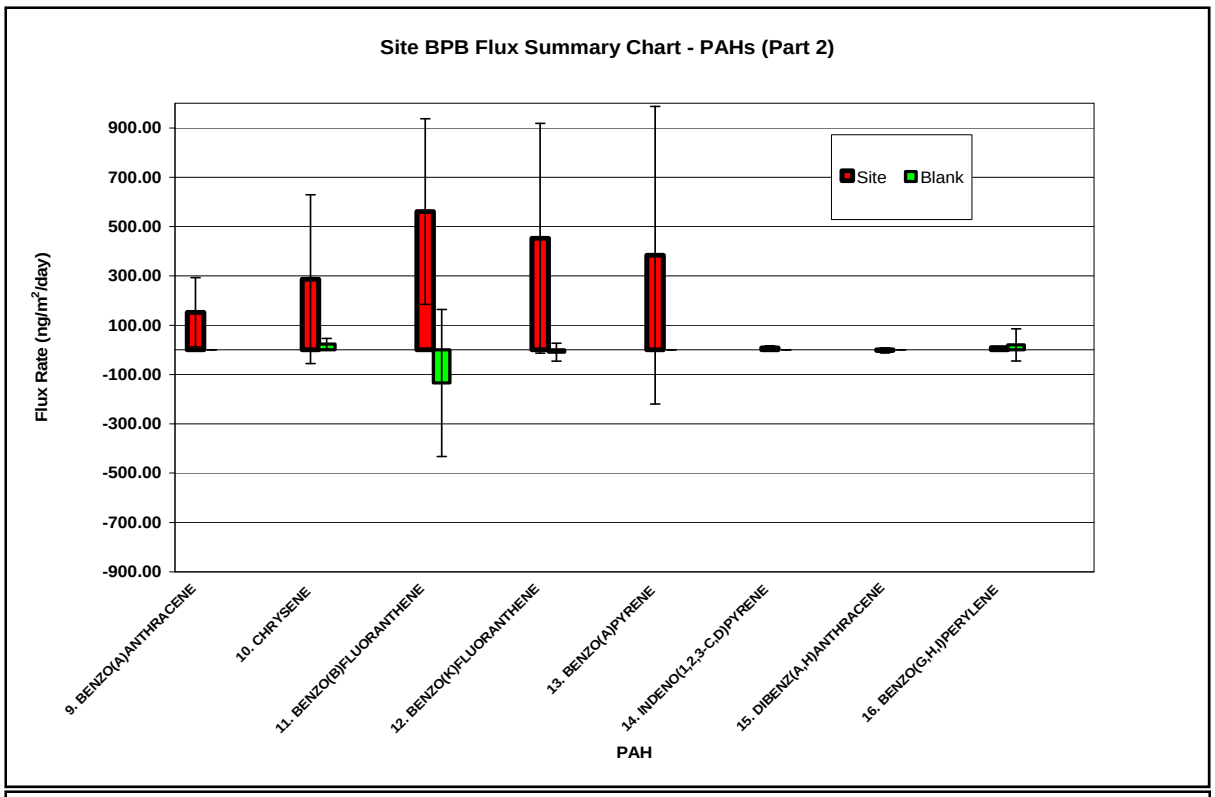



**Figure 73. Pearl Harbor Bishop Point Combined Demonstration Metals Time Series Graphs.**

**Table 19. Pearl Harbor, Bishop Point Combined Demo Summary Results for PAH's (**all samples**).**

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. |
|---|---|---|---|---|---|
| 1. Naphthalene | 711.03 | 2352.17 | 92.8% | -440.30 | 458.38 |
| 2. Acenaphthene | -1387.81 | 1989.31 | 91.4% | -32.40 | 50.34 |
| 3. Acenaphthylene | 106.66 | 213.64 | 31.9% | 208.47 | 112.60 |
| 4. Fluorene | -359.38 | 256.56 | 100.0% | -76.74 | 28.38 |
| 5. Phenanthrene | -639.76 | 1228.00 | 99.6% | 10.95 | 10.95 |
| 6. Anthracene | 763.68 | 546.29 | 100.0% | 117.68 | 64.62 |
| 7. Fluoranthene | 2749.93 | 3651.35 | 100.0% | -1423.95 | 178.41 |
| 8. Pyrene | 2191.62 | 2392.29 | 100.0% | -439.51 | 70.73 |

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. |
|---|---|---|---|---|---|
| 9. BENZO(A)ANTHRACENE | 152.67 | 140.49 | NA | NA | NA |
| 10. CHRYSENE | 286.65 | 341.92 | 94.7% | 23.94 | 22.32 |
| 11. BENZO(B)FLUORANTHENE | 561.07 | 376.08 | 97.9% | -134.30 | 297.91 |
| 12. BENZO(K)FLUORANTHENE | 452.24 | 465.75 | 82.8% | -9.71 | 36.30 |
| 13. BENZO(A)PYRENE | 383.46 | 603.38 | NA | NA | NA |
| 14. INDENO(1,2,3-C,D)PYRENE | 8.68 | 10.98 | NA | NA | NA |
| 15. DIBENZ(A,H)ANTHRACENE | -1.97 | 7.69 | NA | NA | NA |
| 16. BENZO(G,H,I)PERYLENE | 8.77 | 10.59 | 12.9% | 20.15 | 65.15 |



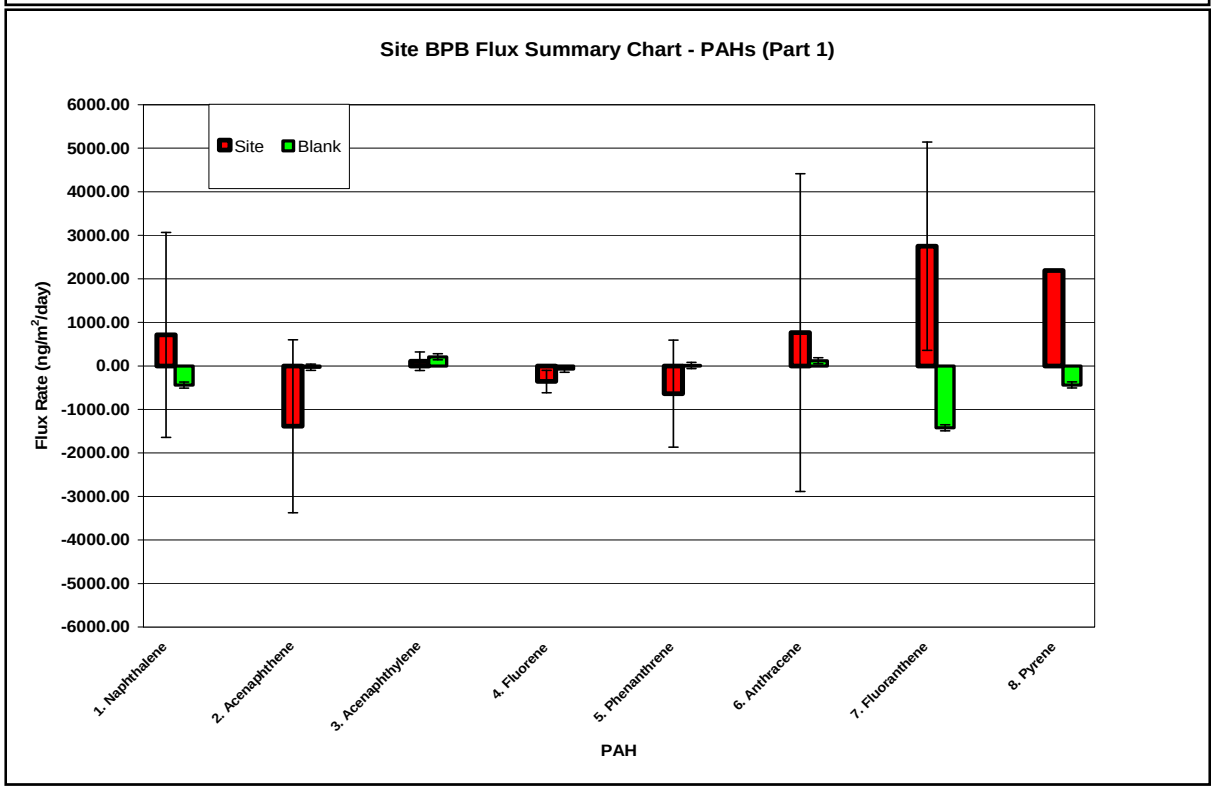




**Figure 74. Pearl Harbor, Bishop Point Combined PAH Comparison of Flux to Blanks (**all samples**).**

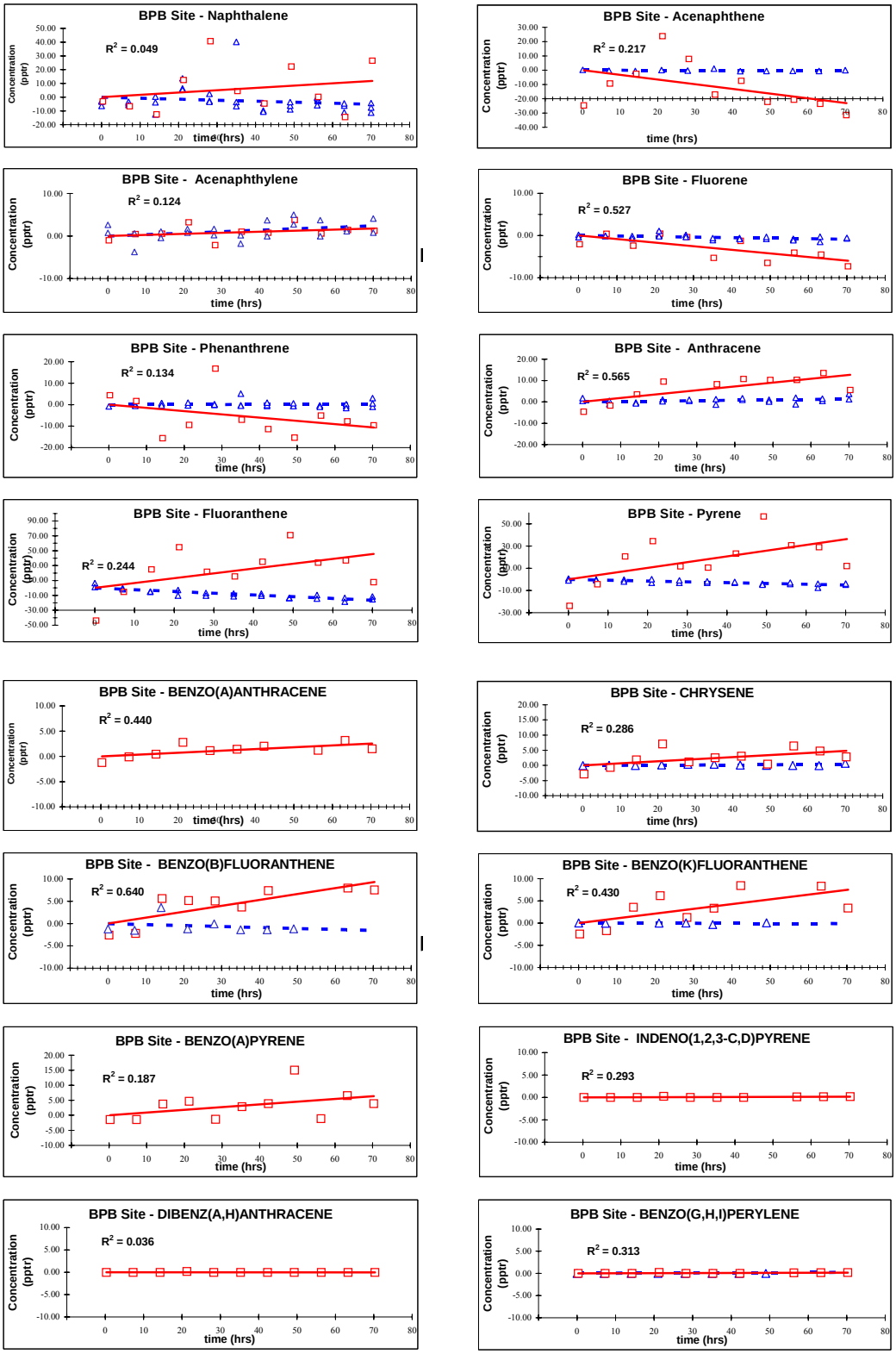



**Figure 75. Pearl Harbor, Bishop Point Combined Demonstration PAH Time Series Graphs (**all samples**).**

**Table 20. Pearl Harbor, Bishop Point Combined Demo Summary Results for PAH's (**First 4 samples**).**

| PAH | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m2/day) Average | +/- 95% C.L. |
|---|---|---|---|---|---|
| 1. Naphthalene | 2456.72 | 13211.63 | 100.0% | -440.30 | 458.38 |
| 2. Acenaphthene | 9222.27 | 6867.34 | 100.0% | -32.40 | 50.34 |
| 3. Acenaphthylene | 778.37 | 880.29 | 100.0% | 208.47 | 112.60 |
| 4. Fluorene | 285.70 | 2021.66 | 100.0% | -76.74 | 28.38 |
| 5. Phenanthrene | -3555.98 | 7892.27 | 100.0% | 10.95 | 10.95 |
| 6. Anthracene | 2874.10 | 1330.22 | 100.0% | 117.68 | 64.62 |
| 7. Fluoranthene | 19696.65 | 3869.67 | 100.0% | -1423.95 | 178.41 |
| 8. Pyrene | 12101.21 | 3884.64 | 100.0% | -439.51 | 70.73 |
| **PAH** | **Flux (ng/m2/day)*** | **+/- 95% C.L. (ng/m2/day)** | **Flux rate Confidence (%)** | **Triplicate Blank Flux (ng/m2/day) Average** | **+/- 95% C.L.** |
| 9. BENZO(A)ANTHRACI | 760.90 | 668.14 | NA | NA | NA |
| 10. CHRYSENE | 1949.20 | 1370.02 | 100.0% | 23.94 | 22.32 |
| 11. BENZO(B)FLUORAN | 1878.90 | 2921.78 | 100.0% | -134.30 | 297.91 |
| 12. BENZO(K)FLUORAN | 1890.04 | 1526.34 | 100.0% | -9.71 | 36.30 |
| 13. BENZO(A)PYRENE | 1413.41 | 1785.07 | NA | NA | NA |
| 14. INDENO(1,2,3-C,D)PY | 41.71 | 103.62 | NA | NA | NA |
| 15. DIBENZ(A,H)ANTHR | 34.46 | 85.60 | NA | NA | NA |
| 16. BENZO(G,H,I)PERYI | 39.90 | 99.12 | 43.2% | 20.15 | 65.15 |

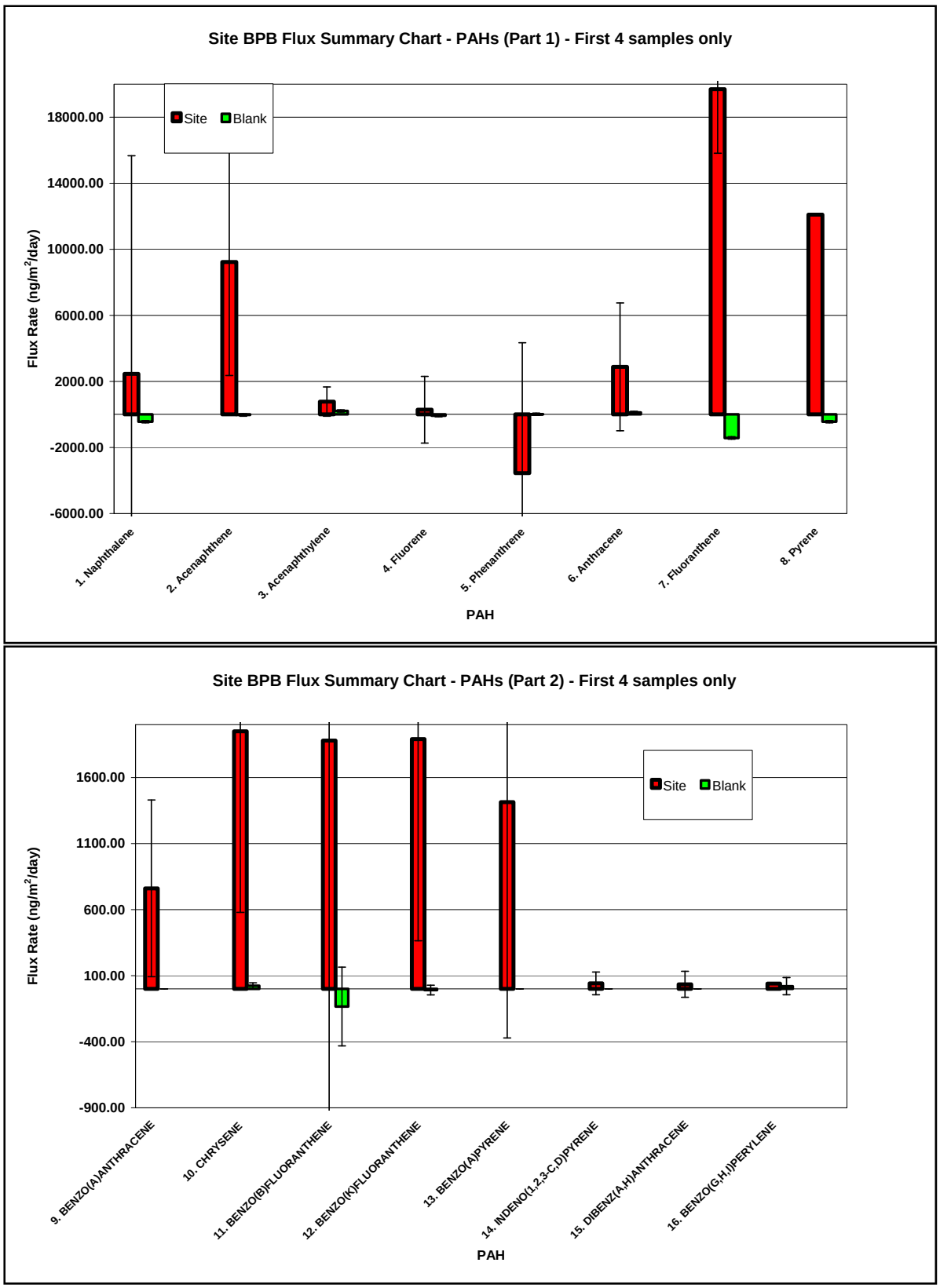



**Figure 76. Pearl Harbor, Bishop Point Combined PAH Comparison of Flux to Blanks (**First 4 samples**).**

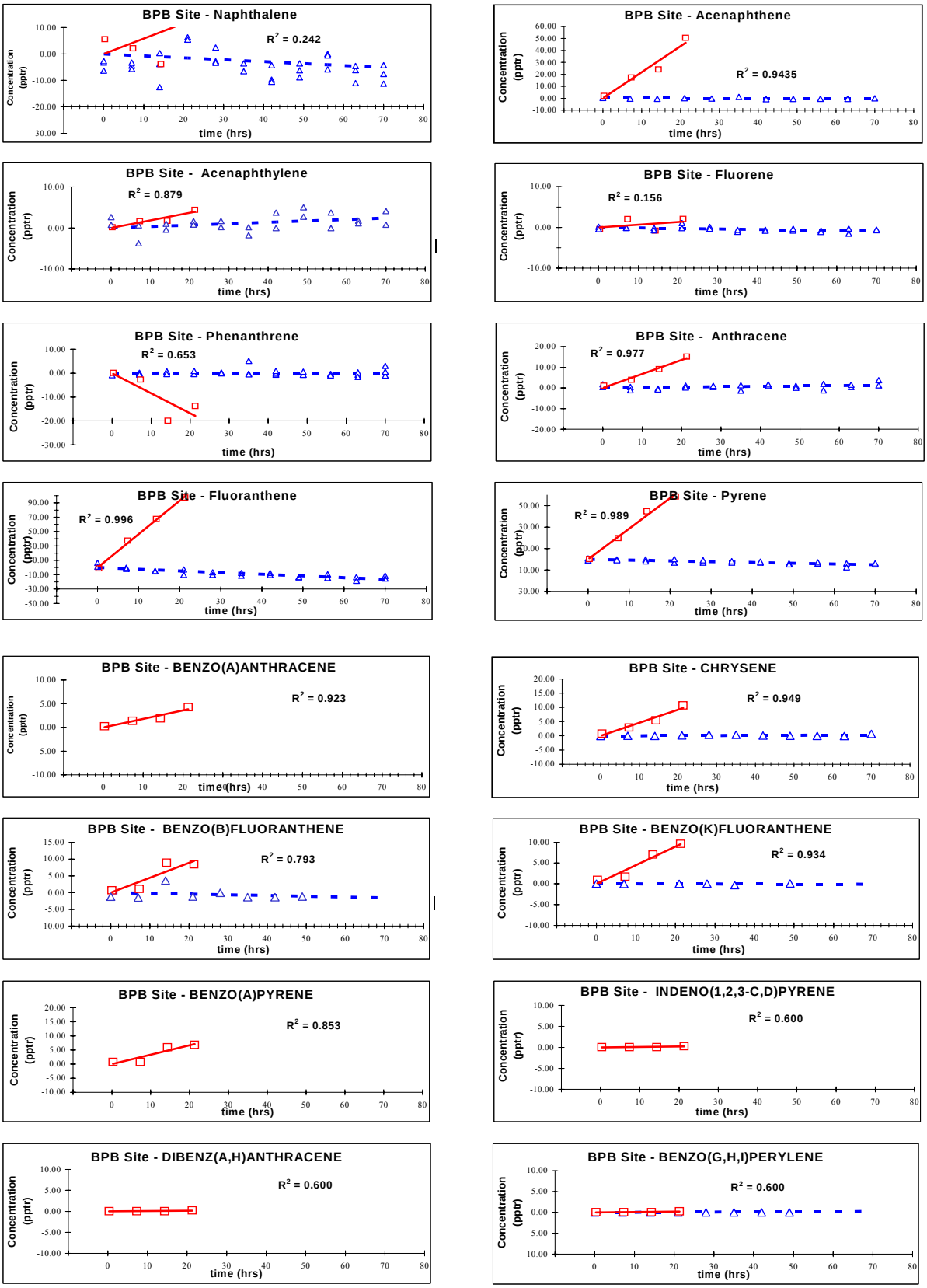



**Figure 77. Pearl Harbor, Bishop Point Combined Demonstration PAH Time Series Graphs (**First 4 samples**).**

### 5.1.7.2 Pearl Harbor Combined Demonstration Discussion

For the most part, flux rates for metals and organics behaved similarly at the Bishop Point sight for both the organics-only, metals-only and this combined demonstration of both organics and metals. Tables 21 and 22 show a side by side comparison of these demonstration flux results.

**Table 21. Comparison of Flux Rates from Metals-only and Combined Demonstrations.**

| | Combined Demo | | | Metals Only Demo | |
|---|---|---|---|---|---|
| Metal | Flux (□g/m2/day)* | +/- 95% C.L. (□g/m2/day) | | Flux (□g/m2/day)* | +/- 95% C.L. (□g/m2/day) |
| Arsenic (As) | 23.48 | 6.94 | | | |
| Copper (Cu) | -71.30 | 39.43 | | 112.46 | 17.60 |
| Cadmium (Cd) | 1.31 | 1.63 | | 1.85 | 1.96 |
| Lead (Pb) | 17.40 | 24.63 | | 0.71 | 1.11 |
| Nickel (Ni) | 59.18 | 55.96 | | 21.04 | 15.41 |
| Manganese (Mn) | 427.65 | 238.42 | | 223.33 | 284.79 |
| Manganese (Mn)1 | 1940.13 | 3853.39 | | 2177.45 | 192.60 |
| Silver (Ag) | -0.36 | 0.88 | | | |
| Zinc (Zn) | 374.36 | 133.74 | | 191.18 | 54.07 |

Copper and zinc are the only metals which showed a significant difference between sampling during the first metals only demo and the combined demo. Copper actually showed a reverse trend during the second test. Zinc flux rate was higher during the combined demo than during the first. However, cadmium, lead, nickel and manganese showed similar trends and lay within the 95% confidence intervals of the calculated slopes. Arsenic and silver were not reported during the first test and could not be compared here.

Flux rates for PAH's were calculated for the first 4 samples taken in order to compare with the original Bishop Point organics test. Concentrations for PAH's for both tests evened out or plateaued after the fourth sample was collected at about 22 hours. The "first four" flux rates are probably more realistic as that was measured before any interference or interaction with natural, in-situ processes caused by the chamber itself. The only organic which was significantly different from the first test was Phenanthrene which showed a negative flux or and absorption into sediments during the combined demo. All other organic compounds measured during the first test showed similar flux rates when compared to the 95% confidence limits of the flux curves.

The cause for the organic concentrations leveling off is not immediately known. Low oxygen levels and anoxic conditions inside the chamber during the first test were blamed for the effect. However

adequate oxygen conditions were maintained during the second test with the same result. High bulk sediment concentrations measured at Bishop Point may suggest a loading or saturation of PAH's within the chamber after 22 hours which would result in a dampening of the flux processes.

**Table 22. Comparison of Flux Rates from PAH-only and Combined Demonstration.**

| | Combined Demo | | PAH Only Demo | |
|---|---|---|---|---|
| PAH | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) |
| 1. Naphthalene | 2456.72 | 13211.63 | 1848.00 | 4406.00 |
| 2. Acenaphthene | 9222.27 | 6867.34 | 71053.00 | 327574.00 |
| 3. Acenaphthylene | 778.37 | 880.29 | 6862.00 | 14388.00 |
| 4. Fluorene | 285.70 | 2021.66 | 10387.00 | 110972.00 |
| 5. Phenanthrene | -3555.98 | 7892.27 | 3031.00 | 106689.00 |
| 6. Anthracene | 2874.10 | 1330.22 | 26955.00 | 27293.00 |
| 7. Fluoranthene | 19696.65 | 3869.67 | 69812.00 | 380980.00 |
| 8. Pyrene | 12101.21 | 3884.64 | 24512.00 | 190722.00 |
| PAH | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) | Flux (ng/m2/day)* | +/- 95% C.L. (ng/m2/day) |
| 9. BENZO(A)ANTHRACENE | 760.90 | 668.14 | Non-Detect | NA |
| 10. CHRYSENE | 1949.20 | 1370.02 | 8792.74 | 10650.17 |
| 11. BENZO(B)FLUORANTHENE | 1878.90 | 2921.78 | 3080.74 | 17862.21 |
| 12. BENZO(K)FLUORANTHENE | 1890.04 | 1526.34 | 977.52 | 3135.53 |
| 13. BENZO(A)PYRENE | 1413.41 | 1785.07 | Non-Detect | NA |
| 14. INDENO(1,2,3-C,D)PYRENE | 41.71 | 103.62 | 122.97 | 7141.99 |
| 15. DIBENZ(A,H)ANTHRACENE | 34.46 | 85.60 | Non-Detect | NA |
| 16. BENZO(G,H,I)PERYLENE | 39.90 | 99.12 | 33.19 | 5249.47 |

### 5.1.8 Paleta Creek and Pearl Harbor Metals Demonstrations Data Assessment.

BFSD2 performance assurance indicators show that: (1) a proper seal was achieved during both sets of demonstration deployments and chamber isolation of test water was maintained; (2) oxygen levels were maintained close to ambient levels, and; (3) silica, oxygen and pH trends varied as expected.

It was concluded that the two sets of deployments of BFSD2 at Paleta Creek and at Pearl Harbor, Hawaii demonstrated consistent performance and the ability to measure trace metal mobility at distinctly different sites. Ease of operation and reliability were also demonstrated. It was further concluded that BFSD2 can provide accurate and repeatable measurements of the mobility of trace metal contaminants to and from shallow water marine sediments when certain prerequisite conditions

are met. These sediment flux rates can be established with high confidence when the routine procedures, standard methods and protocols demonstrated during this study are followed. The BFSD2 and its support equipment are mobile by air transport, field portable and can be operated with a minimum of resources. Comparison of measured sediment fluxes with blank-chamber fluxes provides a statistical benchmark for the significance of the measured flux rates. Where statistically significant fluxes are observed, evaluation of impacts on water quality can be carried out, or comparisons can be made to bioaccumulation measurements to help identify exposure pathways. The resulting analysis will provide a significant new tool in evaluating potential cleanup options at contaminated sediment sites.

### 5.1.9 Technology Comparison

There are no directly comparable technologies to the Benthic Flux Sampling Device for *in situ* contaminated sediment flux measurements. Current alternative approaches, such as bulk sediment analysis, have been discussed throughout this report. Alternate methods and associated costs are discussed in section 6.1.4. Site specific considerations must be considered in determining which combination of technologies will provide the best information. Data analysis and interpretation is likewise dependent on site specific considerations as illustrated in this report.

# 6. Cost Assessment

## 6.1 Cost Performance

The expected operational costs for the Benthic Flux Sampling Device 2 (BFSD2) are largely driven by analytical laboratory costs. Although typical analytical laboratory prices have shown reductions, the detection level required to achieve meaningful BFSD2 flux measurements requires specialized equipment and highly skilled technicians available at limited sources. Other BFSD2 expected operational costs are driven primarily by labor, supplies and transportation costs during the pre-operational, operational and post-operational phases of deployment. The combined metals and organics demo has shown how a single deployment can collect data for both metals and organic compounds thus reducing the cost if both are desired at a single location. Lab analysis costs are increased but are offset by logistical and travel costs.

### 6.1.1 Pre-Operational Phase Costs

The costs incurred prior to field operations are derived from expenses involved with: site research and applicability; logistics planning and scheduling; equipment maintenance and repair; and pre-deployment readiness preparations (supplies, packing, checkout). Table 23 and Figure 78 below include expected pre-operational phase costs and an associated schedule of activities.

**Table 23. Expected Pre-Operational Phase Costs for BFSD2 Deployment.**

| | Labor | | Non-Labor | | Totals |
|---|---|---|---|---|---|
| | Govt | Contr | Matls | Other | |
| **Site Research** | $5,580 | $0 | n/a | $1,000 | **$6,580** |
| **Logistics Plans** | $7,000 | $0 | n/a | $0 | **$7,000** |
| **Maint and Repair** | $1,600 | $4,200 | $500 | $0 | **$6,300** |
| **Readiness Prep** | $2,000 | $10,850 | $500 | $0 | **$13,350** |
| **Totals** | **$16,180** | **$15,050** | **1000** | **$1,000** | **$33,230** |

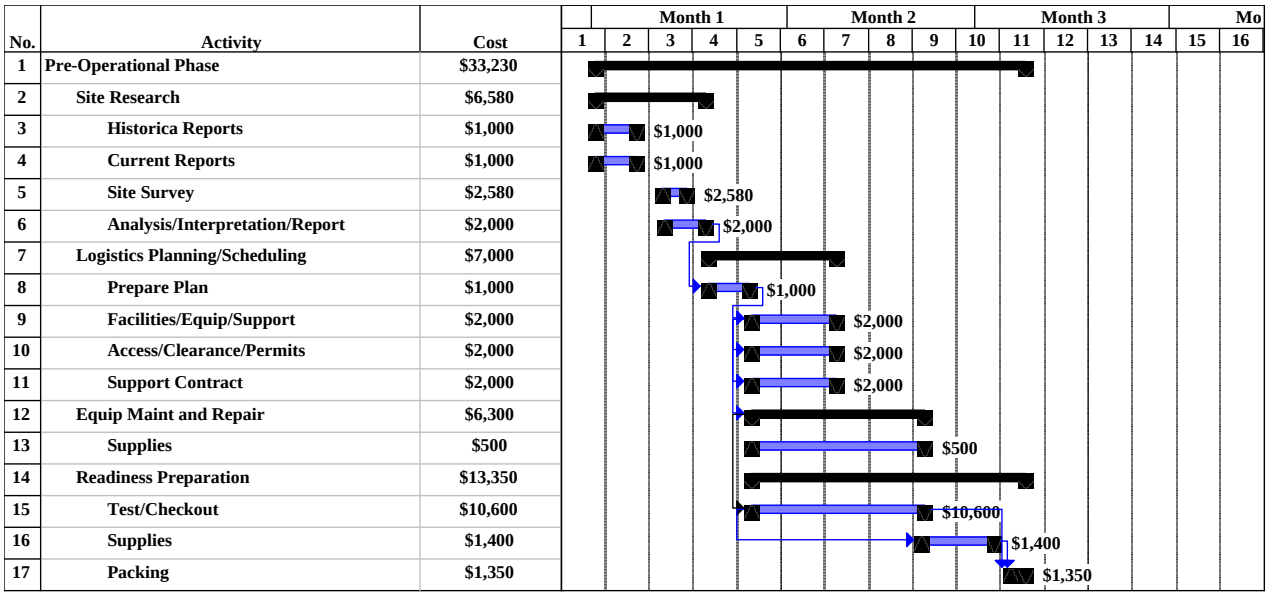



**Figure 78. Expected Pre-Operational Phase Schedule for BFSD2 Deployment.**

### 6.1.2 Operational Phase Costs

The costs incurred for field operations are derived from expenses involved with: equipment transportation; personnel travel and per diem; field facilities (shoreside work area, surface vessel, handling equipment); deployment, recovery and turnaround on a 5-day cycle; and analytical laboratory costs for one blank test and the required number of sites. Table 24 and Figure 79 below include expected operational phase costs and an associated schedule of activities.

**Table 24. Expected Operational Phase Costs for BFSD2 Deployment.**

| | Labor | | Non-Labor | | | Totals |
|---|---|---|---|---|---|---|
| | Govt | Contr | Matls | Lab | Other | |
| **Equip Trans** | $100 | $200 | $0 | n/a | $1,000 | **$1,300** |
| **Travel** | $800 | $600 | $0 | n/a | $1,240 | **$2,640** |
| **Equip/Facilities** | $1,600 | $1,200 | $0 | $0 | $0 | **$2,800** |
| **Blank Test** | $4,000 | $3,000 | $0 | $12,000 | $1,200 | **$20,200** |
| **Site #1** | $4,000 | $3,000 | $0 | $12,000 | $2,700 | **$21,700** |
| **Site #2** | $4,000 | $3,000 | $0 | $12,000 | $2,700 | **$21,700** |
| **Totals** | **$14,500** | **$11,000** | **$0** | **$36,000** | **$8,840** | **$70,340** |

| No. | Activity | Cost |
|---|---|---|
| 18 | Operational Phase | $70,340 |
| 19 | Equipment Transportation | $1,300 |
| 20 | Personnel Travel | $2,640 |
| 21 | Equipment/Facilities setup/checkout | $2,800 |
| 22 | Blank Test | $20,200 |
| 23 | Blank Test | $8,200 |
| 24 | Lab Anaysis | $12,000 |
| 25 | Site #1 | $21,700 |
| 26 | Decon/Deploy/Recover | $9,700 |
| 27 | Lab Analysis | $12,000 |
| 28 | Site #2 | $21,700 |
| 29 | Decon/Deploy/Recover | $9,700 |
| 30 | Lab Analysis | $12,000 |

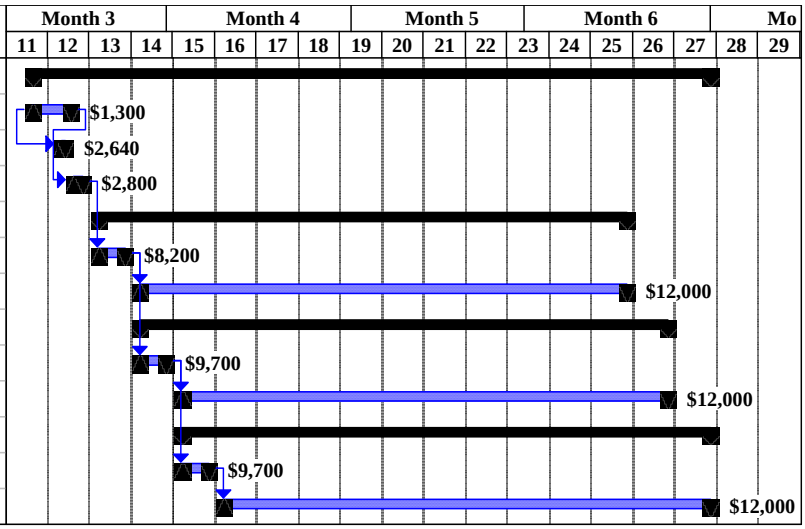



**Figure 79. Expected Operational Phase Schedule for BFSD2 Deployment.**

The operational phase costs for one site, which includes the costs for transportation, setup and a blank test are $48,640, of which 49% is for analysis of the samples. Each additional site adds $21,700 to the total, of which 55% is for analysis of the samples. The operational phase schedule is likewise strongly driven by the standard 60-day laboratory analysis time, which can be shortened to 30-days or less, at additional cost. The 5-day operations period for a BFSD2 72-hour deployment, recovery and turnaround cycle fits conveniently with a standard workweek schedule. An accelerated schedule which shortens turnaround time and includes weekend work periods can achieve two deployments per week.

### 6.1.3 Post-Operational Phase Costs

The costs incurred following completion of site operations are derived from expenses involved with: equipment packing and transportation; personnel travel; data processing, analysis and interpretation; report preparation. Table 25 and Figure 80 below include expected post-operational phase costs and an associated schedule of activities.

**Table 25. Expected Post-Operational Phase Costs for BFSD2 Deployment.**

| | Labor | | Non-Labor | | | Totals |
|---|---|---|---|---|---|---|
| | Govt | Contr | Matls | Lab | Other | |
| **Equip Pkg/Trans** | $0 | $1,500 | $0 | n/a | $1,000 | **$2,500** |
| **Travel** | $800 | $600 | $0 | n/a | $1,240 | **$2,640** |
| **Data Review** | $20,000 | $13,000 | $0 | $0 | $0 | **$33,000** |
| **Report Prep** | $24,000 | $0 | $0 | n/a | $0 | **$24,000** |
| **Totals** | **$44,800** | **$15,100** | **$0** | **$0** | **$2,240** | **$62,140** |

| No. | Activity | Cost |
|---|---|---|
| 31 | Post-Operational Phase | $62,260 |
| 32 | Equipment Packing/Transportation | $2,500 |
| 33 | Personnel Travel | $2,640 |
| 34 | Data Processing, Analysis, Interpretat | $33,120 |
| 35 | Report Preparation | $24,000 |

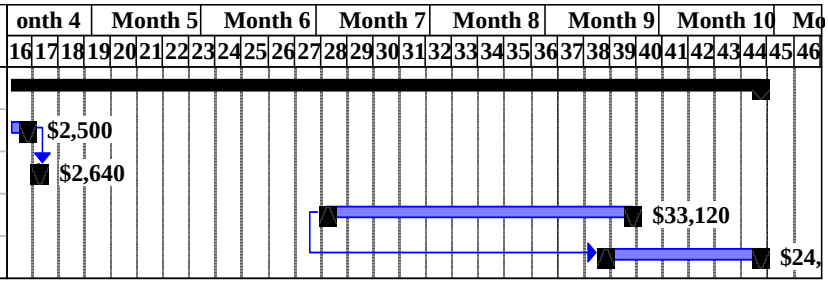



**Figure 80. Expected Post-Operational Phases Schedule for BFSD2 Deployment.**

The post-operational phase costs are largely the labor costs to process, analyze, interpret and report the results of the BFSD2 deployments. The costs are approximately the same regardless of the number of deployments as long as the sites have generally common geophysical and geochemical characteristics. The schedule is driven by the inactive period of time while awaiting results from laboratory analysis of the samples.

### 6.1.4 Alternative Methods

As discussed extensively in key reference 3, alternative sample collection methods to BFSD2's *in situ* collection and filtering of samples from the sediment-water diffusive interface are available. As with BFSD2, samples collected with alternative methods will require equivalent specialized laboratory analyses in order to determine contaminant flux rates. Those costs would be equivalent. Thus a direct comparison focusing on the method of sample collection is useful. Available alternate methods fall into two approaches, *ex situ* and *in situ*. Either of the approaches introduce error sources not present with BFSD2 and minimizing the affects of the error sources increases costs and complexity. Sample integrity becomes a significant factor. These issues aside, *ex situ* approaches can be as much as 50% cheaper for the field work, but this advantage quickly disappears with sediment processing costs. Alternative *In Situ* approaches, where applicable, may yield even greater savings than 50% for the field work, but careful consideration of the factors discussed below may discourage their use.

Both alternative approaches involve isolation of sediment pore water. With either approach, the primary source of error is the oxidation of anoxic pore water, which can significantly alter the aqueous phase trace metals. To prevent oxidation, samples must be processed and handled in an inert atmosphere, typically nitrogen or argon. *Ex Situ* methods typically first collect sediment samples which then require additional processing to extract pore water – requiring an inert atmosphere. Centrifuging or squeezing the sediment are accepted practices, but they too introduce error sources including solid-solution interactions. Sectioning samples prior to extraction to resolve sample depth for gradient determinations also adds cost and introduces errors. In addition, *Ex Situ* samplers must be rugged enough for field use yet provide isolation of the sediment sample from metal components. This is particularly difficult for dredging and grab sampling equipment however coring equipment can include non-metallic sleeves. Alternative *in situ* methods collect pore water samples at the sediment interface using either suction filtration techniques or dialysis. *In Situ* filtration techniques are limited to coarse grain sediments and do not offer depth resolution. Dialysis techniques incur minimum error sources, but suffer sample collection times as long as 20 days and produce small sample volumes. Periodic sample collection comparable to BFSD2 could require months, which in turn raises a number of additional issues.

# 7. Regulatory Issues

## 7.1 Approach to Regulatory Compliance and Acceptance

Regulatory acceptance has been a fundamental part of this project from the start and was included in the initial execution plan. The approach included application to the California Environmental Protection Agency (CA EPA), Department of Toxic Substances Control (DTSC) program known as "Cal Cert". A formal "Services Agreement" was signed with the State of California and funded for technology evaluation and certification services. In addition, CA EPA membership in the Interstate Technology and Regulatory Cooperation (ITRC) group of the Western Governors Association (WGA) and the resulting multi-state recognition of certified technologies by at least the 26 member states' environmental protection agencies promotes recognition and acceptance the BFSD2. Recognition and acceptance by the U.S. Environmental Protection Agency (US EPA), as well as private sector, Native American and foreign interests, is also promoted by their active participation in the ITRC. And, US EPA, state, local and private environmental professionals, as well as CA EPA evaluators were in attendance at field demonstrations, which included technology briefings and displays. Finally, certification by CA EPA includes public notifications and listings officially distributed to a wide range of recipients.

The Cal Cert application involved CA EPA review of the technology including background publications, reports, test and evaluation data, and a SSC SD site visit for technical discussions and equipment inspection. Due to the unique nature of the BFSD2 technology, a DTSC-wide search for a qualified lead technology evaluator was necessary to locate and secure the services needed for this project. Following acceptance of the Cal Cert application a performance claim was made by SSC SD After initial certification for metals, the CA Cert formal Services Agreement was amended to include organics applications. Additional funds to support their organics evaluation were provided also as amendments to previous documents.

The demonstrations performed for this project were key elements in the Cal Cert process. CA EPA evaluators reviewed the site selections, the test plans and attended the field demonstrations. Independent measurements, data review and analyses were accomplished by the CA EPA evaluators. Appendix F is the formal Cal Cert certificate and publicly released report. The Final Technology Evaluation report is listed in References, Section 10.

# 8. Technology Implementation

## 8.1 DoD Need

Sediments in many US bays and harbors are contaminated with potentially harmful metal and organic compounds. Contamination occurred directly through disposal of shipyard and shipboard waste, and indirectly through urban runoff and groundwater exchange with land sites. Federal, state and local regulatory agencies are in the process of adopting strict sediment quality criteria. These regulations represent a significant compliance issue for the DoD relative to discharge practices, dredging operations and clean-up techniques. Previous studies indicate that biological uptake, accumulation, and toxicity result primarily from the fraction of the toxicant pool that is readily solubilized. In surface sediments, the production of this soluble fraction will, in most cases, cause it to migrate through the pore water and across the sediment-water interface. Contaminated sediments at DoD sites pose a potential human health and ecological risk. Source control programs will not eliminate sediment contamination immediately because of the slow degradation and cycling processes that control many pollutants in these systems

For these reasons, benthic toxicant fluxes can provide a unique *in situ* indicator of bioavailability and hence an estimate of the potential for risk to human health or environmental harm. Using direct measurements, DoD can reduce the escalating costs of compliance and remediation of contaminated sediments by determining if the contamination poses a significant risk for remobilization. Quantifying the mobility of these in-place contaminants is an essential requirement for deciding the proper method of remediation. The complexity of marine sediment systems makes it very difficult to predict contaminant mobility by indirect methods. There is currently no other satisfactory direct means of quantifying the mobility of contaminants from marine sediments except the Benthic Flux Sampling Device (BFSD2 and its prototype version).

## 8.2 Transition

Technology transition of the BFSD2 is well underway. It consists of commercialization, regulatory acceptance, product improvement, and performance extension elements.

### 8.2.1 Commercialization

BFSD2 is a commercialized version of the prototype BFSD. The prototype BFSD was used during the Research, Development, Test and Evaluation (RDTE) phase of the program and was followed by fabrication of BFSD2 during the subsequent Acquisition phase. A Technical Data Package (TDP) and procurement package were generated to support a fixed-price, competitive contract solicitation for fabrication of a commercialized version of the prototype BFSD, called BFSD2. The winner, Ocean Sensors, Incorporated in San Diego, utilized commercial-off-the-shelf (COTS) and replaceable/repairable assemblies in meeting the requirements of the TDP.

#### 8.2.1.1 Cooperative Research and Development Agreement

A Cooperative Research and Development Agreement (CRADA) was negotiated with Ocean Sensors, Inc., however it was not formalized and consummated. The company suggested, and SSC SD agreed, that a formal CRADA would not promote its goals for producing additional systems for other customers in response to market demand. No conflicting intellectual property issues were identified with their strategy and the company is currently awaiting new orders.

### 8.2.2 Regulatory Acceptance

See Approach to Regulatory Compliance and Acceptance, Section 7.1.

### 8.2.3 Product Improvement

Both incremental and continuing product improvements have been included in technology implementation. New methods, processes and procedures applicable to the BFSD2 were evaluated for use as a result of problems, constraints or other drawbacks identified during operations.

#### 8.2.3.1 Incremental Product Improvements

Incremental improvements were implemented during the project, such as: reconfiguring the circulation pump for improved flow rate control: reconfiguring for *in situ* sample filtration using vacuum-filled collection bottles; installation of a insertion sensor subsystem to assure minimum sediment penetration; installation of a subsystem to inject sodium bromide into the collection chamber as a conservative tracer to facilitate more accurate volume determination. Care was taken to assure that such improvements did not invalidate ongoing certification efforts.

#### 8.2.3.2 Continuing Product Improvements

Continuing improvements were implemented during the project, such as: method, timing and location for collection of a suitable ambient water sample; numerous computational spreadsheet data reduction, processing and display improvements; numerous improvements for turnaround cleaning and preparation; processes and procedures to improve maintenance and minimize corrosion. Again, care was taken to assure that such improvements did not invalidate ongoing certification efforts.

# 9. Lessons Learned

## 9.1 Flexibility

This project has been relatively straight forward and trouble free. As with any multi-faceted program which involves a complex new technology, flexibility must be maintained in order to accommodate any number of emergent issues. Plans and schedules must flex to allow for changes. This project suffered delayed funding at several points, but plans were flexible enough to allow work around efforts which ultimately recovered schedule losses. Technical approaches must flex to allow for changes. This project benefited from a number of incremental and continuing product improvements which were accommodated within the technical approach without invalidating demonstration results.

## 9.2 Mother Nature

Earlier studies had forecast it and it was clear from demonstration results that contaminated sediments are non-homogeneous and are subject to influences involving benthic organisms, complex marine geochemistry, and other factors. Accommodation of differences between blank measurements made a few days apart and site measurements made a few feet apart were necessary.

## 9.3 Statistics

With consideration for the very low levels of contaminants being measured (parts per *billion* and lower!) metrics involving statistical methods were needed to put meaning to results. Accommodation for results in terms of probabilities and confidence levels must be made to tease out the true meaning of some flux measurements. All throughout, consistent and repeatable materials, processes and procedures were necessary to minimize their influence on true results.

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# Appendix A

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# Appendix B

## Spreadsheet Products for Each Demonstration

Bishop Point Combined - PAHs first 4 (Part 1)
Bishop Point Combined - PAHs first 4 (Part 2)
BP Organics Demo - PAHs (Part1)
BP Organics Demo - PAHs (Part1-First 4 Samples)
BP Organics Demo - PAHs (Part1-last 8 samples)
BP Organics Demo - PAHs (Part 2)
BP Organics Demo - PAHs (Part 2
BP Organics Demo - PAHs (Part 2
BP Organics Demo-PCBs
BP Organics Demo-Pesticides
PC Organics Demo - PAHs (Part1)
PC Organics Demo - PAHs (Part 2)
PC Organics Demo-PCBs
PC Organics Demo-Pesticides
BFSD2 Blank Tests (CA Cert)-Metals
BFSD2 Blank Tests- PAHs (CA Cert)
BFSD2 Blank Tests- PCBs (CA Cert)
BFSD2 Blank Tests- Pesticides (CA Cert)
BFSD2 PCD(All-CA Cert)
BFSD2 PCPD(All-CA Cert)
BFSD2 PHBP(All-CA Cert)
BFSD2 PHML(All-CA Cert)
Bishop Point Combined - Metals_1
Bishop Point Combined - PAHs (Part 1)
Bishop Point Combined - PAHs (Part 2)

# BFSD 2 Triplicate Blank Tests
# Copper

**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

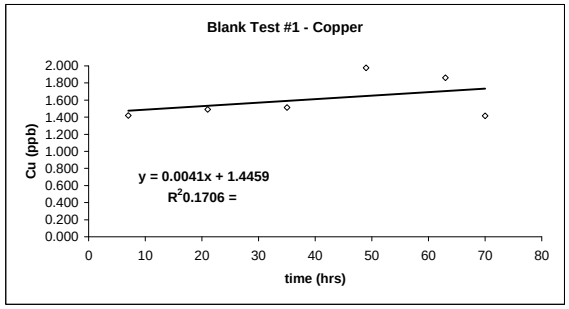
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

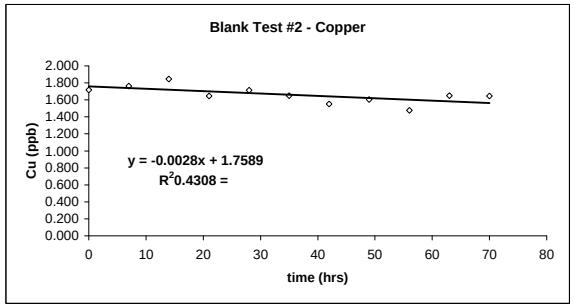
| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | $cm^2$ |

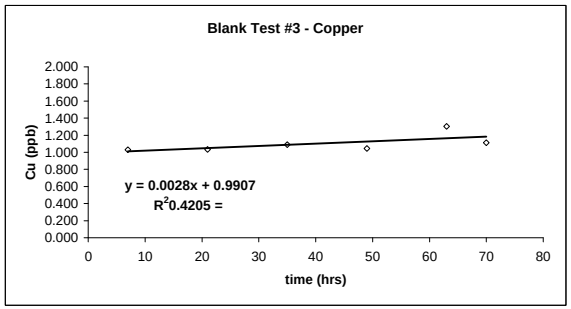
| Sample id | BFSD 2 Data: Measured Concentration (ppb)** | BFSD 2 Data: Sample No.* | BFSD 2 Data: Elapsed Time (hrs) | Dilution Correction: Measured Concentration (ppb)** | Dilution Correction: Corrected Concentration (ppb)** | Dilution Correction: # of Dilutions | From Regression Concentration (ppb)** |
|---|---|---|---|---|---|---|---|
| **Copper (Cu)** | | | | | | | |
| **Test #1** | | | | | | | |
| | 1.42 | T-#0 | | 1.420 | | | |
| **BT1-03** | 1.42 | #1 | 7 | 1.420 | 1.420 | 0 | 1.475 |
| **BT1-05** | 1.50 | #2 | 21 | 1.500 | 1.492 | 2 | 1.532 |
| **BT1-07** | 1.53 | #3 | 35 | 1.530 | 1.515 | 4 | 1.590 |
| **BT1-09** | 2.00 | #4 | 49 | 2.000 | 1.978 | 6 | 1.648 |
| **BT1-11** | 1.89 | #5 | 63 | 1.890 | 1.863 | 8 | 1.705 |
| **BT1-12** | 1.44 | #6 | 70 | 1.440 | 1.416 | 9 | 1.734 |
| **Test #2** | | | | | | | |
| **BT2-01** | 2.57 | T-#0 | -0.1 | 2.574 | | n/a | |
| **BT2-02** | 1.72 | #1 | 0 | 1.718 | 1.718 | 0 | 1.759 |
| **BT2-03** | 1.77 | #2 | 7 | 1.769 | 1.764 | 1 | 1.739 |
| **BT2-04** | 1.85 | #3 | 14 | 1.853 | 1.844 | 2 | 1.719 |
| **BT2-05** | 1.66 | #4 | 21 | 1.660 | 1.647 | 3 | 1.700 |
| **BT2-06** | 1.73 | #5 | 28 | 1.730 | 1.712 | 4 | 1.680 |
| **BT2-07** | 1.67 | #6 | 35 | 1.671 | 1.648 | 5 | 1.660 |
| **BT2-08** | 1.58 | #7 | 42 | 1.579 | 1.551 | 6 | 1.640 |
| **BT2-09** | 1.64 | #8 | 49 | 1.639 | 1.606 | 7 | 1.621 |
| **BT2-10** | 1.52 | #9 | 56 | 1.515 | 1.477 | 8 | 1.601 |
| **BT2-11** | 1.69 | #10 | 63 | 1.693 | 1.649 | 9 | 1.581 |
| **BT2-12** | 1.69 | #11 | 70 | 1.693 | 1.644 | 10 | 1.561 |
| **Test #3** | | | | | | | |
| | 1.03 | T-#0 | | 1.030 | | | |
| **BT3-02** | 1.03 | #1 | 7 | 1.030 | 1.030 | 0 | 1.010 |
| **BT3-04** | 1.04 | #2 | 21 | 1.040 | 1.034 | 2 | 1.049 |
| **BT3-06** | 1.10 | #3 | 35 | 1.102 | 1.091 | 4 | 1.087 |
| **BT3-08** | 1.06 | #4 | 49 | 1.063 | 1.047 | 6 | 1.126 |
| **BT3-10** | 1.33 | #5 | 63 | 1.326 | 1.304 | 8 | 1.164 |
| **BT3-12** | 1.14 | #6 | 70 | 1.140 | 1.114 | 10 | 1.184 |

**Linear Regression Statistics**

| Test #1 | | Test #2 | | Test #3 | |
|---|---|---|---|---|---|
| Regression Output: | | Regression Output: | | Regression Output: | |
| Constant | 1.446 | Constant | 1.759 | Constant | 0.991 |
| Std Err of Y Est | 0.211 | Std Err of Y Est | 0.045 | Std Err of Y Est | 0.075 |
| R Squared | 0.171 | R Squared | 0.431 | R Squared | 0.420 |
| No. of Observations | 6 | No. of Observations | 12 | No. of Observations | 6 |
| Degrees of Freedom | 4 | Degrees of Freedom | 4 | Degrees of Freedom | 4 |
| X Coefficient(s) | 0.004 | X Coefficient(s) | -0.003 | X Coefficient(s) | 0.003 |
| Std Err of Coef. | 0.005 | Std Err of Coef. | 0.001 | Std Err of Coef. | 0.002 |
| **Flux = 25 ug/m^2/day** | | **Flux = -17 ug/m^2/day** | | **Flux = 17 ug/m^2/day** | |
| 80% CI (low) = | **-17** $\mu g/m^2/day$ | 80% CI (low) = | **-27** $\mu g/m^2/day$ | 80% CI (low) = | **2** $\mu g/m^2/day$ |
| (high) = | **67** $\mu g/m^2/day$ | (high) = | **-7** $\mu g/m^2/day$ | (high) = | **32** $\mu g/m^2/day$ |



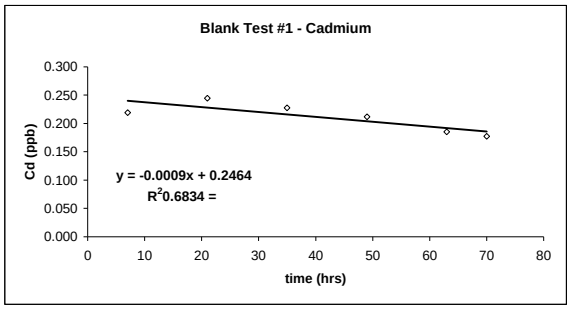
# BFSD 2 Triplicate Blank Tests
# Cadmium

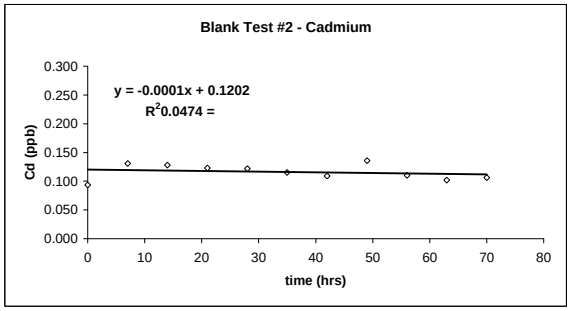
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

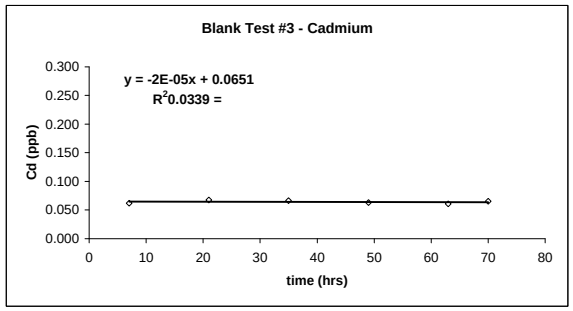
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | | |
| | | | | | | | | | | Bottle Volume = | 0.235 | liters |
| | | | | | | | | | | Blank Chamber Volume = | 42.97 | liters |
| | | | | | | | | | | Chamber Area = | 1701.4 | $cm^2$ |
| **Cadmium (Cd)** | | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | | |
| | 0.219 | T-#0 | | 0.219 | | | | Constant | 0.246 | | | |
| **BT1-03** | 0.219 | #1 | 7 | 0.219 | 0.219 | 0 | 0.240 | Std Err of Y Est | 0.014 | | | |
| **BT1-05** | 0.246 | #2 | 21 | 0.246 | 0.245 | 2 | 0.228 | R Squared | 0.683 | | | |
| **BT1-07** | 0.230 | #3 | 35 | 0.230 | 0.228 | 4 | 0.216 | No. of Observations | 6 | **Flux = -5.3 ug/m^2/day** | | |
| **BT1-09** | 0.215 | #4 | 49 | 0.215 | 0.212 | 6 | 0.204 | Degrees of Freedom | 4 | | | |
| **BT1-11** | 0.190 | #5 | 63 | 0.190 | 0.185 | 8 | 0.192 | | | 80% CI (low) = | **-8.0** | $\mu g/m^2/day$ |
| **BT1-12** | 0.182 | #6 | 70 | 0.182 | 0.177 | 9 | 0.186 | X Coefficient(s) | -0.001 | (high) = | **-2.5** | $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.000 | | | |
| **Test #2** | | | | | | | | Regression Output: | | | | |
| **BT2-01** | 0.0752 | T-#0 | -0.1 | 0.075 | | n/a | | Constant | 0.120 | | | |
| **BT2-02** | 0.0937 | #1 | 0 | 0.094 | 0.094 | 0 | 0.120 | Std Err of Y Est | 0.008 | | | |
| **BT2-03** | 0.131 | #2 | 7 | 0.131 | 0.131 | 1 | 0.119 | R Squared | 0.047 | | | |
| **BT2-04** | 0.128 | #3 | 14 | 0.128 | 0.128 | 2 | 0.118 | No. of Observations | 12 | **Flux = -0.7 ug/m^2/day** | | |
| **BT2-05** | 0.122 | #4 | 21 | 0.122 | 0.123 | 3 | 0.118 | Degrees of Freedom | 4 | | | |
| **BT2-06** | 0.121 | #5 | 28 | 0.121 | 0.122 | 4 | 0.117 | | | 80% CI (low) = | **-2.5** | $\mu g/m^2/day$ |
| **BT2-07** | 0.114 | #6 | 35 | 0.114 | 0.115 | 5 | 0.116 | X Coefficient(s) | 0.000 | (high) = | **1.0** | $\mu g/m^2/day$ |
| **BT2-08** | 0.108 | #7 | 42 | 0.108 | 0.109 | 6 | 0.115 | | | | | |
| **BT2-09** | 0.134 | #8 | 49 | 0.134 | 0.136 | 7 | 0.114 | | | | | |
| **BT2-10** | 0.108 | #9 | 56 | 0.108 | 0.110 | 8 | 0.113 | | | | | |
| **BT2-11** | 0.0998 | #10 | 63 | 0.100 | 0.102 | 9 | 0.112 | | | | | |
| **BT2-12** | 0.104 | #11 | 70 | 0.104 | 0.106 | 10 | 0.112 | | | | | |
| | | | | | | | | Std Err of Coef. | 0.000 | | | |
| **Test #3** | | | | | | | | Regression Output: | | | | |
| | 0.0622 | T-#0 | | 0.062 | | | | Constant | 0.065 | | | |
| **BT3-02** | 0.0622 | #1 | 7 | 0.062 | 0.062 | 0 | 0.065 | Std Err of Y Est | 0.002 | | | |
| **BT3-04** | 0.0679 | #2 | 21 | 0.068 | 0.068 | 2 | 0.065 | R Squared | 0.034 | | | |
| **BT3-06** | 0.0669 | #3 | 35 | 0.067 | 0.066 | 4 | 0.064 | No. of Observations | 6 | **Flux = -0.12 ug/m^2/day** | | |
| **BT3-08** | 0.0643 | #4 | 49 | 0.064 | 0.063 | 6 | 0.064 | Degrees of Freedom | 4 | | | |
| **BT3-10** | 0.0623 | #5 | 63 | 0.062 | 0.061 | 8 | 0.064 | | | 80% CI (low) = | **-0.59** | $\mu g/m^2/day$ |
| **BT3-12** | 0.0670 | #6 | 70 | 0.067 | 0.065 | 10 | 0.064 | X Coefficient(s) | 0.000 | (high) = | **0.36** | $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.000 | | | |



# BFSD 2 Triplicate Blank Tests
## Lead

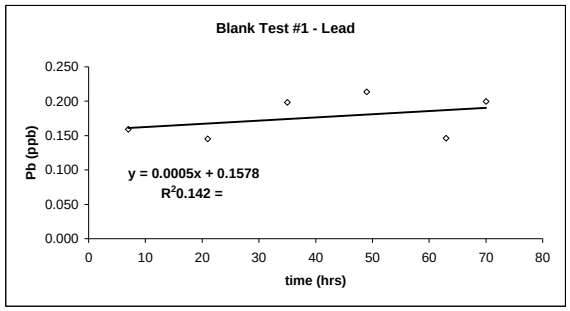
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

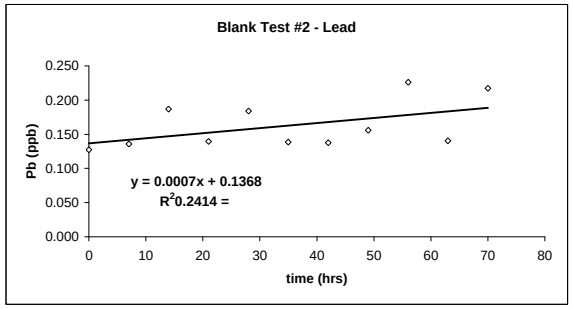
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

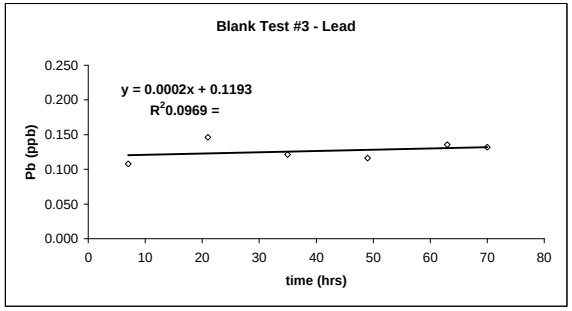
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | |
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | |
| **Lead (Pb)** | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | |
| | 0.159 | T-#0 | | 0.159 | | | | Constant | 0.158 | | |
| **BT1-03** | 0.159 | #1 | 7 | 0.159 | 0.159 | 0 | 0.161 | Std Err of Y Est | 0.027 | | |
| **BT1-05** | 0.146 | #2 | 21 | 0.146 | 0.145 | 2 | 0.168 | R Squared | 0.142 | | |
| **BT1-07** | 0.200 | #3 | 35 | 0.200 | 0.198 | 4 | 0.174 | No. of Observations | 6 | **Flux = 2.8 ug/m^2/day** | |
| **BT1-09** | 0.216 | #4 | 49 | 0.216 | 0.214 | 6 | 0.181 | Degrees of Freedom | 4 | | |
| **BT1-11** | 0.149 | #5 | 63 | 0.149 | 0.146 | 8 | 0.187 | | | 80% CI (low) = | **-2.5** µg/m$^2$/day |
| **BT1-12** | 0.203 | #6 | 70 | 0.203 | 0.200 | 9 | 0.191 | X Coefficient(s) | 0.000 | (high) = | **8.2** µg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.001 | | |
| **Test #2** | | | | | | | | Regression Output: | | | |
| **BT2-01** | 0.237 | T-#0 | -0.1 | 0.237 | | n/a | | Constant | 0.137 | | |
| **BT2-02** | 0.128 | #1 | 0 | 0.128 | 0.128 | 0 | 0.137 | Std Err of Y Est | 0.018 | | |
| **BT2-03** | 0.137 | #2 | 7 | 0.137 | 0.136 | 1 | 0.142 | R Squared | 0.241 | | |
| **BT2-04** | 0.188 | #3 | 14 | 0.188 | 0.187 | 2 | 0.147 | No. of Observations | 12 | **Flux = 4.5 ug/m^2/day** | |
| **BT2-05** | 0.141 | #4 | 21 | 0.141 | 0.140 | 3 | 0.152 | Degrees of Freedom | 4 | | |
| **BT2-06** | 0.186 | #5 | 28 | 0.186 | 0.184 | 4 | 0.158 | | | 80% CI (low) = | **0.4** µg/m$^2$/day |
| **BT2-07** | 0.141 | #6 | 35 | 0.141 | 0.138 | 5 | 0.163 | X Coefficient(s) | 0.001 | (high) = | **8.6** µg/m$^2$/day |
| **BT2-08** | 0.141 | #7 | 42 | 0.141 | 0.138 | 6 | 0.168 | | | | |
| **BT2-09** | 0.159 | #8 | 49 | 0.159 | 0.156 | 7 | 0.173 | | | | |
| **BT2-10** | 0.230 | #9 | 56 | 0.230 | 0.226 | 8 | 0.178 | | | | |
| **BT2-11** | 0.144 | #10 | 63 | 0.144 | 0.140 | 9 | 0.183 | | | | |
| **BT2-12** | 0.221 | #11 | 70 | 0.221 | 0.217 | 10 | 0.189 | | | | |
| | | | | | | | | Std Err of Coef. | 0.000 | | |
| **Test #3** | | | | | | | | Regression Output: | | | |
| | 0.108 | T-#0 | | 0.108 | | | | Constant | 0.119 | | |
| **BT3-02** | 0.108 | #1 | 7 | 0.108 | 0.108 | 0 | 0.121 | Std Err of Y Est | 0.013 | | |
| **BT3-04** | 0.147 | #2 | 21 | 0.147 | 0.146 | 2 | 0.123 | R Squared | 0.097 | | |
| **BT3-06** | 0.123 | #3 | 35 | 0.123 | 0.122 | 4 | 0.126 | No. of Observations | 6 | **Flux = 1.1 ug/m^2/day** | |
| **BT3-08** | 0.118 | #4 | 49 | 0.118 | 0.116 | 6 | 0.128 | Degrees of Freedom | 4 | | |
| **BT3-10** | 0.138 | #5 | 63 | 0.138 | 0.136 | 8 | 0.131 | | | 80% CI (low) = | **-1.5** µg/m$^2$/day |
| **BT3-12** | 0.134 | #6 | 70 | 0.134 | 0.132 | 10 | 0.132 | X Coefficient(s) | 0.000 | (high) = | **3.6** µg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.000 | | |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | cm$^2$ |



# BFSD 2 Triplicate Blank Tests
# Nickle

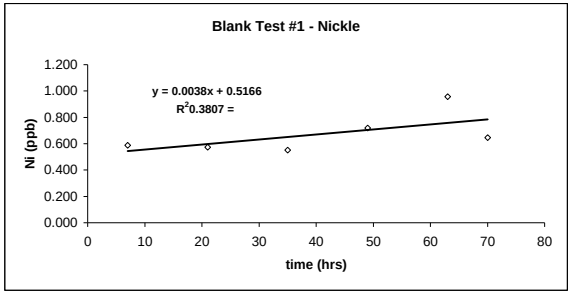
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

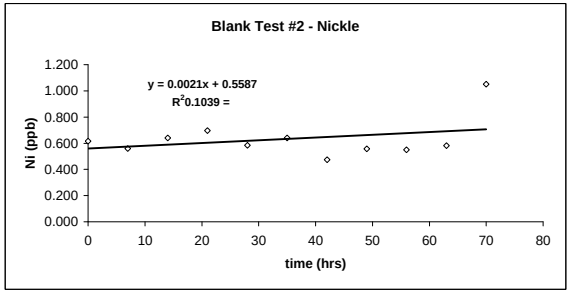
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

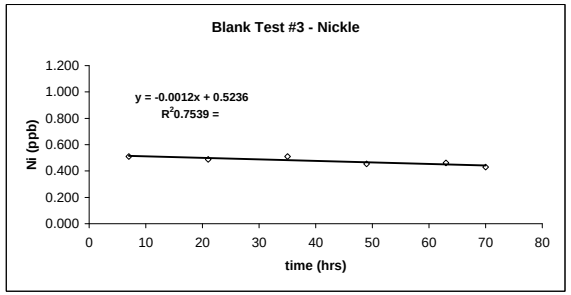
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | |
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | |
| **Nickle (Ni)** | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | |
| | 0.589 | T-#0 | | 0.589 | | | | Constant | 0.517 | | |
| **BT1-03** | 0.589 | #1 | 7 | 0.589 | 0.589 | 0 | 0.543 | Std Err of Y Est | 0.114 | | |
| **BT1-05** | 0.577 | #2 | 21 | 0.577 | 0.574 | 2 | 0.597 | R Squared | 0.381 | | |
| **BT1-07** | 0.559 | #3 | 35 | 0.559 | 0.552 | 4 | 0.651 | No. of Observations | 6 | **Flux = 23 ug/m^2/day** | |
| **BT1-09** | 0.730 | #4 | 49 | 0.730 | 0.720 | 6 | 0.705 | Degrees of Freedom | 4 | | |
| **BT1-11** | 0.970 | #5 | 63 | 0.970 | 0.958 | 8 | 0.758 | | | 80% CI (low) = | **1** μg/m$^2$/day |
| **BT1-12** | 0.657 | #6 | 70 | 0.657 | 0.647 | 9 | 0.785 | X Coefficient(s) | 0.004 | (high) = | **46** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.002 | | |
| **Test #2** | | | | | | | | Regression Output: | | | |
| **BT2-01** | 2.13 | T-#0 | -0.1 | 2.126 | | n/a | | Constant | 0.559 | | |
| **BT2-02** | 0.615 | #1 | 0 | 0.615 | 0.615 | 0 | 0.559 | Std Err of Y Est | 0.085 | | |
| **BT2-03** | 0.568 | #2 | 7 | 0.568 | 0.560 | 1 | 0.573 | R Squared | 0.104 | | |
| **BT2-04** | 0.658 | #3 | 14 | 0.658 | 0.641 | 2 | 0.588 | No. of Observations | 12 | **Flux = 13 ug/m^2/day** | |
| **BT2-05** | 0.721 | #4 | 21 | 0.721 | 0.696 | 3 | 0.603 | Degrees of Freedom | 4 | | |
| **BT2-06** | 0.618 | #5 | 28 | 0.618 | 0.585 | 4 | 0.617 | | | 80% CI (low) = | **-6** μg/m$^2$/day |
| **BT2-07** | 0.681 | #6 | 35 | 0.681 | 0.640 | 5 | 0.632 | X Coefficient(s) | 0.002 | (high) = | **32** μg/m$^2$/day |
| **BT2-08** | 0.523 | #7 | 42 | 0.523 | 0.474 | 6 | 0.647 | | | | |
| **BT2-09** | 0.614 | #8 | 49 | 0.614 | 0.556 | 7 | 0.661 | | | | |
| **BT2-10** | 0.617 | #9 | 56 | 0.617 | 0.551 | 8 | 0.676 | | | | |
| **BT2-11** | 0.656 | #10 | 63 | 0.656 | 0.582 | 9 | 0.691 | | | | |
| **BT2-12** | 1.13 | #11 | 70 | 1.134 | 1.052 | 10 | 0.705 | | | | |
| | | | | | | | | Std Err of Coef. | 0.002 | | |
| **Test #3** | | | | | | | | Regression Output: | | | |
| | 0.511 | T-#0 | | 0.511 | | | | Constant | 0.524 | | |
| **BT3-02** | 0.511 | #1 | 7 | 0.511 | 0.511 | 0 | 0.515 | Std Err of Y Est | 0.016 | | |
| **BT3-04** | 0.492 | #2 | 21 | 0.492 | 0.489 | 2 | 0.499 | R Squared | 0.754 | | |
| **BT3-06** | 0.516 | #3 | 35 | 0.516 | 0.510 | 4 | 0.483 | No. of Observations | 6 | **Flux = -7.1 ug/m^2/day** | |
| **BT3-08** | 0.462 | #4 | 49 | 0.462 | 0.454 | 6 | 0.466 | Degrees of Freedom | 4 | | |
| **BT3-10** | 0.474 | #5 | 63 | 0.474 | 0.462 | 8 | 0.450 | | | 80% CI (low) = | **-10.2** μg/m$^2$/day |
| **BT3-12** | 0.444 | #6 | 70 | 0.444 | 0.429 | 10 | 0.442 | X Coefficient(s) | -0.001 | (high) = | **-4.0** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.000 | | |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | cm$^2$ |



# BFSD 2 Triplicate Blank Tests
## Manganese

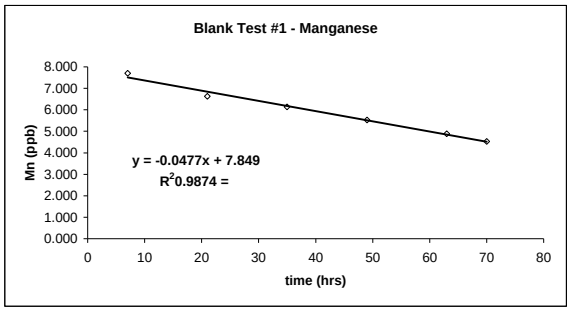
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

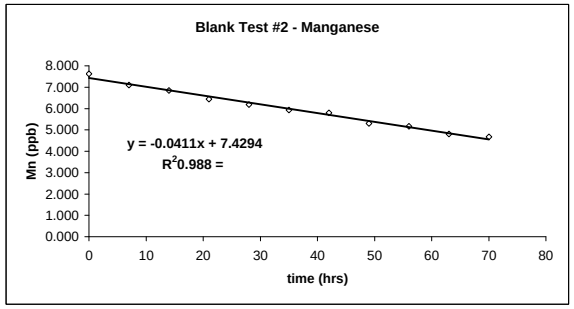
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

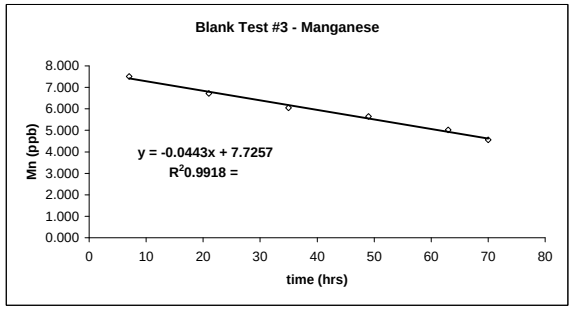
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BFSD 2 Data | | | Dilution Correction | | | From Regression | Linear Regression Statistics | | | |
| Sample id | Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | Concentration (ppb)** | | | | |
| **Manganese(Mn)** | | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | | |
| | 7.70 | T-#0 | | 7.700 | | | | Constant | 7.849 | | |
| **BT1-03** | 7.70 | #1 | 7 | 7.700 | 7.700 | 0 | 7.515 | Std Err of Y Est | 0.125 | | |
| **BT1-05** | 6.67 | #2 | 21 | 6.670 | 6.628 | 2 | 6.847 | R Squared | 0.987 | | |
| **BT1-07** | 6.23 | #3 | 35 | 6.230 | 6.140 | 4 | 6.179 | No. of Observations | 6 | **Flux = -289 ug/m^2/day** | |
| **BT1-09** | 5.66 | #4 | 49 | 5.660 | 5.520 | 6 | 5.512 | Degrees of Freedom | 4 | | |
| **BT1-11** | 5.08 | #5 | 63 | 5.080 | 4.887 | 8 | 4.844 | | | 80% CI (low) = | **-314** μg/m$^2$/day |
| **BT1-12** | 4.74 | #6 | 70 | 4.740 | 4.532 | 9 | 4.510 | X Coefficient(s) | -0.048 | (high) = | **-264** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.003 | | |
| **Test #2** | | | | | | | | Regression Output: | | | |
| **BT2-01** | 7.80 | T-#0 | -0.1 | 7.803 | | n/a | | Constant | 7.429 | | |
| **BT2-02** | 7.63 | #1 | 0 | 7.632 | 7.632 | 0 | 7.429 | Std Err of Y Est | 0.063 | | |
| **BT2-03** | 7.10 | #2 | 7 | 7.097 | 7.096 | 1 | 7.141 | R Squared | 0.988 | | |
| **BT2-04** | 6.85 | #3 | 14 | 6.854 | 6.849 | 2 | 6.853 | No. of Observations | 12 | **Flux = -249 ug/m^2/day** | |
| **BT2-05** | 6.45 | #4 | 21 | 6.454 | 6.444 | 3 | 6.565 | Degrees of Freedom | 4 | | |
| **BT2-06** | 6.20 | #5 | 28 | 6.198 | 6.181 | 4 | 6.277 | | | 80% CI (low) = | **-263** μg/m$^2$/day |
| **BT2-07** | 5.96 | #6 | 35 | 5.961 | 5.935 | 5 | 5.989 | X Coefficient(s) | -0.041 | (high) = | **-235** μg/m$^2$/day |
| **BT2-08** | 5.84 | #7 | 42 | 5.837 | 5.801 | 6 | 5.702 | | | | |
| **BT2-09** | 5.35 | #8 | 49 | 5.349 | 5.302 | 7 | 5.414 | | | | |
| **BT2-10** | 5.23 | #9 | 56 | 5.232 | 5.172 | 8 | 5.126 | | | | |
| **BT2-11** | 4.88 | #10 | 63 | 4.877 | 4.803 | 9 | 4.838 | | | | |
| **BT2-12** | 4.76 | #11 | 70 | 4.761 | 4.671 | 10 | 4.550 | | | | |
| | | | | | | | | Std Err of Coef. | 0.002 | | |
| **Test #3** | | | | | | | | Regression Output: | | | |
| | 7.50 | T-#0 | | 7.503 | | | | Constant | 7.726 | | |
| **BT3-02** | 7.50 | #1 | 7 | 7.503 | 7.503 | 0 | 7.416 | Std Err of Y Est | 0.094 | | |
| **BT3-04** | 6.76 | #2 | 21 | 6.762 | 6.721 | 2 | 6.795 | R Squared | 0.992 | | |
| **BT3-06** | 6.14 | #3 | 35 | 6.137 | 6.051 | 4 | 6.175 | No. of Observations | 6 | **Flux = -269 ug/m^2/day** | |
| **BT3-08** | 5.78 | #4 | 49 | 5.777 | 5.642 | 6 | 5.555 | Degrees of Freedom | 4 | | |
| **BT3-10** | 5.21 | #5 | 63 | 5.208 | 5.023 | 8 | 4.934 | | | 80% CI (low) = | **-287** μg/m$^2$/day |
| **BT3-12** | 4.80 | #6 | 70 | 4.797 | 4.558 | 10 | 4.624 | X Coefficient(s) | -0.044 | (high) = | **-250** μg/m$^2$/day |
| | | | | | | | | Std Err of Coef. | 0.002 | | |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | cm$^2$ |



# BFSD 2 Triplicate Blank Tests
# Zinc

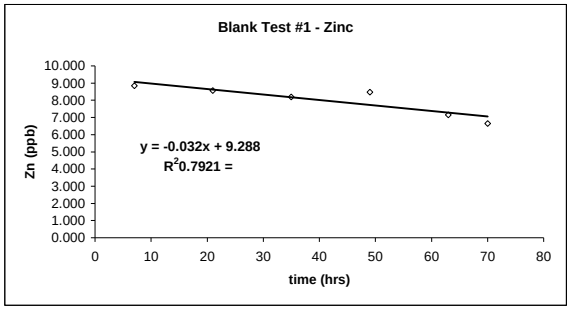
**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

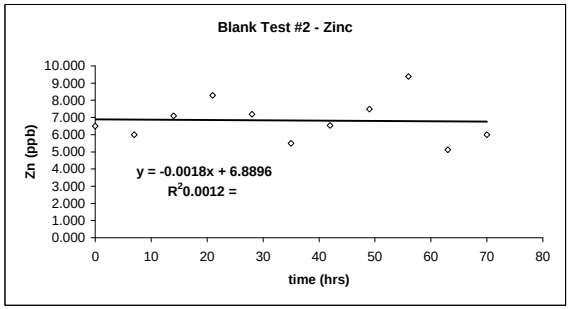
**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

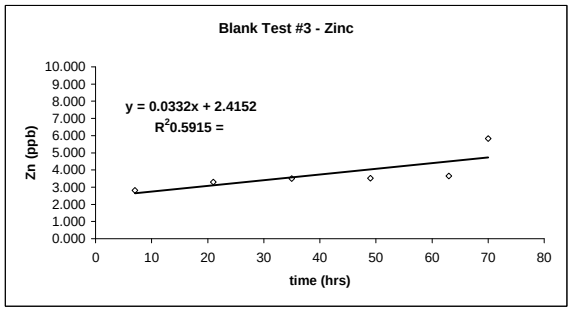
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

| | | |
|---|---|---|
| **Bottle Volume =** | 0.235 | liters |
| **Blank Chamber Volume =** | 42.97 | liters |
| **Chamber Area =** | 1701.4 | $cm^2$ |

| Sample id | BFSD 2 Data: Measured Concentration (ppb)** | BFSD 2 Data: Sample No.* | BFSD 2 Data: Elapsed Time (hrs) | Dilution Correction: Measured Concentration (ppb)** | Dilution Correction: Corrected Concentration (ppb)** | Dilution Correction: # of Dilutions | From Regression Concentration (ppb)** | Linear Regression Statistics | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Zinc (Zn)** | | | | | | | | | | |
| **Test #1** | | | | | | | | Regression Output: | | |
| | 8.85 | T-#0 | | 8.850 | | | | Constant | 9.288 | |
| **BT1-03** | 8.85 | #1 | 7 | 8.850 | 8.850 | 0 | 9.064 | Std Err of Y Est | 0.381 | |
| **BT1-05** | 8.61 | #2 | 21 | 8.610 | 8.562 | 2 | 8.617 | R Squared | 0.792 | |
| **BT1-07** | 8.30 | #3 | 35 | 8.300 | 8.202 | 4 | 8.169 | No. of Observations | 6 | **Flux = -194 ug/m^2/day** |
| **BT1-09** | 8.63 | #4 | 49 | 8.630 | 8.480 | 6 | 7.722 | Degrees of Freedom | 4 | |
| **BT1-11** | 7.35 | #5 | 63 | 7.350 | 7.151 | 8 | 7.274 | | | 80% CI (low) = **-270** $\mu g/m^2/day$ |
| **BT1-12** | 6.86 | #6 | 70 | 6.860 | 6.653 | 9 | 7.051 | X Coefficient(s) | -0.032 | (high) = **-118** $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.008 | |
| **Test #2** | | | | | | | | Regression Output: | | |
| **BT2-01** | 6.04 | T-#0 | -0.1 | 6.037 | | n/a | | Constant | 6.890 | |
| **BT2-02** | 6.50 | #1 | 0 | 6.497 | 6.497 | 0 | 6.890 | Std Err of Y Est | 0.742 | |
| **BT2-03** | 5.99 | #2 | 7 | 5.992 | 5.995 | 1 | 6.877 | R Squared | 0.001 | |
| **BT2-04** | 7.10 | #3 | 14 | 7.102 | 7.104 | 2 | 6.864 | No. of Observations | 12 | **Flux = -11 ug/m^2/day** |
| **BT2-05** | 8.28 | #4 | 21 | 8.276 | 8.284 | 3 | 6.851 | Degrees of Freedom | 4 | |
| **BT2-06** | 7.17 | #5 | 28 | 7.173 | 7.193 | 4 | 6.838 | | | 80% CI (low) = **-178** $\mu g/m^2/day$ |
| **BT2-07** | 5.46 | #6 | 35 | 5.460 | 5.487 | 5 | 6.825 | X Coefficient(s) | -0.002 | (high) = **155** $\mu g/m^2/day$ |
| **BT2-08** | 6.51 | #7 | 42 | 6.510 | 6.533 | 6 | 6.812 | | | |
| **BT2-09** | 7.46 | #8 | 49 | 7.458 | 7.484 | 7 | 6.799 | | | |
| **BT2-10** | 9.35 | #9 | 56 | 9.349 | 9.383 | 8 | 6.787 | | | |
| **BT2-11** | 5.06 | #10 | 63 | 5.064 | 5.116 | 9 | 6.774 | | | |
| **BT2-12** | 5.96 | #11 | 70 | 5.955 | 6.002 | 10 | 6.761 | | | |
| | | | | | | | | Std Err of Coef. | 0.018 | |
| **Test #3** | | | | | | | | Regression Output: | | |
| | 2.82 | T-#0 | | 2.817 | | | | Constant | 2.415 | |
| **BT3-02** | 2.82 | #1 | 7 | 2.817 | 2.817 | 0 | 2.647 | Std Err of Y Est | 0.641 | |
| **BT3-04** | 3.31 | #2 | 21 | 3.313 | 3.298 | 2 | 3.112 | R Squared | 0.592 | |
| **BT3-06** | 3.52 | #3 | 35 | 3.521 | 3.493 | 4 | 3.576 | No. of Observations | 6 | **Flux = 201 ug/m^2/day** |
| **BT3-08** | 3.56 | #4 | 49 | 3.558 | 3.518 | 6 | 4.040 | Degrees of Freedom | 4 | |
| **BT3-10** | 3.71 | #5 | 63 | 3.708 | 3.657 | 8 | 4.504 | | | 80% CI (low) = **73** $\mu g/m^2/day$ |
| **BT3-12** | 5.90 | #6 | 70 | 5.895 | 5.833 | 10 | 4.737 | X Coefficient(s) | 0.033 | (high) = **329** $\mu g/m^2/day$ |
| | | | | | | | | Std Err of Coef. | 0.014 | |



# BFSD 2 Triplicate Blank Tests
## Silica Dioxide

**Site:** End of SSC,SD Pier 159
**Date:** 5/14-5/31/98 (3 tests)

**Start time:** See indivdual tests
**Duration/Interval:** 77hrs (min)/7 hrs
**End time:** See individual tests

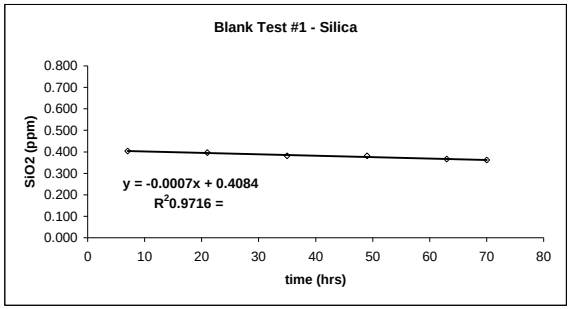
*Note: See individual tests for "Time 0 Ambient" sample id (Sample T-#0)

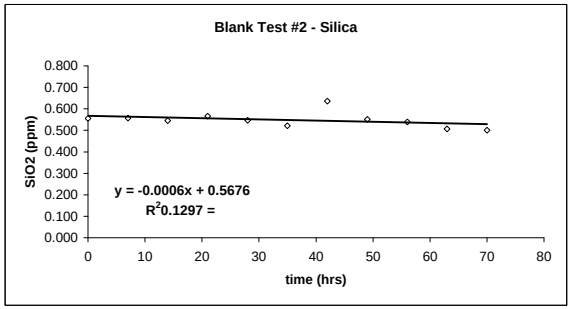
**Bottle Volume =** 0.235 liters
**Blank Chamber Volume =** 42.97 liters
**Chamber Area =** 1701.4 $cm^2$

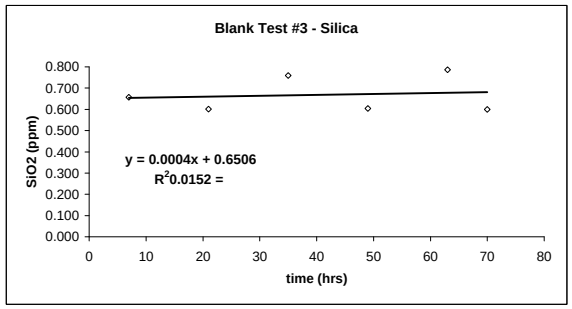
| Sample id | BFSD 2 Data: Measured Concentration (ppb)** | Sample No.* | Elapsed Time (hrs) | Dilution Correction: Measured Concentration (ppb)** | Corrected Concentration (ppb)** | # of Dilutions | From Regression Concentration (ppb)** |
|---|---|---|---|---|---|---|---|
| **Silica ($SiO_2$)** | **Concentrations are in ppm (mg/L) | | | | | | |
| **Test #1** | | | | | | | |
| | 0.403 | T-#0 | | 0.403 | | | |
| **BT1-03** | 0.403 | #1 | 7 | 0.403 | 0.403 | 0 | 0.404 |
| **BT1-05** | 0.398 | #2 | 21 | 0.398 | 0.396 | 2 | 0.395 |
| **BT1-07** | 0.386 | #3 | 35 | 0.386 | 0.382 | 4 | 0.386 |
| **BT1-09** | 0.388 | #4 | 49 | 0.388 | 0.381 | 6 | 0.376 |
| **BT1-11** | 0.376 | #5 | 63 | 0.376 | 0.367 | 8 | 0.367 |
| **BT1-12** | 0.371 | #6 | 70 | 0.371 | 0.362 | 9 | 0.363 |
| **Test #2** | | | | | | | |
| **BT2-01** | 0.581 | T-#0 | -0.1 | 0.581 | | n/a | |
| **BT2-02** | 0.556 | #1 | 0 | 0.556 | 0.556 | 0 | 0.568 |
| **BT2-03** | 0.557 | #2 | 7 | 0.557 | 0.557 | 1 | 0.564 |
| **BT2-04** | 0.545 | #3 | 14 | 0.545 | 0.545 | 2 | 0.560 |
| **BT2-05** | 0.566 | #4 | 21 | 0.566 | 0.566 | 3 | 0.556 |
| **BT2-06** | 0.548 | #5 | 28 | 0.548 | 0.547 | 4 | 0.552 |
| **BT2-07** | 0.523 | #6 | 35 | 0.523 | 0.522 | 5 | 0.548 |
| **BT2-08** | 0.638 | #7 | 42 | 0.638 | 0.637 | 6 | 0.544 |
| **BT2-09** | 0.552 | #8 | 49 | 0.552 | 0.551 | 7 | 0.540 |
| **BT2-10** | 0.540 | #9 | 56 | 0.540 | 0.539 | 8 | 0.536 |
| **BT2-11** | 0.508 | #10 | 63 | 0.508 | 0.507 | 9 | 0.532 |
| **BT2-12** | 0.503 | #11 | 70 | 0.503 | 0.501 | 10 | 0.528 |
| **Test #3** | | | | | | | |
| | 0.657 | T-#0 | | 0.657 | | | |
| **BT3-02** | 0.657 | #1 | 7 | 0.657 | 0.657 | 0 | 0.654 |
| **BT3-04** | 0.605 | #2 | 21 | 0.605 | 0.602 | 2 | 0.660 |
| **BT3-06** | 0.766 | #3 | 35 | 0.766 | 0.759 | 4 | 0.665 |
| **BT3-08** | 0.614 | #4 | 49 | 0.614 | 0.604 | 6 | 0.671 |
| **BT3-10** | 0.801 | #5 | 63 | 0.801 | 0.787 | 8 | 0.677 |
| **BT3-12** | 0.617 | #6 | 70 | 0.617 | 0.600 | 10 | 0.680 |

**Linear Regression Statistics**

| | | | | |
|---|---|---|---|---|
| **Test #1** Regression Output: | | | | |
| Constant | 0.408 | **Flux = -4.0 mg/m^2/day** | | |
| Std Err of Y Est | 0.003 | | | |
| R Squared | 0.972 | | | |
| No. of Observations | 6 | 80% CI (low) = | **-4.5** | $mg/m^2/day$ |
| Degrees of Freedom | 4 | (high) = | **-3.4** | $mg/m^2/day$ |
| X Coefficient(s) | -0.001 | | | |
| Std Err of Coef. | 0.000 | | | |
| **Test #2** Regression Output: | | | | |
| Constant | 0.568 | **Flux = -3.4 mg/m^2/day** | | |
| Std Err of Y Est | 0.020 | | | |
| R Squared | 0.130 | | | |
| No. of Observations | 12 | 80% CI (low) = | **-7.9** | $mg/m^2/day$ |
| Degrees of Freedom | 4 | (high) = | **1.1** | $mg/m^2/day$ |
| X Coefficient(s) | -0.001 | | | |
| Std Err of Coef. | 0.000 | | | |
| **Test #3** Regression Output: | | | | |
| Constant | 0.651 | **Flux = 2.6 mg/m^2/day** | | |
| Std Err of Y Est | 0.080 | | | |
| R Squared | 0.015 | | | |
| No. of Observations | 6 | 80% CI (low) = | **-13.3** | $mg/m^2/day$ |
| Degrees of Freedom | 4 | (high) = | **18.5** | $mg/m^2/day$ |
| X Coefficient(s) | 0.000 | | | |
| Std Err of Coef. | 0.002 | | | |



***BATTELLE MARINE SCIENCES LABORATORY***
1529 West Sequim Bay Road
Sequim, WA 98382-9099
360/681-3604

TETRA TECH
METALS IN SEAWATER
(Samples Received 6/3/98)

(concentrations in µg/L - not blank corrected)

| MSL Code | Sponsor ID | Sb | As | Cd | Cu | Pb | Mn | Ni | Se | Ag | Tl | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1225-2 | BFSD2-BT1-3 | 0.125 | 1.25 | 0.219 | 1.42 | 0.159 | 7.70 | 0.589 | 0.568 | 0.0120 | 0.0113 | 8.85 |
| 1225-4 | BFSD2-BT1-5 | 0.126 | 1.16 | 0.246 | 1.50 | 0.146 | 6.67 | 0.577 | 0.521 | 0.0151 | 0.0119 | 8.61 |
| 1225-6 | BFSD2-BT1-7 | 0.121 | 1.18 | 0.230 | 1.53 | 0.200 | 6.23 | 0.559 | 0.488 | 0.0181 | 0.0115 | 8.30 |
| 1225-8 | BFSD2-BT1-9 | 0.192 | 1.14 | 0.215 | 2.00 | 0.216 | 5.66 | 0.730 | 0.468 | 0.0120 | 0.0125 | 8.63 |
| 1225-10 | BFSD2-BT1-11 | 0.142 | 1.10 | 0.190 | 1.89 | 0.149 | 5.08 | 0.970 | 0.452 | 0.0722 | 0.0118 | 7.35 |
| 1225-11 | BFSD2-BT1-12 | 0.143 | 1.15 | 0.182 | 1.44 | 0.203 | 4.74 | 0.657 | 0.450 | 0.0181 | 0.0119 | 6.86 |
| 1225-12 | BFSD2-BT2-EB | 0.0168 | 0.00728 J | 0.0120 | 0.376 | 0.0998 | 0.664 J | 0.0522 J | 0.0351 J | 0.00903 | 0.000499 J | 3.32 |
| 1225-13 | BFSD2-BT2-SB | 0.0248 | 0.00745 J | 0.00750 | 0.169 | 4.33 | 0.689 J | 0.0729 J | 0.0248 J | 0.0120 | 0.00121 | 0.984 |
| 1225-14 | BFSD2-BT2-1 | 0.117 | 1.16 | 0.0752 | 2.57 | 0.237 | 7.80 | 2.13 | 0.372 | 0.00903 | 0.0109 | 6.04 |
| 1225-15 | BFSD2-BT2-2 | 0.127 | 1.13 | 0.0937 | 1.72 | 0.128 | 7.63 | 0.615 | 0.519 | 0.0151 | 0.0110 | 6.50 |
| 1225-16 | BFSD2-BT2-3 | 0.118 | 1.16 | 0.131 | 1.77 | 0.137 | 7.10 | 0.568 | 0.461 | 0.0181 | 0.0114 | 5.99 |
| 1225-17 | BFSD2-BT2-4 | 0.124 | 1.14 | 0.128 | 1.85 | 0.188 | 6.85 | 0.658 | 0.410 | 0.0181 | 0.0111 | 7.10 |
| 1225-18 | BFSD2-BT2-5 | 0.113 | 1.12 | 0.122 | 1.66 | 0.141 | 6.45 | 0.721 | 0.405 | 0.0181 | 0.0112 | 8.28 |
| 1225-19 | BFSD2-BT2-6 | 0.0770 | 1.15 | 0.121 | 1.73 | 0.186 | 6.20 | 0.618 | 0.443 | 0.0151 | 0.0116 | 7.17 |
| 1225-20 | BFSD2-BT2-7 | 0.0761 | 1.13 | 0.114 | 1.67 | 0.141 | 5.96 | 0.681 | 0.430 | 0.0120 | 0.0122 | 5.46 |
| 1225-21 | BFSD2-BT2-8 | 0.104 | 1.13 | 0.108 | 1.58 | 0.141 | 5.84 | 0.523 | 0.454 | 0.0151 | 0.0114 | 6.51 |
| 1225-22 | BFSD2-BT2-9 | 0.0551 | 1.09 | 0.134 | 1.64 | 0.159 | 5.35 | 0.614 | 0.427 | 0.0181 | 0.0117 | 7.46 |
| 1225-23 | BFSD2-BT2-10 | 0.0783 | 1.10 | 0.108 | 1.52 | 0.230 | 5.23 | 0.617 | 0.407 | 0.0181 | 0.0118 | 9.35 |
| 1225-24 | BFSD2-BT2-11 | 0.0689 | 1.16 | 0.0998 | 1.69 | 0.144 | 4.88 | 0.656 | 0.418 | 0.0120 | 0.0124 | 5.06 |
| 1225-25 | BFSD2-BT2-12 | 0.0807 | 1.09 | 0.104 | 1.69 | 0.221 | 4.76 | 1.13 | 0.349 | 0.0120 | 0.0123 | 5.96 |
| 1225-27 | BFSD2-BT3-2 | 0.0759 | 1.12 | 0.0622 | 1.03 | 0.108 | 7.50 | 0.511 | 0.453 | 0.0120 | 0.0113 | 2.82 |
| 1225-29 | BFSD2-BT3-4 | 0.0750 | 1.05 | 0.0679 | 1.04 | 0.147 | 6.76 | 0.492 | 0.341 | 0.00903 | 0.0118 | 3.31 |
| 1225-31 | BFSD2-BT3-6 | 0.130 | 1.03 | 0.0669 | 1.10 | 0.123 | 6.14 | 0.516 | 0.441 | 0.0151 | 0.0113 | 3.52 |
| 1225-33 | BFSD2-BT3-8 | 0.0867 | 1.14 | 0.0643 | 1.06 | 0.118 | 5.78 | 0.462 | 0.435 | 0.0120 | 0.0121 | 3.56 |
| 1225-35 | BFSD2-BT3-10 | 0.0612 | 1.12 | 0.0623 | 1.33 | 0.138 | 5.21 | 0.474 | 0.453 | 0.0120 | 0.0119 | 3.71 |
| 1225-37 | BFSD2-BT3-12 | 0.125 | 1.10 | 0.0670 | 1.14 | 0.134 | 4.80 | 0.444 | 0.373 | 0.0120 | 0.0112 | 5.90 |
| BLANKS | | | | | | | | | | | | |
| 1225-blk r1 | | 0.0158 | 0.0227 J | 0.000444 J | 0.0420 J | 0.00580 J | 0.510 J | 0.0165 J | 0.0529 J | 0.00903 | 0.00070 J | 0.119 J |
| 1225-blk r2 | | 0.0145 | 0.0180 J | 0.000611 J | 0.0395 J | 0.00800 | 0.596 J | 0.0178 J | 0.0212 J | 0.00602 | 0.00054 J | 0.140 J |
| Mean | | 0.0152 | 0.0204 J | 0.000528 J | 0.0407 J | 0.00690 | 0.553 J | 0.0171 J | 0.0371 J | 0.00753 | 0.00062 J | 0.130 J |
| DETECTION LIMIT | | 0.01 | 0.12 | 0.007 | 0.076 | 0.006 | 0.87 | 0.08 | 0.16 | 0.00532 | 0.001 | 0.66 |

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360/681-3604

TETRA TECH
METALS IN SEAWATER
(Samples Received 6/3/98)

(concentrations in µg/L - not blank corrected)

| MSL Code | Sponsor ID | Sb | As | Cd | Cu | Pb | Mn | Ni | Se | Ag | Tl | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLANK SPIKE RESULTS | | | | | | | | | | | | |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Mean Blank | | 0.0152 | 0.0204 | 0.00053 J | 0.0407 | 0.00690 | 0.553 | 0.0171 | 0.0371 | 0.00753 | 0.00062 J | 0.130 |
| Blank Spike | | 3.66 | 2.98 | 3.69 | 4.31 | 4.60 | 5.07 | 4.30 | 1.26 | 2.12 | 4.70 | 4.61 |
| Amount Recovered | | 3.64 | 2.96 | 3.69 | 4.27 | 4.59 | 4.52 | 4.29 | 1.22 | 2.11 | 4.69 | 4.48 |
| Percent Recovery | | 73% # | 59% # | 74% # | 85% | 92% | 90% | 86% | 24% # | 42% # | 94% | 90% |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Mean Blank | | 0.0152 | 0.0204 | 0.00053 J | 0.0407 | 0.00690 | 0.553 | 0.0171 | 0.0371 | 0.00753 | 0.00062 J | 0.130 |
| Blank Spike Dup | | 3.84 | 3.04 | 3.64 | 4.38 | 4.69 | 5.19 | 4.53 | 1.61 | 2.09 | 4.87 | 4.64 |
| Amount Recovered | | 3.83 | 3.01 | 3.63 | 4.34 | 4.68 | 4.64 | 4.51 | 1.57 | 2.08 | 4.87 | 4.51 |
| Percent Recovery | | 77% | 60% # | 73% # | 87% | 94% | 93% | 90% | 31% # | 42% # | 97% | 90% |
| RPD | | 5% | 2% | 1% | 2% | 2% | 3% | 5% | 25% | 1% | 4% | 1% |
| MATRIX SPIKE RESULTS | | | | | | | | | | | | |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 1225-24 | | 0.0689 | 1.16 | 0.0998 | 1.69 | 0.144 | 4.88 | 0.656 | 0.418 | 0.0120 | 0.0124 | 5.06 |
| 1225-24 MS | | 2.48 | 5.21 | 4.74 | 5.99 | 5.15 | 9.53 | 4.84 | 4.92 | 4.40 | 5.20 | 8.71 |
| Amount Recovered | | 2.41 | 4.05 | 4.64 | 4.29 | 5.00 | 4.66 | 4.18 | 4.50 | 4.39 | 5.19 | 3.64 |
| Percent Recovery | | 48% # | 81% | 93% | 86% | 100% | 93% | 84% | 90% | 88% | 104% | 73% # |
| Amount Spiked | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 1225-24 | | 0.0689 | 1.16 | 0.0998 | 1.69 | 0.144 | 4.88 | 0.656 | 0.418 | 0.0120 | 0.0124 | 5.06 |
| 1225-24 MSD | | 3.12 | 5.30 | 4.74 | 5.93 | 5.17 | 9.58 | 4.89 | 4.97 | 4.44 | 5.18 | 8.56 |
| Amount Recovered | | 3.05 | 4.14 | 4.64 | 4.24 | 5.02 | 4.71 | 4.24 | 4.55 | 4.43 | 5.17 | 3.50 |
| Percent Recovery | | 61% # | 83% | 93% | 85% | 100% | 94% | 85% | 91% | 89% | 103% | 70% # |
| RPD | | 24% | 2% | 0% | 1% | 0% | 1% | 1% | 1% | 1% | 0% | 4% |

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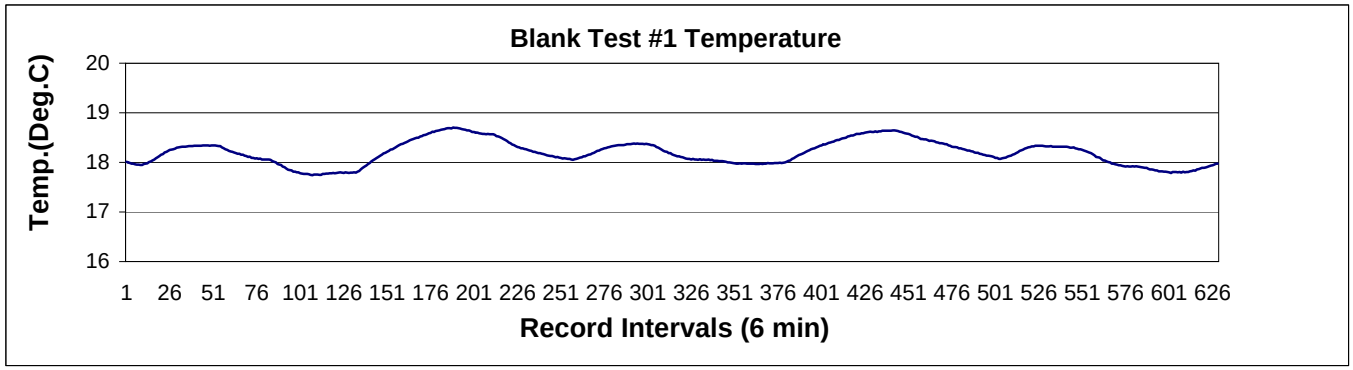
TETRA TECH
METALS IN SEAWATER
(Samples Received 6/3/98)

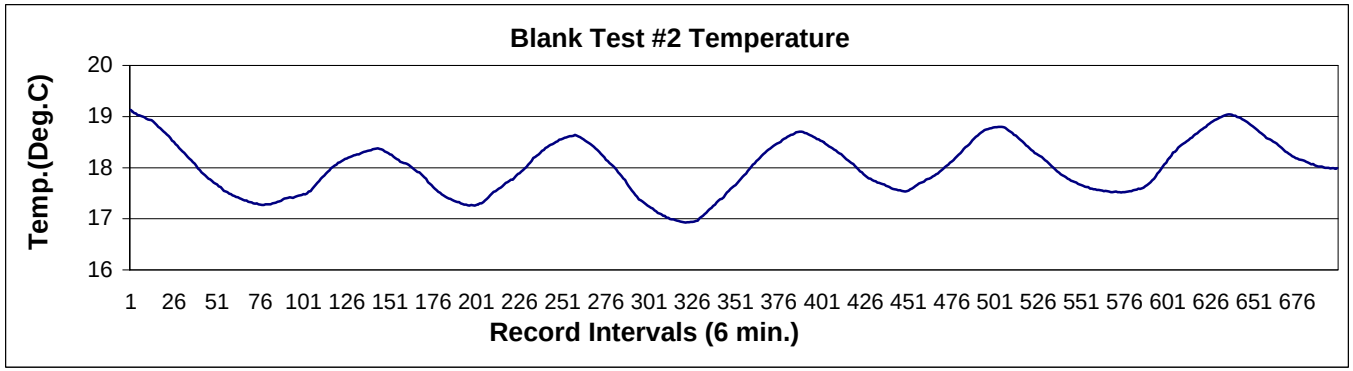
(concentrations in µg/L - not blank corrected)

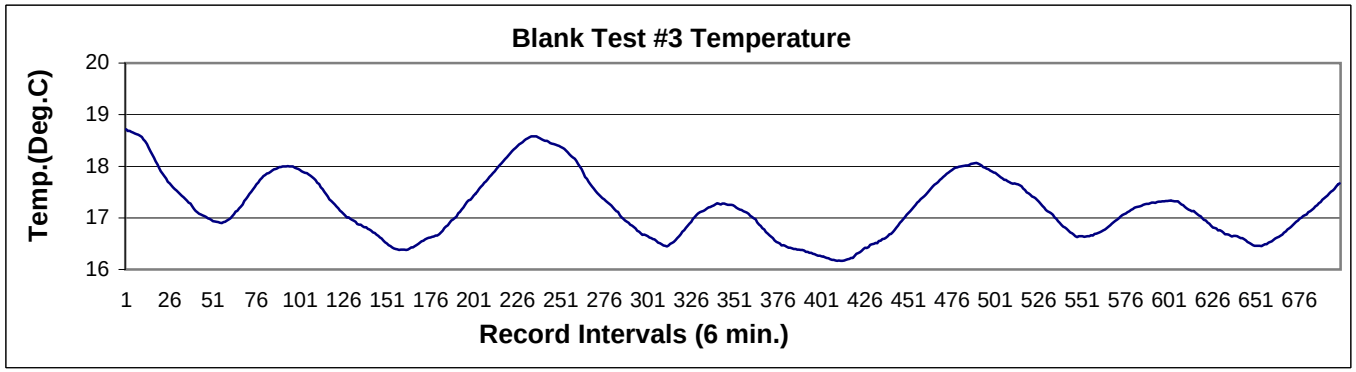
| MSL Code | Sponsor ID | Sb | As | Cd | Cu | Pb | Mn | Ni | Se | Ag | Tl | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STANDARD REFERENCE MATERIAL | | | | | | | | | | | | |
| cass3 r1 | | 0.139 | 0.975 | 0.0339 | 0.550 | 0.0230 | 3.10 | 0.417 | 0.441 | 0.0120 | 0.0127 | 1.25 |
| cass3 r2 | | 0.112 | 0.961 | 0.0345 | 0.529 | 0.0230 | 3.03 | 0.400 | 0.404 | 0.0120 | 0.0119 | 1.21 |
| | certified value | NC | 1.09 | 0.030 | 0.517 | 0.0120 | 2.51 | 0.386 | 0.042 r | NC | NC | 1.24 |
| | range | | ±0.07 | ±0.005 | ±0.062 | ±0.004 | ±0.36 | ±0.062 | | | | ±0.25 |
| | percent difference | NA | 11% | 13% | 6% | 91% # | 23% | 8% | NA | NA | NA | 1% |
| | | NA | 12% | 15% | 2% | 91% # | 21% | 4% | NA | NA | NA | 2% |

| | |
|---|---|
| # | Outside QA limits of ±25% |
| r | Reference value only; not certified |
| J | Value reported is below DL shown |
| NA | Not available/applicable |
| NC | Not certified |
| RPD | Relative percent difference |

# BFSD 2
# Triplicate Blank Tests
# Temperature

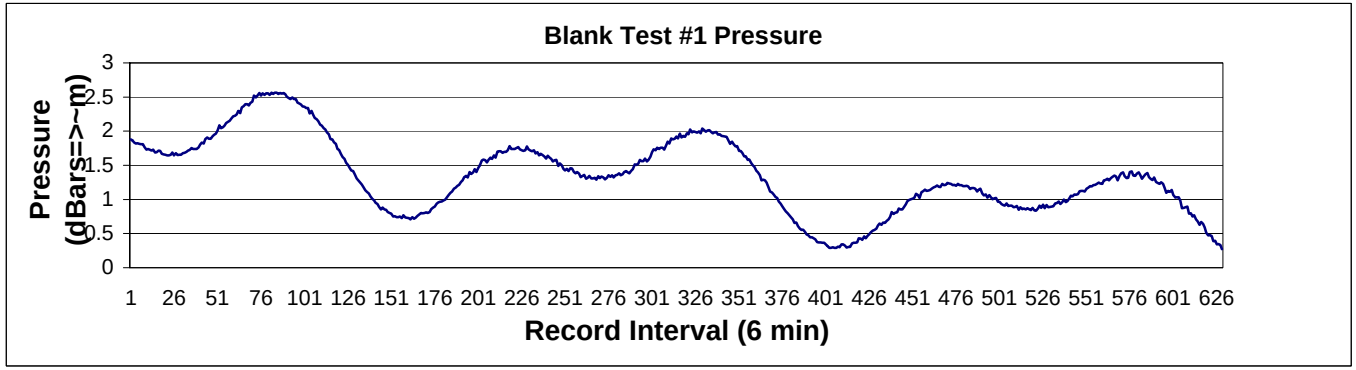


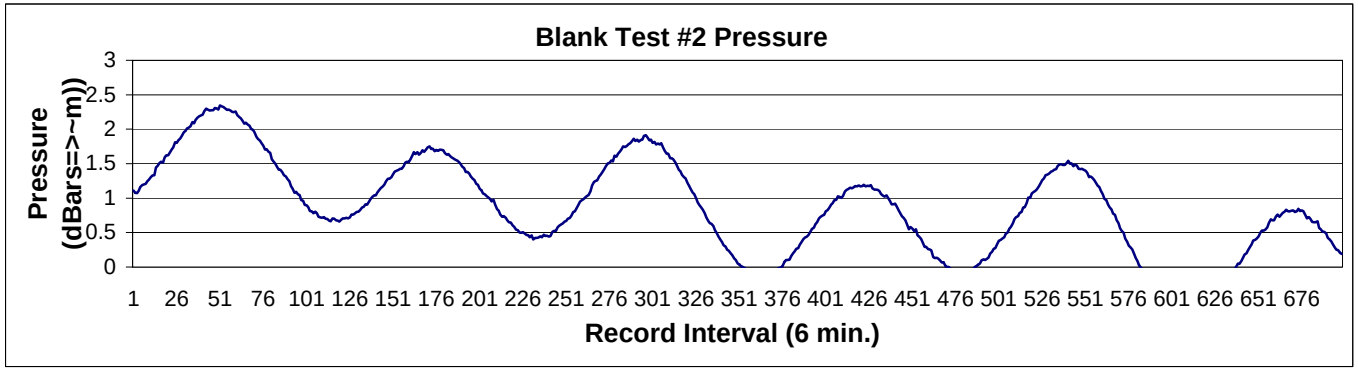



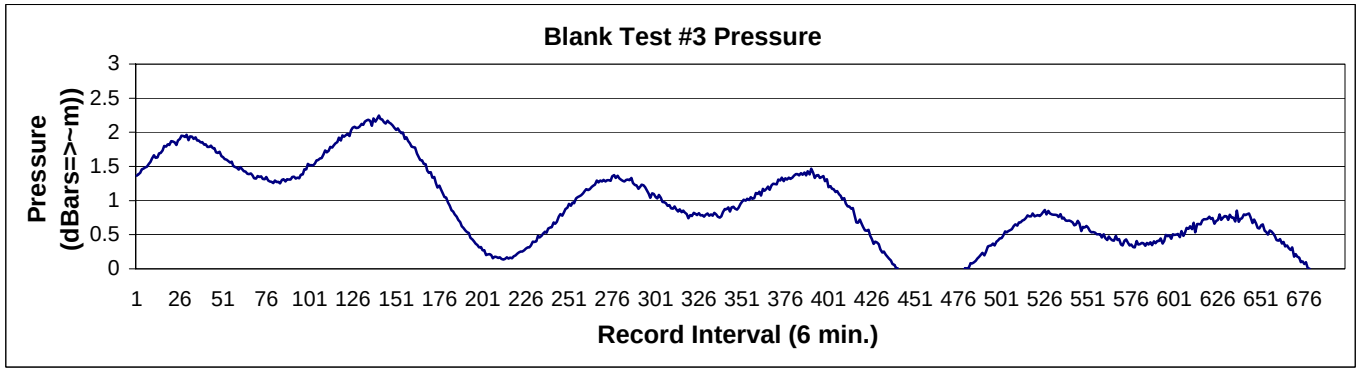



# BFSD 2
# Triplicate BlankTests
# Pressure

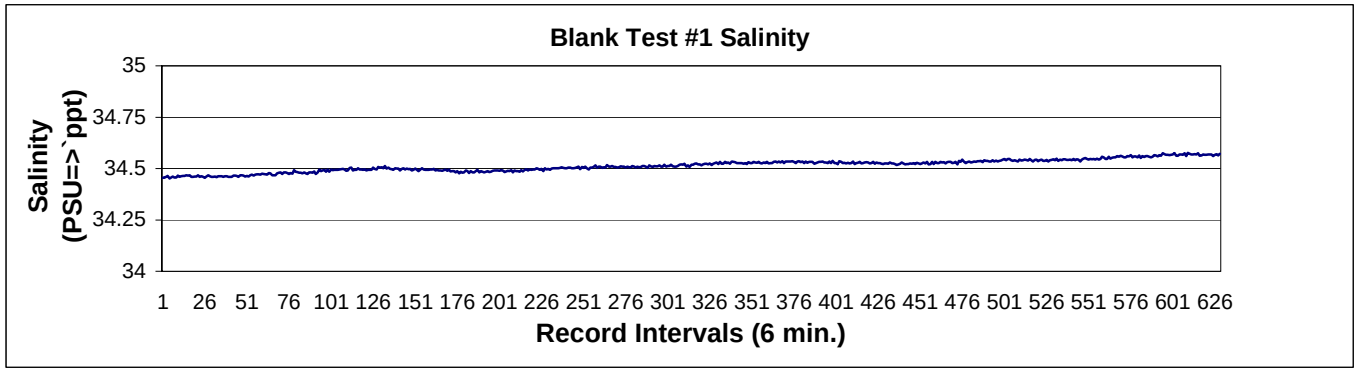
Note: Allow for (faulty) sensor drift
(subsequently corrected)

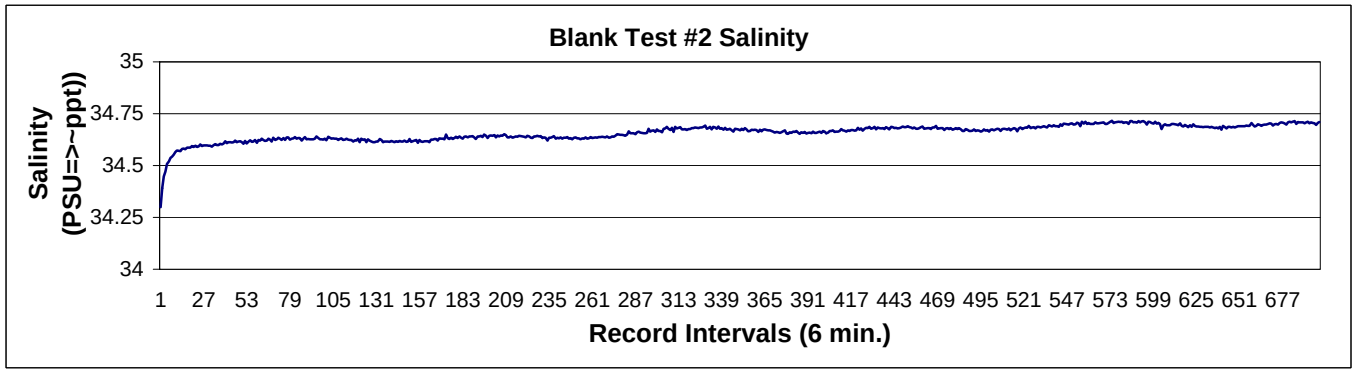


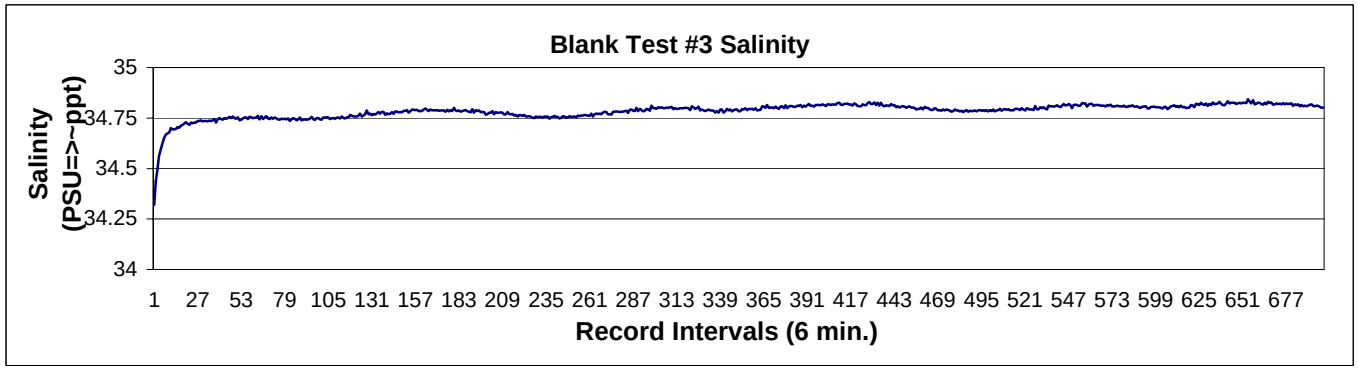



# BFSD 2
# Triplicate BlankTests
# Salinity

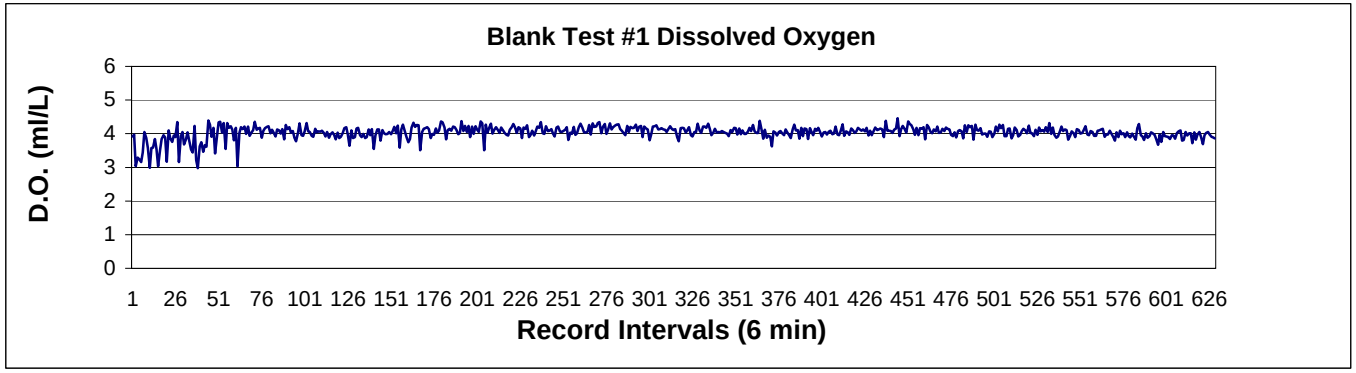


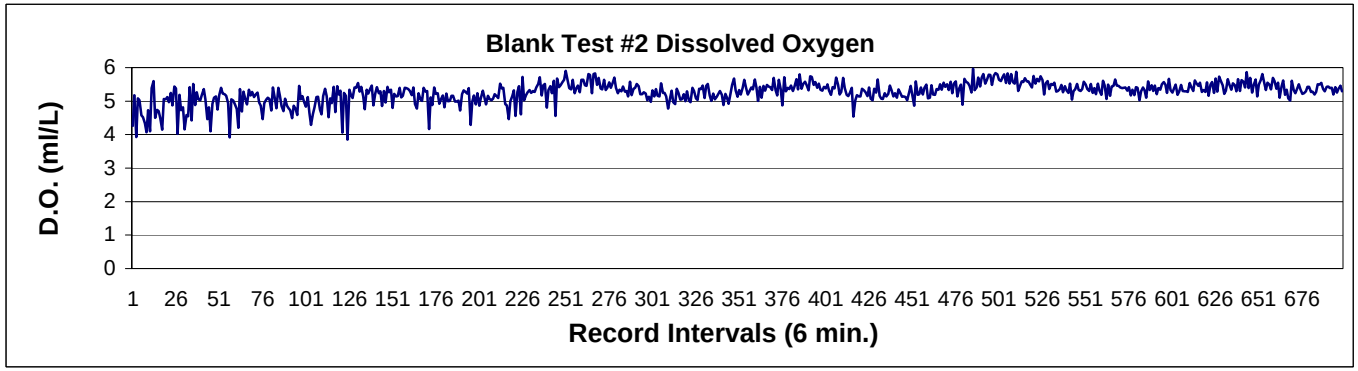



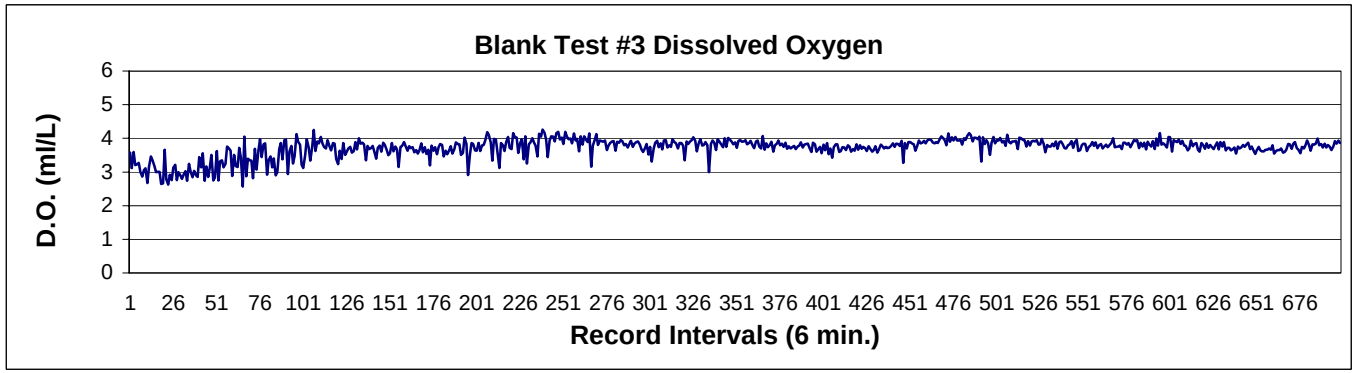



# BFSD 2
# Triplicate BlankTests
# Dissolved Oxygen

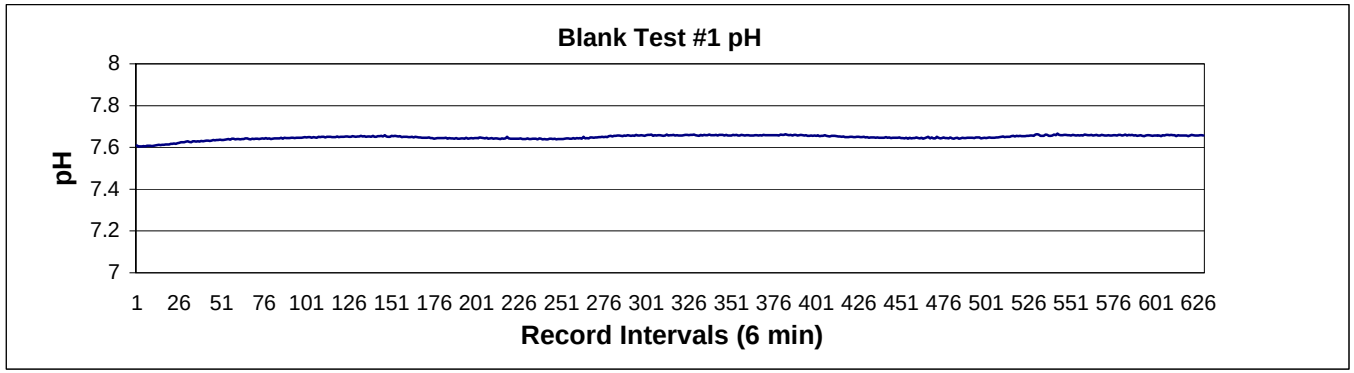
Note: "Noisey" traces due to restricted flow over sensor (subsequently corrected)

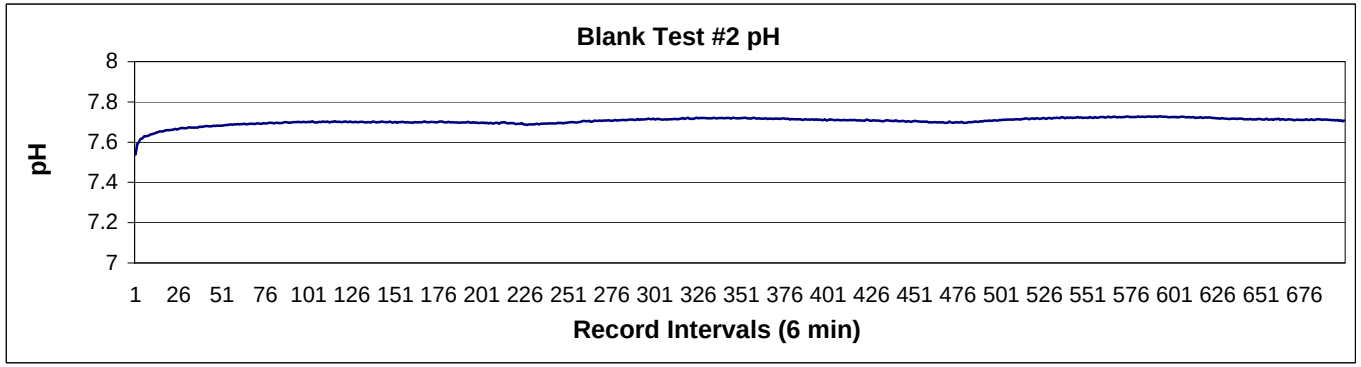


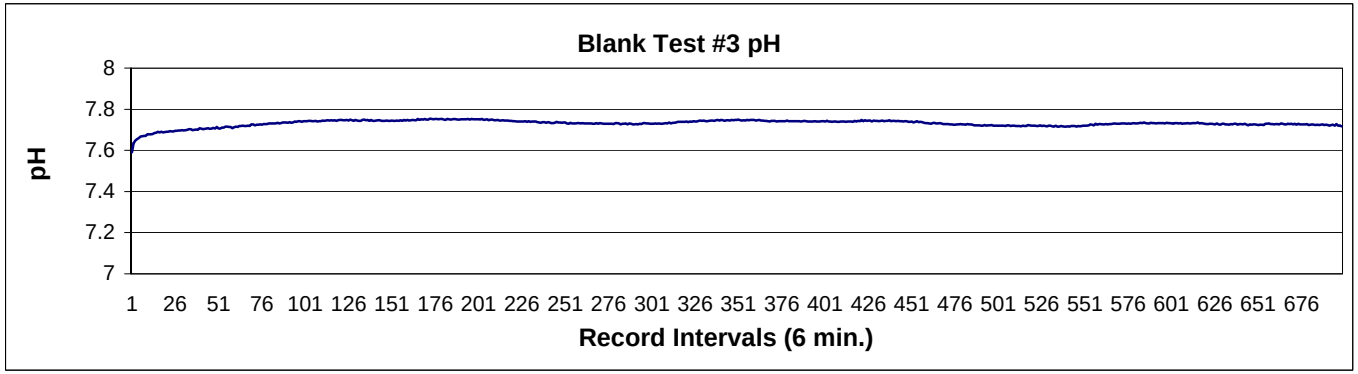



# BFSD 2
# Triplicate BlankTests
# pH



# Blank Test #1 Sensor Data

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45.276 | 18.011 | 1.881 | 34.455 | 13.262 | 2339916 | 2456346 | 5/14/1998 | 14:34:30.70 | 3.917 | 7.610 |
| 2 | 45.265 | 17.998 | 1.866 | 34.457 | 13.312 | 2346641 | 2455075 | 5/14/1998 | 14:40:31.49 | 3.963 | 7.605 |
| 3 | 45.255 | 17.986 | 1.834 | 34.459 | 13.325 | 2211156 | 2455165 | 5/14/1998 | 14:46:32.28 | 3.034 | 7.605 |
| 4 | 45.248 | 17.972 | 1.817 | 34.464 | 13.334 | 2248927 | 2455032 | 5/14/1998 | 14:52:33.07 | 3.293 | 7.604 |
| 5 | 45.233 | 17.971 | 1.823 | 34.452 | 13.337 | 2241082 | 2455530 | 5/14/1998 | 14:58:33.86 | 3.239 | 7.607 |
| 6 | 45.227 | 17.96 | 1.813 | 34.457 | 13.342 | 2228945 | 2455191 | 5/14/1998 | 15:04:34.65 | 3.156 | 7.605 |
| 7 | 45.225 | 17.953 | 1.811 | 34.461 | 13.342 | 2270518 | 2455686 | 5/14/1998 | 15:10:35.44 | 3.441 | 7.607 |
| 8 | 45.222 | 17.955 | 1.808 | 34.457 | 13.344 | 2359142 | 2455926 | 5/14/1998 | 15:16:36.23 | 4.049 | 7.608 |
| 9 | 45.212 | 17.947 | 1.769 | 34.456 | 13.309 | 2333397 | 2455695 | 5/14/1998 | 15:22:37.02 | 3.873 | 7.607 |
| 10 | 45.223 | 17.946 | 1.731 | 34.466 | 13.334 | 2290483 | 2455503 | 5/14/1998 | 15:28:37.81 | 3.578 | 7.606 |
| 11 | 45.236 | 17.967 | 1.738 | 34.459 | 13.339 | 2204401 | 2455996 | 5/14/1998 | 15:34:38.60 | 2.987 | 7.609 |
| 12 | 45.245 | 17.971 | 1.73 | 34.463 | 13.34 | 2289578 | 2456336 | 5/14/1998 | 15:40:39.39 | 3.572 | 7.610 |
| 13 | 45.257 | 17.982 | 1.715 | 34.464 | 13.342 | 2291758 | 2456695 | 5/14/1998 | 15:46:40.18 | 3.587 | 7.612 |
| 14 | 45.279 | 18.004 | 1.73 | 34.464 | 13.343 | 2328554 | 2456877 | 5/14/1998 | 15:52:40.97 | 3.839 | 7.612 |
| 15 | 45.295 | 18.017 | 1.686 | 34.467 | 13.345 | 2284263 | 2456437 | 5/14/1998 | 15:58:41.76 | 3.535 | 7.610 |
| 16 | 45.317 | 18.041 | 1.69 | 34.465 | 13.345 | 2211735 | 2456885 | 5/14/1998 | 16:04:42.55 | 3.038 | 7.612 |
| 17 | 45.335 | 18.057 | 1.715 | 34.467 | 13.346 | 2279745 | 2456945 | 5/14/1998 | 16:10:43.34 | 3.504 | 7.613 |
| 18 | 45.356 | 18.087 | 1.709 | 34.46 | 13.346 | 2328233 | 2457334 | 5/14/1998 | 16:16:44.13 | 3.837 | 7.614 |
| 19 | 45.375 | 18.106 | 1.668 | 34.46 | 13.345 | 2346193 | 2457414 | 5/14/1998 | 16:22:44.92 | 3.960 | 7.615 |
| 20 | 45.401 | 18.131 | 1.661 | 34.461 | 13.348 | 2335558 | 2457412 | 5/14/1998 | 16:28:45.71 | 3.887 | 7.615 |
| 21 | 45.422 | 18.152 | 1.657 | 34.461 | 13.346 | 2230192 | 2458049 | 5/14/1998 | 16:34:46.50 | 3.164 | 7.617 |
| 22 | 45.447 | 18.17 | 1.646 | 34.467 | 13.347 | 2365600 | 2458046 | 5/14/1998 | 16:40:47.29 | 4.094 | 7.617 |
| 23 | 45.47 | 18.203 | 1.647 | 34.459 | 13.347 | 2332186 | 2458176 | 5/14/1998 | 16:46:48.08 | 3.864 | 7.618 |
| 24 | 45.488 | 18.216 | 1.654 | 34.463 | 13.347 | 2316255 | 2458154 | 5/14/1998 | 16:52:48.87 | 3.755 | 7.618 |
| 25 | 45.502 | 18.235 | 1.687 | 34.459 | 13.346 | 2343800 | 2458859 | 5/14/1998 | 16:58:49.66 | 3.944 | 7.621 |
| 26 | 45.511 | 18.249 | 1.646 | 34.455 | 13.346 | 2337673 | 2458981 | 5/14/1998 | 17:04:50.45 | 3.902 | 7.621 |
| 27 | 45.528 | 18.258 | 1.676 | 34.461 | 13.346 | 2402169 | 2459741 | 5/14/1998 | 17:10:51.24 | 4.345 | 7.625 |
| 28 | 45.541 | 18.263 | 1.648 | 34.468 | 13.345 | 2229313 | 2459899 | 5/14/1998 | 17:16:52.03 | 3.158 | 7.625 |
| 29 | 45.551 | 18.28 | 1.656 | 34.463 | 13.328 | 2341141 | 2459764 | 5/14/1998 | 17:22:52.82 | 3.926 | 7.625 |
| 30 | 45.563 | 18.295 | 1.657 | 34.46 | 13.336 | 2359001 | 2460457 | 5/14/1998 | 17:28:53.61 | 4.048 | 7.628 |
| 31 | 45.566 | 18.3 | 1.68 | 34.459 | 13.34 | 2305131 | 2460661 | 5/14/1998 | 17:34:54.40 | 3.679 | 7.629 |
| 32 | 45.577 | 18.309 | 1.682 | 34.461 | 13.339 | 2327314 | 2460177 | 5/14/1998 | 17:40:55.19 | 3.831 | 7.627 |
| 33 | 45.579 | 18.314 | 1.698 | 34.458 | 13.34 | 2357361 | 2459776 | 5/14/1998 | 17:46:55.98 | 4.037 | 7.625 |
| 34 | 45.586 | 18.316 | 1.714 | 34.462 | 13.339 | 2323358 | 2460836 | 5/14/1998 | 17:52:56.77 | 3.804 | 7.629 |
| 35 | 45.587 | 18.318 | 1.726 | 34.462 | 13.339 | 2282749 | 2460833 | 5/14/1998 | 17:58:57.56 | 3.525 | 7.629 |
| 36 | 45.593 | 18.322 | 1.752 | 34.463 | 13.34 | 2271057 | 2460620 | 5/14/1998 | 18:04:58.35 | 3.445 | 7.629 |
| 37 | 45.593 | 18.327 | 1.739 | 34.459 | 13.34 | 2386149 | 2460929 | 5/14/1998 | 18:10:59.14 | 4.235 | 7.630 |
| 38 | 45.6 | 18.329 | 1.737 | 34.463 | 13.339 | 2237429 | 2460319 | 5/14/1998 | 18:16:59.93 | 3.214 | 7.627 |
| 39 | 45.6 | 18.329 | 1.739 | 34.463 | 13.338 | 2202846 | 2460996 | 5/14/1998 | 18:23:00.72 | 2.977 | 7.630 |
| 40 | 45.602 | 18.336 | 1.763 | 34.459 | 13.339 | 2296880 | 2460929 | 5/14/1998 | 18:29:01.51 | 3.622 | 7.630 |
| 41 | 45.605 | 18.338 | 1.804 | 34.46 | 13.339 | 2314948 | 2461308 | 5/14/1998 | 18:35:02.30 | 3.746 | 7.632 |
| 42 | 45.604 | 18.336 | 1.831 | 34.46 | 13.338 | 2273005 | 2461633 | 5/14/1998 | 18:41:03.09 | 3.458 | 7.633 |
| 43 | 45.607 | 18.333 | 1.82 | 34.466 | 13.336 | 2302834 | 2461552 | 5/14/1998 | 18:47:03.88 | 3.663 | 7.633 |
| 44 | 45.609 | 18.335 | 1.883 | 34.465 | 13.337 | 2295581 | 2461217 | 5/14/1998 | 18:53:04.67 | 3.613 | 7.631 |
| 45 | 45.612 | 18.339 | 1.906 | 34.464 | 13.337 | 2409399 | 2461591 | 5/14/1998 | 18:59:05.46 | 4.394 | 7.633 |
| 46 | 45.611 | 18.345 | 1.888 | 34.459 | 13.336 | 2391571 | 2462197 | 5/14/1998 | 19:05:06.25 | 4.272 | 7.635 |
| 47 | 45.616 | 18.339 | 1.889 | 34.468 | 13.336 | 2338360 | 2461855 | 5/14/1998 | 19:11:07.04 | 3.907 | 7.634 |
| 48 | 45.617 | 18.341 | 1.922 | 34.468 | 13.336 | 2377738 | 2462122 | 5/14/1998 | 19:17:07.83 | 4.177 | 7.635 |
| 49 | 45.611 | 18.338 | 1.946 | 34.465 | 13.338 | 2266786 | 2462090 | 5/14/1998 | 19:23:08.62 | 3.415 | 7.635 |
| 50 | 45.607 | 18.339 | 1.966 | 34.461 | 13.336 | 2340669 | 2462577 | 5/14/1998 | 19:29:09.41 | 3.922 | 7.637 |
| 51 | 45.612 | 18.339 | 2.004 | 34.464 | 13.335 | 2401428 | 2462098 | 5/14/1998 | 19:35:10.20 | 4.339 | 7.635 |
| 52 | 45.608 | 18.34 | 2.084 | 34.461 | 13.335 | 2403924 | 2462223 | 5/14/1998 | 19:41:10.99 | 4.357 | 7.635 |
| 53 | 45.61 | 18.335 | 2.042 | 34.467 | 13.337 | 2356018 | 2462593 | 5/14/1998 | 19:47:11.78 | 4.028 | 7.637 |
| 54 | 45.606 | 18.326 | 2.059 | 34.47 | 13.333 | 2397528 | 2462807 | 5/14/1998 | 19:53:12.57 | 4.313 | 7.638 |
| 55 | 45.6 | 18.327 | 2.081 | 34.465 | 13.333 | 2285816 | 2463198 | 5/14/1998 | 19:59:13.36 | 3.546 | 7.640 |
| 56 | 45.584 | 18.303 | 2.117 | 34.471 | 13.333 | 2398260 | 2462569 | 5/14/1998 | 20:05:14.15 | 4.318 | 7.637 |
| 57 | 45.567 | 18.285 | 2.137 | 34.472 | 13.332 | 2377051 | 2463576 | 5/14/1998 | 20:11:14.94 | 4.172 | 7.641 |
| 58 | 45.544 | 18.263 | 2.153 | 34.472 | 13.331 | 2383918 | 2463667 | 5/14/1998 | 20:17:15.73 | 4.219 | 7.642 |
| 59 | 45.531 | 18.25 | 2.191 | 34.471 | 13.331 | 2368433 | 2463074 | 5/14/1998 | 20:23:16.52 | 4.113 | 7.639 |
| 60 | 45.52 | 18.235 | 2.219 | 34.475 | 13.331 | 2323805 | 2463263 | 5/14/1998 | 20:29:17.31 | 3.807 | 7.640 |
| 61 | 45.504 | 18.221 | 2.226 | 34.473 | 13.331 | 2376991 | 2463289 | 5/14/1998 | 20:35:18.10 | 4.172 | 7.640 |
| 62 | 45.493 | 18.21 | 2.244 | 34.472 | 13.333 | 2210825 | 2463077 | 5/14/1998 | 20:41:18.89 | 3.031 | 7.639 |
| 63 | 45.48 | 18.2 | 2.297 | 34.47 | 13.33 | 2355678 | 2463360 | 5/14/1998 | 20:47:19.68 | 4.025 | 7.640 |
| 64 | 45.477 | 18.187 | 2.263 | 34.478 | 13.33 | 2379611 | 2463320 | 5/14/1998 | 20:53:20.47 | 4.190 | 7.640 |
| 65 | 45.465 | 18.176 | 2.349 | 34.476 | 13.331 | 2371687 | 2464053 | 5/14/1998 | 20:59:21.26 | 4.135 | 7.643 |
| 66 | 45.452 | 18.173 | 2.369 | 34.468 | 13.327 | 2383050 | 2464100 | 5/14/1998 | 21:05:22.05 | 4.213 | 7.644 |
| 67 | 45.437 | 18.158 | 2.397 | 34.468 | 13.327 | 2351063 | 2463189 | 5/14/1998 | 21:11:22.84 | 3.994 | 7.640 |
| 68 | 45.43 | 18.152 | 2.397 | 34.467 | 13.326 | 2383023 | 2463037 | 5/14/1998 | 21:17:23.63 | 4.213 | 7.639 |
| 69 | 45.422 | 18.133 | 2.375 | 34.477 | 13.326 | 2343310 | 2463752 | 5/14/1998 | 21:23:24.42 | 3.941 | 7.642 |
| 70 | 45.417 | 18.126 | 2.416 | 34.479 | 13.328 | 2355325 | 2463448 | 5/14/1998 | 21:29:25.21 | 4.023 | 7.641 |
| 71 | 45.406 | 18.112 | 2.431 | 34.481 | 13.327 | 2367457 | 2463585 | 5/14/1998 | 21:35:26.00 | 4.106 | 7.641 |
| 72 | 45.401 | 18.116 | 2.52 | 34.473 | 13.324 | 2403576 | 2463594 | 5/14/1998 | 21:42:08.00 | 4.354 | 7.641 |
| 73 | 45.388 | 18.093 | 2.496 | 34.481 | 13.324 | 2369041 | 2463392 | 5/14/1998 | 21:48:08.79 | 4.117 | 7.641 |
| 74 | 45.387 | 18.091 | 2.521 | 34.482 | 13.323 | 2373998 | 2463809 | 5/14/1998 | 21:54:09.58 | 4.151 | 7.642 |
| 75 | 45.37 | 18.078 | 2.559 | 34.478 | 13.324 | 2377182 | 2463890 | 5/14/1998 | 22:00:10.37 | 4.173 | 7.643 |
| 76 | 45.371 | 18.084 | 2.524 | 34.474 | 13.324 | 2334801 | 2463724 | 5/14/1998 | 22:06:11.16 | 3.882 | 7.642 |
| 77 | 45.365 | 18.074 | 2.555 | 34.478 | 13.322 | 2365159 | 2464469 | 5/14/1998 | 22:12:11.95 | 4.091 | 7.645 |
| 78 | 45.363 | 18.076 | 2.533 | 34.475 | 13.323 | 2375688 | 2463809 | 5/14/1998 | 22:18:12.74 | 4.163 | 7.642 |
| 79 | 45.362 | 18.055 | 2.555 | 34.492 | 13.323 | 2381254 | 2464032 | 5/14/1998 | 22:24:13.53 | 4.201 | 7.643 |
| 80 | 45.357 | 18.059 | 2.556 | 34.484 | 13.325 | 2384078 | 2463464 | 5/14/1998 | 22:30:14.32 | 4.220 | 7.641 |
| 81 | 45.354 | 18.057 | 2.53 | 34.483 | 13.322 | 2353772 | 2463593 | 5/14/1998 | 22:36:15.11 | 4.012 | 7.641 |
| 82 | 45.349 | 18.055 | 2.563 | 34.48 | 13.321 | 2368779 | 2463860 | 5/14/1998 | 22:42:15.90 | 4.115 | 7.643 |
| 83 | 45.348 | 18.056 | 2.543 | 34.479 | 13.321 | 2356085 | 2463896 | 5/14/1998 | 22:48:16.69 | 4.028 | 7.643 |
| 84 | 45.342 | 18.053 | 2.566 | 34.476 | 13.32 | 2340172 | 2464056 | 5/14/1998 | 22:54:17.48 | 3.919 | 7.643 |
| 85 | 45.323 | 18.027 | 2.562 | 34.482 | 13.32 | 2370278 | 2463957 | 5/14/1998 | 23:00:18.27 | 4.126 | 7.643 |
| 86 | 45.306 | 18.016 | 2.546 | 34.477 | 13.319 | 2366424 | 2464550 | 5/14/1998 | 23:06:19.06 | 4.099 | 7.646 |
| 87 | 45.287 | 17.999 | 2.558 | 34.474 | 13.318 | 2352180 | 2463720 | 5/14/1998 | 23:12:19.85 | 4.001 | 7.642 |
| 88 | 45.264 | 17.968 | 2.552 | 34.481 | 13.318 | 2372135 | 2464649 | 5/14/1998 | 23:18:20.64 | 4.138 | 7.646 |
| 89 | 45.252 | 17.955 | 2.558 | 34.482 | 13.318 | 2327818 | 2464429 | 5/14/1998 | 23:24:21.43 | 3.834 | 7.645 |
| 90 | 45.24 | 17.946 | 2.539 | 34.48 | 13.319 | 2389883 | 2464399 | 5/14/1998 | 23:30:22.22 | 4.260 | 7.645 |
| 91 | 45.22 | 17.917 | 2.504 | 34.486 | 13.319 | 2371560 | 2464360 | 5/14/1998 | 23:36:23.01 | 4.134 | 7.645 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **92** | 45.193 | 17.905 | 2.486 | 34.474 | 13.316 | 2380525 | 2464586 | 5/14/1998 | 23:42:23.80 | 4.196 | 7.646 |
| **93** | 45.174 | 17.876 | 2.47 | 34.482 | 13.315 | 2356383 | 2464819 | 5/14/1998 | 23:48:24.59 | 4.030 | 7.647 |
| **94** | 45.165 | 17.852 | 2.495 | 34.495 | 13.316 | 2363233 | 2464439 | 5/14/1998 | 23:54:25.38 | 4.077 | 7.645 |
| **95** | 45.152 | 17.847 | 2.471 | 34.488 | 13.315 | 2334303 | 2464571 | 5/15/1998 | 00:00:26.17 | 3.879 | 7.646 |
| **96** | 45.145 | 17.836 | 2.471 | 34.491 | 13.315 | 2318677 | 2464603 | 5/15/1998 | 00:06:26.96 | 3.772 | 7.646 |
| **97** | 45.126 | 17.815 | 2.42 | 34.493 | 13.314 | 2354618 | 2464559 | 5/15/1998 | 00:12:27.75 | 4.018 | 7.646 |
| **98** | 45.112 | 17.811 | 2.403 | 34.484 | 13.315 | 2396418 | 2464540 | 5/15/1998 | 00:18:28.54 | 4.305 | 7.645 |
| **99** | 45.111 | 17.797 | 2.39 | 34.495 | 13.313 | 2345937 | 2465214 | 5/15/1998 | 00:24:29.33 | 3.959 | 7.648 |
| **100** | 45.1 | 17.797 | 2.364 | 34.485 | 13.314 | 2343263 | 2465354 | 5/15/1998 | 00:30:30.12 | 3.940 | 7.649 |
| **101** | 45.095 | 17.781 | 2.36 | 34.496 | 13.314 | 2361929 | 2464998 | 5/15/1998 | 00:36:30.91 | 4.068 | 7.647 |
| **102** | 45.085 | 17.776 | 2.338 | 34.492 | 13.312 | 2397693 | 2465248 | 5/15/1998 | 00:42:31.70 | 4.314 | 7.649 |
| **103** | 45.082 | 17.77 | 2.339 | 34.494 | 13.313 | 2361991 | 2465327 | 5/15/1998 | 00:48:32.49 | 4.069 | 7.649 |
| **104** | 45.077 | 17.766 | 2.26 | 34.493 | 13.311 | 2359765 | 2464850 | 5/15/1998 | 00:54:33.28 | 4.054 | 7.647 |
| **105** | 45.078 | 17.765 | 2.297 | 34.494 | 13.311 | 2343112 | 2465278 | 5/15/1998 | 01:00:34.07 | 3.939 | 7.649 |
| **106** | 45.073 | 17.759 | 2.24 | 34.495 | 13.31 | 2339118 | 2465036 | 5/15/1998 | 01:06:34.86 | 3.912 | 7.648 |
| **107** | 45.067 | 17.75 | 2.192 | 34.497 | 13.309 | 2373443 | 2464837 | 5/15/1998 | 01:12:35.65 | 4.147 | 7.647 |
| **108** | 45.06 | 17.743 | 2.175 | 34.498 | 13.309 | 2358277 | 2465788 | 5/15/1998 | 01:18:36.44 | 4.043 | 7.651 |
| **109** | 45.069 | 17.754 | 2.147 | 34.495 | 13.309 | 2361881 | 2465250 | 5/15/1998 | 01:24:37.23 | 4.068 | 7.649 |
| **110** | 45.061 | 17.754 | 2.095 | 34.489 | 13.308 | 2360513 | 2465788 | 5/15/1998 | 01:30:38.02 | 4.059 | 7.651 |
| **111** | 45.064 | 17.755 | 2.082 | 34.491 | 13.308 | 2365125 | 2465730 | 5/15/1998 | 01:36:38.81 | 4.090 | 7.651 |
| **112** | 45.071 | 17.748 | 2.043 | 34.503 | 13.308 | 2354717 | 2465046 | 5/15/1998 | 01:42:39.60 | 4.019 | 7.648 |
| **113** | 45.076 | 17.75 | 2.024 | 34.505 | 13.307 | 2339792 | 2465843 | 5/15/1998 | 01:48:40.39 | 3.916 | 7.651 |
| **114** | 45.074 | 17.767 | 1.981 | 34.49 | 13.307 | 2359431 | 2465605 | 5/15/1998 | 01:54:41.18 | 4.051 | 7.650 |
| **115** | 45.077 | 17.765 | 1.954 | 34.493 | 13.308 | 2334336 | 2465603 | 5/15/1998 | 02:00:41.97 | 3.879 | 7.650 |
| **116** | 45.085 | 17.773 | 1.883 | 34.493 | 13.308 | 2349904 | 2465524 | 5/15/1998 | 02:06:42.76 | 3.986 | 7.650 |
| **117** | 45.092 | 17.771 | 1.879 | 34.501 | 13.307 | 2357965 | 2465475 | 5/15/1998 | 02:12:43.55 | 4.041 | 7.650 |
| **118** | 45.096 | 17.781 | 1.838 | 34.496 | 13.307 | 2346763 | 2465589 | 5/15/1998 | 02:18:44.34 | 3.964 | 7.650 |
| **119** | 45.096 | 17.782 | 1.815 | 34.495 | 13.306 | 2327530 | 2466033 | 5/15/1998 | 02:24:45.13 | 3.832 | 7.652 |
| **120** | 45.095 | 17.785 | 1.74 | 34.493 | 13.307 | 2356530 | 2465461 | 5/15/1998 | 02:30:45.92 | 4.031 | 7.649 |
| **121** | 45.099 | 17.783 | 1.727 | 34.497 | 13.308 | 2333205 | 2465944 | 5/15/1998 | 02:36:46.71 | 3.871 | 7.652 |
| **122** | 45.093 | 17.785 | 1.662 | 34.491 | 13.306 | 2337882 | 2465861 | 5/15/1998 | 02:42:47.50 | 3.903 | 7.651 |
| **123** | 45.106 | 17.795 | 1.62 | 34.494 | 13.305 | 2355699 | 2465839 | 5/15/1998 | 02:48:48.29 | 4.026 | 7.651 |
| **124** | 45.108 | 17.797 | 1.596 | 34.493 | 13.306 | 2375615 | 2466033 | 5/15/1998 | 02:54:49.08 | 4.162 | 7.652 |
| **125** | 45.107 | 17.795 | 1.538 | 34.494 | 13.304 | 2380729 | 2466074 | 5/15/1998 | 03:00:49.87 | 4.197 | 7.652 |
| **126** | 45.113 | 17.79 | 1.505 | 34.504 | 13.303 | 2346873 | 2465608 | 5/15/1998 | 03:06:50.66 | 3.965 | 7.650 |
| **127** | 45.117 | 17.799 | 1.463 | 34.498 | 13.303 | 2299817 | 2465916 | 5/15/1998 | 03:12:51.45 | 3.642 | 7.651 |
| **128** | 45.108 | 17.795 | 1.426 | 34.496 | 13.302 | 2365956 | 2466497 | 5/15/1998 | 03:18:52.24 | 4.096 | 7.654 |
| **129** | 45.115 | 17.786 | 1.414 | 34.508 | 13.302 | 2333427 | 2466179 | 5/15/1998 | 03:24:53.03 | 3.873 | 7.653 |
| **130** | 45.115 | 17.791 | 1.368 | 34.504 | 13.302 | 2337033 | 2465739 | 5/15/1998 | 03:30:53.82 | 3.898 | 7.651 |
| **131** | 45.121 | 17.793 | 1.31 | 34.507 | 13.303 | 2374985 | 2466073 | 5/15/1998 | 03:36:54.61 | 4.158 | 7.652 |
| **132** | 45.125 | 17.803 | 1.281 | 34.502 | 13.302 | 2376677 | 2466292 | 5/15/1998 | 03:42:55.40 | 4.170 | 7.653 |
| **133** | 45.126 | 17.792 | 1.249 | 34.512 | 13.302 | 2345688 | 2466780 | 5/15/1998 | 03:48:56.19 | 3.957 | 7.655 |
| **134** | 45.133 | 17.814 | 1.217 | 34.5 | 13.301 | 2336899 | 2466162 | 5/15/1998 | 03:54:56.98 | 3.897 | 7.653 |
| **135** | 45.148 | 17.825 | 1.183 | 34.504 | 13.301 | 2351237 | 2466577 | 5/15/1998 | 04:00:57.77 | 3.995 | 7.654 |
| **136** | 45.178 | 17.863 | 1.134 | 34.498 | 13.303 | 2333080 | 2465691 | 5/15/1998 | 04:06:58.56 | 3.870 | 7.650 |
| **137** | 45.205 | 17.891 | 1.111 | 34.497 | 13.303 | 2336919 | 2466221 | 5/15/1998 | 04:12:59.35 | 3.897 | 7.653 |
| **138** | 45.224 | 17.913 | 1.089 | 34.494 | 13.303 | 2371025 | 2466294 | 5/15/1998 | 04:19:00.14 | 4.131 | 7.653 |
| **139** | 45.257 | 17.937 | 1.044 | 34.502 | 13.303 | 2345181 | 2465861 | 5/15/1998 | 04:25:00.93 | 3.953 | 7.651 |
| **140** | 45.285 | 17.968 | 1.008 | 34.5 | 13.301 | 2372030 | 2466755 | 5/15/1998 | 04:31:01.72 | 4.138 | 7.655 |
| **141** | 45.305 | 17.988 | 0.987 | 34.5 | 13.301 | 2285279 | 2465932 | 5/15/1998 | 04:37:02.51 | 3.542 | 7.652 |
| **142** | 45.327 | 18.02 | 0.95 | 34.491 | 13.302 | 2344166 | 2465843 | 5/15/1998 | 04:43:44.53 | 3.946 | 7.651 |
| **143** | 45.362 | 18.048 | 0.933 | 34.498 | 13.3 | 2369962 | 2466366 | 5/15/1998 | 04:49:45.32 | 4.123 | 7.653 |
| **144** | 45.381 | 18.062 | 0.892 | 34.502 | 13.3 | 2369947 | 2466500 | 5/15/1998 | 04:55:46.11 | 4.123 | 7.654 |
| **145** | 45.399 | 18.088 | 0.855 | 34.495 | 13.299 | 2322085 | 2466747 | 5/15/1998 | 05:01:46.90 | 3.795 | 7.655 |
| **146** | 45.427 | 18.111 | 0.882 | 34.5 | 13.299 | 2368270 | 2466240 | 5/15/1998 | 05:07:47.69 | 4.112 | 7.653 |
| **147** | 45.446 | 18.133 | 0.855 | 34.497 | 13.299 | 2353575 | 2467488 | 5/15/1998 | 05:13:48.48 | 4.011 | 7.658 |
| **148** | 45.468 | 18.154 | 0.849 | 34.499 | 13.3 | 2350109 | 2466098 | 5/15/1998 | 05:19:49.27 | 3.987 | 7.652 |
| **149** | 45.482 | 18.179 | 0.817 | 34.49 | 13.299 | 2351218 | 2465947 | 5/15/1998 | 05:25:50.06 | 3.995 | 7.652 |
| **150** | 45.501 | 18.194 | 0.803 | 34.493 | 13.3 | 2359344 | 2465720 | 5/15/1998 | 05:31:50.85 | 4.051 | 7.651 |
| **151** | 45.526 | 18.21 | 0.79 | 34.5 | 13.298 | 2349084 | 2466761 | 5/15/1998 | 05:37:51.64 | 3.980 | 7.655 |
| **152** | 45.543 | 18.234 | 0.749 | 34.494 | 13.299 | 2362851 | 2466357 | 5/15/1998 | 05:43:52.43 | 4.075 | 7.653 |
| **153** | 45.561 | 18.261 | 0.757 | 34.488 | 13.298 | 2381029 | 2466728 | 5/15/1998 | 05:49:53.22 | 4.199 | 7.655 |
| **154** | 45.574 | 18.266 | 0.74 | 34.495 | 13.298 | 2353587 | 2466647 | 5/15/1998 | 05:55:54.01 | 4.011 | 7.655 |
| **155** | 45.598 | 18.282 | 0.741 | 34.501 | 13.298 | 2386931 | 2466048 | 5/15/1998 | 06:01:54.80 | 4.240 | 7.652 |
| **156** | 45.612 | 18.303 | 0.751 | 34.496 | 13.298 | 2291650 | 2466400 | 5/15/1998 | 06:07:55.59 | 3.586 | 7.654 |
| **157** | 45.634 | 18.327 | 0.727 | 34.494 | 13.299 | 2371093 | 2465348 | 5/15/1998 | 06:13:56.38 | 4.131 | 7.649 |
| **158** | 45.654 | 18.347 | 0.769 | 34.494 | 13.298 | 2391363 | 2465810 | 5/15/1998 | 06:19:57.17 | 4.270 | 7.651 |
| **159** | 45.672 | 18.365 | 0.735 | 34.493 | 13.299 | 2362448 | 2465915 | 5/15/1998 | 06:25:57.96 | 4.072 | 7.651 |
| **160** | 45.687 | 18.377 | 0.729 | 34.496 | 13.298 | 2338958 | 2465723 | 5/15/1998 | 06:31:58.75 | 3.911 | 7.651 |
| **161** | 45.702 | 18.394 | 0.726 | 34.496 | 13.299 | 2314425 | 2465538 | 5/15/1998 | 06:37:59.54 | 3.742 | 7.650 |
| **162** | 45.72 | 18.408 | 0.708 | 34.498 | 13.299 | 2328691 | 2465559 | 5/15/1998 | 06:44:00.33 | 3.840 | 7.650 |
| **163** | 45.732 | 18.429 | 0.741 | 34.491 | 13.298 | 2379082 | 2465707 | 5/15/1998 | 06:50:01.12 | 4.186 | 7.651 |
| **164** | 45.748 | 18.443 | 0.719 | 34.493 | 13.298 | 2399845 | 2465226 | 5/15/1998 | 06:56:01.91 | 4.329 | 7.648 |
| **165** | 45.762 | 18.459 | 0.731 | 34.491 | 13.297 | 2380967 | 2465836 | 5/15/1998 | 07:02:02.70 | 4.199 | 7.651 |
| **166** | 45.772 | 18.47 | 0.759 | 34.491 | 13.297 | 2390271 | 2465550 | 5/15/1998 | 07:08:03.49 | 4.263 | 7.650 |
| **167** | 45.786 | 18.486 | 0.777 | 34.489 | 13.297 | 2388876 | 2465017 | 5/15/1998 | 07:14:04.28 | 4.253 | 7.648 |
| **168** | 45.802 | 18.497 | 0.801 | 34.492 | 13.297 | 2280680 | 2465085 | 5/15/1998 | 07:20:05.07 | 3.511 | 7.648 |
| **169** | 45.808 | 18.5 | 0.799 | 34.496 | 13.296 | 2359304 | 2464679 | 5/15/1998 | 07:26:05.86 | 4.050 | 7.646 |
| **170** | 45.824 | 18.524 | 0.801 | 34.489 | 13.297 | 2372525 | 2464574 | 5/15/1998 | 07:32:06.65 | 4.141 | 7.646 |
| **171** | 45.835 | 18.527 | 0.809 | 34.496 | 13.295 | 2375619 | 2464652 | 5/15/1998 | 07:38:07.44 | 4.162 | 7.646 |
| **172** | 45.846 | 18.549 | 0.8 | 34.486 | 13.295 | 2380342 | 2464870 | 5/15/1998 | 07:44:08.23 | 4.195 | 7.647 |
| **173** | 45.857 | 18.557 | 0.816 | 34.488 | 13.295 | 2371967 | 2465125 | 5/15/1998 | 07:50:09.02 | 4.137 | 7.648 |
| **174** | 45.867 | 18.569 | 0.86 | 34.487 | 13.296 | 2333301 | 2464295 | 5/15/1998 | 07:56:09.81 | 3.872 | 7.644 |
| **175** | 45.879 | 18.589 | 0.882 | 34.481 | 13.295 | 2351599 | 2464428 | 5/15/1998 | 08:02:10.60 | 3.997 | 7.645 |
| **176** | 45.892 | 18.593 | 0.895 | 34.488 | 13.295 | 2346469 | 2463816 | 5/15/1998 | 08:08:11.39 | 3.962 | 7.642 |
| **177** | 45.903 | 18.618 | 0.937 | 34.477 | 13.294 | 2374377 | 2463877 | 5/15/1998 | 08:14:12.18 | 4.154 | 7.643 |
| **178** | 45.911 | 18.616 | 0.956 | 34.485 | 13.295 | 2356857 | 2464421 | 5/15/1998 | 08:20:12.97 | 4.034 | 7.645 |
| **179** | 45.919 | 18.631 | 0.966 | 34.479 | 13.294 | 2366693 | 2464477 | 5/15/1998 | 08:26:13.76 | 4.101 | 7.645 |
| **180** | 45.931 | 18.64 | 0.97 | 34.482 | 13.293 | 2405428 | 2464468 | 5/15/1998 | 08:32:14.55 | 4.367 | 7.645 |
| **181** | 45.947 | 18.645 | 0.984 | 34.491 | 13.293 | 2400302 | 2464281 | 5/15/1998 | 08:38:15.34 | 4.332 | 7.644 |
| **182** | 45.958 | 18.661 | 0.997 | 34.487 | 13.276 | 2378810 | 2464468 | 5/15/1998 | 08:44:16.14 | 4.184 | 7.645 |
| **183** | 45.952 | 18.666 | 1.029 | 34.478 | 13.257 | 2326999 | 2464612 | 5/15/1998 | 08:50:16.93 | 3.829 | 7.646 |
| **184** | 45.971 | 18.673 | 1.067 | 34.488 | 13.27 | 2367434 | 2463728 | 5/15/1998 | 08:56:17.72 | 4.106 | 7.642 |
| **185** | 45.972 | 18.682 | 1.095 | 34.481 | 13.276 | 2373371 | 2464243 | 5/15/1998 | 09:02:18.51 | 4.147 | 7.644 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **186** | 45.98 | 18.691 | 1.115 | 34.481 | 13.281 | 2364539 | 2464082 | 5/15/1998 | 09:08:19.30 | 4.086 | 7.644 |
| **187** | 45.985 | 18.688 | 1.156 | 34.487 | 13.28 | 2383525 | 2464173 | 5/15/1998 | 09:14:20.09 | 4.217 | 7.644 |
| **188** | 45.992 | 18.687 | 1.172 | 34.494 | 13.282 | 2380216 | 2463707 | 5/15/1998 | 09:20:20.88 | 4.194 | 7.642 |
| **189** | 45.992 | 18.703 | 1.202 | 34.481 | 13.28 | 2368968 | 2464278 | 5/15/1998 | 09:26:21.67 | 4.117 | 7.644 |
| **190** | 45.992 | 18.694 | 1.213 | 34.488 | 13.283 | 2350019 | 2463640 | 5/15/1998 | 09:32:22.46 | 3.987 | 7.642 |
| **191** | 45.987 | 18.694 | 1.254 | 34.484 | 13.28 | 2354642 | 2463795 | 5/15/1998 | 09:38:23.25 | 4.018 | 7.642 |
| **192** | 45.983 | 18.692 | 1.282 | 34.482 | 13.28 | 2406127 | 2463927 | 5/15/1998 | 09:44:24.04 | 4.372 | 7.643 |
| **193** | 45.976 | 18.682 | 1.325 | 34.484 | 13.282 | 2364024 | 2464092 | 5/15/1998 | 09:50:24.83 | 4.083 | 7.644 |
| **194** | 45.972 | 18.674 | 1.347 | 34.488 | 13.283 | 2385935 | 2463686 | 5/15/1998 | 09:56:25.62 | 4.233 | 7.642 |
| **195** | 45.96 | 18.667 | 1.324 | 34.483 | 13.28 | 2358993 | 2464565 | 5/15/1998 | 10:02:26.41 | 4.048 | 7.646 |
| **196** | 45.952 | 18.657 | 1.4 | 34.485 | 13.282 | 2385743 | 2463581 | 5/15/1998 | 10:08:27.20 | 4.232 | 7.641 |
| **197** | 45.948 | 18.648 | 1.374 | 34.489 | 13.28 | 2337293 | 2464040 | 5/15/1998 | 10:14:27.99 | 3.899 | 7.643 |
| **198** | 45.943 | 18.642 | 1.397 | 34.49 | 13.281 | 2382243 | 2464224 | 5/15/1998 | 10:20:28.78 | 4.208 | 7.644 |
| **199** | 45.935 | 18.633 | 1.442 | 34.491 | 13.28 | 2350789 | 2464025 | 5/15/1998 | 10:26:29.57 | 3.992 | 7.643 |
| **200** | 45.918 | 18.616 | 1.4 | 34.491 | 13.281 | 2383707 | 2464502 | 5/15/1998 | 10:32:30.36 | 4.218 | 7.645 |
| **201** | 45.914 | 18.614 | 1.461 | 34.489 | 13.28 | 2369711 | 2464506 | 5/15/1998 | 10:38:31.15 | 4.122 | 7.645 |
| **202** | 45.907 | 18.603 | 1.499 | 34.492 | 13.28 | 2361019 | 2464312 | 5/15/1998 | 10:44:31.94 | 4.062 | 7.645 |
| **203** | 45.898 | 18.597 | 1.57 | 34.49 | 13.28 | 2404815 | 2464943 | 5/15/1998 | 10:50:32.73 | 4.363 | 7.647 |
| **204** | 45.882 | 18.589 | 1.586 | 34.483 | 13.28 | 2396909 | 2464743 | 5/15/1998 | 10:56:33.52 | 4.308 | 7.646 |
| **205** | 45.878 | 18.581 | 1.573 | 34.486 | 13.279 | 2280660 | 2464190 | 5/15/1998 | 11:02:34.31 | 3.511 | 7.644 |
| **206** | 45.876 | 18.576 | 1.54 | 34.489 | 13.279 | 2391740 | 2464058 | 5/15/1998 | 11:08:35.10 | 4.273 | 7.643 |
| **207** | 45.87 | 18.572 | 1.58 | 34.487 | 13.278 | 2356241 | 2464542 | 5/15/1998 | 11:14:35.89 | 4.029 | 7.646 |
| **208** | 45.871 | 18.567 | 1.611 | 34.492 | 13.278 | 2378496 | 2463580 | 5/15/1998 | 11:20:36.68 | 4.182 | 7.641 |
| **209** | 45.864 | 18.572 | 1.593 | 34.482 | 13.278 | 2395631 | 2463980 | 5/15/1998 | 11:26:37.47 | 4.300 | 7.643 |
| **210** | 45.867 | 18.566 | 1.643 | 34.49 | 13.277 | 2352619 | 2464314 | 5/15/1998 | 11:32:38.26 | 4.004 | 7.645 |
| **211** | 45.868 | 18.57 | 1.614 | 34.487 | 13.277 | 2369975 | 2463766 | 5/15/1998 | 11:38:39.05 | 4.124 | 7.642 |
| **212** | 45.864 | 18.565 | 1.7 | 34.488 | 13.276 | 2379839 | 2464065 | 5/15/1998 | 11:45:21.07 | 4.191 | 7.643 |
| **213** | 45.851 | 18.556 | 1.707 | 34.484 | 13.276 | 2367463 | 2464065 | 5/15/1998 | 11:51:21.86 | 4.106 | 7.643 |
| **214** | 45.832 | 18.529 | 1.705 | 34.492 | 13.276 | 2354682 | 2463791 | 5/15/1998 | 11:57:22.65 | 4.019 | 7.642 |
| **215** | 45.82 | 18.523 | 1.683 | 34.486 | 13.276 | 2378706 | 2463284 | 5/15/1998 | 12:03:23.44 | 4.184 | 7.640 |
| **216** | 45.814 | 18.508 | 1.696 | 34.493 | 13.277 | 2366231 | 2463930 | 5/15/1998 | 12:09:24.23 | 4.098 | 7.643 |
| **217** | 45.798 | 18.488 | 1.698 | 34.497 | 13.274 | 2355692 | 2463649 | 5/15/1998 | 12:15:25.02 | 4.026 | 7.642 |
| **218** | 45.775 | 18.473 | 1.719 | 34.49 | 13.274 | 2346827 | 2463915 | 5/15/1998 | 12:21:25.81 | 3.965 | 7.643 |
| **219** | 45.758 | 18.449 | 1.779 | 34.496 | 13.272 | 2344638 | 2465705 | 5/15/1998 | 12:27:26.60 | 3.950 | 7.651 |
| **220** | 45.737 | 18.43 | 1.737 | 34.494 | 13.272 | 2368711 | 2464033 | 5/15/1998 | 12:33:27.39 | 4.115 | 7.643 |
| **221** | 45.712 | 18.403 | 1.74 | 34.496 | 13.273 | 2380056 | 2463707 | 5/15/1998 | 12:39:28.18 | 4.193 | 7.642 |
| **222** | 45.695 | 18.387 | 1.74 | 34.495 | 13.272 | 2393889 | 2463532 | 5/15/1998 | 12:45:28.97 | 4.288 | 7.641 |
| **223** | 45.677 | 18.361 | 1.753 | 34.501 | 13.271 | 2379914 | 2463815 | 5/15/1998 | 12:51:29.76 | 4.192 | 7.642 |
| **224** | 45.661 | 18.348 | 1.769 | 34.499 | 13.27 | 2355802 | 2463778 | 5/15/1998 | 12:57:30.55 | 4.026 | 7.642 |
| **225** | 45.637 | 18.331 | 1.736 | 34.493 | 13.27 | 2380692 | 2463615 | 5/15/1998 | 13:03:31.34 | 4.197 | 7.642 |
| **226** | 45.625 | 18.312 | 1.721 | 34.498 | 13.269 | 2375283 | 2463711 | 5/15/1998 | 13:09:32.13 | 4.160 | 7.642 |
| **227** | 45.605 | 18.305 | 1.709 | 34.488 | 13.269 | 2332420 | 2464032 | 5/15/1998 | 13:15:32.92 | 3.866 | 7.643 |
| **228** | 45.6 | 18.283 | 1.718 | 34.502 | 13.27 | 2379168 | 2463435 | 5/15/1998 | 13:21:33.71 | 4.187 | 7.641 |
| **229** | 45.594 | 18.284 | 1.776 | 34.496 | 13.269 | 2373904 | 2463396 | 5/15/1998 | 13:27:34.50 | 4.151 | 7.641 |
| **230** | 45.587 | 18.272 | 1.733 | 34.499 | 13.27 | 2389117 | 2463288 | 5/15/1998 | 13:33:35.29 | 4.255 | 7.640 |
| **231** | 45.569 | 18.262 | 1.717 | 34.493 | 13.267 | 2336928 | 2464156 | 5/15/1998 | 13:39:36.08 | 3.897 | 7.644 |
| **232** | 45.566 | 18.251 | 1.704 | 34.5 | 13.267 | 2347445 | 2463202 | 5/15/1998 | 13:45:36.87 | 3.969 | 7.640 |
| **233** | 45.553 | 18.236 | 1.719 | 34.501 | 13.267 | 2364355 | 2463414 | 5/15/1998 | 13:51:37.66 | 4.085 | 7.641 |
| **234** | 45.55 | 18.233 | 1.674 | 34.501 | 13.267 | 2344025 | 2463584 | 5/15/1998 | 13:57:38.45 | 3.945 | 7.641 |
| **235** | 45.533 | 18.216 | 1.692 | 34.502 | 13.266 | 2362191 | 2463667 | 5/15/1998 | 14:03:39.24 | 4.070 | 7.642 |
| **236** | 45.53 | 18.213 | 1.646 | 34.502 | 13.267 | 2383481 | 2463735 | 5/15/1998 | 14:09:40.03 | 4.216 | 7.642 |
| **237** | 45.52 | 18.201 | 1.668 | 34.503 | 13.268 | 2376804 | 2463101 | 5/15/1998 | 14:15:40.82 | 4.170 | 7.639 |
| **238** | 45.509 | 18.185 | 1.649 | 34.507 | 13.266 | 2402584 | 2464023 | 5/15/1998 | 14:21:41.61 | 4.347 | 7.643 |
| **239** | 45.503 | 18.184 | 1.629 | 34.503 | 13.266 | 2353467 | 2463492 | 5/15/1998 | 14:27:42.40 | 4.010 | 7.641 |
| **240** | 45.489 | 18.172 | 1.598 | 34.501 | 13.264 | 2351016 | 2463020 | 5/15/1998 | 14:33:43.19 | 3.993 | 7.639 |
| **241** | 45.482 | 18.165 | 1.639 | 34.501 | 13.265 | 2384912 | 2463441 | 5/15/1998 | 14:39:43.98 | 4.226 | 7.641 |
| **242** | 45.473 | 18.152 | 1.611 | 34.504 | 13.263 | 2363394 | 2463111 | 5/15/1998 | 14:45:44.77 | 4.078 | 7.639 |
| **243** | 45.463 | 18.141 | 1.592 | 34.505 | 13.263 | 2365024 | 2463029 | 5/15/1998 | 14:51:45.56 | 4.090 | 7.639 |
| **244** | 45.453 | 18.136 | 1.555 | 34.501 | 13.262 | 2371528 | 2463597 | 5/15/1998 | 14:57:46.35 | 4.134 | 7.641 |
| **245** | 45.448 | 18.13 | 1.575 | 34.502 | 13.262 | 2352113 | 2463504 | 5/15/1998 | 15:03:47.14 | 4.001 | 7.641 |
| **246** | 45.448 | 18.128 | 1.579 | 34.503 | 13.261 | 2339784 | 2463469 | 5/15/1998 | 15:09:47.93 | 3.916 | 7.641 |
| **247** | 45.442 | 18.117 | 1.492 | 34.507 | 13.262 | 2379245 | 2463490 | 5/15/1998 | 15:15:48.72 | 4.187 | 7.641 |
| **248** | 45.432 | 18.104 | 1.527 | 34.51 | 13.261 | 2383217 | 2462880 | 5/15/1998 | 15:21:49.51 | 4.214 | 7.638 |
| **249** | 45.423 | 18.11 | 1.499 | 34.497 | 13.261 | 2360587 | 2463319 | 5/15/1998 | 15:27:50.30 | 4.059 | 7.640 |
| **250** | 45.42 | 18.094 | 1.449 | 34.508 | 13.26 | 2359980 | 2463330 | 5/15/1998 | 15:33:51.09 | 4.055 | 7.640 |
| **251** | 45.41 | 18.091 | 1.425 | 34.503 | 13.259 | 2363695 | 2463184 | 5/15/1998 | 15:39:51.88 | 4.080 | 7.640 |
| **252** | 45.406 | 18.079 | 1.45 | 34.509 | 13.261 | 2368615 | 2463361 | 5/15/1998 | 15:45:52.67 | 4.114 | 7.640 |
| **253** | 45.399 | 18.082 | 1.415 | 34.501 | 13.26 | 2380394 | 2463643 | 5/15/1998 | 15:51:53.46 | 4.195 | 7.642 |
| **254** | 45.388 | 18.077 | 1.458 | 34.496 | 13.259 | 2324128 | 2464041 | 5/15/1998 | 15:57:54.25 | 3.809 | 7.643 |
| **255** | 45.394 | 18.071 | 1.451 | 34.505 | 13.258 | 2357274 | 2464178 | 5/15/1998 | 16:03:55.04 | 4.036 | 7.644 |
| **256** | 45.391 | 18.068 | 1.4 | 34.505 | 13.258 | 2351656 | 2463736 | 5/15/1998 | 16:09:55.83 | 3.998 | 7.642 |
| **257** | 45.385 | 18.058 | 1.381 | 34.508 | 13.258 | 2381841 | 2463657 | 5/15/1998 | 16:15:56.62 | 4.205 | 7.642 |
| **258** | 45.389 | 18.054 | 1.4 | 34.516 | 13.258 | 2346587 | 2464198 | 5/15/1998 | 16:21:57.41 | 3.963 | 7.644 |
| **259** | 45.386 | 18.066 | 1.378 | 34.503 | 13.258 | 2354135 | 2463708 | 5/15/1998 | 16:27:58.20 | 4.015 | 7.642 |
| **260** | 45.397 | 18.068 | 1.328 | 34.51 | 13.258 | 2381200 | 2464481 | 5/15/1998 | 16:33:58.99 | 4.201 | 7.645 |
| **261** | 45.41 | 18.084 | 1.345 | 34.509 | 13.258 | 2395788 | 2463932 | 5/15/1998 | 16:39:59.78 | 4.301 | 7.643 |
| **262** | 45.414 | 18.094 | 1.361 | 34.503 | 13.258 | 2377841 | 2464211 | 5/15/1998 | 16:46:00.57 | 4.178 | 7.644 |
| **263** | 45.429 | 18.104 | 1.301 | 34.507 | 13.259 | 2358469 | 2463743 | 5/15/1998 | 16:52:01.36 | 4.045 | 7.642 |
| **264** | 45.443 | 18.12 | 1.315 | 34.505 | 13.257 | 2356930 | 2465759 | 5/15/1998 | 16:58:02.15 | 4.034 | 7.651 |
| **265** | 45.458 | 18.123 | 1.344 | 34.517 | 13.258 | 2361082 | 2463896 | 5/15/1998 | 17:04:02.94 | 4.063 | 7.643 |
| **266** | 45.468 | 18.141 | 1.31 | 34.51 | 13.258 | 2390020 | 2464435 | 5/15/1998 | 17:10:03.73 | 4.261 | 7.645 |
| **267** | 45.479 | 18.152 | 1.308 | 34.509 | 13.258 | 2348005 | 2464148 | 5/15/1998 | 17:16:04.52 | 3.973 | 7.644 |
| **268** | 45.492 | 18.161 | 1.319 | 34.513 | 13.256 | 2396793 | 2465141 | 5/15/1998 | 17:22:05.31 | 4.308 | 7.648 |
| **269** | 45.508 | 18.183 | 1.289 | 34.508 | 13.258 | 2381427 | 2465049 | 5/15/1998 | 17:28:06.10 | 4.202 | 7.648 |
| **270** | 45.521 | 18.196 | 1.339 | 34.508 | 13.257 | 2382892 | 2464671 | 5/15/1998 | 17:34:06.89 | 4.212 | 7.646 |
| **271** | 45.533 | 18.213 | 1.313 | 34.504 | 13.256 | 2397674 | 2465097 | 5/15/1998 | 17:40:07.68 | 4.314 | 7.648 |
| **272** | 45.553 | 18.23 | 1.337 | 34.507 | 13.258 | 2402697 | 2465238 | 5/15/1998 | 17:46:08.47 | 4.348 | 7.649 |
| **273** | 45.566 | 18.238 | 1.322 | 34.511 | 13.257 | 2353153 | 2465328 | 5/15/1998 | 17:52:09.26 | 4.008 | 7.649 |
| **274** | 45.582 | 18.257 | 1.294 | 34.509 | 13.257 | 2380839 | 2465578 | 5/15/1998 | 17:58:10.05 | 4.198 | 7.650 |
| **275** | 45.598 | 18.272 | 1.316 | 34.509 | 13.256 | 2394227 | 2465849 | 5/15/1998 | 18:04:10.84 | 4.290 | 7.651 |
| **276** | 45.603 | 18.283 | 1.355 | 34.505 | 13.258 | 2351650 | 2465497 | 5/15/1998 | 18:10:11.63 | 3.998 | 7.650 |
| **277** | 45.62 | 18.293 | 1.331 | 34.51 | 13.254 | 2369528 | 2465711 | 5/15/1998 | 18:16:12.42 | 4.121 | 7.651 |
| **278** | 45.626 | 18.304 | 1.353 | 34.506 | 13.258 | 2397359 | 2465550 | 5/15/1998 | 18:22:13.21 | 4.312 | 7.650 |
| **279** | 45.635 | 18.312 | 1.321 | 34.507 | 13.255 | 2371123 | 2466458 | 5/15/1998 | 18:28:14.00 | 4.131 | 7.654 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **280** | 45.651 | 18.321 | 1.353 | 34.513 | 13.255 | 2380264 | 2466741 | 5/15/1998 | 18:34:14.79 | 4.194 | 7.655 |
| **281** | 45.657 | 18.332 | 1.359 | 34.509 | 13.255 | 2387365 | 2466233 | 5/15/1998 | 18:40:15.58 | 4.243 | 7.653 |
| **282** | 45.656 | 18.336 | 1.383 | 34.505 | 13.253 | 2391766 | 2466929 | 5/15/1998 | 18:46:57.62 | 4.273 | 7.656 |
| **283** | 45.67 | 18.344 | 1.353 | 34.509 | 13.253 | 2392285 | 2466969 | 5/15/1998 | 18:52:58.41 | 4.277 | 7.656 |
| **284** | 45.669 | 18.346 | 1.37 | 34.507 | 13.256 | 2371420 | 2467163 | 5/15/1998 | 18:58:59.20 | 4.134 | 7.657 |
| **285** | 45.675 | 18.351 | 1.4 | 34.508 | 13.254 | 2364223 | 2467230 | 5/15/1998 | 19:04:59.99 | 4.084 | 7.657 |
| **286** | 45.675 | 18.346 | 1.415 | 34.513 | 13.251 | 2354463 | 2466804 | 5/15/1998 | 19:11:00.78 | 4.017 | 7.655 |
| **287** | 45.677 | 18.347 | 1.397 | 34.513 | 13.252 | 2345955 | 2466627 | 5/15/1998 | 19:17:01.57 | 3.959 | 7.655 |
| **288** | 45.684 | 18.358 | 1.384 | 34.51 | 13.254 | 2385862 | 2467170 | 5/15/1998 | 19:23:02.36 | 4.233 | 7.657 |
| **289** | 45.686 | 18.368 | 1.418 | 34.503 | 13.252 | 2359116 | 2466945 | 5/15/1998 | 19:29:03.15 | 4.049 | 7.656 |
| **290** | 45.698 | 18.365 | 1.445 | 34.516 | 13.251 | 2381054 | 2467458 | 5/15/1998 | 19:35:03.94 | 4.200 | 7.658 |
| **291** | 45.697 | 18.369 | 1.513 | 34.511 | 13.25 | 2375820 | 2467191 | 5/15/1998 | 19:41:04.73 | 4.164 | 7.657 |
| **292** | 45.698 | 18.374 | 1.507 | 34.508 | 13.25 | 2377280 | 2467003 | 5/15/1998 | 19:47:05.52 | 4.174 | 7.656 |
| **293** | 45.706 | 18.378 | 1.524 | 34.512 | 13.25 | 2391057 | 2467266 | 5/15/1998 | 19:53:06.31 | 4.268 | 7.657 |
| **294** | 45.703 | 18.376 | 1.579 | 34.511 | 13.249 | 2362852 | 2466873 | 5/15/1998 | 19:59:07.10 | 4.075 | 7.656 |
| **295** | 45.705 | 18.378 | 1.563 | 34.511 | 13.249 | 2381681 | 2467730 | 5/15/1998 | 20:05:07.89 | 4.204 | 7.659 |
| **296** | 45.708 | 18.376 | 1.559 | 34.515 | 13.249 | 2385570 | 2467100 | 5/15/1998 | 20:11:08.68 | 4.231 | 7.657 |
| **297** | 45.7 | 18.375 | 1.599 | 34.509 | 13.248 | 2337237 | 2467344 | 5/15/1998 | 20:17:09.47 | 3.899 | 7.658 |
| **298** | 45.703 | 18.376 | 1.558 | 34.51 | 13.249 | 2382983 | 2467469 | 5/15/1998 | 20:23:10.26 | 4.213 | 7.658 |
| **299** | 45.702 | 18.365 | 1.58 | 34.519 | 13.249 | 2374780 | 2467039 | 5/15/1998 | 20:29:11.05 | 4.157 | 7.656 |
| **300** | 45.697 | 18.371 | 1.627 | 34.51 | 13.248 | 2370041 | 2466759 | 5/15/1998 | 20:35:11.84 | 4.124 | 7.655 |
| **301** | 45.696 | 18.366 | 1.691 | 34.513 | 13.247 | 2323110 | 2467521 | 5/15/1998 | 20:41:12.63 | 3.802 | 7.658 |
| **302** | 45.688 | 18.359 | 1.734 | 34.512 | 13.246 | 2349356 | 2468039 | 5/15/1998 | 20:47:13.42 | 3.982 | 7.661 |
| **303** | 45.687 | 18.351 | 1.722 | 34.518 | 13.247 | 2382767 | 2467841 | 5/15/1998 | 20:53:14.21 | 4.211 | 7.660 |
| **304** | 45.676 | 18.349 | 1.759 | 34.511 | 13.244 | 2384210 | 2468098 | 5/15/1998 | 20:59:15.00 | 4.221 | 7.661 |
| **305** | 45.661 | 18.335 | 1.741 | 34.509 | 13.245 | 2388360 | 2466741 | 5/15/1998 | 21:05:15.79 | 4.250 | 7.655 |
| **306** | 45.637 | 18.31 | 1.756 | 34.51 | 13.243 | 2369829 | 2467429 | 5/15/1998 | 21:11:16.58 | 4.123 | 7.658 |
| **307** | 45.624 | 18.294 | 1.759 | 34.513 | 13.245 | 2372489 | 2467231 | 5/15/1998 | 21:17:17.37 | 4.141 | 7.657 |
| **308** | 45.616 | 18.28 | 1.732 | 34.518 | 13.244 | 2376284 | 2467547 | 5/15/1998 | 21:23:18.16 | 4.167 | 7.658 |
| **309** | 45.597 | 18.259 | 1.783 | 34.52 | 13.241 | 2370010 | 2467382 | 5/15/1998 | 21:29:18.95 | 4.124 | 7.658 |
| **310** | 45.572 | 18.235 | 1.846 | 34.519 | 13.242 | 2369035 | 2467334 | 5/15/1998 | 21:35:19.74 | 4.117 | 7.658 |
| **311** | 45.56 | 18.217 | 1.82 | 34.523 | 13.243 | 2359090 | 2466974 | 5/15/1998 | 21:41:20.53 | 4.049 | 7.656 |
| **312** | 45.54 | 18.213 | 1.892 | 34.51 | 13.24 | 2373006 | 2467145 | 5/15/1998 | 21:47:21.32 | 4.144 | 7.657 |
| **313** | 45.524 | 18.19 | 1.88 | 34.516 | 13.24 | 2384965 | 2468153 | 5/15/1998 | 21:53:22.11 | 4.226 | 7.661 |
| **314** | 45.51 | 18.184 | 1.891 | 34.508 | 13.24 | 2372198 | 2467057 | 5/15/1998 | 21:59:22.90 | 4.139 | 7.656 |
| **315** | 45.501 | 18.163 | 1.922 | 34.519 | 13.24 | 2367592 | 2467374 | 5/15/1998 | 22:05:23.69 | 4.107 | 7.658 |
| **316** | 45.49 | 18.151 | 1.893 | 34.519 | 13.24 | 2371961 | 2467695 | 5/15/1998 | 22:11:24.48 | 4.137 | 7.659 |
| **317** | 45.482 | 18.138 | 1.963 | 34.524 | 13.238 | 2337747 | 2467876 | 5/15/1998 | 22:17:25.27 | 3.902 | 7.660 |
| **318** | 45.469 | 18.124 | 1.91 | 34.525 | 13.239 | 2319494 | 2467315 | 5/15/1998 | 22:23:26.06 | 3.777 | 7.657 |
| **319** | 45.461 | 18.121 | 1.931 | 34.52 | 13.239 | 2375343 | 2467483 | 5/15/1998 | 22:29:26.85 | 4.160 | 7.658 |
| **320** | 45.448 | 18.107 | 1.918 | 34.52 | 13.237 | 2377429 | 2467054 | 5/15/1998 | 22:35:27.64 | 4.175 | 7.656 |
| **321** | 45.435 | 18.1 | 1.969 | 34.516 | 13.238 | 2376011 | 2467161 | 5/15/1998 | 22:41:28.43 | 4.165 | 7.657 |
| **322** | 45.429 | 18.088 | 1.956 | 34.52 | 13.237 | 2356935 | 2467112 | 5/15/1998 | 22:47:29.22 | 4.034 | 7.657 |
| **323** | 45.423 | 18.08 | 2.023 | 34.523 | 13.237 | 2367734 | 2467518 | 5/15/1998 | 22:53:30.01 | 4.108 | 7.658 |
| **324** | 45.418 | 18.073 | 1.985 | 34.524 | 13.237 | 2379972 | 2467754 | 5/15/1998 | 22:59:30.80 | 4.192 | 7.659 |
| **325** | 45.414 | 18.073 | 1.998 | 34.52 | 13.237 | 2345571 | 2467752 | 5/15/1998 | 23:05:31.59 | 3.956 | 7.659 |
| **326** | 45.407 | 18.061 | 1.987 | 34.525 | 13.235 | 2339841 | 2467434 | 5/15/1998 | 23:11:32.38 | 3.917 | 7.658 |
| **327** | 45.408 | 18.071 | 1.978 | 34.517 | 13.236 | 2359499 | 2467795 | 5/15/1998 | 23:17:33.17 | 4.052 | 7.660 |
| **328** | 45.401 | 18.057 | 1.996 | 34.524 | 13.233 | 2358925 | 2467783 | 5/15/1998 | 23:23:33.96 | 4.048 | 7.660 |
| **329** | 45.405 | 18.058 | 1.971 | 34.526 | 13.234 | 2395086 | 2468229 | 5/15/1998 | 23:29:34.75 | 4.296 | 7.661 |
| **330** | 45.401 | 18.05 | 2.04 | 34.529 | 13.235 | 2365691 | 2467615 | 5/15/1998 | 23:35:35.54 | 4.094 | 7.659 |
| **331** | 45.405 | 18.062 | 2.014 | 34.522 | 13.234 | 2355304 | 2467233 | 5/15/1998 | 23:41:36.33 | 4.023 | 7.657 |
| **332** | 45.407 | 18.053 | 1.99 | 34.532 | 13.233 | 2383424 | 2467011 | 5/15/1998 | 23:47:37.12 | 4.216 | 7.656 |
| **333** | 45.4 | 18.056 | 2.009 | 34.523 | 13.232 | 2383121 | 2467779 | 5/15/1998 | 23:53:37.91 | 4.214 | 7.659 |
| **334** | 45.395 | 18.052 | 2.015 | 34.523 | 13.233 | 2377891 | 2467329 | 5/15/1998 | 23:59:38.70 | 4.178 | 7.658 |
| **335** | 45.405 | 18.05 | 1.989 | 34.533 | 13.232 | 2395826 | 2467853 | 5/16/1998 | 00:05:39.49 | 4.301 | 7.660 |
| **336** | 45.406 | 18.057 | 1.969 | 34.527 | 13.231 | 2373496 | 2467524 | 5/16/1998 | 00:11:40.28 | 4.148 | 7.658 |
| **337** | 45.395 | 18.042 | 1.985 | 34.53 | 13.231 | 2346109 | 2467578 | 5/16/1998 | 00:17:41.07 | 3.960 | 7.659 |
| **338** | 45.394 | 18.049 | 1.988 | 34.524 | 13.23 | 2356741 | 2468195 | 5/16/1998 | 00:23:41.86 | 4.033 | 7.661 |
| **339** | 45.389 | 18.031 | 1.952 | 34.535 | 13.231 | 2372855 | 2467422 | 5/16/1998 | 00:29:42.65 | 4.143 | 7.658 |
| **340** | 45.39 | 18.033 | 1.957 | 34.533 | 13.228 | 2356792 | 2467648 | 5/16/1998 | 00:35:43.44 | 4.033 | 7.659 |
| **341** | 45.386 | 18.033 | 1.932 | 34.531 | 13.233 | 2359037 | 2467677 | 5/16/1998 | 00:41:44.23 | 4.049 | 7.659 |
| **342** | 45.378 | 18.029 | 1.926 | 34.527 | 13.229 | 2357632 | 2467844 | 5/16/1998 | 00:47:45.02 | 4.039 | 7.660 |
| **343** | 45.375 | 18.027 | 1.923 | 34.526 | 13.228 | 2363040 | 2467285 | 5/16/1998 | 00:53:45.81 | 4.076 | 7.657 |
| **344** | 45.371 | 18.024 | 1.915 | 34.526 | 13.227 | 2359224 | 2467800 | 5/16/1998 | 00:59:46.60 | 4.050 | 7.660 |
| **345** | 45.37 | 18.022 | 1.862 | 34.526 | 13.231 | 2355096 | 2467827 | 5/16/1998 | 01:05:47.39 | 4.021 | 7.660 |
| **346** | 45.36 | 18.015 | 1.816 | 34.523 | 13.229 | 2352383 | 2467772 | 5/16/1998 | 01:11:48.18 | 4.003 | 7.659 |
| **347** | 45.351 | 18.003 | 1.846 | 34.527 | 13.229 | 2340953 | 2467358 | 5/16/1998 | 01:17:48.97 | 3.924 | 7.658 |
| **348** | 45.345 | 18.002 | 1.81 | 34.522 | 13.229 | 2367112 | 2467796 | 5/16/1998 | 01:23:49.76 | 4.104 | 7.660 |
| **349** | 45.345 | 17.992 | 1.778 | 34.531 | 13.23 | 2358870 | 2467168 | 5/16/1998 | 01:29:50.55 | 4.047 | 7.657 |
| **350** | 45.337 | 17.989 | 1.78 | 34.526 | 13.229 | 2377140 | 2467209 | 5/16/1998 | 01:35:51.34 | 4.173 | 7.657 |
| **351** | 45.331 | 17.982 | 1.712 | 34.527 | 13.229 | 2375405 | 2467268 | 5/16/1998 | 01:41:52.13 | 4.161 | 7.657 |
| **352** | 45.332 | 17.976 | 1.71 | 34.533 | 13.227 | 2348207 | 2467943 | 5/16/1998 | 01:48:34.16 | 3.974 | 7.660 |
| **353** | 45.329 | 17.976 | 1.685 | 34.53 | 13.226 | 2374527 | 2467638 | 5/16/1998 | 01:54:34.95 | 4.155 | 7.659 |
| **354** | 45.33 | 17.98 | 1.633 | 34.528 | 13.227 | 2349078 | 2467880 | 5/16/1998 | 02:00:35.74 | 3.980 | 7.660 |
| **355** | 45.328 | 17.973 | 1.631 | 34.532 | 13.225 | 2366638 | 2467221 | 5/16/1998 | 02:06:36.53 | 4.101 | 7.657 |
| **356** | 45.327 | 17.978 | 1.579 | 34.527 | 13.225 | 2350933 | 2467135 | 5/16/1998 | 02:12:37.32 | 3.993 | 7.657 |
| **357** | 45.327 | 17.981 | 1.583 | 34.525 | 13.226 | 2350551 | 2468078 | 5/16/1998 | 02:18:38.11 | 3.990 | 7.661 |
| **358** | 45.328 | 17.975 | 1.532 | 34.53 | 13.224 | 2360349 | 2467595 | 5/16/1998 | 02:24:38.90 | 4.058 | 7.659 |
| **359** | 45.32 | 17.971 | 1.498 | 34.527 | 13.225 | 2377524 | 2467360 | 5/16/1998 | 02:30:39.69 | 4.175 | 7.658 |
| **360** | 45.327 | 17.971 | 1.476 | 34.532 | 13.224 | 2362956 | 2467649 | 5/16/1998 | 02:36:40.48 | 4.075 | 7.659 |
| **361** | 45.32 | 17.973 | 1.422 | 34.525 | 13.223 | 2389833 | 2467475 | 5/16/1998 | 02:42:41.27 | 4.260 | 7.658 |
| **362** | 45.323 | 17.976 | 1.398 | 34.526 | 13.224 | 2361460 | 2467332 | 5/16/1998 | 02:48:42.06 | 4.065 | 7.658 |
| **363** | 45.317 | 17.969 | 1.356 | 34.526 | 13.222 | 2354738 | 2467231 | 5/16/1998 | 02:54:42.85 | 4.019 | 7.657 |
| **364** | 45.325 | 17.969 | 1.28 | 34.533 | 13.222 | 2354665 | 2467091 | 5/16/1998 | 03:00:43.64 | 4.019 | 7.657 |
| **365** | 45.327 | 17.969 | 1.289 | 34.535 | 13.222 | 2408383 | 2467583 | 5/16/1998 | 03:06:44.43 | 4.387 | 7.659 |
| **366** | 45.327 | 17.974 | 1.278 | 34.53 | 13.221 | 2367075 | 2467466 | 5/16/1998 | 03:12:45.22 | 4.104 | 7.658 |
| **367** | 45.324 | 17.967 | 1.248 | 34.534 | 13.222 | 2330680 | 2467166 | 5/16/1998 | 03:18:46.01 | 3.854 | 7.657 |
| **368** | 45.325 | 17.974 | 1.178 | 34.529 | 13.22 | 2369441 | 2467372 | 5/16/1998 | 03:24:46.80 | 4.120 | 7.658 |
| **369** | 45.332 | 17.973 | 1.115 | 34.536 | 13.22 | 2334352 | 2467339 | 5/16/1998 | 03:30:47.59 | 3.879 | 7.658 |
| **370** | 45.335 | 17.987 | 1.101 | 34.526 | 13.222 | 2343750 | 2467793 | 5/16/1998 | 03:36:48.38 | 3.944 | 7.660 |
| **371** | 45.338 | 17.981 | 1.073 | 34.534 | 13.219 | 2338593 | 2467577 | 5/16/1998 | 03:42:49.17 | 3.908 | 7.659 |
| **372** | 45.339 | 17.98 | 1.038 | 34.535 | 13.22 | 2297495 | 2467468 | 5/16/1998 | 03:48:49.96 | 3.626 | 7.658 |
| **373** | 45.34 | 17.983 | 1.022 | 34.534 | 13.219 | 2362710 | 2467716 | 5/16/1998 | 03:54:50.75 | 4.074 | 7.659 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **374** | 45.345 | 17.988 | 0.97 | 34.534 | 13.218 | 2356859 | 2467618 | 5/16/1998 | 04:00:51.54 | 4.034 | 7.659 |
| **375** | 45.345 | 17.986 | 0.936 | 34.536 | 13.22 | 2344295 | 2467594 | 5/16/1998 | 04:06:52.33 | 3.947 | 7.659 |
| **376** | 45.342 | 17.987 | 0.902 | 34.533 | 13.219 | 2359049 | 2467549 | 5/16/1998 | 04:12:53.12 | 4.049 | 7.658 |
| **377** | 45.341 | 17.993 | 0.858 | 34.526 | 13.22 | 2362960 | 2467567 | 5/16/1998 | 04:18:53.91 | 4.075 | 7.659 |
| **378** | 45.344 | 17.987 | 0.827 | 34.535 | 13.22 | 2354292 | 2467652 | 5/16/1998 | 04:24:54.70 | 4.016 | 7.659 |
| **379** | 45.353 | 17.994 | 0.798 | 34.536 | 13.217 | 2346094 | 2467114 | 5/16/1998 | 04:30:55.49 | 3.960 | 7.657 |
| **380** | 45.356 | 18.003 | 0.769 | 34.531 | 13.22 | 2370973 | 2468124 | 5/16/1998 | 04:36:56.28 | 4.130 | 7.661 |
| **381** | 45.367 | 18.01 | 0.74 | 34.534 | 13.221 | 2357293 | 2467836 | 5/16/1998 | 04:42:57.07 | 4.037 | 7.660 |
| **382** | 45.38 | 18.032 | 0.708 | 34.526 | 13.221 | 2345507 | 2467879 | 5/16/1998 | 04:48:57.86 | 3.956 | 7.660 |
| **383** | 45.399 | 18.041 | 0.655 | 34.535 | 13.223 | 2333597 | 2468524 | 5/16/1998 | 04:54:58.65 | 3.874 | 7.663 |
| **384** | 45.421 | 18.071 | 0.663 | 34.528 | 13.223 | 2370228 | 2467806 | 5/16/1998 | 05:00:59.44 | 4.125 | 7.660 |
| **385** | 45.44 | 18.086 | 0.61 | 34.532 | 13.222 | 2391255 | 2467502 | 5/16/1998 | 05:07:00.23 | 4.270 | 7.658 |
| **386** | 45.461 | 18.107 | 0.572 | 34.532 | 13.221 | 2366862 | 2467934 | 5/16/1998 | 05:13:01.02 | 4.102 | 7.660 |
| **387** | 45.48 | 18.126 | 0.555 | 34.532 | 13.222 | 2367017 | 2467180 | 5/16/1998 | 05:19:01.81 | 4.103 | 7.657 |
| **388** | 45.493 | 18.149 | 0.556 | 34.524 | 13.22 | 2330259 | 2468073 | 5/16/1998 | 05:25:02.60 | 3.851 | 7.661 |
| **389** | 45.509 | 18.161 | 0.526 | 34.527 | 13.221 | 2377135 | 2467749 | 5/16/1998 | 05:31:03.39 | 4.173 | 7.659 |
| **390** | 45.527 | 18.177 | 0.489 | 34.529 | 13.219 | 2341738 | 2467318 | 5/16/1998 | 05:37:04.18 | 3.930 | 7.658 |
| **391** | 45.545 | 18.192 | 0.473 | 34.532 | 13.22 | 2375006 | 2467446 | 5/16/1998 | 05:43:04.97 | 4.158 | 7.658 |
| **392** | 45.566 | 18.213 | 0.444 | 34.533 | 13.222 | 2372313 | 2467936 | 5/16/1998 | 05:49:05.76 | 4.140 | 7.660 |
| **393** | 45.585 | 18.231 | 0.447 | 34.534 | 13.222 | 2328565 | 2467610 | 5/16/1998 | 05:55:06.55 | 3.839 | 7.659 |
| **394** | 45.592 | 18.243 | 0.433 | 34.529 | 13.227 | 2375820 | 2467135 | 5/16/1998 | 06:01:07.34 | 4.164 | 7.657 |
| **395** | 45.611 | 18.262 | 0.416 | 34.53 | 13.223 | 2358893 | 2467654 | 5/16/1998 | 06:07:08.13 | 4.048 | 7.659 |
| **396** | 45.623 | 18.277 | 0.377 | 34.527 | 13.225 | 2346040 | 2466958 | 5/16/1998 | 06:13:08.92 | 3.959 | 7.656 |
| **397** | 45.639 | 18.284 | 0.368 | 34.534 | 13.225 | 2372790 | 2466916 | 5/16/1998 | 06:19:09.71 | 4.143 | 7.656 |
| **398** | 45.652 | 18.305 | 0.371 | 34.527 | 13.223 | 2364436 | 2467155 | 5/16/1998 | 06:25:10.50 | 4.086 | 7.657 |
| **399** | 45.67 | 18.313 | 0.364 | 34.537 | 13.224 | 2377688 | 2466795 | 5/16/1998 | 06:31:11.29 | 4.177 | 7.655 |
| **400** | 45.679 | 18.333 | 0.365 | 34.527 | 13.222 | 2357551 | 2467141 | 5/16/1998 | 06:37:12.08 | 4.038 | 7.657 |
| **401** | 45.689 | 18.345 | 0.343 | 34.526 | 13.222 | 2339971 | 2466786 | 5/16/1998 | 06:43:12.87 | 3.918 | 7.655 |
| **402** | 45.704 | 18.364 | 0.319 | 34.522 | 13.223 | 2356143 | 2467253 | 5/16/1998 | 06:49:13.66 | 4.029 | 7.657 |
| **403** | 45.716 | 18.36 | 0.289 | 34.536 | 13.224 | 2358772 | 2466608 | 5/16/1998 | 06:55:14.45 | 4.047 | 7.654 |
| **404** | 45.728 | 18.376 | 0.292 | 34.532 | 13.223 | 2348538 | 2466863 | 5/16/1998 | 07:01:15.24 | 3.976 | 7.656 |
| **405** | 45.739 | 18.393 | 0.299 | 34.527 | 13.226 | 2360453 | 2466802 | 5/16/1998 | 07:07:16.03 | 4.058 | 7.655 |
| **406** | 45.747 | 18.4 | 0.29 | 34.528 | 13.221 | 2365582 | 2467431 | 5/16/1998 | 07:13:16.82 | 4.093 | 7.658 |
| **407** | 45.759 | 18.416 | 0.289 | 34.525 | 13.221 | 2349223 | 2466994 | 5/16/1998 | 07:19:17.61 | 3.981 | 7.656 |
| **408** | 45.767 | 18.42 | 0.308 | 34.528 | 13.222 | 2352634 | 2466620 | 5/16/1998 | 07:25:18.40 | 4.005 | 7.654 |
| **409** | 45.781 | 18.438 | 0.298 | 34.525 | 13.222 | 2383224 | 2466270 | 5/16/1998 | 07:31:19.19 | 4.215 | 7.653 |
| **410** | 45.796 | 18.451 | 0.342 | 34.527 | 13.22 | 2348780 | 2466878 | 5/16/1998 | 07:37:19.98 | 3.978 | 7.656 |
| **411** | 45.807 | 18.454 | 0.34 | 34.534 | 13.221 | 2345413 | 2466815 | 5/16/1998 | 07:43:20.77 | 3.955 | 7.655 |
| **412** | 45.812 | 18.472 | 0.322 | 34.522 | 13.222 | 2363050 | 2466966 | 5/16/1998 | 07:49:21.56 | 4.076 | 7.656 |
| **413** | 45.829 | 18.484 | 0.296 | 34.527 | 13.222 | 2391920 | 2466354 | 5/16/1998 | 07:55:22.35 | 4.274 | 7.653 |
| **414** | 45.838 | 18.491 | 0.306 | 34.528 | 13.221 | 2343056 | 2466144 | 5/16/1998 | 08:01:23.14 | 3.939 | 7.652 |
| **415** | 45.851 | 18.5 | 0.303 | 34.532 | 13.222 | 2362069 | 2466077 | 5/16/1998 | 08:07:23.93 | 4.069 | 7.652 |
| **416** | 45.863 | 18.52 | 0.354 | 34.525 | 13.221 | 2358005 | 2465813 | 5/16/1998 | 08:13:24.72 | 4.041 | 7.651 |
| **417** | 45.876 | 18.532 | 0.366 | 34.526 | 13.22 | 2346991 | 2466243 | 5/16/1998 | 08:19:25.51 | 3.966 | 7.653 |
| **418** | 45.888 | 18.54 | 0.367 | 34.529 | 13.22 | 2374849 | 2465587 | 5/16/1998 | 08:25:26.30 | 4.157 | 7.650 |
| **419** | 45.894 | 18.545 | 0.368 | 34.531 | 13.219 | 2367514 | 2465572 | 5/16/1998 | 08:31:27.09 | 4.107 | 7.650 |
| **420** | 45.905 | 18.556 | 0.433 | 34.53 | 13.22 | 2355595 | 2465302 | 5/16/1998 | 08:37:27.88 | 4.025 | 7.649 |
| **421** | 45.914 | 18.572 | 0.427 | 34.525 | 13.221 | 2362177 | 2465679 | 5/16/1998 | 08:43:28.67 | 4.070 | 7.650 |
| **422** | 45.916 | 18.572 | 0.407 | 34.527 | 13.219 | 2376817 | 2465779 | 5/16/1998 | 08:50:10.73 | 4.171 | 7.651 |
| **423** | 45.928 | 18.577 | 0.46 | 34.533 | 13.22 | 2370694 | 2465513 | 5/16/1998 | 08:56:11.52 | 4.129 | 7.650 |
| **424** | 45.93 | 18.588 | 0.433 | 34.524 | 13.218 | 2364710 | 2465486 | 5/16/1998 | 09:02:12.31 | 4.087 | 7.650 |
| **425** | 45.934 | 18.587 | 0.466 | 34.529 | 13.219 | 2370880 | 2465688 | 5/16/1998 | 09:08:13.10 | 4.130 | 7.650 |
| **426** | 45.946 | 18.603 | 0.49 | 34.526 | 13.22 | 2362163 | 2465688 | 5/16/1998 | 09:14:13.89 | 4.070 | 7.650 |
| **427** | 45.951 | 18.607 | 0.519 | 34.526 | 13.217 | 2377732 | 2465540 | 5/16/1998 | 09:20:14.68 | 4.177 | 7.650 |
| **428** | 45.954 | 18.613 | 0.542 | 34.524 | 13.218 | 2343442 | 2465321 | 5/16/1998 | 09:26:15.47 | 3.941 | 7.649 |
| **429** | 45.958 | 18.619 | 0.555 | 34.522 | 13.218 | 2364455 | 2465740 | 5/16/1998 | 09:32:16.26 | 4.086 | 7.651 |
| **430** | 45.957 | 18.615 | 0.571 | 34.525 | 13.217 | 2345549 | 2465131 | 5/16/1998 | 09:38:17.05 | 3.956 | 7.648 |
| **431** | 45.958 | 18.616 | 0.619 | 34.525 | 13.217 | 2364135 | 2465252 | 5/16/1998 | 09:44:17.84 | 4.084 | 7.649 |
| **432** | 45.965 | 18.624 | 0.645 | 34.524 | 13.217 | 2378187 | 2464878 | 5/16/1998 | 09:50:18.63 | 4.180 | 7.647 |
| **433** | 45.962 | 18.615 | 0.629 | 34.53 | 13.216 | 2367755 | 2465241 | 5/16/1998 | 09:56:19.42 | 4.108 | 7.649 |
| **434** | 45.968 | 18.626 | 0.661 | 34.525 | 13.217 | 2371058 | 2465142 | 5/16/1998 | 10:02:20.21 | 4.131 | 7.648 |
| **435** | 45.971 | 18.629 | 0.655 | 34.525 | 13.218 | 2374850 | 2464974 | 5/16/1998 | 10:08:21.00 | 4.157 | 7.647 |
| **436** | 45.974 | 18.636 | 0.683 | 34.522 | 13.215 | 2370542 | 2464716 | 5/16/1998 | 10:14:21.79 | 4.127 | 7.646 |
| **437** | 45.971 | 18.639 | 0.709 | 34.517 | 13.218 | 2337076 | 2464915 | 5/16/1998 | 10:20:22.58 | 3.898 | 7.647 |
| **438** | 45.977 | 18.64 | 0.746 | 34.521 | 13.219 | 2407642 | 2464544 | 5/16/1998 | 10:26:23.37 | 4.382 | 7.646 |
| **439** | 45.981 | 18.64 | 0.815 | 34.524 | 13.215 | 2364894 | 2464814 | 5/16/1998 | 10:32:24.16 | 4.089 | 7.647 |
| **440** | 45.988 | 18.641 | 0.789 | 34.529 | 13.214 | 2365434 | 2464745 | 5/16/1998 | 10:38:24.95 | 4.092 | 7.646 |
| **441** | 45.98 | 18.638 | 0.808 | 34.525 | 13.214 | 2363864 | 2464677 | 5/16/1998 | 10:44:25.74 | 4.082 | 7.646 |
| **442** | 45.981 | 18.646 | 0.812 | 34.52 | 13.215 | 2355393 | 2465537 | 5/16/1998 | 10:50:26.53 | 4.024 | 7.650 |
| **443** | 45.983 | 18.645 | 0.865 | 34.522 | 13.214 | 2369408 | 2464854 | 5/16/1998 | 10:56:27.32 | 4.120 | 7.647 |
| **444** | 45.975 | 18.636 | 0.852 | 34.522 | 13.214 | 2375164 | 2465230 | 5/16/1998 | 11:02:28.11 | 4.159 | 7.648 |
| **445** | 45.972 | 18.63 | 0.854 | 34.525 | 13.213 | 2419238 | 2464471 | 5/16/1998 | 11:08:28.90 | 4.462 | 7.645 |
| **446** | 45.961 | 18.621 | 0.885 | 34.523 | 13.212 | 2341615 | 2464577 | 5/16/1998 | 11:14:29.69 | 3.929 | 7.646 |
| **447** | 45.954 | 18.61 | 0.929 | 34.527 | 13.212 | 2371574 | 2464745 | 5/16/1998 | 11:20:30.48 | 4.135 | 7.646 |
| **448** | 45.939 | 18.6 | 0.976 | 34.522 | 13.212 | 2386174 | 2464794 | 5/16/1998 | 11:26:31.27 | 4.235 | 7.647 |
| **449** | 45.935 | 18.589 | 0.992 | 34.528 | 13.211 | 2372143 | 2464763 | 5/16/1998 | 11:32:32.06 | 4.138 | 7.646 |
| **450** | 45.924 | 18.581 | 1.002 | 34.525 | 13.211 | 2356895 | 2464913 | 5/16/1998 | 11:38:32.85 | 4.034 | 7.647 |
| **451** | 45.911 | 18.572 | 1.013 | 34.522 | 13.21 | 2405453 | 2464511 | 5/16/1998 | 11:44:33.64 | 4.367 | 7.645 |
| **452** | 45.902 | 18.56 | 1.028 | 34.525 | 13.211 | 2394661 | 2464205 | 5/16/1998 | 11:50:34.43 | 4.293 | 7.644 |
| **453** | 45.889 | 18.542 | 1.084 | 34.529 | 13.21 | 2388545 | 2464097 | 5/16/1998 | 11:56:35.22 | 4.251 | 7.644 |
| **454** | 45.874 | 18.531 | 1.063 | 34.525 | 13.21 | 2369847 | 2464778 | 5/16/1998 | 12:02:36.01 | 4.123 | 7.647 |
| **455** | 45.867 | 18.515 | 1.023 | 34.533 | 13.21 | 2346747 | 2463775 | 5/16/1998 | 12:08:36.80 | 3.964 | 7.642 |
| **456** | 45.853 | 18.515 | 1.107 | 34.521 | 13.209 | 2377117 | 2464732 | 5/16/1998 | 12:14:37.59 | 4.173 | 7.646 |
| **457** | 45.839 | 18.499 | 1.12 | 34.522 | 13.209 | 2345139 | 2463841 | 5/16/1998 | 12:20:38.38 | 3.953 | 7.642 |
| **458** | 45.825 | 18.474 | 1.143 | 34.532 | 13.208 | 2376179 | 2464477 | 5/16/1998 | 12:26:39.17 | 4.166 | 7.645 |
| **459** | 45.81 | 18.47 | 1.125 | 34.522 | 13.208 | 2373567 | 2464374 | 5/16/1998 | 12:32:39.96 | 4.148 | 7.645 |
| **460** | 45.816 | 18.465 | 1.129 | 34.532 | 13.206 | 2380481 | 2464950 | 5/16/1998 | 12:38:40.75 | 4.196 | 7.647 |
| **461** | 45.807 | 18.462 | 1.137 | 34.527 | 13.209 | 2327573 | 2464215 | 5/16/1998 | 12:44:41.54 | 3.833 | 7.644 |
| **462** | 45.797 | 18.451 | 1.158 | 34.527 | 13.207 | 2389970 | 2464029 | 5/16/1998 | 12:50:42.33 | 4.261 | 7.643 |
| **463** | 45.788 | 18.435 | 1.178 | 34.533 | 13.206 | 2379758 | 2464539 | 5/16/1998 | 12:56:43.12 | 4.191 | 7.645 |
| **464** | 45.787 | 18.438 | 1.186 | 34.529 | 13.207 | 2358934 | 2463697 | 5/16/1998 | 13:02:43.91 | 4.048 | 7.642 |
| **465** | 45.781 | 18.431 | 1.207 | 34.531 | 13.206 | 2353875 | 2464250 | 5/16/1998 | 13:08:44.70 | 4.013 | 7.644 |
| **466** | 45.767 | 18.424 | 1.188 | 34.525 | 13.206 | 2370977 | 2465039 | 5/16/1998 | 13:14:45.49 | 4.130 | 7.648 |
| **467** | 45.757 | 18.407 | 1.183 | 34.531 | 13.203 | 2362247 | 2465663 | 5/16/1998 | 13:20:46.28 | 4.071 | 7.650 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **468** | 45.75 | 18.398 | 1.229 | 34.532 | 13.204 | 2382850 | 2463941 | 5/16/1998 | 13:26:47.07 | 4.212 | 7.643 |
| **469** | 45.739 | 18.386 | 1.211 | 34.533 | 13.203 | 2354702 | 2465103 | 5/16/1998 | 13:32:47.86 | 4.019 | 7.648 |
| **470** | 45.734 | 18.389 | 1.215 | 34.526 | 13.203 | 2358478 | 2464088 | 5/16/1998 | 13:38:48.65 | 4.045 | 7.644 |
| **471** | 45.727 | 18.38 | 1.242 | 34.528 | 13.202 | 2373397 | 2464084 | 5/16/1998 | 13:44:49.44 | 4.147 | 7.644 |
| **472** | 45.719 | 18.367 | 1.233 | 34.532 | 13.199 | 2363116 | 2465939 | 5/16/1998 | 13:50:50.23 | 4.077 | 7.652 |
| **473** | 45.706 | 18.367 | 1.227 | 34.521 | 13.2 | 2378673 | 2464619 | 5/16/1998 | 13:56:51.02 | 4.183 | 7.646 |
| **474** | 45.703 | 18.343 | 1.21 | 34.538 | 13.199 | 2372531 | 2463910 | 5/16/1998 | 14:02:51.81 | 4.141 | 7.643 |
| **475** | 45.685 | 18.333 | 1.214 | 34.532 | 13.199 | 2370729 | 2464530 | 5/16/1998 | 14:08:52.60 | 4.129 | 7.645 |
| **476** | 45.681 | 18.316 | 1.202 | 34.543 | 13.198 | 2346686 | 2464976 | 5/16/1998 | 14:14:53.39 | 3.964 | 7.647 |
| **477** | 45.662 | 18.308 | 1.228 | 34.533 | 13.2 | 2341954 | 2464430 | 5/16/1998 | 14:20:54.18 | 3.931 | 7.645 |
| **478** | 45.657 | 18.311 | 1.209 | 34.527 | 13.201 | 2357701 | 2464421 | 5/16/1998 | 14:26:54.97 | 4.039 | 7.645 |
| **479** | 45.653 | 18.302 | 1.209 | 34.531 | 13.199 | 2335402 | 2464029 | 5/16/1998 | 14:32:55.76 | 3.886 | 7.643 |
| **480** | 45.639 | 18.283 | 1.193 | 34.535 | 13.198 | 2363415 | 2465040 | 5/16/1998 | 14:38:56.55 | 4.079 | 7.648 |
| **481** | 45.632 | 18.282 | 1.196 | 34.53 | 13.199 | 2367654 | 2464068 | 5/16/1998 | 14:44:57.34 | 4.108 | 7.643 |
| **482** | 45.625 | 18.273 | 1.198 | 34.531 | 13.199 | 2361687 | 2463712 | 5/16/1998 | 14:50:58.13 | 4.067 | 7.642 |
| **483** | 45.616 | 18.262 | 1.192 | 34.534 | 13.199 | 2332234 | 2464235 | 5/16/1998 | 14:56:58.92 | 3.865 | 7.644 |
| **484** | 45.606 | 18.253 | 1.151 | 34.532 | 13.197 | 2387899 | 2464733 | 5/16/1998 | 15:02:59.71 | 4.247 | 7.646 |
| **485** | 45.599 | 18.241 | 1.165 | 34.536 | 13.198 | 2358923 | 2463690 | 5/16/1998 | 15:09:00.50 | 4.048 | 7.642 |
| **486** | 45.595 | 18.238 | 1.168 | 34.536 | 13.2 | 2388218 | 2464004 | 5/16/1998 | 15:15:01.29 | 4.249 | 7.643 |
| **487** | 45.583 | 18.223 | 1.159 | 34.538 | 13.197 | 2380298 | 2464683 | 5/16/1998 | 15:21:02.08 | 4.194 | 7.646 |
| **488** | 45.571 | 18.22 | 1.115 | 34.531 | 13.197 | 2386229 | 2464287 | 5/16/1998 | 15:27:02.87 | 4.235 | 7.644 |
| **489** | 45.566 | 18.203 | 1.143 | 34.541 | 13.197 | 2326244 | 2464329 | 5/16/1998 | 15:33:03.66 | 3.823 | 7.645 |
| **490** | 45.556 | 18.196 | 1.157 | 34.538 | 13.198 | 2391305 | 2464642 | 5/16/1998 | 15:39:04.45 | 4.270 | 7.646 |
| **491** | 45.552 | 18.193 | 1.087 | 34.537 | 13.196 | 2367932 | 2464694 | 5/16/1998 | 15:45:05.24 | 4.110 | 7.646 |
| **492** | 45.533 | 18.176 | 1.061 | 34.535 | 13.194 | 2364999 | 2464541 | 5/16/1998 | 15:51:47.30 | 4.089 | 7.646 |
| **493** | 45.526 | 18.17 | 1.072 | 34.534 | 13.195 | 2375858 | 2464794 | 5/16/1998 | 15:57:48.09 | 4.164 | 7.647 |
| **494** | 45.516 | 18.152 | 1.027 | 34.541 | 13.194 | 2348960 | 2464449 | 5/16/1998 | 16:03:48.88 | 3.979 | 7.645 |
| **495** | 45.504 | 18.147 | 1.062 | 34.535 | 13.194 | 2352109 | 2464971 | 5/16/1998 | 16:09:49.67 | 4.001 | 7.647 |
| **496** | 45.498 | 18.136 | 1.032 | 34.539 | 13.195 | 2352347 | 2464998 | 5/16/1998 | 16:15:50.46 | 4.003 | 7.647 |
| **497** | 45.493 | 18.136 | 1.005 | 34.535 | 13.194 | 2339196 | 2464992 | 5/16/1998 | 16:21:51.25 | 3.912 | 7.647 |
| **498** | 45.487 | 18.126 | 1.015 | 34.538 | 13.196 | 2361574 | 2464142 | 5/16/1998 | 16:27:52.04 | 4.066 | 7.644 |
| **499** | 45.482 | 18.12 | 1.022 | 34.539 | 13.193 | 2360144 | 2464436 | 5/16/1998 | 16:33:52.83 | 4.056 | 7.645 |
| **500** | 45.474 | 18.108 | 0.967 | 34.543 | 13.194 | 2337115 | 2464595 | 5/16/1998 | 16:39:53.62 | 3.898 | 7.646 |
| **501** | 45.463 | 18.091 | 0.964 | 34.547 | 13.193 | 2351100 | 2464490 | 5/16/1998 | 16:45:54.41 | 3.994 | 7.645 |
| **502** | 45.451 | 18.088 | 0.933 | 34.54 | 13.193 | 2383584 | 2464778 | 5/16/1998 | 16:51:55.20 | 4.217 | 7.647 |
| **503** | 45.446 | 18.074 | 0.921 | 34.547 | 13.192 | 2361530 | 2465183 | 5/16/1998 | 16:57:55.99 | 4.066 | 7.648 |
| **504** | 45.441 | 18.07 | 0.908 | 34.546 | 13.193 | 2391573 | 2464763 | 5/16/1998 | 17:03:56.78 | 4.272 | 7.646 |
| **505** | 45.448 | 18.085 | 0.943 | 34.54 | 13.193 | 2375491 | 2464601 | 5/16/1998 | 17:09:57.57 | 4.161 | 7.646 |
| **506** | 45.45 | 18.089 | 0.905 | 34.538 | 13.194 | 2389529 | 2464738 | 5/16/1998 | 17:15:58.36 | 4.258 | 7.646 |
| **507** | 45.46 | 18.097 | 0.91 | 34.54 | 13.192 | 2340969 | 2464962 | 5/16/1998 | 17:21:59.15 | 3.925 | 7.647 |
| **508** | 45.477 | 18.117 | 0.909 | 34.537 | 13.192 | 2342003 | 2464992 | 5/16/1998 | 17:27:59.94 | 3.932 | 7.647 |
| **509** | 45.488 | 18.132 | 0.888 | 34.534 | 13.192 | 2372901 | 2465404 | 5/16/1998 | 17:34:00.73 | 4.144 | 7.649 |
| **510** | 45.502 | 18.134 | 0.892 | 34.544 | 13.191 | 2374499 | 2465829 | 5/16/1998 | 17:40:01.52 | 4.155 | 7.651 |
| **511** | 45.518 | 18.157 | 0.904 | 34.539 | 13.188 | 2332155 | 2466200 | 5/16/1998 | 17:46:02.31 | 3.864 | 7.653 |
| **512** | 45.53 | 18.167 | 0.847 | 34.541 | 13.19 | 2345892 | 2465381 | 5/16/1998 | 17:52:03.10 | 3.958 | 7.649 |
| **513** | 45.553 | 18.186 | 0.888 | 34.543 | 13.19 | 2378091 | 2465739 | 5/16/1998 | 17:58:03.89 | 4.179 | 7.651 |
| **514** | 45.57 | 18.205 | 0.86 | 34.542 | 13.188 | 2367452 | 2465820 | 5/16/1998 | 18:04:04.68 | 4.106 | 7.651 |
| **515** | 45.591 | 18.23 | 0.865 | 34.539 | 13.188 | 2339761 | 2465898 | 5/16/1998 | 18:10:05.47 | 3.916 | 7.651 |
| **516** | 45.611 | 18.242 | 0.853 | 34.546 | 13.191 | 2346266 | 2466400 | 5/16/1998 | 18:16:06.26 | 3.961 | 7.654 |
| **517** | 45.623 | 18.261 | 0.871 | 34.54 | 13.188 | 2364061 | 2466960 | 5/16/1998 | 18:22:07.05 | 4.083 | 7.656 |
| **518** | 45.637 | 18.28 | 0.857 | 34.535 | 13.186 | 2372822 | 2466124 | 5/16/1998 | 18:28:07.84 | 4.143 | 7.652 |
| **519** | 45.656 | 18.293 | 0.844 | 34.542 | 13.187 | 2365685 | 2466685 | 5/16/1998 | 18:34:08.63 | 4.094 | 7.655 |
| **520** | 45.67 | 18.305 | 0.878 | 34.543 | 13.187 | 2353791 | 2466438 | 5/16/1998 | 18:40:09.42 | 4.013 | 7.654 |
| **521** | 45.668 | 18.312 | 0.839 | 34.536 | 13.184 | 2386575 | 2466954 | 5/16/1998 | 18:46:10.21 | 4.238 | 7.656 |
| **522** | 45.683 | 18.322 | 0.833 | 34.54 | 13.186 | 2354987 | 2466560 | 5/16/1998 | 18:52:11.00 | 4.021 | 7.654 |
| **523** | 45.692 | 18.325 | 0.869 | 34.544 | 13.187 | 2354107 | 2466625 | 5/16/1998 | 18:58:11.79 | 4.015 | 7.655 |
| **524** | 45.696 | 18.336 | 0.908 | 34.538 | 13.189 | 2341134 | 2466451 | 5/16/1998 | 19:04:12.58 | 3.926 | 7.654 |
| **525** | 45.694 | 18.335 | 0.875 | 34.538 | 13.187 | 2368882 | 2466764 | 5/16/1998 | 19:10:13.37 | 4.116 | 7.655 |
| **526** | 45.697 | 18.333 | 0.924 | 34.542 | 13.186 | 2347339 | 2466919 | 5/16/1998 | 19:16:14.16 | 3.968 | 7.656 |
| **527** | 45.693 | 18.337 | 0.87 | 34.535 | 13.186 | 2378758 | 2467027 | 5/16/1998 | 19:22:14.95 | 4.184 | 7.656 |
| **528** | 45.697 | 18.335 | 0.918 | 34.54 | 13.184 | 2362681 | 2467232 | 5/16/1998 | 19:28:15.74 | 4.074 | 7.657 |
| **529** | 45.694 | 18.331 | 0.886 | 34.542 | 13.187 | 2366986 | 2466913 | 5/16/1998 | 19:34:16.53 | 4.103 | 7.656 |
| **530** | 45.691 | 18.324 | 0.89 | 34.545 | 13.185 | 2360421 | 2468338 | 5/16/1998 | 19:40:17.32 | 4.058 | 7.662 |
| **531** | 45.687 | 18.325 | 0.894 | 34.541 | 13.183 | 2379600 | 2468490 | 5/16/1998 | 19:46:18.11 | 4.190 | 7.663 |
| **532** | 45.693 | 18.32 | 0.901 | 34.549 | 13.183 | 2359686 | 2468207 | 5/16/1998 | 19:52:18.90 | 4.053 | 7.661 |
| **533** | 45.689 | 18.33 | 0.941 | 34.537 | 13.185 | 2397885 | 2467017 | 5/16/1998 | 19:58:19.69 | 4.315 | 7.656 |
| **534** | 45.685 | 18.319 | 0.949 | 34.544 | 13.187 | 2350642 | 2466877 | 5/16/1998 | 20:04:20.48 | 3.991 | 7.656 |
| **535** | 45.679 | 18.317 | 0.969 | 34.54 | 13.184 | 2378571 | 2466798 | 5/16/1998 | 20:10:21.27 | 4.183 | 7.655 |
| **536** | 45.684 | 18.317 | 0.933 | 34.545 | 13.183 | 2346928 | 2468411 | 5/16/1998 | 20:16:22.06 | 3.965 | 7.662 |
| **537** | 45.682 | 18.314 | 0.962 | 34.545 | 13.185 | 2334539 | 2467785 | 5/16/1998 | 20:22:22.85 | 3.880 | 7.660 |
| **538** | 45.682 | 18.318 | 0.998 | 34.542 | 13.184 | 2339871 | 2467012 | 5/16/1998 | 20:28:23.64 | 3.917 | 7.656 |
| **539** | 45.68 | 18.317 | 0.961 | 34.542 | 13.185 | 2362783 | 2466783 | 5/16/1998 | 20:34:24.43 | 4.074 | 7.655 |
| **540** | 45.683 | 18.318 | 0.974 | 34.543 | 13.184 | 2383029 | 2467048 | 5/16/1998 | 20:40:25.22 | 4.213 | 7.656 |
| **541** | 45.681 | 18.318 | 1.006 | 34.541 | 13.182 | 2363565 | 2468321 | 5/16/1998 | 20:46:26.01 | 4.080 | 7.662 |
| **542** | 45.684 | 18.316 | 1.053 | 34.546 | 13.185 | 2369824 | 2467478 | 5/16/1998 | 20:52:26.80 | 4.123 | 7.658 |
| **543** | 45.67 | 18.308 | 1.047 | 34.541 | 13.182 | 2368282 | 2469173 | 5/16/1998 | 20:58:27.59 | 4.112 | 7.666 |
| **544** | 45.666 | 18.299 | 1.073 | 34.545 | 13.183 | 2326759 | 2467904 | 5/16/1998 | 21:04:28.38 | 3.827 | 7.660 |
| **545** | 45.66 | 18.295 | 1.068 | 34.543 | 13.182 | 2342929 | 2467685 | 5/16/1998 | 21:10:29.17 | 3.938 | 7.659 |
| **546** | 45.658 | 18.304 | 1.076 | 34.534 | 13.179 | 2361774 | 2467671 | 5/16/1998 | 21:16:29.96 | 4.067 | 7.659 |
| **547** | 45.653 | 18.286 | 1.12 | 34.544 | 13.181 | 2353908 | 2467763 | 5/16/1998 | 21:22:30.75 | 4.013 | 7.659 |
| **548** | 45.648 | 18.276 | 1.125 | 34.548 | 13.179 | 2337217 | 2467807 | 5/16/1998 | 21:28:31.54 | 3.899 | 7.660 |
| **549** | 45.639 | 18.264 | 1.127 | 34.551 | 13.179 | 2371271 | 2467590 | 5/16/1998 | 21:34:32.33 | 4.132 | 7.659 |
| **550** | 45.632 | 18.262 | 1.117 | 34.547 | 13.178 | 2367347 | 2467603 | 5/16/1998 | 21:40:33.12 | 4.106 | 7.659 |
| **551** | 45.617 | 18.25 | 1.157 | 34.544 | 13.178 | 2352441 | 2467076 | 5/16/1998 | 21:46:33.91 | 4.003 | 7.656 |
| **552** | 45.606 | 18.237 | 1.171 | 34.546 | 13.178 | 2354748 | 2467900 | 5/16/1998 | 21:52:34.70 | 4.019 | 7.660 |
| **553** | 45.592 | 18.224 | 1.195 | 34.545 | 13.178 | 2368829 | 2467686 | 5/16/1998 | 21:58:35.49 | 4.116 | 7.659 |
| **554** | 45.584 | 18.214 | 1.189 | 34.547 | 13.176 | 2384793 | 2467288 | 5/16/1998 | 22:04:36.28 | 4.225 | 7.657 |
| **555** | 45.563 | 18.198 | 1.21 | 34.543 | 13.176 | 2348787 | 2467643 | 5/16/1998 | 22:10:37.07 | 3.978 | 7.659 |
| **556** | 45.556 | 18.184 | 1.212 | 34.548 | 13.178 | 2345808 | 2467217 | 5/16/1998 | 22:16:37.86 | 3.958 | 7.657 |
| **557** | 45.532 | 18.165 | 1.227 | 34.544 | 13.176 | 2363619 | 2467489 | 5/16/1998 | 22:22:38.65 | 4.080 | 7.658 |
| **558** | 45.513 | 18.143 | 1.246 | 34.546 | 13.176 | 2359755 | 2467180 | 5/16/1998 | 22:28:39.44 | 4.053 | 7.657 |
| **559** | 45.491 | 18.108 | 1.232 | 34.557 | 13.175 | 2343311 | 2468087 | 5/16/1998 | 22:34:40.23 | 3.941 | 7.661 |
| **560** | 45.483 | 18.103 | 1.226 | 34.554 | 13.174 | 2342689 | 2467742 | 5/16/1998 | 22:40:41.02 | 3.936 | 7.659 |
| **561** | 45.467 | 18.098 | 1.279 | 34.546 | 13.171 | 2364423 | 2467491 | 5/16/1998 | 22:46:41.81 | 4.085 | 7.658 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **562** | 45.444 | 18.073 | 1.286 | 34.547 | 13.173 | 2365753 | 2467437 | 5/16/1998 | 22:53:23.87 | 4.095 | 7.658 |
| **563** | 45.422 | 18.039 | 1.301 | 34.557 | 13.171 | 2370680 | 2468064 | 5/16/1998 | 22:59:24.66 | 4.128 | 7.661 |
| **564** | 45.41 | 18.037 | 1.281 | 34.548 | 13.171 | 2372768 | 2467330 | 5/16/1998 | 23:05:25.45 | 4.143 | 7.658 |
| **565** | 45.397 | 18.017 | 1.311 | 34.553 | 13.171 | 2338758 | 2467691 | 5/16/1998 | 23:11:26.24 | 3.909 | 7.659 |
| **566** | 45.388 | 18.008 | 1.332 | 34.554 | 13.173 | 2347926 | 2467937 | 5/16/1998 | 23:17:27.03 | 3.972 | 7.660 |
| **567** | 45.38 | 17.998 | 1.349 | 34.555 | 13.172 | 2348759 | 2467185 | 5/16/1998 | 23:23:27.82 | 3.978 | 7.657 |
| **568** | 45.364 | 17.977 | 1.334 | 34.56 | 13.169 | 2365185 | 2467211 | 5/16/1998 | 23:29:28.61 | 4.091 | 7.657 |
| **569** | 45.358 | 17.972 | 1.278 | 34.558 | 13.171 | 2351984 | 2467960 | 5/16/1998 | 23:35:29.40 | 4.000 | 7.660 |
| **570** | 45.352 | 17.962 | 1.343 | 34.562 | 13.172 | 2337874 | 2467387 | 5/16/1998 | 23:41:30.19 | 3.903 | 7.658 |
| **571** | 45.34 | 17.954 | 1.382 | 34.559 | 13.17 | 2321696 | 2467304 | 5/16/1998 | 23:47:30.98 | 3.792 | 7.657 |
| **572** | 45.322 | 17.941 | 1.399 | 34.554 | 13.169 | 2358306 | 2467359 | 5/16/1998 | 23:53:31.77 | 4.044 | 7.658 |
| **573** | 45.319 | 17.939 | 1.339 | 34.554 | 13.17 | 2337583 | 2467462 | 5/16/1998 | 23:59:32.56 | 3.901 | 7.658 |
| **574** | 45.318 | 17.929 | 1.312 | 34.561 | 13.169 | 2365470 | 2467248 | 5/17/1998 | 00:05:33.35 | 4.093 | 7.657 |
| **575** | 45.312 | 17.925 | 1.315 | 34.559 | 13.167 | 2349387 | 2467050 | 5/17/1998 | 00:11:34.14 | 3.982 | 7.656 |
| **576** | 45.311 | 17.916 | 1.402 | 34.565 | 13.168 | 2353205 | 2467416 | 5/17/1998 | 00:17:34.93 | 4.008 | 7.658 |
| **577** | 45.301 | 17.92 | 1.411 | 34.554 | 13.166 | 2337473 | 2467619 | 5/17/1998 | 00:23:35.72 | 3.901 | 7.659 |
| **578** | 45.3 | 17.914 | 1.351 | 34.559 | 13.169 | 2358633 | 2467290 | 5/17/1998 | 00:29:36.51 | 4.046 | 7.657 |
| **579** | 45.306 | 17.919 | 1.343 | 34.559 | 13.167 | 2341838 | 2467741 | 5/17/1998 | 00:35:37.30 | 3.930 | 7.659 |
| **580** | 45.303 | 17.921 | 1.378 | 34.555 | 13.168 | 2335597 | 2467766 | 5/17/1998 | 00:41:38.09 | 3.888 | 7.659 |
| **581** | 45.306 | 17.914 | 1.395 | 34.564 | 13.168 | 2352442 | 2467056 | 5/17/1998 | 00:47:38.88 | 4.003 | 7.656 |
| **582** | 45.298 | 17.92 | 1.357 | 34.551 | 13.167 | 2339605 | 2467423 | 5/17/1998 | 00:53:39.67 | 3.915 | 7.658 |
| **583** | 45.304 | 17.916 | 1.302 | 34.56 | 13.172 | 2325629 | 2468335 | 5/17/1998 | 00:59:40.46 | 3.819 | 7.662 |
| **584** | 45.292 | 17.908 | 1.339 | 34.556 | 13.171 | 2375801 | 2467323 | 5/17/1998 | 01:05:41.25 | 4.164 | 7.658 |
| **585** | 45.291 | 17.901 | 1.371 | 34.561 | 13.171 | 2393714 | 2467936 | 5/17/1998 | 01:11:42.04 | 4.287 | 7.660 |
| **586** | 45.286 | 17.897 | 1.386 | 34.56 | 13.17 | 2344911 | 2467390 | 5/17/1998 | 01:17:42.83 | 3.952 | 7.658 |
| **587** | 45.277 | 17.892 | 1.328 | 34.557 | 13.171 | 2340091 | 2467983 | 5/17/1998 | 01:23:43.62 | 3.918 | 7.660 |
| **588** | 45.27 | 17.888 | 1.298 | 34.555 | 13.171 | 2324607 | 2467197 | 5/17/1998 | 01:29:44.41 | 3.812 | 7.657 |
| **589** | 45.256 | 17.871 | 1.286 | 34.557 | 13.17 | 2354488 | 2467486 | 5/17/1998 | 01:35:45.20 | 4.017 | 7.658 |
| **590** | 45.255 | 17.86 | 1.32 | 34.565 | 13.171 | 2334609 | 2466970 | 5/17/1998 | 01:41:45.99 | 3.881 | 7.656 |
| **591** | 45.249 | 17.855 | 1.255 | 34.564 | 13.168 | 2341522 | 2467301 | 5/17/1998 | 01:47:46.78 | 3.928 | 7.657 |
| **592** | 45.239 | 17.851 | 1.241 | 34.559 | 13.169 | 2357362 | 2467528 | 5/17/1998 | 01:53:47.57 | 4.037 | 7.658 |
| **593** | 45.233 | 17.838 | 1.227 | 34.565 | 13.168 | 2354461 | 2466798 | 5/17/1998 | 01:59:48.36 | 4.017 | 7.655 |
| **594** | 45.227 | 17.836 | 1.251 | 34.562 | 13.169 | 2346498 | 2466464 | 5/17/1998 | 02:05:49.15 | 3.962 | 7.654 |
| **595** | 45.223 | 17.818 | 1.228 | 34.574 | 13.169 | 2329462 | 2467108 | 5/17/1998 | 02:11:49.94 | 3.846 | 7.657 |
| **596** | 45.219 | 17.818 | 1.168 | 34.57 | 13.169 | 2303440 | 2467571 | 5/17/1998 | 02:17:50.73 | 3.667 | 7.659 |
| **597** | 45.215 | 17.818 | 1.099 | 34.567 | 13.168 | 2348828 | 2467607 | 5/17/1998 | 02:23:51.52 | 3.978 | 7.659 |
| **598** | 45.211 | 17.813 | 1.124 | 34.567 | 13.167 | 2315842 | 2467344 | 5/17/1998 | 02:29:52.31 | 3.752 | 7.658 |
| **599** | 45.207 | 17.811 | 1.113 | 34.566 | 13.168 | 2359304 | 2466972 | 5/17/1998 | 02:35:53.10 | 4.050 | 7.656 |
| **600** | 45.204 | 17.807 | 1.139 | 34.567 | 13.168 | 2341558 | 2467290 | 5/17/1998 | 02:41:53.89 | 3.929 | 7.657 |
| **601** | 45.197 | 17.797 | 1.066 | 34.569 | 13.166 | 2339620 | 2467203 | 5/17/1998 | 02:47:54.68 | 3.915 | 7.657 |
| **602** | 45.194 | 17.789 | 1.033 | 34.574 | 13.166 | 2336496 | 2467142 | 5/17/1998 | 02:53:55.47 | 3.894 | 7.657 |
| **603** | 45.197 | 17.805 | 1.031 | 34.562 | 13.167 | 2329092 | 2467169 | 5/17/1998 | 02:59:56.26 | 3.843 | 7.657 |
| **604** | 45.199 | 17.806 | 1.029 | 34.563 | 13.165 | 2345839 | 2466527 | 5/17/1998 | 03:05:57.05 | 3.958 | 7.654 |
| **605** | 45.202 | 17.804 | 0.98 | 34.568 | 13.166 | 2343813 | 2467411 | 5/17/1998 | 03:11:57.84 | 3.944 | 7.658 |
| **606** | 45.197 | 17.798 | 0.872 | 34.569 | 13.165 | 2330224 | 2467036 | 5/17/1998 | 03:17:58.63 | 3.851 | 7.656 |
| **607** | 45.2 | 17.804 | 0.878 | 34.567 | 13.164 | 2355436 | 2467817 | 5/17/1998 | 03:23:59.42 | 4.024 | 7.660 |
| **608** | 45.197 | 17.791 | 0.884 | 34.574 | 13.165 | 2361804 | 2467743 | 5/17/1998 | 03:30:00.21 | 4.068 | 7.659 |
| **609** | 45.202 | 17.813 | 0.897 | 34.56 | 13.165 | 2365687 | 2467669 | 5/17/1998 | 03:36:01.00 | 4.094 | 7.659 |
| **610** | 45.205 | 17.797 | 0.794 | 34.576 | 13.166 | 2321636 | 2467781 | 5/17/1998 | 03:42:01.79 | 3.792 | 7.660 |
| **611** | 45.209 | 17.807 | 0.795 | 34.571 | 13.165 | 2325346 | 2467497 | 5/17/1998 | 03:48:02.58 | 3.817 | 7.658 |
| **612** | 45.208 | 17.809 | 0.752 | 34.569 | 13.164 | 2359005 | 2467658 | 5/17/1998 | 03:54:03.37 | 4.048 | 7.659 |
| **613** | 45.216 | 17.817 | 0.768 | 34.569 | 13.164 | 2343460 | 2466552 | 5/17/1998 | 04:00:04.16 | 3.942 | 7.654 |
| **614** | 45.227 | 17.827 | 0.71 | 34.57 | 13.163 | 2353426 | 2467467 | 5/17/1998 | 04:06:04.95 | 4.010 | 7.658 |
| **615** | 45.235 | 17.836 | 0.678 | 34.569 | 13.164 | 2354205 | 2467116 | 5/17/1998 | 04:12:05.74 | 4.015 | 7.657 |
| **616** | 45.238 | 17.832 | 0.63 | 34.574 | 13.164 | 2310477 | 2467348 | 5/17/1998 | 04:18:06.53 | 3.715 | 7.658 |
| **617** | 45.25 | 17.858 | 0.668 | 34.563 | 13.164 | 2357586 | 2467347 | 5/17/1998 | 04:24:07.32 | 4.039 | 7.658 |
| **618** | 45.256 | 17.863 | 0.643 | 34.564 | 13.163 | 2326316 | 2467019 | 5/17/1998 | 04:30:08.11 | 3.824 | 7.656 |
| **619** | 45.276 | 17.877 | 0.591 | 34.569 | 13.164 | 2348954 | 2467217 | 5/17/1998 | 04:36:08.90 | 3.979 | 7.657 |
| **620** | 45.286 | 17.89 | 0.51 | 34.567 | 13.164 | 2359153 | 2466636 | 5/17/1998 | 04:42:09.69 | 4.049 | 7.655 |
| **621** | 45.285 | 17.889 | 0.474 | 34.567 | 13.163 | 2338852 | 2467149 | 5/17/1998 | 04:48:10.48 | 3.910 | 7.657 |
| **622** | 45.296 | 17.897 | 0.477 | 34.569 | 13.162 | 2306267 | 2467817 | 5/17/1998 | 04:54:11.27 | 3.686 | 7.660 |
| **623** | 45.307 | 17.908 | 0.463 | 34.569 | 13.164 | 2346058 | 2467430 | 5/17/1998 | 05:00:12.06 | 3.959 | 7.658 |
| **624** | 45.323 | 17.924 | 0.391 | 34.569 | 13.164 | 2355039 | 2467178 | 5/17/1998 | 05:06:12.85 | 4.021 | 7.657 |
| **625** | 45.322 | 17.934 | 0.395 | 34.56 | 13.162 | 2359708 | 2467231 | 5/17/1998 | 05:12:13.64 | 4.053 | 7.657 |
| **626** | 45.34 | 17.944 | 0.344 | 34.567 | 13.163 | 2348177 | 2467303 | 5/17/1998 | 05:18:14.43 | 3.974 | 7.657 |
| **627** | 45.352 | 17.952 | 0.345 | 34.57 | 13.163 | 2338359 | 2467454 | 5/17/1998 | 05:24:15.22 | 3.907 | 7.658 |
| **628** | 45.365 | 17.973 | 0.335 | 34.564 | 13.163 | 2335940 | 2467496 | 5/17/1998 | 05:30:16.01 | 3.890 | 7.658 |
| **629** | 45.373 | 17.973 | 0.273 | 34.571 | 13.164 | 2331284 | 2467326 | 5/17/1998 | 05:36:16.80 | 3.858 | 7.658 |
| **630** | 45.38 | 17.984 | 0.24 | 34.567 | 13.163 | 2322278 | 2467280 | 5/17/1998 | 05:42:17.59 | 3.796 | 7.657 |
| **631** | 45.398 | 18.004 | 0.211 | 34.566 | 13.164 | 2350069 | 2466876 | 5/17/1998 | 05:48:18.38 | 3.987 | 7.656 |

## Blank Test #2 Sensor Data

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 46.202 | 19.133 | 1.108 | 34.299 | 13.16 | 2390314 | 2440004 | 5/21/1998 | 13:38:51.25 | 4.263 | 7.539 |
| **2** | 46.278 | 19.098 | 1.076 | 34.39 | 13.167 | 2522865 | 2451441 | 5/21/1998 | 13:45:33.26 | 5.173 | 7.589 |
| **3** | 46.316 | 19.068 | 1.072 | 34.448 | 13.169 | 2340983 | 2454720 | 5/21/1998 | 13:51:34.06 | 3.925 | 7.603 |
| **4** | 46.337 | 19.061 | 1.105 | 34.471 | 13.172 | 2509529 | 2457809 | 5/21/1998 | 13:57:34.86 | 5.081 | 7.616 |
| **5** | 46.353 | 19.032 | 1.159 | 34.508 | 13.152 | 2501876 | 2458357 | 5/21/1998 | 14:03:35.66 | 5.029 | 7.619 |
| **6** | 46.359 | 19.024 | 1.187 | 34.52 | 13.162 | 2435298 | 2460954 | 5/21/1998 | 14:09:36.46 | 4.572 | 7.630 |
| **7** | 46.366 | 19.012 | 1.199 | 34.537 | 13.163 | 2427763 | 2460922 | 5/21/1998 | 14:15:37.26 | 4.520 | 7.630 |
| **8** | 46.363 | 19.001 | 1.208 | 34.543 | 13.163 | 2400872 | 2461056 | 5/21/1998 | 14:21:38.06 | 4.336 | 7.630 |
| **9** | 46.358 | 18.984 | 1.243 | 34.553 | 13.163 | 2361794 | 2461934 | 5/21/1998 | 14:27:38.86 | 4.067 | 7.634 |
| **10** | 46.353 | 18.964 | 1.269 | 34.565 | 13.162 | 2458406 | 2463035 | 5/21/1998 | 14:33:39.66 | 4.730 | 7.639 |
| **11** | 46.343 | 18.945 | 1.304 | 34.572 | 13.161 | 2365812 | 2463574 | 5/21/1998 | 14:39:40.46 | 4.095 | 7.641 |
| **12** | 46.334 | 18.937 | 1.328 | 34.571 | 13.16 | 2553596 | 2464094 | 5/21/1998 | 14:45:41.26 | 5.384 | 7.644 |
| **13** | 46.326 | 18.932 | 1.334 | 34.569 | 13.16 | 2584932 | 2464757 | 5/21/1998 | 14:51:42.06 | 5.599 | 7.646 |
| **14** | 46.312 | 18.904 | 1.444 | 34.581 | 13.159 | 2424556 | 2465466 | 5/21/1998 | 14:57:42.86 | 4.498 | 7.649 |
| **15** | 46.281 | 18.871 | 1.468 | 34.582 | 13.158 | 2459465 | 2466503 | 5/21/1998 | 15:03:43.66 | 4.738 | 7.654 |
| **16** | 46.243 | 18.838 | 1.51 | 34.579 | 13.159 | 2454382 | 2466498 | 5/21/1998 | 15:09:44.46 | 4.703 | 7.654 |
| **17** | 46.216 | 18.801 | 1.53 | 34.587 | 13.138 | 2423580 | 2466276 | 5/21/1998 | 15:15:45.26 | 4.491 | 7.653 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 46.184 | 18.77 | 1.512 | 34.586 | 13.148 | 2373287 | 2467426 | 5/21/1998 | 15:21:46.06 | 4.146 | 7.658 |
| 19 | 46.158 | 18.743 | 1.589 | 34.586 | 13.149 | 2507339 | 2467756 | 5/21/1998 | 15:27:46.86 | 5.066 | 7.659 |
| 20 | 46.132 | 18.708 | 1.619 | 34.594 | 13.15 | 2505078 | 2467849 | 5/21/1998 | 15:33:47.66 | 5.051 | 7.660 |
| 21 | 46.097 | 18.678 | 1.619 | 34.589 | 13.15 | 2515458 | 2467839 | 5/21/1998 | 15:39:48.46 | 5.122 | 7.660 |
| 22 | 46.072 | 18.646 | 1.66 | 34.596 | 13.148 | 2493683 | 2468153 | 5/21/1998 | 15:45:49.26 | 4.973 | 7.661 |
| 23 | 46.037 | 18.618 | 1.704 | 34.589 | 13.148 | 2533075 | 2468413 | 5/21/1998 | 15:51:50.06 | 5.243 | 7.662 |
| 24 | 46.006 | 18.582 | 1.735 | 34.593 | 13.146 | 2478840 | 2469294 | 5/21/1998 | 15:57:50.86 | 4.871 | 7.666 |
| 25 | 45.967 | 18.532 | 1.812 | 34.602 | 13.146 | 2561193 | 2468621 | 5/21/1998 | 16:03:51.66 | 5.436 | 7.663 |
| 26 | 45.927 | 18.502 | 1.803 | 34.594 | 13.146 | 2552714 | 2469184 | 5/21/1998 | 16:09:52.46 | 5.378 | 7.666 |
| 27 | 45.888 | 18.46 | 1.839 | 34.597 | 13.143 | 2355165 | 2470047 | 5/21/1998 | 16:15:53.26 | 4.022 | 7.669 |
| 28 | 45.854 | 18.426 | 1.869 | 34.597 | 13.143 | 2525326 | 2470359 | 5/21/1998 | 16:21:54.06 | 5.190 | 7.671 |
| 29 | 45.817 | 18.388 | 1.904 | 34.597 | 13.146 | 2458766 | 2469934 | 5/21/1998 | 16:27:54.86 | 4.733 | 7.669 |
| 30 | 45.78 | 18.352 | 1.956 | 34.596 | 13.142 | 2470958 | 2470148 | 5/21/1998 | 16:33:55.66 | 4.817 | 7.670 |
| 31 | 45.746 | 18.319 | 1.974 | 34.595 | 13.141 | 2374208 | 2470550 | 5/21/1998 | 16:39:56.46 | 4.153 | 7.671 |
| 32 | 45.712 | 18.289 | 2.009 | 34.591 | 13.14 | 2437755 | 2471185 | 5/21/1998 | 16:45:57.26 | 4.589 | 7.674 |
| 33 | 45.68 | 18.248 | 2.023 | 34.599 | 13.139 | 2431687 | 2470966 | 5/21/1998 | 16:51:58.06 | 4.547 | 7.673 |
| 34 | 45.645 | 18.207 | 2.044 | 34.604 | 13.14 | 2558848 | 2470882 | 5/21/1998 | 16:57:58.86 | 5.420 | 7.673 |
| 35 | 45.612 | 18.179 | 2.102 | 34.599 | 13.136 | 2413532 | 2470847 | 5/21/1998 | 17:03:59.66 | 4.423 | 7.673 |
| 36 | 45.579 | 18.148 | 2.085 | 34.598 | 13.135 | 2572176 | 2470840 | 5/21/1998 | 17:10:00.46 | 5.511 | 7.673 |
| 37 | 45.549 | 18.109 | 2.135 | 34.605 | 13.137 | 2480318 | 2470963 | 5/21/1998 | 17:16:01.26 | 4.881 | 7.673 |
| 38 | 45.514 | 18.078 | 2.167 | 34.602 | 13.135 | 2536597 | 2471746 | 5/21/1998 | 17:22:02.06 | 5.267 | 7.677 |
| 39 | 45.478 | 18.036 | 2.189 | 34.606 | 13.135 | 2505750 | 2471657 | 5/21/1998 | 17:28:02.86 | 5.055 | 7.676 |
| 40 | 45.442 | 17.985 | 2.199 | 34.618 | 13.133 | 2500701 | 2471833 | 5/21/1998 | 17:34:03.66 | 5.021 | 7.677 |
| 41 | 45.4 | 17.956 | 2.21 | 34.608 | 13.131 | 2525424 | 2472433 | 5/21/1998 | 17:40:04.46 | 5.190 | 7.680 |
| 42 | 45.363 | 17.912 | 2.26 | 34.613 | 13.13 | 2550208 | 2472446 | 5/21/1998 | 17:46:05.26 | 5.361 | 7.680 |
| 43 | 45.327 | 17.876 | 2.297 | 34.613 | 13.129 | 2506076 | 2472325 | 5/21/1998 | 17:52:06.06 | 5.058 | 7.679 |
| 44 | 45.301 | 17.852 | 2.283 | 34.611 | 13.129 | 2418967 | 2472158 | 5/21/1998 | 17:58:06.86 | 4.460 | 7.678 |
| 45 | 45.273 | 17.824 | 2.272 | 34.612 | 13.128 | 2471378 | 2472321 | 5/21/1998 | 18:04:07.66 | 4.820 | 7.679 |
| 46 | 45.246 | 17.786 | 2.274 | 34.621 | 13.127 | 2366864 | 2473064 | 5/21/1998 | 18:10:08.46 | 4.102 | 7.682 |
| 47 | 45.22 | 17.77 | 2.274 | 34.612 | 13.127 | 2485840 | 2472505 | 5/21/1998 | 18:16:09.26 | 4.919 | 7.680 |
| 48 | 45.197 | 17.742 | 2.307 | 34.615 | 13.125 | 2512483 | 2472953 | 5/21/1998 | 18:22:10.06 | 5.102 | 7.682 |
| 49 | 45.164 | 17.707 | 2.303 | 34.618 | 13.125 | 2517881 | 2473129 | 5/21/1998 | 18:28:10.86 | 5.139 | 7.683 |
| 50 | 45.143 | 17.691 | 2.285 | 34.612 | 13.124 | 2461695 | 2473022 | 5/21/1998 | 18:34:11.66 | 4.753 | 7.682 |
| 51 | 45.112 | 17.669 | 2.343 | 34.605 | 13.123 | 2521923 | 2473058 | 5/21/1998 | 18:40:12.46 | 5.166 | 7.682 |
| 52 | 45.091 | 17.631 | 2.329 | 34.619 | 13.123 | 2555670 | 2473504 | 5/21/1998 | 18:46:13.26 | 5.398 | 7.684 |
| 53 | 45.065 | 17.619 | 2.324 | 34.607 | 13.122 | 2530853 | 2473616 | 5/21/1998 | 18:52:14.06 | 5.228 | 7.685 |
| 54 | 45.037 | 17.581 | 2.304 | 34.615 | 13.123 | 2527753 | 2473714 | 5/21/1998 | 18:58:14.86 | 5.206 | 7.685 |
| 55 | 45.012 | 17.548 | 2.278 | 34.622 | 13.122 | 2520220 | 2474142 | 5/21/1998 | 19:04:15.66 | 5.155 | 7.687 |
| 56 | 44.988 | 17.534 | 2.286 | 34.614 | 13.122 | 2488670 | 2474554 | 5/21/1998 | 19:10:16.46 | 4.938 | 7.689 |
| 57 | 44.974 | 17.518 | 2.273 | 34.615 | 13.12 | 2340159 | 2473935 | 5/21/1998 | 19:16:17.26 | 3.919 | 7.686 |
| 58 | 44.958 | 17.492 | 2.253 | 34.624 | 13.12 | 2505343 | 2474372 | 5/21/1998 | 19:22:18.06 | 5.053 | 7.688 |
| 59 | 44.934 | 17.483 | 2.247 | 34.61 | 13.124 | 2499414 | 2474364 | 5/21/1998 | 19:28:18.86 | 5.012 | 7.688 |
| 60 | 44.923 | 17.458 | 2.259 | 34.623 | 13.12 | 2484125 | 2474709 | 5/21/1998 | 19:34:19.66 | 4.907 | 7.689 |
| 61 | 44.911 | 17.449 | 2.206 | 34.62 | 13.12 | 2463238 | 2474635 | 5/21/1998 | 19:40:20.46 | 4.764 | 7.689 |
| 62 | 44.899 | 17.426 | 2.177 | 34.629 | 13.119 | 2382057 | 2474805 | 5/21/1998 | 19:46:21.26 | 4.207 | 7.690 |
| 63 | 44.885 | 17.418 | 2.161 | 34.624 | 13.118 | 2550609 | 2474660 | 5/21/1998 | 19:52:22.06 | 5.363 | 7.689 |
| 64 | 44.864 | 17.402 | 2.125 | 34.619 | 13.119 | 2452850 | 2475328 | 5/21/1998 | 19:58:22.86 | 4.692 | 7.692 |
| 65 | 44.852 | 17.389 | 2.079 | 34.621 | 13.118 | 2539657 | 2474369 | 5/21/1998 | 20:04:23.66 | 5.288 | 7.688 |
| 66 | 44.845 | 17.372 | 2.096 | 34.629 | 13.116 | 2505340 | 2474789 | 5/21/1998 | 20:10:24.46 | 5.053 | 7.690 |
| 67 | 44.826 | 17.357 | 2.065 | 34.625 | 13.118 | 2483477 | 2475315 | 5/21/1998 | 20:16:25.26 | 4.903 | 7.692 |
| 68 | 44.816 | 17.358 | 2.054 | 34.615 | 13.117 | 2546740 | 2475066 | 5/21/1998 | 20:22:26.06 | 5.337 | 7.691 |
| 69 | 44.814 | 17.334 | 2.003 | 34.634 | 13.117 | 2521575 | 2475101 | 5/21/1998 | 20:28:26.86 | 5.164 | 7.691 |
| 70 | 44.796 | 17.329 | 1.99 | 34.623 | 13.116 | 2537269 | 2474887 | 5/21/1998 | 20:34:27.66 | 5.272 | 7.690 |
| 71 | 44.792 | 17.321 | 1.957 | 34.627 | 13.113 | 2514934 | 2475563 | 5/21/1998 | 20:40:28.46 | 5.118 | 7.693 |
| 72 | 44.784 | 17.304 | 1.888 | 34.634 | 13.114 | 2527107 | 2475467 | 5/21/1998 | 20:47:10.46 | 5.202 | 7.693 |
| 73 | 44.773 | 17.298 | 1.858 | 34.63 | 13.113 | 2535439 | 2475272 | 5/21/1998 | 20:53:11.26 | 5.259 | 7.692 |
| 74 | 44.769 | 17.301 | 1.835 | 34.624 | 13.111 | 2491451 | 2475189 | 5/21/1998 | 20:59:12.06 | 4.957 | 7.692 |
| 75 | 44.764 | 17.286 | 1.795 | 34.632 | 13.112 | 2478345 | 2476044 | 5/21/1998 | 21:05:12.86 | 4.867 | 7.695 |
| 76 | 44.747 | 17.28 | 1.764 | 34.623 | 13.111 | 2419311 | 2475569 | 5/21/1998 | 21:11:13.66 | 4.462 | 7.693 |
| 77 | 44.751 | 17.269 | 1.703 | 34.636 | 13.109 | 2489444 | 2475393 | 5/21/1998 | 21:17:14.46 | 4.944 | 7.692 |
| 78 | 44.753 | 17.271 | 1.71 | 34.636 | 13.111 | 2503768 | 2476429 | 5/21/1998 | 21:23:15.26 | 5.042 | 7.697 |
| 79 | 44.752 | 17.282 | 1.671 | 34.625 | 13.112 | 2512456 | 2476399 | 5/21/1998 | 21:29:16.06 | 5.101 | 7.697 |
| 80 | 44.761 | 17.285 | 1.659 | 34.63 | 13.11 | 2506785 | 2476267 | 5/21/1998 | 21:35:16.86 | 5.063 | 7.696 |
| 81 | 44.761 | 17.285 | 1.563 | 34.631 | 13.111 | 2457003 | 2475595 | 5/21/1998 | 21:41:17.66 | 4.721 | 7.693 |
| 82 | 44.767 | 17.284 | 1.527 | 34.637 | 13.109 | 2557588 | 2476434 | 5/21/1998 | 21:47:18.46 | 5.411 | 7.697 |
| 83 | 44.776 | 17.3 | 1.502 | 34.63 | 13.109 | 2509352 | 2476291 | 5/21/1998 | 21:53:19.26 | 5.080 | 7.696 |
| 84 | 44.786 | 17.308 | 1.449 | 34.633 | 13.108 | 2466104 | 2476058 | 5/21/1998 | 21:59:20.06 | 4.783 | 7.695 |
| 85 | 44.791 | 17.313 | 1.413 | 34.633 | 13.108 | 2555568 | 2476098 | 5/21/1998 | 22:05:20.86 | 5.397 | 7.695 |
| 86 | 44.8 | 17.335 | 1.413 | 34.621 | 13.108 | 2519069 | 2476377 | 5/21/1998 | 22:11:21.66 | 5.147 | 7.697 |
| 87 | 44.815 | 17.341 | 1.374 | 34.629 | 13.107 | 2476979 | 2476875 | 5/21/1998 | 22:17:22.46 | 4.858 | 7.699 |
| 88 | 44.834 | 17.351 | 1.333 | 34.637 | 13.108 | 2453701 | 2476864 | 5/21/1998 | 22:23:23.26 | 4.698 | 7.699 |
| 89 | 44.847 | 17.377 | 1.312 | 34.627 | 13.108 | 2508059 | 2476798 | 5/21/1998 | 22:29:24.06 | 5.071 | 7.698 |
| 90 | 44.867 | 17.395 | 1.276 | 34.628 | 13.107 | 2477922 | 2476404 | 5/21/1998 | 22:35:24.86 | 4.864 | 7.697 |
| 91 | 44.871 | 17.4 | 1.244 | 34.627 | 13.107 | 2466918 | 2476771 | 5/21/1998 | 22:41:25.66 | 4.789 | 7.698 |
| 92 | 44.876 | 17.406 | 1.175 | 34.627 | 13.108 | 2458859 | 2477017 | 5/21/1998 | 22:47:26.46 | 4.734 | 7.699 |
| 93 | 44.889 | 17.42 | 1.137 | 34.626 | 13.107 | 2423035 | 2476877 | 5/21/1998 | 22:53:27.26 | 4.488 | 7.699 |
| 94 | 44.887 | 17.412 | 1.077 | 34.63 | 13.107 | 2477639 | 2477159 | 5/21/1998 | 22:59:28.06 | 4.862 | 7.700 |
| 95 | 44.893 | 17.408 | 1.092 | 34.64 | 13.107 | 2463486 | 2477276 | 5/21/1998 | 23:05:28.86 | 4.765 | 7.701 |
| 96 | 44.906 | 17.428 | 1.052 | 34.633 | 13.108 | 2437951 | 2476897 | 5/21/1998 | 23:11:29.66 | 4.590 | 7.699 |
| 97 | 44.912 | 17.442 | 1.045 | 34.627 | 13.104 | 2564190 | 2477004 | 5/21/1998 | 23:17:30.46 | 5.456 | 7.699 |
| 98 | 44.921 | 17.451 | 0.969 | 34.627 | 13.105 | 2505644 | 2477244 | 5/21/1998 | 23:23:31.26 | 5.055 | 7.700 |
| 99 | 44.928 | 17.46 | 0.961 | 34.625 | 13.104 | 2519770 | 2476920 | 5/21/1998 | 23:29:32.06 | 5.152 | 7.699 |
| 100 | 44.939 | 17.466 | 0.902 | 34.63 | 13.106 | 2492289 | 2477066 | 5/21/1998 | 23:35:32.86 | 4.963 | 7.700 |
| 101 | 44.944 | 17.481 | 0.894 | 34.622 | 13.107 | 2474222 | 2477496 | 5/21/1998 | 23:41:33.66 | 4.839 | 7.701 |
| 102 | 44.958 | 17.475 | 0.867 | 34.639 | 13.103 | 2514833 | 2476933 | 5/21/1998 | 23:47:34.46 | 5.118 | 7.699 |
| 103 | 44.977 | 17.498 | 0.813 | 34.635 | 13.1 | 2447485 | 2478166 | 5/21/1998 | 23:53:35.26 | 4.656 | 7.704 |
| 104 | 45.006 | 17.533 | 0.81 | 34.63 | 13.1 | 2394625 | 2477179 | 5/21/1998 | 23:59:36.06 | 4.293 | 7.700 |
| 105 | 45.017 | 17.543 | 0.778 | 34.631 | 13.103 | 2441267 | 2476859 | 5/22/1998 | 00:05:36.86 | 4.613 | 7.699 |
| 106 | 45.057 | 17.586 | 0.803 | 34.629 | 13.103 | 2471410 | 2476729 | 5/22/1998 | 00:11:37.66 | 4.820 | 7.698 |
| 107 | 45.096 | 17.624 | 0.778 | 34.63 | 13.103 | 2515227 | 2477467 | 5/22/1998 | 00:17:38.46 | 5.120 | 7.701 |
| 108 | 45.129 | 17.666 | 0.731 | 34.623 | 13.103 | 2516008 | 2477202 | 5/22/1998 | 00:23:39.26 | 5.126 | 7.700 |
| 109 | 45.172 | 17.703 | 0.722 | 34.628 | 13.101 | 2461183 | 2477837 | 5/22/1998 | 00:29:40.06 | 4.750 | 7.703 |
| 110 | 45.214 | 17.742 | 0.717 | 34.631 | 13.103 | 2439726 | 2477267 | 5/22/1998 | 00:35:40.86 | 4.602 | 7.700 |
| 111 | 45.245 | 17.783 | 0.723 | 34.623 | 13.103 | 2519799 | 2477347 | 5/22/1998 | 00:41:41.66 | 5.152 | 7.701 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **112** | 45.278 | 17.814 | 0.702 | 34.625 | 13.102 | 2550837 | 2477708 | 5/22/1998 | 00:47:42.46 | 5.365 | 7.702 |
| **113** | 45.313 | 17.844 | 0.695 | 34.629 | 13.105 | 2519264 | 2476562 | 5/22/1998 | 00:53:43.26 | 5.148 | 7.697 |
| **114** | 45.349 | 17.886 | 0.675 | 34.625 | 13.102 | 2427305 | 2477508 | 5/22/1998 | 00:59:44.06 | 4.517 | 7.702 |
| **115** | 45.381 | 17.92 | 0.666 | 34.623 | 13.106 | 2510104 | 2477272 | 5/22/1998 | 01:05:44.86 | 5.085 | 7.701 |
| **116** | 45.409 | 17.948 | 0.706 | 34.623 | 13.106 | 2489018 | 2477992 | 5/22/1998 | 01:11:45.66 | 4.941 | 7.704 |
| **117** | 45.441 | 17.989 | 0.702 | 34.616 | 13.107 | 2559590 | 2477596 | 5/22/1998 | 01:17:46.46 | 5.425 | 7.702 |
| **118** | 45.474 | 18.014 | 0.676 | 34.622 | 13.106 | 2449186 | 2477557 | 5/22/1998 | 01:23:47.26 | 4.667 | 7.702 |
| **119** | 45.497 | 18.04 | 0.674 | 34.62 | 13.106 | 2562210 | 2477342 | 5/22/1998 | 01:29:48.06 | 5.443 | 7.701 |
| **120** | 45.529 | 18.062 | 0.66 | 34.629 | 13.106 | 2526724 | 2477193 | 5/22/1998 | 01:35:48.86 | 5.199 | 7.700 |
| **121** | 45.545 | 18.097 | 0.685 | 34.613 | 13.106 | 2543469 | 2477368 | 5/22/1998 | 01:41:49.66 | 5.314 | 7.701 |
| **122** | 45.573 | 18.105 | 0.706 | 34.629 | 13.106 | 2360954 | 2477673 | 5/22/1998 | 01:47:50.46 | 4.062 | 7.702 |
| **123** | 45.591 | 18.129 | 0.705 | 34.624 | 13.104 | 2533349 | 2477321 | 5/22/1998 | 01:53:51.26 | 5.245 | 7.701 |
| **124** | 45.608 | 18.145 | 0.715 | 34.626 | 13.104 | 2520575 | 2477208 | 5/22/1998 | 01:59:52.06 | 5.157 | 7.700 |
| **125** | 45.621 | 18.173 | 0.708 | 34.613 | 13.105 | 2329882 | 2477674 | 5/22/1998 | 02:05:52.86 | 3.848 | 7.702 |
| **126** | 45.641 | 18.176 | 0.722 | 34.627 | 13.104 | 2547123 | 2477206 | 5/22/1998 | 02:11:53.66 | 5.339 | 7.700 |
| **127** | 45.653 | 18.197 | 0.763 | 34.62 | 13.106 | 2523985 | 2477146 | 5/22/1998 | 02:17:54.46 | 5.181 | 7.700 |
| **128** | 45.66 | 18.208 | 0.761 | 34.616 | 13.104 | 2510639 | 2477250 | 5/22/1998 | 02:23:55.26 | 5.089 | 7.700 |
| **129** | 45.672 | 18.225 | 0.781 | 34.612 | 13.104 | 2556839 | 2476997 | 5/22/1998 | 02:29:56.06 | 5.406 | 7.699 |
| **130** | 45.688 | 18.24 | 0.798 | 34.613 | 13.102 | 2555538 | 2477086 | 5/22/1998 | 02:35:56.86 | 5.397 | 7.700 |
| **131** | 45.697 | 18.247 | 0.802 | 34.615 | 13.103 | 2577033 | 2477383 | 5/22/1998 | 02:41:57.66 | 5.545 | 7.701 |
| **132** | 45.713 | 18.261 | 0.826 | 34.616 | 13.104 | 2538299 | 2477239 | 5/22/1998 | 02:47:58.46 | 5.279 | 7.700 |
| **133** | 45.724 | 18.259 | 0.866 | 34.628 | 13.104 | 2559382 | 2477180 | 5/22/1998 | 02:53:59.26 | 5.423 | 7.700 |
| **134** | 45.738 | 18.279 | 0.873 | 34.623 | 13.104 | 2520177 | 2476853 | 5/22/1998 | 03:00:00.06 | 5.154 | 7.699 |
| **135** | 45.746 | 18.298 | 0.911 | 34.613 | 13.103 | 2462069 | 2477108 | 5/22/1998 | 03:06:00.86 | 4.756 | 7.700 |
| **136** | 45.758 | 18.308 | 0.906 | 34.615 | 13.102 | 2546888 | 2476971 | 5/22/1998 | 03:12:01.66 | 5.338 | 7.699 |
| **137** | 45.77 | 18.319 | 0.942 | 34.615 | 13.103 | 2531091 | 2476808 | 5/22/1998 | 03:18:02.46 | 5.229 | 7.699 |
| **138** | 45.781 | 18.33 | 0.988 | 34.616 | 13.101 | 2552020 | 2477715 | 5/22/1998 | 03:24:03.26 | 5.373 | 7.702 |
| **139** | 45.786 | 18.337 | 1.017 | 34.614 | 13.101 | 2564959 | 2477456 | 5/22/1998 | 03:30:04.06 | 5.462 | 7.701 |
| **140** | 45.798 | 18.344 | 1.04 | 34.619 | 13.101 | 2478992 | 2476837 | 5/22/1998 | 03:36:04.86 | 4.872 | 7.699 |
| **141** | 45.809 | 18.358 | 1.042 | 34.616 | 13.101 | 2531656 | 2476966 | 5/22/1998 | 03:42:05.66 | 5.233 | 7.699 |
| **142** | 45.813 | 18.365 | 1.081 | 34.613 | 13.1 | 2558407 | 2477173 | 5/22/1998 | 03:48:47.68 | 5.417 | 7.700 |
| **143** | 45.824 | 18.372 | 1.12 | 34.617 | 13.1 | 2531641 | 2477906 | 5/22/1998 | 03:54:48.48 | 5.233 | 7.703 |
| **144** | 45.825 | 18.376 | 1.145 | 34.614 | 13.1 | 2540305 | 2477434 | 5/22/1998 | 04:00:49.28 | 5.293 | 7.701 |
| **145** | 45.824 | 18.369 | 1.168 | 34.619 | 13.099 | 2476107 | 2477134 | 5/22/1998 | 04:06:50.08 | 4.852 | 7.700 |
| **146** | 45.808 | 18.357 | 1.198 | 34.616 | 13.1 | 2542306 | 2476991 | 5/22/1998 | 04:12:50.88 | 5.306 | 7.699 |
| **147** | 45.796 | 18.346 | 1.243 | 34.615 | 13.098 | 2491920 | 2477085 | 5/22/1998 | 04:18:51.68 | 4.960 | 7.700 |
| **148** | 45.777 | 18.319 | 1.283 | 34.621 | 13.097 | 2559809 | 2477640 | 5/22/1998 | 04:24:52.48 | 5.426 | 7.702 |
| **149** | 45.753 | 18.304 | 1.283 | 34.614 | 13.097 | 2535834 | 2476651 | 5/22/1998 | 04:30:53.28 | 5.262 | 7.698 |
| **150** | 45.738 | 18.286 | 1.306 | 34.616 | 13.097 | 2546808 | 2476655 | 5/22/1998 | 04:36:54.08 | 5.337 | 7.698 |
| **151** | 45.722 | 18.257 | 1.345 | 34.628 | 13.095 | 2468557 | 2477490 | 5/22/1998 | 04:42:54.88 | 4.800 | 7.701 |
| **152** | 45.701 | 18.251 | 1.383 | 34.614 | 13.096 | 2528798 | 2476453 | 5/22/1998 | 04:48:55.68 | 5.214 | 7.697 |
| **153** | 45.671 | 18.217 | 1.396 | 34.617 | 13.095 | 2517556 | 2477030 | 5/22/1998 | 04:54:56.48 | 5.136 | 7.699 |
| **154** | 45.648 | 18.191 | 1.405 | 34.62 | 13.095 | 2519308 | 2477160 | 5/22/1998 | 05:00:57.28 | 5.148 | 7.700 |
| **155** | 45.627 | 18.166 | 1.428 | 34.623 | 13.094 | 2555662 | 2477278 | 5/22/1998 | 05:06:58.08 | 5.398 | 7.701 |
| **156** | 45.596 | 18.152 | 1.425 | 34.61 | 13.093 | 2513395 | 2476905 | 5/22/1998 | 05:12:58.88 | 5.108 | 7.699 |
| **157** | 45.577 | 18.116 | 1.464 | 34.623 | 13.093 | 2521306 | 2476796 | 5/22/1998 | 05:18:59.68 | 5.162 | 7.698 |
| **158** | 45.558 | 18.105 | 1.513 | 34.616 | 13.092 | 2555370 | 2477149 | 5/22/1998 | 05:25:00.48 | 5.396 | 7.700 |
| **159** | 45.542 | 18.092 | 1.526 | 34.614 | 13.093 | 2553861 | 2476514 | 5/22/1998 | 05:31:01.28 | 5.386 | 7.697 |
| **160** | 45.537 | 18.083 | 1.524 | 34.617 | 13.093 | 2550637 | 2476525 | 5/22/1998 | 05:37:02.08 | 5.363 | 7.697 |
| **161** | 45.524 | 18.069 | 1.559 | 34.618 | 13.092 | 2541907 | 2476470 | 5/22/1998 | 05:43:02.88 | 5.304 | 7.697 |
| **162** | 45.508 | 18.054 | 1.615 | 34.617 | 13.091 | 2523072 | 2477189 | 5/22/1998 | 05:49:03.68 | 5.174 | 7.700 |
| **163** | 45.472 | 18.024 | 1.665 | 34.612 | 13.091 | 2556613 | 2477205 | 5/22/1998 | 05:55:04.48 | 5.404 | 7.700 |
| **164** | 45.458 | 17.994 | 1.638 | 34.625 | 13.09 | 2484451 | 2476845 | 5/22/1998 | 06:01:05.28 | 4.909 | 7.699 |
| **165** | 45.432 | 17.967 | 1.667 | 34.625 | 13.089 | 2464945 | 2477186 | 5/22/1998 | 06:07:06.08 | 4.775 | 7.700 |
| **166** | 45.407 | 17.939 | 1.632 | 34.628 | 13.088 | 2531457 | 2476656 | 5/22/1998 | 06:13:06.88 | 5.232 | 7.698 |
| **167** | 45.386 | 17.918 | 1.659 | 34.628 | 13.088 | 2505329 | 2477277 | 5/22/1998 | 06:19:07.68 | 5.053 | 7.701 |
| **168** | 45.369 | 17.909 | 1.695 | 34.621 | 13.089 | 2498060 | 2477641 | 5/22/1998 | 06:25:08.48 | 5.003 | 7.702 |
| **169** | 45.348 | 17.876 | 1.674 | 34.631 | 13.089 | 2555347 | 2476938 | 5/22/1998 | 06:31:09.28 | 5.396 | 7.699 |
| **170** | 45.313 | 17.843 | 1.705 | 34.629 | 13.087 | 2538492 | 2476915 | 5/22/1998 | 06:37:10.08 | 5.280 | 7.699 |
| **171** | 45.281 | 17.812 | 1.735 | 34.629 | 13.086 | 2542194 | 2476964 | 5/22/1998 | 06:43:10.88 | 5.306 | 7.699 |
| **172** | 45.25 | 17.783 | 1.751 | 34.626 | 13.085 | 2376488 | 2477291 | 5/22/1998 | 06:49:11.68 | 4.168 | 7.701 |
| **173** | 45.209 | 17.716 | 1.712 | 34.649 | 13.085 | 2513666 | 2477088 | 5/22/1998 | 06:55:12.48 | 5.110 | 7.700 |
| **174** | 45.166 | 17.693 | 1.717 | 34.632 | 13.085 | 2480147 | 2476989 | 5/22/1998 | 07:01:13.28 | 4.880 | 7.699 |
| **175** | 45.13 | 17.66 | 1.679 | 34.628 | 13.084 | 2557294 | 2476859 | 5/22/1998 | 07:07:14.08 | 5.409 | 7.699 |
| **176** | 45.098 | 17.62 | 1.699 | 34.635 | 13.083 | 2529115 | 2477376 | 5/22/1998 | 07:13:14.88 | 5.216 | 7.701 |
| **177** | 45.057 | 17.587 | 1.684 | 34.628 | 13.082 | 2532466 | 2477867 | 5/22/1998 | 07:19:15.68 | 5.239 | 7.703 |
| **178** | 45.036 | 17.56 | 1.704 | 34.633 | 13.081 | 2486409 | 2477678 | 5/22/1998 | 07:25:16.48 | 4.923 | 7.702 |
| **179** | 45.011 | 17.527 | 1.7 | 34.639 | 13.082 | 2508540 | 2476940 | 5/22/1998 | 07:31:17.28 | 5.075 | 7.699 |
| **180** | 44.985 | 17.508 | 1.693 | 34.633 | 13.082 | 2521874 | 2476530 | 5/22/1998 | 07:37:18.08 | 5.166 | 7.697 |
| **181** | 44.962 | 17.475 | 1.653 | 34.641 | 13.08 | 2470629 | 2476918 | 5/22/1998 | 07:43:18.88 | 4.814 | 7.699 |
| **182** | 44.935 | 17.456 | 1.632 | 34.634 | 13.08 | 2530286 | 2477282 | 5/22/1998 | 07:49:19.68 | 5.224 | 7.701 |
| **183** | 44.911 | 17.436 | 1.638 | 34.63 | 13.08 | 2497136 | 2476602 | 5/22/1998 | 07:55:20.48 | 4.996 | 7.698 |
| **184** | 44.898 | 17.413 | 1.607 | 34.639 | 13.08 | 2499170 | 2476886 | 5/22/1998 | 08:01:21.28 | 5.010 | 7.699 |
| **185** | 44.885 | 17.399 | 1.589 | 34.64 | 13.078 | 2521135 | 2476775 | 5/22/1998 | 08:07:22.08 | 5.161 | 7.698 |
| **186** | 44.87 | 17.388 | 1.574 | 34.636 | 13.079 | 2520418 | 2476553 | 5/22/1998 | 08:13:22.88 | 5.156 | 7.697 |
| **187** | 44.856 | 17.368 | 1.555 | 34.641 | 13.079 | 2496176 | 2476810 | 5/22/1998 | 08:19:23.68 | 4.990 | 7.699 |
| **188** | 44.838 | 17.351 | 1.545 | 34.641 | 13.078 | 2495921 | 2476436 | 5/22/1998 | 08:25:24.48 | 4.988 | 7.697 |
| **189** | 44.827 | 17.338 | 1.525 | 34.642 | 13.076 | 2499587 | 2476681 | 5/22/1998 | 08:31:25.28 | 5.013 | 7.698 |
| **190** | 44.811 | 17.328 | 1.497 | 34.636 | 13.078 | 2456752 | 2476819 | 5/22/1998 | 08:37:26.08 | 4.719 | 7.699 |
| **191** | 44.799 | 17.326 | 1.459 | 34.628 | 13.078 | 2527192 | 2476673 | 5/22/1998 | 08:43:26.88 | 5.203 | 7.698 |
| **192** | 44.786 | 17.299 | 1.434 | 34.64 | 13.076 | 2544265 | 2476520 | 5/22/1998 | 08:49:27.68 | 5.320 | 7.697 |
| **193** | 44.773 | 17.287 | 1.378 | 34.64 | 13.074 | 2539162 | 2477420 | 5/22/1998 | 08:55:28.48 | 5.285 | 7.701 |
| **194** | 44.767 | 17.276 | 1.381 | 34.643 | 13.075 | 2530529 | 2476615 | 5/22/1998 | 09:01:29.28 | 5.225 | 7.698 |
| **195** | 44.76 | 17.276 | 1.358 | 34.637 | 13.074 | 2554847 | 2476194 | 5/22/1998 | 09:07:30.08 | 5.392 | 7.696 |
| **196** | 44.763 | 17.264 | 1.315 | 34.65 | 13.074 | 2394760 | 2476965 | 5/22/1998 | 09:13:30.88 | 4.294 | 7.699 |
| **197** | 44.752 | 17.261 | 1.284 | 34.643 | 13.074 | 2495131 | 2476273 | 5/22/1998 | 09:19:31.68 | 4.983 | 7.696 |
| **198** | 44.748 | 17.268 | 1.262 | 34.633 | 13.074 | 2522533 | 2476803 | 5/22/1998 | 09:25:32.48 | 5.171 | 7.698 |
| **199** | 44.752 | 17.262 | 1.209 | 34.643 | 13.073 | 2482657 | 2476080 | 5/22/1998 | 09:31:33.28 | 4.897 | 7.695 |
| **200** | 44.753 | 17.26 | 1.192 | 34.645 | 13.073 | 2531466 | 2476243 | 5/22/1998 | 09:37:34.08 | 5.232 | 7.696 |
| **201** | 44.763 | 17.272 | 1.135 | 34.644 | 13.072 | 2478414 | 2476247 | 5/22/1998 | 09:43:34.88 | 4.868 | 7.696 |
| **202** | 44.776 | 17.281 | 1.113 | 34.647 | 13.072 | 2512870 | 2476179 | 5/22/1998 | 09:49:35.68 | 5.104 | 7.696 |
| **203** | 44.782 | 17.3 | 1.069 | 34.636 | 13.072 | 2542990 | 2476101 | 5/22/1998 | 09:55:36.48 | 5.311 | 7.695 |
| **204** | 44.795 | 17.303 | 1.054 | 34.645 | 13.073 | 2514186 | 2476201 | 5/22/1998 | 10:01:37.28 | 5.113 | 7.696 |
| **205** | 44.815 | 17.328 | 1.03 | 34.64 | 13.072 | 2482869 | 2475749 | 5/22/1998 | 10:07:38.08 | 4.898 | 7.694 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **206** | 44.847 | 17.356 | 1.009 | 34.645 | 13.072 | 2521376 | 2476367 | 5/22/1998 | 10:13:38.88 | 5.163 | 7.697 |
| **207** | 44.879 | 17.389 | 0.99 | 34.644 | 13.072 | 2506430 | 2475594 | 5/22/1998 | 10:19:39.68 | 5.060 | 7.693 |
| **208** | 44.917 | 17.419 | 0.951 | 34.651 | 13.074 | 2501957 | 2475565 | 5/22/1998 | 10:25:40.48 | 5.029 | 7.693 |
| **209** | 44.951 | 17.46 | 0.973 | 34.646 | 13.073 | 2508257 | 2476163 | 5/22/1998 | 10:31:41.28 | 5.073 | 7.696 |
| **210** | 44.978 | 17.498 | 0.906 | 34.636 | 13.074 | 2527258 | 2476195 | 5/22/1998 | 10:37:42.08 | 5.203 | 7.696 |
| **211** | 45.01 | 17.53 | 0.841 | 34.636 | 13.074 | 2520040 | 2475221 | 5/22/1998 | 10:43:42.88 | 5.153 | 7.692 |
| **212** | 45.022 | 17.538 | 0.817 | 34.64 | 13.073 | 2511075 | 2476560 | 5/22/1998 | 10:50:24.90 | 5.092 | 7.697 |
| **213** | 45.043 | 17.565 | 0.761 | 34.634 | 13.072 | 2573094 | 2476536 | 5/22/1998 | 10:56:25.70 | 5.518 | 7.697 |
| **214** | 45.069 | 17.588 | 0.727 | 34.637 | 13.072 | 2553586 | 2477014 | 5/22/1998 | 11:02:26.50 | 5.384 | 7.699 |
| **215** | 45.095 | 17.611 | 0.737 | 34.64 | 13.071 | 2555903 | 2476480 | 5/22/1998 | 11:08:27.30 | 5.400 | 7.697 |
| **216** | 45.117 | 17.635 | 0.716 | 34.639 | 13.072 | 2484253 | 2475660 | 5/22/1998 | 11:14:28.10 | 4.908 | 7.694 |
| **217** | 45.157 | 17.669 | 0.678 | 34.644 | 13.07 | 2479726 | 2476035 | 5/22/1998 | 11:20:28.90 | 4.877 | 7.695 |
| **218** | 45.186 | 17.701 | 0.649 | 34.642 | 13.072 | 2419273 | 2476067 | 5/22/1998 | 11:26:29.70 | 4.462 | 7.695 |
| **219** | 45.2 | 17.717 | 0.647 | 34.64 | 13.072 | 2497828 | 2475766 | 5/22/1998 | 11:32:30.50 | 5.001 | 7.694 |
| **220** | 45.223 | 17.742 | 0.609 | 34.639 | 13.072 | 2519695 | 2475132 | 5/22/1998 | 11:38:31.30 | 5.151 | 7.691 |
| **221** | 45.242 | 17.764 | 0.579 | 34.636 | 13.072 | 2544067 | 2474886 | 5/22/1998 | 11:44:32.10 | 5.318 | 7.690 |
| **222** | 45.253 | 17.766 | 0.543 | 34.644 | 13.071 | 2432940 | 2475029 | 5/22/1998 | 11:50:32.90 | 4.556 | 7.691 |
| **223** | 45.283 | 17.8 | 0.534 | 34.641 | 13.071 | 2537971 | 2475207 | 5/22/1998 | 11:56:33.70 | 5.277 | 7.692 |
| **224** | 45.317 | 17.843 | 0.501 | 34.634 | 13.072 | 2562296 | 2475944 | 5/22/1998 | 12:02:34.50 | 5.443 | 7.695 |
| **225** | 45.348 | 17.875 | 0.495 | 34.633 | 13.073 | 2440713 | 2474609 | 5/22/1998 | 12:08:35.30 | 4.609 | 7.689 |
| **226** | 45.376 | 17.893 | 0.508 | 34.641 | 13.072 | 2602873 | 2474617 | 5/22/1998 | 12:14:36.10 | 5.722 | 7.689 |
| **227** | 45.41 | 17.927 | 0.487 | 34.641 | 13.073 | 2501132 | 2473855 | 5/22/1998 | 12:20:36.90 | 5.024 | 7.686 |
| **228** | 45.438 | 17.952 | 0.466 | 34.644 | 13.073 | 2524167 | 2474290 | 5/22/1998 | 12:26:37.70 | 5.182 | 7.688 |
| **229** | 45.469 | 17.987 | 0.465 | 34.641 | 13.073 | 2536048 | 2474344 | 5/22/1998 | 12:32:38.50 | 5.263 | 7.688 |
| **230** | 45.501 | 18.018 | 0.43 | 34.642 | 13.072 | 2545965 | 2474540 | 5/22/1998 | 12:38:39.30 | 5.331 | 7.689 |
| **231** | 45.532 | 18.061 | 0.458 | 34.632 | 13.072 | 2533242 | 2474607 | 5/22/1998 | 12:44:40.10 | 5.244 | 7.689 |
| **232** | 45.573 | 18.097 | 0.398 | 34.636 | 13.074 | 2542412 | 2474832 | 5/22/1998 | 12:50:40.90 | 5.307 | 7.690 |
| **233** | 45.607 | 18.132 | 0.424 | 34.635 | 13.072 | 2537286 | 2475282 | 5/22/1998 | 12:56:41.70 | 5.272 | 7.692 |
| **234** | 45.649 | 18.191 | 0.424 | 34.621 | 13.073 | 2557397 | 2474541 | 5/22/1998 | 13:02:42.50 | 5.410 | 7.689 |
| **235** | 45.682 | 18.208 | 0.426 | 34.635 | 13.075 | 2572214 | 2475073 | 5/22/1998 | 13:08:43.30 | 5.512 | 7.691 |
| **236** | 45.71 | 18.237 | 0.444 | 34.635 | 13.075 | 2601694 | 2475205 | 5/22/1998 | 13:14:44.10 | 5.714 | 7.692 |
| **237** | 45.738 | 18.261 | 0.434 | 34.638 | 13.073 | 2522882 | 2475577 | 5/22/1998 | 13:20:44.90 | 5.173 | 7.693 |
| **238** | 45.77 | 18.288 | 0.47 | 34.642 | 13.074 | 2566391 | 2475066 | 5/22/1998 | 13:26:45.70 | 5.472 | 7.691 |
| **239** | 45.795 | 18.328 | 0.452 | 34.629 | 13.073 | 2572739 | 2475476 | 5/22/1998 | 13:32:46.50 | 5.515 | 7.693 |
| **240** | 45.821 | 18.348 | 0.457 | 34.635 | 13.073 | 2469582 | 2475410 | 5/22/1998 | 13:38:47.30 | 4.807 | 7.692 |
| **241** | 45.855 | 18.386 | 0.44 | 34.631 | 13.072 | 2546359 | 2475661 | 5/22/1998 | 13:44:48.10 | 5.334 | 7.694 |
| **242** | 45.878 | 18.403 | 0.449 | 34.636 | 13.073 | 2562619 | 2475641 | 5/22/1998 | 13:50:48.90 | 5.446 | 7.693 |
| **243** | 45.896 | 18.429 | 0.512 | 34.63 | 13.072 | 2531384 | 2475645 | 5/22/1998 | 13:56:49.70 | 5.231 | 7.693 |
| **244** | 45.919 | 18.447 | 0.525 | 34.634 | 13.073 | 2586375 | 2475526 | 5/22/1998 | 14:02:50.50 | 5.609 | 7.693 |
| **245** | 45.936 | 18.463 | 0.523 | 34.635 | 13.072 | 2432841 | 2476249 | 5/22/1998 | 14:08:51.30 | 4.555 | 7.696 |
| **246** | 45.956 | 18.481 | 0.574 | 34.637 | 13.074 | 2596008 | 2475959 | 5/22/1998 | 14:14:52.10 | 5.675 | 7.695 |
| **247** | 45.972 | 18.506 | 0.598 | 34.629 | 13.074 | 2559090 | 2476459 | 5/22/1998 | 14:20:52.90 | 5.421 | 7.697 |
| **248** | 45.987 | 18.518 | 0.618 | 34.632 | 13.073 | 2567108 | 2475733 | 5/22/1998 | 14:26:53.70 | 5.477 | 7.694 |
| **249** | 46.011 | 18.548 | 0.631 | 34.627 | 13.072 | 2580755 | 2476464 | 5/22/1998 | 14:32:54.50 | 5.570 | 7.697 |
| **250** | 46.028 | 18.555 | 0.658 | 34.635 | 13.071 | 2590000 | 2476157 | 5/22/1998 | 14:38:55.30 | 5.634 | 7.696 |
| **251** | 46.038 | 18.564 | 0.668 | 34.636 | 13.071 | 2629935 | 2476675 | 5/22/1998 | 14:44:56.10 | 5.908 | 7.698 |
| **252** | 46.051 | 18.583 | 0.702 | 34.631 | 13.07 | 2587591 | 2476883 | 5/22/1998 | 14:50:56.90 | 5.617 | 7.699 |
| **253** | 46.061 | 18.593 | 0.709 | 34.631 | 13.071 | 2554636 | 2476962 | 5/22/1998 | 14:56:57.70 | 5.391 | 7.699 |
| **254** | 46.069 | 18.607 | 0.741 | 34.626 | 13.071 | 2549037 | 2477047 | 5/22/1998 | 15:02:58.50 | 5.352 | 7.700 |
| **255** | 46.083 | 18.615 | 0.8 | 34.631 | 13.07 | 2589924 | 2476830 | 5/22/1998 | 15:08:59.30 | 5.633 | 7.699 |
| **256** | 46.083 | 18.617 | 0.809 | 34.629 | 13.071 | 2532447 | 2476741 | 5/22/1998 | 15:15:00.10 | 5.239 | 7.698 |
| **257** | 46.097 | 18.624 | 0.848 | 34.636 | 13.069 | 2553231 | 2477012 | 5/22/1998 | 15:21:00.90 | 5.381 | 7.699 |
| **258** | 46.104 | 18.639 | 0.902 | 34.629 | 13.07 | 2565389 | 2477423 | 5/22/1998 | 15:27:01.70 | 5.465 | 7.701 |
| **259** | 46.098 | 18.63 | 0.946 | 34.631 | 13.07 | 2535611 | 2478286 | 5/22/1998 | 15:33:02.50 | 5.260 | 7.705 |
| **260** | 46.088 | 18.613 | 0.971 | 34.637 | 13.069 | 2590498 | 2478543 | 5/22/1998 | 15:39:03.30 | 5.637 | 7.706 |
| **261** | 46.065 | 18.595 | 0.985 | 34.632 | 13.069 | 2590037 | 2478087 | 5/22/1998 | 15:45:04.10 | 5.634 | 7.704 |
| **262** | 46.045 | 18.573 | 1.009 | 34.634 | 13.069 | 2567389 | 2478166 | 5/22/1998 | 15:51:04.90 | 5.478 | 7.704 |
| **263** | 46.024 | 18.551 | 1.03 | 34.636 | 13.066 | 2563393 | 2478502 | 5/22/1998 | 15:57:05.70 | 5.451 | 7.706 |
| **264** | 46.002 | 18.529 | 1.044 | 34.635 | 13.066 | 2615503 | 2477569 | 5/22/1998 | 16:03:06.50 | 5.809 | 7.702 |
| **265** | 45.98 | 18.504 | 1.101 | 34.637 | 13.066 | 2611635 | 2477929 | 5/22/1998 | 16:09:07.30 | 5.782 | 7.703 |
| **266** | 45.959 | 18.483 | 1.186 | 34.637 | 13.064 | 2531634 | 2478889 | 5/22/1998 | 16:15:08.10 | 5.233 | 7.707 |
| **267** | 45.935 | 18.458 | 1.236 | 34.639 | 13.064 | 2615934 | 2478497 | 5/22/1998 | 16:21:08.90 | 5.812 | 7.706 |
| **268** | 45.911 | 18.434 | 1.249 | 34.638 | 13.064 | 2617829 | 2478638 | 5/22/1998 | 16:27:09.70 | 5.825 | 7.706 |
| **269** | 45.882 | 18.407 | 1.26 | 34.636 | 13.062 | 2568530 | 2479045 | 5/22/1998 | 16:33:10.50 | 5.486 | 7.708 |
| **270** | 45.854 | 18.375 | 1.314 | 34.64 | 13.062 | 2598543 | 2478537 | 5/22/1998 | 16:39:11.30 | 5.692 | 7.706 |
| **271** | 45.819 | 18.346 | 1.34 | 34.634 | 13.062 | 2552557 | 2478703 | 5/22/1998 | 16:45:12.10 | 5.377 | 7.707 |
| **272** | 45.784 | 18.309 | 1.384 | 34.636 | 13.06 | 2549410 | 2478786 | 5/22/1998 | 16:51:12.90 | 5.355 | 7.707 |
| **273** | 45.753 | 18.274 | 1.421 | 34.64 | 13.061 | 2590254 | 2478743 | 5/22/1998 | 16:57:13.70 | 5.635 | 7.707 |
| **274** | 45.718 | 18.239 | 1.462 | 34.639 | 13.061 | 2545525 | 2479306 | 5/22/1998 | 17:03:14.50 | 5.328 | 7.709 |
| **275** | 45.687 | 18.202 | 1.505 | 34.644 | 13.059 | 2555879 | 2479001 | 5/22/1998 | 17:09:15.30 | 5.399 | 7.708 |
| **276** | 45.649 | 18.156 | 1.511 | 34.651 | 13.058 | 2579929 | 2478432 | 5/22/1998 | 17:15:16.10 | 5.565 | 7.706 |
| **277** | 45.622 | 18.129 | 1.547 | 34.65 | 13.057 | 2555170 | 2478719 | 5/22/1998 | 17:21:16.90 | 5.395 | 7.707 |
| **278** | 45.583 | 18.093 | 1.532 | 34.648 | 13.057 | 2577298 | 2479581 | 5/22/1998 | 17:27:17.70 | 5.546 | 7.710 |
| **279** | 45.554 | 18.063 | 1.618 | 34.648 | 13.057 | 2600785 | 2479058 | 5/22/1998 | 17:33:18.50 | 5.708 | 7.708 |
| **280** | 45.521 | 18.033 | 1.604 | 34.646 | 13.056 | 2555234 | 2479098 | 5/22/1998 | 17:39:19.30 | 5.395 | 7.708 |
| **281** | 45.491 | 18.005 | 1.644 | 34.644 | 13.056 | 2531467 | 2479407 | 5/22/1998 | 17:45:20.10 | 5.232 | 7.710 |
| **282** | 45.453 | 17.96 | 1.676 | 34.649 | 13.055 | 2547282 | 2479640 | 5/22/1998 | 17:52:02.15 | 5.340 | 7.711 |
| **283** | 45.421 | 17.91 | 1.711 | 34.665 | 13.055 | 2540432 | 2479686 | 5/22/1998 | 17:58:02.95 | 5.293 | 7.711 |
| **284** | 45.378 | 17.877 | 1.752 | 34.656 | 13.054 | 2560748 | 2479403 | 5/22/1998 | 18:04:03.75 | 5.433 | 7.710 |
| **285** | 45.333 | 17.833 | 1.743 | 34.656 | 13.053 | 2538473 | 2479535 | 5/22/1998 | 18:10:04.55 | 5.280 | 7.710 |
| **286** | 45.291 | 17.789 | 1.756 | 34.656 | 13.052 | 2541569 | 2479947 | 5/22/1998 | 18:16:05.35 | 5.301 | 7.712 |
| **287** | 45.255 | 17.758 | 1.784 | 34.652 | 13.051 | 2518730 | 2479962 | 5/22/1998 | 18:22:06.15 | 5.144 | 7.712 |
| **288** | 45.206 | 17.699 | 1.795 | 34.661 | 13.05 | 2581636 | 2480060 | 5/22/1998 | 18:28:06.95 | 5.576 | 7.713 |
| **289** | 45.156 | 17.645 | 1.831 | 34.664 | 13.048 | 2522983 | 2479464 | 5/22/1998 | 18:34:07.75 | 5.174 | 7.710 |
| **290** | 45.1 | 17.594 | 1.863 | 34.659 | 13.049 | 2551811 | 2479704 | 5/22/1998 | 18:40:08.55 | 5.372 | 7.711 |
| **291** | 45.057 | 17.553 | 1.832 | 34.657 | 13.048 | 2555795 | 2480717 | 5/22/1998 | 18:46:09.35 | 5.399 | 7.715 |
| **292** | 45.013 | 17.51 | 1.848 | 34.656 | 13.047 | 2572267 | 2479715 | 5/22/1998 | 18:52:10.15 | 5.512 | 7.711 |
| **293** | 44.968 | 17.463 | 1.819 | 34.656 | 13.047 | 2562524 | 2480199 | 5/22/1998 | 18:58:10.95 | 5.445 | 7.713 |
| **294** | 44.94 | 17.433 | 1.844 | 34.658 | 13.046 | 2527876 | 2480112 | 5/22/1998 | 19:04:11.75 | 5.207 | 7.713 |
| **295** | 44.907 | 17.377 | 1.85 | 34.678 | 13.047 | 2528236 | 2480174 | 5/22/1998 | 19:10:12.55 | 5.210 | 7.713 |
| **296** | 44.879 | 17.366 | 1.904 | 34.663 | 13.047 | 2536020 | 2480288 | 5/22/1998 | 19:16:13.35 | 5.263 | 7.714 |
| **297** | 44.858 | 17.339 | 1.915 | 34.668 | 13.047 | 2530089 | 2481096 | 5/22/1998 | 19:22:14.15 | 5.222 | 7.717 |
| **298** | 44.835 | 17.313 | 1.881 | 34.67 | 13.045 | 2501618 | 2480710 | 5/22/1998 | 19:28:14.95 | 5.027 | 7.715 |
| **299** | 44.804 | 17.292 | 1.841 | 34.662 | 13.044 | 2516179 | 2480394 | 5/22/1998 | 19:34:15.75 | 5.127 | 7.714 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **300** | 44.787 | 17.259 | 1.846 | 34.675 | 13.046 | 2494858 | 2480956 | 5/22/1998 | 19:40:16.55 | 4.981 | 7.716 |
| **301** | 44.756 | 17.239 | 1.801 | 34.666 | 13.047 | 2544731 | 2479916 | 5/22/1998 | 19:46:17.35 | 5.323 | 7.712 |
| **302** | 44.735 | 17.216 | 1.817 | 34.667 | 13.043 | 2517467 | 2480882 | 5/22/1998 | 19:52:18.15 | 5.136 | 7.716 |
| **303** | 44.716 | 17.205 | 1.779 | 34.66 | 13.045 | 2549646 | 2480589 | 5/22/1998 | 19:58:18.95 | 5.357 | 7.715 |
| **304** | 44.695 | 17.163 | 1.791 | 34.678 | 13.043 | 2521162 | 2480455 | 5/22/1998 | 20:04:19.75 | 5.161 | 7.714 |
| **305** | 44.676 | 17.143 | 1.777 | 34.679 | 13.042 | 2518000 | 2480039 | 5/22/1998 | 20:10:20.55 | 5.139 | 7.712 |
| **306** | 44.657 | 17.115 | 1.799 | 34.687 | 13.042 | 2574959 | 2479869 | 5/22/1998 | 20:16:21.35 | 5.530 | 7.712 |
| **307** | 44.636 | 17.103 | 1.73 | 34.678 | 13.041 | 2532930 | 2480393 | 5/22/1998 | 20:22:22.15 | 5.242 | 7.714 |
| **308** | 44.614 | 17.089 | 1.688 | 34.671 | 13.043 | 2532986 | 2479990 | 5/22/1998 | 20:28:22.95 | 5.242 | 7.712 |
| **309** | 44.595 | 17.058 | 1.643 | 34.682 | 13.04 | 2517637 | 2480252 | 5/22/1998 | 20:34:23.75 | 5.137 | 7.713 |
| **310** | 44.572 | 17.057 | 1.645 | 34.662 | 13.04 | 2465567 | 2480180 | 5/22/1998 | 20:40:24.55 | 4.780 | 7.713 |
| **311** | 44.563 | 17.021 | 1.581 | 34.686 | 13.039 | 2502866 | 2480502 | 5/22/1998 | 20:46:25.35 | 5.036 | 7.714 |
| **312** | 44.553 | 17.018 | 1.578 | 34.679 | 13.039 | 2543391 | 2480776 | 5/22/1998 | 20:52:26.15 | 5.314 | 7.716 |
| **313** | 44.534 | 16.996 | 1.56 | 34.682 | 13.039 | 2492834 | 2480874 | 5/22/1998 | 20:58:26.95 | 4.967 | 7.716 |
| **314** | 44.532 | 16.991 | 1.518 | 34.685 | 13.04 | 2484181 | 2480518 | 5/22/1998 | 21:04:27.75 | 4.907 | 7.715 |
| **315** | 44.519 | 16.989 | 1.472 | 34.674 | 13.041 | 2551100 | 2480860 | 5/22/1998 | 21:10:28.55 | 5.367 | 7.716 |
| **316** | 44.505 | 16.975 | 1.414 | 34.674 | 13.038 | 2534409 | 2480932 | 5/22/1998 | 21:16:29.35 | 5.252 | 7.716 |
| **317** | 44.494 | 16.962 | 1.39 | 34.676 | 13.038 | 2503673 | 2481790 | 5/22/1998 | 21:22:30.15 | 5.041 | 7.720 |
| **318** | 44.487 | 16.96 | 1.336 | 34.672 | 13.038 | 2505018 | 2480901 | 5/22/1998 | 21:28:30.95 | 5.050 | 7.716 |
| **319** | 44.476 | 16.944 | 1.304 | 34.676 | 13.037 | 2527721 | 2481551 | 5/22/1998 | 21:34:31.75 | 5.206 | 7.719 |
| **320** | 44.473 | 16.942 | 1.288 | 34.676 | 13.038 | 2497366 | 2482178 | 5/22/1998 | 21:40:32.55 | 4.998 | 7.722 |
| **321** | 44.471 | 16.933 | 1.222 | 34.681 | 13.037 | 2540504 | 2480869 | 5/22/1998 | 21:46:33.35 | 5.294 | 7.716 |
| **322** | 44.464 | 16.927 | 1.178 | 34.681 | 13.037 | 2500477 | 2481066 | 5/22/1998 | 21:52:34.15 | 5.019 | 7.717 |
| **323** | 44.472 | 16.933 | 1.132 | 34.683 | 13.037 | 2493677 | 2480772 | 5/22/1998 | 21:58:34.95 | 4.973 | 7.716 |
| **324** | 44.471 | 16.932 | 1.084 | 34.682 | 13.037 | 2555636 | 2481482 | 5/22/1998 | 22:04:35.75 | 5.398 | 7.719 |
| **325** | 44.475 | 16.937 | 1.059 | 34.681 | 13.036 | 2541651 | 2482014 | 5/22/1998 | 22:10:36.55 | 5.302 | 7.721 |
| **326** | 44.48 | 16.94 | 0.999 | 34.683 | 13.039 | 2510246 | 2481305 | 5/22/1998 | 22:16:37.35 | 5.086 | 7.718 |
| **327** | 44.486 | 16.947 | 0.937 | 34.683 | 13.035 | 2502953 | 2481824 | 5/22/1998 | 22:22:38.15 | 5.036 | 7.720 |
| **328** | 44.503 | 16.959 | 0.901 | 34.687 | 13.036 | 2551338 | 2481762 | 5/22/1998 | 22:28:38.95 | 5.368 | 7.720 |
| **329** | 44.518 | 16.966 | 0.866 | 34.693 | 13.036 | 2549862 | 2481929 | 5/22/1998 | 22:34:39.75 | 5.358 | 7.721 |
| **330** | 44.54 | 17.007 | 0.831 | 34.678 | 13.035 | 2565331 | 2481888 | 5/22/1998 | 22:40:40.55 | 5.464 | 7.720 |
| **331** | 44.567 | 17.032 | 0.778 | 34.68 | 13.036 | 2511606 | 2481505 | 5/22/1998 | 22:46:41.35 | 5.096 | 7.719 |
| **332** | 44.599 | 17.056 | 0.721 | 34.687 | 13.036 | 2563539 | 2481368 | 5/22/1998 | 22:52:42.15 | 5.452 | 7.718 |
| **333** | 44.617 | 17.088 | 0.671 | 34.675 | 13.036 | 2572075 | 2481500 | 5/22/1998 | 22:58:42.95 | 5.511 | 7.719 |
| **334** | 44.662 | 17.121 | 0.634 | 34.686 | 13.036 | 2522143 | 2481644 | 5/22/1998 | 23:04:43.75 | 5.168 | 7.719 |
| **335** | 44.694 | 17.157 | 0.625 | 34.683 | 13.036 | 2498086 | 2482211 | 5/22/1998 | 23:10:44.55 | 5.003 | 7.722 |
| **336** | 44.723 | 17.191 | 0.594 | 34.678 | 13.037 | 2529994 | 2481445 | 5/22/1998 | 23:16:45.35 | 5.222 | 7.719 |
| **337** | 44.756 | 17.212 | 0.533 | 34.689 | 13.036 | 2505395 | 2481385 | 5/22/1998 | 23:22:46.15 | 5.053 | 7.718 |
| **338** | 44.786 | 17.255 | 0.486 | 34.678 | 13.036 | 2516920 | 2481856 | 5/22/1998 | 23:28:46.95 | 5.132 | 7.720 |
| **339** | 44.812 | 17.279 | 0.439 | 34.681 | 13.036 | 2528784 | 2481838 | 5/22/1998 | 23:34:47.75 | 5.213 | 7.720 |
| **340** | 44.842 | 17.318 | 0.403 | 34.673 | 13.037 | 2541116 | 2481893 | 5/22/1998 | 23:40:48.55 | 5.298 | 7.720 |
| **341** | 44.886 | 17.352 | 0.364 | 34.682 | 13.037 | 2524601 | 2481596 | 5/22/1998 | 23:46:49.35 | 5.185 | 7.719 |
| **342** | 44.91 | 17.386 | 0.315 | 34.673 | 13.04 | 2480835 | 2481857 | 5/22/1998 | 23:52:50.15 | 4.884 | 7.720 |
| **343** | 44.917 | 17.392 | 0.296 | 34.674 | 13.037 | 2529532 | 2481861 | 5/22/1998 | 23:58:50.95 | 5.219 | 7.720 |
| **344** | 44.946 | 17.418 | 0.253 | 34.678 | 13.036 | 2512864 | 2481803 | 5/23/1998 | 00:04:51.75 | 5.104 | 7.720 |
| **345** | 44.989 | 17.47 | 0.239 | 34.669 | 13.036 | 2486088 | 2481248 | 5/23/1998 | 00:10:52.55 | 4.920 | 7.718 |
| **346** | 45.025 | 17.513 | 0.2 | 34.664 | 13.037 | 2530735 | 2482099 | 5/23/1998 | 00:16:53.35 | 5.227 | 7.721 |
| **347** | 45.072 | 17.544 | 0.171 | 34.678 | 13.038 | 2567634 | 2481896 | 5/23/1998 | 00:22:54.15 | 5.480 | 7.720 |
| **348** | 45.111 | 17.585 | 0.127 | 34.676 | 13.039 | 2596736 | 2481618 | 5/23/1998 | 00:28:54.95 | 5.680 | 7.719 |
| **349** | 45.138 | 17.614 | 0.102 | 34.675 | 13.039 | 2544673 | 2481384 | 5/23/1998 | 00:34:55.75 | 5.323 | 7.718 |
| **350** | 45.154 | 17.637 | 0.053 | 34.669 | 13.037 | 2516014 | 2481507 | 5/23/1998 | 00:40:56.55 | 5.126 | 7.719 |
| **351** | 45.188 | 17.661 | 0.039 | 34.677 | 13.038 | 2546135 | 2481698 | 5/23/1998 | 00:46:57.35 | 5.333 | 7.720 |
| **352** | 45.223 | 17.703 | 0.014 | 34.672 | 13.037 | 2526513 | 2481972 | 5/23/1998 | 00:53:39.39 | 5.198 | 7.721 |
| **353** | 45.269 | 17.741 | 0 | 34.68 | 13.037 | 2555885 | 2482028 | 5/23/1998 | 00:59:40.19 | 5.399 | 7.721 |
| **354** | 45.306 | 17.783 | -0.014 | 34.675 | 13.038 | 2590430 | 2481398 | 5/23/1998 | 01:05:40.99 | 5.637 | 7.718 |
| **355** | 45.333 | 17.823 | -0.037 | 34.665 | 13.038 | 2553058 | 2481499 | 5/23/1998 | 01:11:41.79 | 5.380 | 7.719 |
| **356** | 45.366 | 17.854 | -0.062 | 34.666 | 13.039 | 2526912 | 2481095 | 5/23/1998 | 01:17:42.59 | 5.201 | 7.717 |
| **357** | 45.404 | 17.884 | -0.071 | 34.673 | 13.038 | 2540613 | 2481352 | 5/23/1998 | 01:23:43.39 | 5.295 | 7.718 |
| **358** | 45.452 | 17.934 | -0.095 | 34.672 | 13.038 | 2556517 | 2482037 | 5/23/1998 | 01:29:44.19 | 5.404 | 7.721 |
| **359** | 45.495 | 17.976 | -0.105 | 34.673 | 13.038 | 2548104 | 2481425 | 5/23/1998 | 01:35:44.99 | 5.346 | 7.718 |
| **360** | 45.531 | 18.013 | -0.117 | 34.672 | 13.039 | 2592367 | 2481265 | 5/23/1998 | 01:41:45.79 | 5.650 | 7.718 |
| **361** | 45.565 | 18.058 | -0.109 | 34.662 | 13.038 | 2556901 | 2481470 | 5/23/1998 | 01:47:46.59 | 5.406 | 7.719 |
| **362** | 45.606 | 18.087 | -0.102 | 34.673 | 13.039 | 2498739 | 2481178 | 5/23/1998 | 01:53:47.39 | 5.007 | 7.717 |
| **363** | 45.638 | 18.128 | -0.099 | 34.665 | 13.04 | 2560534 | 2480973 | 5/23/1998 | 01:59:48.19 | 5.431 | 7.716 |
| **364** | 45.68 | 18.162 | -0.094 | 34.673 | 13.04 | 2512583 | 2481180 | 5/23/1998 | 02:05:48.99 | 5.102 | 7.717 |
| **365** | 45.709 | 18.19 | -0.12 | 34.674 | 13.04 | 2564208 | 2481543 | 5/23/1998 | 02:11:49.79 | 5.457 | 7.719 |
| **366** | 45.746 | 18.229 | -0.131 | 34.672 | 13.039 | 2543685 | 2480836 | 5/23/1998 | 02:17:50.59 | 5.316 | 7.716 |
| **367** | 45.778 | 18.264 | -0.101 | 34.67 | 13.038 | 2568551 | 2481195 | 5/23/1998 | 02:23:51.39 | 5.486 | 7.717 |
| **368** | 45.805 | 18.29 | -0.099 | 34.67 | 13.041 | 2560673 | 2480921 | 5/23/1998 | 02:29:52.19 | 5.432 | 7.716 |
| **369** | 45.836 | 18.326 | -0.105 | 34.666 | 13.038 | 2558218 | 2480783 | 5/23/1998 | 02:35:52.99 | 5.416 | 7.716 |
| **370** | 45.857 | 18.351 | -0.102 | 34.663 | 13.04 | 2545895 | 2481259 | 5/23/1998 | 02:41:53.79 | 5.331 | 7.718 |
| **371** | 45.876 | 18.374 | -0.055 | 34.659 | 13.04 | 2599323 | 2481012 | 5/23/1998 | 02:47:54.59 | 5.698 | 7.717 |
| **372** | 45.91 | 18.405 | -0.045 | 34.662 | 13.04 | 2545121 | 2480984 | 5/23/1998 | 02:53:55.39 | 5.326 | 7.717 |
| **373** | 45.934 | 18.43 | -0.026 | 34.661 | 13.038 | 2522353 | 2480654 | 5/23/1998 | 02:59:56.19 | 5.169 | 7.715 |
| **374** | 45.953 | 18.453 | -0.013 | 34.658 | 13.04 | 2590378 | 2481112 | 5/23/1998 | 03:05:56.99 | 5.636 | 7.717 |
| **375** | 45.973 | 18.47 | -0.011 | 34.66 | 13.04 | 2548980 | 2481494 | 5/23/1998 | 03:11:57.79 | 5.352 | 7.719 |
| **376** | 45.995 | 18.487 | 0.016 | 34.665 | 13.039 | 2479335 | 2481220 | 5/23/1998 | 03:17:58.59 | 4.874 | 7.718 |
| **377** | 46.02 | 18.506 | 0.075 | 34.67 | 13.04 | 2602047 | 2480708 | 5/23/1998 | 03:23:59.39 | 5.716 | 7.715 |
| **378** | 46.041 | 18.544 | 0.104 | 34.655 | 13.04 | 2540454 | 2481055 | 5/23/1998 | 03:30:00.19 | 5.294 | 7.717 |
| **379** | 46.061 | 18.567 | 0.104 | 34.653 | 13.038 | 2556218 | 2480031 | 5/23/1998 | 03:36:00.99 | 5.402 | 7.712 |
| **380** | 46.083 | 18.58 | 0.105 | 34.661 | 13.039 | 2550058 | 2480823 | 5/23/1998 | 03:42:01.79 | 5.359 | 7.716 |
| **381** | 46.1 | 18.601 | 0.158 | 34.657 | 13.04 | 2565084 | 2480477 | 5/23/1998 | 03:48:02.59 | 5.463 | 7.714 |
| **382** | 46.125 | 18.62 | 0.198 | 34.663 | 13.041 | 2541682 | 2480354 | 5/23/1998 | 03:54:03.39 | 5.302 | 7.714 |
| **383** | 46.144 | 18.639 | 0.229 | 34.662 | 13.04 | 2560697 | 2480492 | 5/23/1998 | 04:00:04.19 | 5.433 | 7.714 |
| **384** | 46.156 | 18.647 | 0.264 | 34.666 | 13.041 | 2593683 | 2480358 | 5/23/1998 | 04:06:04.99 | 5.659 | 7.714 |
| **385** | 46.168 | 18.667 | 0.274 | 34.659 | 13.039 | 2549187 | 2480180 | 5/23/1998 | 04:12:05.79 | 5.354 | 7.713 |
| **386** | 46.183 | 18.689 | 0.325 | 34.653 | 13.037 | 2614653 | 2479799 | 5/23/1998 | 04:18:06.59 | 5.803 | 7.711 |
| **387** | 46.199 | 18.697 | 0.367 | 34.66 | 13.041 | 2551814 | 2479998 | 5/23/1998 | 04:24:07.39 | 5.372 | 7.712 |
| **388** | 46.205 | 18.705 | 0.403 | 34.658 | 13.036 | 2572861 | 2480206 | 5/23/1998 | 04:30:08.19 | 5.516 | 7.713 |
| **389** | 46.206 | 18.702 | 0.426 | 34.662 | 13.037 | 2581931 | 2480111 | 5/23/1998 | 04:36:08.99 | 5.578 | 7.713 |
| **390** | 46.196 | 18.701 | 0.443 | 34.654 | 13.036 | 2566662 | 2479960 | 5/23/1998 | 04:42:09.79 | 5.473 | 7.712 |
| **391** | 46.181 | 18.681 | 0.466 | 34.658 | 13.041 | 2544687 | 2480039 | 5/23/1998 | 04:48:10.59 | 5.323 | 7.712 |
| **392** | 46.173 | 18.671 | 0.51 | 34.659 | 13.037 | 2605728 | 2480230 | 5/23/1998 | 04:54:11.39 | 5.742 | 7.713 |
| **393** | 46.152 | 18.655 | 0.554 | 34.656 | 13.037 | 2603563 | 2479793 | 5/23/1998 | 05:00:12.19 | 5.727 | 7.711 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **394** | 46.141 | 18.635 | 0.57 | 34.664 | 13.034 | 2567619 | 2480371 | 5/23/1998 | 05:06:12.99 | 5.480 | 7.714 |
| **395** | 46.12 | 18.621 | 0.622 | 34.657 | 13.034 | 2580806 | 2479782 | 5/23/1998 | 05:12:13.79 | 5.571 | 7.711 |
| **396** | 46.103 | 18.604 | 0.649 | 34.657 | 13.035 | 2556223 | 2480113 | 5/23/1998 | 05:18:14.59 | 5.402 | 7.713 |
| **397** | 46.087 | 18.584 | 0.708 | 34.66 | 13.034 | 2573353 | 2479766 | 5/23/1998 | 05:24:15.39 | 5.519 | 7.711 |
| **398** | 46.068 | 18.562 | 0.727 | 34.663 | 13.033 | 2546761 | 2479405 | 5/23/1998 | 05:30:16.19 | 5.337 | 7.710 |
| **399** | 46.053 | 18.553 | 0.747 | 34.657 | 13.033 | 2543820 | 2480263 | 5/23/1998 | 05:36:16.99 | 5.317 | 7.713 |
| **400** | 46.042 | 18.531 | 0.758 | 34.667 | 13.032 | 2560063 | 2478851 | 5/23/1998 | 05:42:17.79 | 5.428 | 7.707 |
| **401** | 46.025 | 18.518 | 0.807 | 34.664 | 13.032 | 2552301 | 2479747 | 5/23/1998 | 05:48:18.59 | 5.375 | 7.711 |
| **402** | 45.994 | 18.496 | 0.828 | 34.656 | 13.032 | 2570116 | 2479852 | 5/23/1998 | 05:54:19.39 | 5.497 | 7.712 |
| **403** | 45.97 | 18.469 | 0.86 | 34.659 | 13.032 | 2543335 | 2479850 | 5/23/1998 | 06:00:20.19 | 5.313 | 7.712 |
| **404** | 45.952 | 18.441 | 0.904 | 34.666 | 13.031 | 2525443 | 2479693 | 5/23/1998 | 06:06:20.99 | 5.191 | 7.711 |
| **405** | 45.93 | 18.418 | 0.93 | 34.667 | 13.031 | 2558889 | 2479306 | 5/23/1998 | 06:12:21.79 | 5.420 | 7.709 |
| **406** | 45.908 | 18.395 | 0.97 | 34.669 | 13.029 | 2553385 | 2479460 | 5/23/1998 | 06:18:22.59 | 5.382 | 7.710 |
| **407** | 45.881 | 18.376 | 0.974 | 34.662 | 13.029 | 2600458 | 2479745 | 5/23/1998 | 06:24:23.39 | 5.705 | 7.711 |
| **408** | 45.861 | 18.354 | 1.024 | 34.663 | 13.03 | 2569088 | 2479341 | 5/23/1998 | 06:30:24.19 | 5.490 | 7.709 |
| **409** | 45.843 | 18.337 | 1.019 | 34.663 | 13.029 | 2526933 | 2479083 | 5/23/1998 | 06:36:24.99 | 5.201 | 7.708 |
| **410** | 45.816 | 18.304 | 1.004 | 34.667 | 13.028 | 2537581 | 2479577 | 5/23/1998 | 06:42:25.79 | 5.274 | 7.710 |
| **411** | 45.799 | 18.277 | 1.03 | 34.676 | 13.031 | 2599347 | 2479143 | 5/23/1998 | 06:48:26.59 | 5.698 | 7.709 |
| **412** | 45.78 | 18.265 | 1.097 | 34.67 | 13.027 | 2554368 | 2479341 | 5/23/1998 | 06:54:27.39 | 5.389 | 7.709 |
| **413** | 45.749 | 18.235 | 1.118 | 34.668 | 13.025 | 2525123 | 2479203 | 5/23/1998 | 07:00:28.19 | 5.188 | 7.709 |
| **414** | 45.705 | 18.198 | 1.132 | 34.663 | 13.025 | 2519614 | 2479449 | 5/23/1998 | 07:06:28.99 | 5.151 | 7.710 |
| **415** | 45.682 | 18.167 | 1.151 | 34.669 | 13.025 | 2533448 | 2479207 | 5/23/1998 | 07:12:29.79 | 5.246 | 7.709 |
| **416** | 45.654 | 18.141 | 1.143 | 34.667 | 13.026 | 2555954 | 2479500 | 5/23/1998 | 07:18:30.59 | 5.400 | 7.710 |
| **417** | 45.633 | 18.115 | 1.157 | 34.672 | 13.025 | 2430381 | 2479267 | 5/23/1998 | 07:24:31.39 | 4.538 | 7.709 |
| **418** | 45.608 | 18.09 | 1.174 | 34.672 | 13.024 | 2501958 | 2478975 | 5/23/1998 | 07:30:32.19 | 5.029 | 7.708 |
| **419** | 45.584 | 18.07 | 1.17 | 34.668 | 13.023 | 2524197 | 2479309 | 5/23/1998 | 07:36:32.99 | 5.182 | 7.709 |
| **420** | 45.549 | 18.033 | 1.186 | 34.67 | 13.022 | 2517803 | 2478930 | 5/23/1998 | 07:42:33.79 | 5.138 | 7.708 |
| **421** | 45.526 | 17.996 | 1.168 | 34.682 | 13.021 | 2518339 | 2478972 | 5/23/1998 | 07:48:34.59 | 5.142 | 7.708 |
| **422** | 45.486 | 17.966 | 1.173 | 34.673 | 13.021 | 2552188 | 2478608 | 5/23/1998 | 07:55:16.65 | 5.374 | 7.706 |
| **423** | 45.457 | 17.929 | 1.192 | 34.679 | 13.021 | 2544192 | 2479825 | 5/23/1998 | 08:01:17.45 | 5.319 | 7.712 |
| **424** | 45.422 | 17.907 | 1.171 | 34.668 | 13.022 | 2536213 | 2479450 | 5/23/1998 | 08:07:18.25 | 5.264 | 7.710 |
| **425** | 45.399 | 17.872 | 1.178 | 34.678 | 13.019 | 2519791 | 2479019 | 5/23/1998 | 08:13:19.05 | 5.152 | 7.708 |
| **426** | 45.369 | 17.838 | 1.173 | 34.682 | 13.02 | 2557432 | 2478595 | 5/23/1998 | 08:19:19.85 | 5.410 | 7.706 |
| **427** | 45.345 | 17.817 | 1.189 | 34.68 | 13.02 | 2507943 | 2479244 | 5/23/1998 | 08:25:20.65 | 5.070 | 7.709 |
| **428** | 45.328 | 17.792 | 1.144 | 34.686 | 13.02 | 2501972 | 2478712 | 5/23/1998 | 08:31:21.45 | 5.029 | 7.707 |
| **429** | 45.312 | 17.785 | 1.122 | 34.678 | 13.018 | 2550992 | 2479040 | 5/23/1998 | 08:37:22.25 | 5.366 | 7.708 |
| **430** | 45.29 | 17.76 | 1.123 | 34.681 | 13.017 | 2534530 | 2478846 | 5/23/1998 | 08:43:23.05 | 5.253 | 7.707 |
| **431** | 45.274 | 17.738 | 1.118 | 34.686 | 13.019 | 2591470 | 2478496 | 5/23/1998 | 08:49:23.85 | 5.644 | 7.706 |
| **432** | 45.255 | 17.731 | 1.101 | 34.675 | 13.017 | 2521083 | 2478329 | 5/23/1998 | 08:55:24.65 | 5.161 | 7.705 |
| **433** | 45.239 | 17.706 | 1.057 | 34.684 | 13.017 | 2508457 | 2478320 | 5/23/1998 | 09:01:25.45 | 5.074 | 7.705 |
| **434** | 45.232 | 17.701 | 1.037 | 34.681 | 13.017 | 2506494 | 2478702 | 5/23/1998 | 09:07:26.25 | 5.061 | 7.707 |
| **435** | 45.219 | 17.691 | 1.023 | 34.679 | 13.019 | 2531824 | 2479250 | 5/23/1998 | 09:13:27.05 | 5.234 | 7.709 |
| **436** | 45.209 | 17.68 | 1.041 | 34.68 | 13.018 | 2517963 | 2478876 | 5/23/1998 | 09:19:27.85 | 5.139 | 7.707 |
| **437** | 45.196 | 17.671 | 1.002 | 34.676 | 13.016 | 2528560 | 2478525 | 5/23/1998 | 09:25:28.65 | 5.212 | 7.706 |
| **438** | 45.181 | 17.645 | 0.956 | 34.685 | 13.015 | 2565673 | 2478672 | 5/23/1998 | 09:31:29.45 | 5.467 | 7.707 |
| **439** | 45.164 | 17.633 | 0.911 | 34.681 | 13.017 | 2546406 | 2478298 | 5/23/1998 | 09:37:30.25 | 5.334 | 7.705 |
| **440** | 45.148 | 17.624 | 0.909 | 34.674 | 13.014 | 2517827 | 2479205 | 5/23/1998 | 09:43:31.05 | 5.138 | 7.709 |
| **441** | 45.132 | 17.594 | 0.92 | 34.686 | 13.014 | 2531457 | 2478239 | 5/23/1998 | 09:49:31.85 | 5.232 | 7.705 |
| **442** | 45.123 | 17.586 | 0.88 | 34.685 | 13.014 | 2512794 | 2478250 | 5/23/1998 | 09:55:32.65 | 5.104 | 7.705 |
| **443** | 45.11 | 17.578 | 0.822 | 34.681 | 13.016 | 2548249 | 2478050 | 5/23/1998 | 10:01:33.45 | 5.347 | 7.704 |
| **444** | 45.102 | 17.569 | 0.779 | 34.682 | 13.014 | 2534234 | 2478375 | 5/23/1998 | 10:07:34.25 | 5.251 | 7.705 |
| **445** | 45.089 | 17.56 | 0.737 | 34.679 | 13.014 | 2516836 | 2478096 | 5/23/1998 | 10:13:35.05 | 5.131 | 7.704 |
| **446** | 45.091 | 17.56 | 0.71 | 34.68 | 13.015 | 2518174 | 2477505 | 5/23/1998 | 10:19:35.85 | 5.141 | 7.702 |
| **447** | 45.081 | 17.547 | 0.68 | 34.683 | 13.013 | 2514741 | 2478221 | 5/23/1998 | 10:25:36.65 | 5.117 | 7.705 |
| **448** | 45.079 | 17.539 | 0.609 | 34.689 | 13.013 | 2500781 | 2477760 | 5/23/1998 | 10:31:37.45 | 5.021 | 7.703 |
| **449** | 45.072 | 17.536 | 0.548 | 34.685 | 13.012 | 2534647 | 2477540 | 5/23/1998 | 10:37:38.25 | 5.254 | 7.702 |
| **450** | 45.079 | 17.543 | 0.58 | 34.685 | 13.013 | 2563901 | 2477984 | 5/23/1998 | 10:43:39.05 | 5.455 | 7.704 |
| **451** | 45.093 | 17.551 | 0.558 | 34.69 | 13.013 | 2524513 | 2478610 | 5/23/1998 | 10:49:39.85 | 5.184 | 7.706 |
| **452** | 45.11 | 17.575 | 0.526 | 34.685 | 13.013 | 2478230 | 2478030 | 5/23/1998 | 10:55:40.65 | 4.867 | 7.704 |
| **453** | 45.128 | 17.593 | 0.549 | 34.684 | 13.013 | 2582847 | 2477865 | 5/23/1998 | 11:01:41.45 | 5.585 | 7.703 |
| **454** | 45.141 | 17.612 | 0.458 | 34.679 | 13.013 | 2525097 | 2477944 | 5/23/1998 | 11:07:42.25 | 5.188 | 7.703 |
| **455** | 45.17 | 17.637 | 0.44 | 34.683 | 13.013 | 2527647 | 2477413 | 5/23/1998 | 11:13:43.05 | 5.206 | 7.701 |
| **456** | 45.188 | 17.662 | 0.407 | 34.677 | 13.014 | 2557564 | 2477671 | 5/23/1998 | 11:19:43.85 | 5.411 | 7.702 |
| **457** | 45.217 | 17.691 | 0.357 | 34.678 | 13.015 | 2525942 | 2477373 | 5/23/1998 | 11:25:44.65 | 5.194 | 7.701 |
| **458** | 45.231 | 17.701 | 0.294 | 34.68 | 13.013 | 2556153 | 2477652 | 5/23/1998 | 11:31:45.45 | 5.401 | 7.702 |
| **459** | 45.248 | 17.713 | 0.292 | 34.685 | 13.014 | 2569279 | 2476591 | 5/23/1998 | 11:37:46.25 | 5.491 | 7.698 |
| **460** | 45.269 | 17.729 | 0.259 | 34.689 | 13.014 | 2509790 | 2477083 | 5/23/1998 | 11:43:47.05 | 5.083 | 7.700 |
| **461** | 45.292 | 17.767 | 0.257 | 34.677 | 13.013 | 2512965 | 2476853 | 5/23/1998 | 11:49:47.85 | 5.105 | 7.699 |
| **462** | 45.305 | 17.777 | 0.242 | 34.679 | 13.014 | 2566893 | 2476984 | 5/23/1998 | 11:55:48.65 | 5.475 | 7.699 |
| **463** | 45.313 | 17.782 | 0.142 | 34.681 | 13.012 | 2525979 | 2477031 | 5/23/1998 | 12:01:49.45 | 5.194 | 7.699 |
| **464** | 45.329 | 17.8 | 0.128 | 34.68 | 13.014 | 2525679 | 2476737 | 5/23/1998 | 12:07:50.25 | 5.192 | 7.698 |
| **465** | 45.348 | 17.825 | 0.134 | 34.676 | 13.013 | 2550772 | 2477175 | 5/23/1998 | 12:13:51.05 | 5.364 | 7.700 |
| **466** | 45.379 | 17.847 | 0.122 | 34.683 | 13.014 | 2547300 | 2476558 | 5/23/1998 | 12:19:51.85 | 5.341 | 7.697 |
| **467** | 45.405 | 17.873 | 0.097 | 34.683 | 13.016 | 2571228 | 2476897 | 5/23/1998 | 12:25:52.65 | 5.505 | 7.699 |
| **468** | 45.425 | 17.885 | 0.063 | 34.691 | 13.014 | 2547223 | 2476299 | 5/23/1998 | 12:31:53.45 | 5.340 | 7.696 |
| **469** | 45.445 | 17.919 | 0.069 | 34.678 | 13.014 | 2578308 | 2476455 | 5/23/1998 | 12:37:54.25 | 5.553 | 7.697 |
| **470** | 45.475 | 17.948 | 0.017 | 34.679 | 13.016 | 2559621 | 2476264 | 5/23/1998 | 12:43:55.05 | 5.425 | 7.696 |
| **471** | 45.505 | 17.976 | 0 | 34.681 | 13.015 | 2570899 | 2477794 | 5/23/1998 | 12:49:55.85 | 5.503 | 7.703 |
| **472** | 45.537 | 18.009 | 0.002 | 34.681 | 13.015 | 2545682 | 2476519 | 5/23/1998 | 12:55:56.65 | 5.329 | 7.697 |
| **473** | 45.553 | 18.036 | -0.023 | 34.671 | 13.016 | 2582263 | 2476201 | 5/23/1998 | 13:01:57.45 | 5.581 | 7.696 |
| **474** | 45.589 | 18.062 | -0.049 | 34.679 | 13.014 | 2531513 | 2476566 | 5/23/1998 | 13:07:58.25 | 5.232 | 7.697 |
| **475** | 45.624 | 18.097 | -0.037 | 34.68 | 13.014 | 2573840 | 2477014 | 5/23/1998 | 13:13:59.05 | 5.523 | 7.699 |
| **476** | 45.647 | 18.124 | -0.048 | 34.676 | 13.015 | 2583203 | 2476824 | 5/23/1998 | 13:19:59.85 | 5.587 | 7.699 |
| **477** | 45.675 | 18.148 | -0.068 | 34.68 | 13.015 | 2518249 | 2476829 | 5/23/1998 | 13:26:00.65 | 5.141 | 7.699 |
| **478** | 45.706 | 18.187 | -0.057 | 34.673 | 13.014 | 2553641 | 2477265 | 5/23/1998 | 13:32:01.45 | 5.384 | 7.700 |
| **479** | 45.745 | 18.223 | -0.059 | 34.676 | 13.017 | 2569545 | 2476364 | 5/23/1998 | 13:38:02.25 | 5.493 | 7.697 |
| **480** | 45.779 | 18.252 | -0.045 | 34.681 | 13.016 | 2481423 | 2476294 | 5/23/1998 | 13:44:03.05 | 4.888 | 7.696 |
| **481** | 45.808 | 18.287 | -0.065 | 34.676 | 13.016 | 2595313 | 2476444 | 5/23/1998 | 13:50:03.85 | 5.670 | 7.697 |
| **482** | 45.847 | 18.32 | -0.043 | 34.681 | 13.017 | 2582524 | 2477134 | 5/23/1998 | 13:56:04.65 | 5.582 | 7.700 |
| **483** | 45.886 | 18.365 | -0.057 | 34.675 | 13.018 | 2575951 | 2476881 | 5/23/1998 | 14:02:05.45 | 5.537 | 7.699 |
| **484** | 45.915 | 18.405 | -0.051 | 34.666 | 13.016 | 2563593 | 2477154 | 5/23/1998 | 14:08:06.25 | 5.452 | 7.700 |
| **485** | 45.93 | 18.42 | -0.059 | 34.666 | 13.016 | 2535607 | 2477318 | 5/23/1998 | 14:14:07.05 | 5.260 | 7.701 |
| **486** | 45.977 | 18.456 | -0.038 | 34.676 | 13.015 | 2637619 | 2477696 | 5/23/1998 | 14:20:07.85 | 5.960 | 7.702 |
| **487** | 46.01 | 18.493 | -0.002 | 34.673 | 13.016 | 2545646 | 2477409 | 5/23/1998 | 14:26:08.65 | 5.329 | 7.701 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **488** | 46.045 | 18.535 | 0.016 | 34.666 | 13.016 | 2557096 | 2477579 | 5/23/1998 | 14:32:09.45 | 5.408 | 7.702 |
| **489** | 46.081 | 18.572 | 0.034 | 34.666 | 13.017 | 2599859 | 2477999 | 5/23/1998 | 14:38:10.25 | 5.701 | 7.704 |
| **490** | 46.114 | 18.602 | 0.052 | 34.668 | 13.018 | 2561174 | 2477664 | 5/23/1998 | 14:44:11.05 | 5.436 | 7.702 |
| **491** | 46.149 | 18.63 | 0.096 | 34.675 | 13.016 | 2600665 | 2478497 | 5/23/1998 | 14:50:11.85 | 5.707 | 7.706 |
| **492** | 46.171 | 18.66 | 0.11 | 34.667 | 13.015 | 2615404 | 2478598 | 5/23/1998 | 14:56:53.91 | 5.808 | 7.706 |
| **493** | 46.203 | 18.688 | 0.1 | 34.67 | 13.016 | 2574101 | 2478563 | 5/23/1998 | 15:02:54.71 | 5.525 | 7.706 |
| **494** | 46.221 | 18.709 | 0.116 | 34.668 | 13.015 | 2588684 | 2479002 | 5/23/1998 | 15:08:55.51 | 5.625 | 7.708 |
| **495** | 46.244 | 18.737 | 0.14 | 34.664 | 13.017 | 2612098 | 2478674 | 5/23/1998 | 15:14:56.31 | 5.785 | 7.707 |
| **496** | 46.259 | 18.748 | 0.193 | 34.667 | 13.015 | 2611134 | 2478829 | 5/23/1998 | 15:20:57.11 | 5.779 | 7.707 |
| **497** | 46.272 | 18.753 | 0.224 | 34.674 | 13.014 | 2568264 | 2479249 | 5/23/1998 | 15:26:57.91 | 5.484 | 7.709 |
| **498** | 46.28 | 18.768 | 0.265 | 34.668 | 13.016 | 2608994 | 2478914 | 5/23/1998 | 15:32:58.71 | 5.764 | 7.708 |
| **499** | 46.29 | 18.774 | 0.275 | 34.672 | 13.015 | 2619546 | 2478946 | 5/23/1998 | 15:38:59.51 | 5.836 | 7.708 |
| **500** | 46.292 | 18.786 | 0.334 | 34.663 | 13.014 | 2614175 | 2479754 | 5/23/1998 | 15:45:00.31 | 5.800 | 7.711 |
| **501** | 46.309 | 18.791 | 0.381 | 34.673 | 13.015 | 2590866 | 2479348 | 5/23/1998 | 15:51:01.11 | 5.640 | 7.709 |
| **502** | 46.313 | 18.792 | 0.395 | 34.675 | 13.016 | 2585067 | 2480068 | 5/23/1998 | 15:57:01.91 | 5.600 | 7.713 |
| **503** | 46.309 | 18.796 | 0.412 | 34.669 | 13.015 | 2602026 | 2479585 | 5/23/1998 | 16:03:02.71 | 5.716 | 7.710 |
| **504** | 46.319 | 18.8 | 0.431 | 34.674 | 13.015 | 2613919 | 2479851 | 5/23/1998 | 16:09:03.51 | 5.798 | 7.712 |
| **505** | 46.32 | 18.797 | 0.487 | 34.678 | 13.014 | 2576471 | 2479816 | 5/23/1998 | 16:15:04.31 | 5.541 | 7.711 |
| **506** | 46.311 | 18.789 | 0.498 | 34.676 | 13.013 | 2618894 | 2480055 | 5/23/1998 | 16:21:05.11 | 5.832 | 7.713 |
| **507** | 46.286 | 18.777 | 0.559 | 34.666 | 13.013 | 2574140 | 2480093 | 5/23/1998 | 16:27:05.91 | 5.525 | 7.713 |
| **508** | 46.269 | 18.747 | 0.587 | 34.676 | 13.012 | 2615854 | 2480015 | 5/23/1998 | 16:33:06.71 | 5.811 | 7.712 |
| **509** | 46.245 | 18.723 | 0.636 | 34.677 | 13.013 | 2580148 | 2480444 | 5/23/1998 | 16:39:07.51 | 5.566 | 7.714 |
| **510** | 46.224 | 18.703 | 0.695 | 34.676 | 13.011 | 2573582 | 2480412 | 5/23/1998 | 16:45:08.31 | 5.521 | 7.714 |
| **511** | 46.195 | 18.677 | 0.724 | 34.673 | 13.01 | 2625040 | 2480393 | 5/23/1998 | 16:51:09.11 | 5.874 | 7.714 |
| **512** | 46.17 | 18.644 | 0.738 | 34.679 | 13.01 | 2541443 | 2480157 | 5/23/1998 | 16:57:09.91 | 5.300 | 7.713 |
| **513** | 46.142 | 18.628 | 0.786 | 34.67 | 13.009 | 2561447 | 2480584 | 5/23/1998 | 17:03:10.71 | 5.438 | 7.715 |
| **514** | 46.117 | 18.595 | 0.8 | 34.676 | 13.009 | 2583691 | 2480850 | 5/23/1998 | 17:09:11.51 | 5.590 | 7.716 |
| **515** | 46.091 | 18.564 | 0.863 | 34.681 | 13.008 | 2580512 | 2481397 | 5/23/1998 | 17:15:12.31 | 5.569 | 7.718 |
| **516** | 46.058 | 18.535 | 0.869 | 34.677 | 13.009 | 2597700 | 2481068 | 5/23/1998 | 17:21:13.11 | 5.686 | 7.717 |
| **517** | 46.018 | 18.51 | 0.931 | 34.665 | 13.008 | 2583527 | 2480458 | 5/23/1998 | 17:27:13.91 | 5.589 | 7.714 |
| **518** | 45.997 | 18.473 | 1.007 | 34.679 | 13.006 | 2583268 | 2481198 | 5/23/1998 | 17:33:14.71 | 5.587 | 7.717 |
| **519** | 45.968 | 18.438 | 1.004 | 34.683 | 13.006 | 2568334 | 2481410 | 5/23/1998 | 17:39:15.51 | 5.485 | 7.718 |
| **520** | 45.936 | 18.414 | 1.066 | 34.676 | 13.005 | 2557581 | 2480883 | 5/23/1998 | 17:45:16.31 | 5.411 | 7.716 |
| **521** | 45.906 | 18.378 | 1.088 | 34.681 | 13.006 | 2606974 | 2481370 | 5/23/1998 | 17:51:17.11 | 5.750 | 7.718 |
| **522** | 45.878 | 18.346 | 1.107 | 34.684 | 13.005 | 2573104 | 2481574 | 5/23/1998 | 17:57:17.91 | 5.518 | 7.719 |
| **523** | 45.851 | 18.322 | 1.128 | 34.682 | 13.005 | 2594137 | 2480791 | 5/23/1998 | 18:03:18.71 | 5.662 | 7.716 |
| **524** | 45.826 | 18.286 | 1.168 | 34.691 | 13.004 | 2583724 | 2481147 | 5/23/1998 | 18:09:19.51 | 5.591 | 7.717 |
| **525** | 45.799 | 18.272 | 1.214 | 34.68 | 13.003 | 2606361 | 2481657 | 5/23/1998 | 18:15:20.31 | 5.746 | 7.719 |
| **526** | 45.78 | 18.25 | 1.263 | 34.683 | 13.003 | 2588500 | 2481590 | 5/23/1998 | 18:21:21.11 | 5.623 | 7.719 |
| **527** | 45.758 | 18.226 | 1.285 | 34.685 | 13.004 | 2527076 | 2480819 | 5/23/1998 | 18:27:21.91 | 5.202 | 7.716 |
| **528** | 45.735 | 18.208 | 1.332 | 34.679 | 13.002 | 2575497 | 2481792 | 5/23/1998 | 18:33:22.71 | 5.534 | 7.720 |
| **529** | 45.714 | 18.179 | 1.341 | 34.687 | 13.002 | 2585060 | 2481844 | 5/23/1998 | 18:39:23.51 | 5.600 | 7.720 |
| **530** | 45.682 | 18.147 | 1.357 | 34.686 | 13.002 | 2549996 | 2481082 | 5/23/1998 | 18:45:24.31 | 5.359 | 7.717 |
| **531** | 45.652 | 18.12 | 1.384 | 34.683 | 13.001 | 2572520 | 2481750 | 5/23/1998 | 18:51:25.11 | 5.514 | 7.720 |
| **532** | 45.623 | 18.088 | 1.391 | 34.686 | 13.001 | 2568332 | 2481663 | 5/23/1998 | 18:57:25.91 | 5.485 | 7.719 |
| **533** | 45.596 | 18.056 | 1.411 | 34.69 | 13 | 2578605 | 2482370 | 5/23/1998 | 19:03:26.71 | 5.555 | 7.723 |
| **534** | 45.556 | 18.021 | 1.419 | 34.687 | 12.999 | 2538940 | 2481953 | 5/23/1998 | 19:09:27.51 | 5.283 | 7.721 |
| **535** | 45.527 | 17.994 | 1.468 | 34.684 | 13 | 2541101 | 2481752 | 5/23/1998 | 19:15:28.31 | 5.298 | 7.720 |
| **536** | 45.505 | 17.96 | 1.491 | 34.695 | 12.999 | 2549788 | 2482844 | 5/23/1998 | 19:21:29.11 | 5.358 | 7.725 |
| **537** | 45.473 | 17.931 | 1.49 | 34.692 | 13.001 | 2568552 | 2482291 | 5/23/1998 | 19:27:29.91 | 5.486 | 7.722 |
| **538** | 45.445 | 17.905 | 1.48 | 34.689 | 12.998 | 2536868 | 2481457 | 5/23/1998 | 19:33:30.71 | 5.269 | 7.719 |
| **539** | 45.417 | 17.872 | 1.482 | 34.694 | 12.998 | 2562550 | 2482398 | 5/23/1998 | 19:39:31.51 | 5.445 | 7.723 |
| **540** | 45.396 | 17.855 | 1.503 | 34.69 | 12.997 | 2545116 | 2481969 | 5/23/1998 | 19:45:32.31 | 5.326 | 7.721 |
| **541** | 45.373 | 17.832 | 1.541 | 34.69 | 12.996 | 2532734 | 2482432 | 5/23/1998 | 19:51:33.11 | 5.241 | 7.723 |
| **542** | 45.349 | 17.813 | 1.501 | 34.686 | 12.995 | 2573317 | 2481901 | 5/23/1998 | 19:57:33.91 | 5.519 | 7.721 |
| **543** | 45.334 | 17.782 | 1.504 | 34.699 | 12.995 | 2503493 | 2482177 | 5/23/1998 | 20:03:34.71 | 5.040 | 7.722 |
| **544** | 45.316 | 17.772 | 1.465 | 34.692 | 12.997 | 2541711 | 2482256 | 5/23/1998 | 20:09:35.51 | 5.302 | 7.722 |
| **545** | 45.301 | 17.746 | 1.485 | 34.702 | 12.995 | 2549164 | 2482774 | 5/23/1998 | 20:15:36.31 | 5.353 | 7.724 |
| **546** | 45.288 | 17.734 | 1.472 | 34.701 | 12.995 | 2573047 | 2482208 | 5/23/1998 | 20:21:37.11 | 5.517 | 7.722 |
| **547** | 45.271 | 17.719 | 1.425 | 34.699 | 12.996 | 2545708 | 2482614 | 5/23/1998 | 20:27:37.91 | 5.330 | 7.724 |
| **548** | 45.255 | 17.706 | 1.423 | 34.697 | 12.996 | 2542285 | 2481805 | 5/23/1998 | 20:33:38.71 | 5.306 | 7.720 |
| **549** | 45.242 | 17.686 | 1.428 | 34.702 | 12.993 | 2550228 | 2482247 | 5/23/1998 | 20:39:39.51 | 5.361 | 7.722 |
| **550** | 45.23 | 17.673 | 1.414 | 34.703 | 12.995 | 2581937 | 2482300 | 5/23/1998 | 20:45:40.31 | 5.578 | 7.722 |
| **551** | 45.211 | 17.66 | 1.399 | 34.698 | 12.993 | 2570273 | 2481932 | 5/23/1998 | 20:51:41.11 | 5.498 | 7.721 |
| **552** | 45.199 | 17.646 | 1.37 | 34.699 | 12.993 | 2549604 | 2482879 | 5/23/1998 | 20:57:41.91 | 5.356 | 7.725 |
| **553** | 45.187 | 17.626 | 1.305 | 34.707 | 12.993 | 2541774 | 2482251 | 5/23/1998 | 21:03:42.71 | 5.303 | 7.722 |
| **554** | 45.176 | 17.619 | 1.312 | 34.704 | 12.992 | 2572604 | 2481994 | 5/23/1998 | 21:09:43.51 | 5.514 | 7.721 |
| **555** | 45.163 | 17.621 | 1.295 | 34.69 | 12.992 | 2533328 | 2483003 | 5/23/1998 | 21:15:44.31 | 5.245 | 7.725 |
| **556** | 45.16 | 17.593 | 1.264 | 34.712 | 12.992 | 2553867 | 2482282 | 5/23/1998 | 21:21:45.11 | 5.386 | 7.722 |
| **557** | 45.145 | 17.589 | 1.224 | 34.702 | 12.991 | 2528496 | 2482018 | 5/23/1998 | 21:27:45.91 | 5.212 | 7.721 |
| **558** | 45.143 | 17.577 | 1.18 | 34.711 | 12.991 | 2573246 | 2482777 | 5/23/1998 | 21:33:46.71 | 5.519 | 7.724 |
| **559** | 45.136 | 17.58 | 1.162 | 34.701 | 12.99 | 2543755 | 2482861 | 5/23/1998 | 21:39:47.51 | 5.316 | 7.725 |
| **560** | 45.126 | 17.566 | 1.103 | 34.705 | 12.992 | 2524751 | 2482836 | 5/23/1998 | 21:45:48.31 | 5.186 | 7.725 |
| **561** | 45.117 | 17.563 | 1.052 | 34.701 | 12.991 | 2586559 | 2482209 | 5/23/1998 | 21:51:49.11 | 5.610 | 7.722 |
| **562** | 45.115 | 17.561 | 0.987 | 34.701 | 12.99 | 2567427 | 2482785 | 5/23/1998 | 21:58:31.19 | 5.479 | 7.724 |
| **563** | 45.107 | 17.553 | 0.969 | 34.7 | 12.99 | 2506946 | 2483473 | 5/23/1998 | 22:04:31.99 | 5.064 | 7.727 |
| **564** | 45.105 | 17.541 | 0.908 | 34.708 | 12.99 | 2570293 | 2482717 | 5/23/1998 | 22:10:32.79 | 5.498 | 7.724 |
| **565** | 45.101 | 17.544 | 0.87 | 34.703 | 12.989 | 2520401 | 2483099 | 5/23/1998 | 22:16:33.59 | 5.156 | 7.726 |
| **566** | 45.1 | 17.542 | 0.835 | 34.703 | 12.989 | 2560565 | 2483233 | 5/23/1998 | 22:22:34.39 | 5.432 | 7.726 |
| **567** | 45.092 | 17.531 | 0.776 | 34.706 | 12.988 | 2564660 | 2482768 | 5/23/1998 | 22:28:35.19 | 5.460 | 7.724 |
| **568** | 45.087 | 17.524 | 0.757 | 34.707 | 12.989 | 2591988 | 2482636 | 5/23/1998 | 22:34:35.99 | 5.647 | 7.724 |
| **569** | 45.089 | 17.524 | 0.681 | 34.709 | 12.99 | 2564991 | 2482864 | 5/23/1998 | 22:40:36.79 | 5.462 | 7.725 |
| **570** | 45.08 | 17.525 | 0.635 | 34.701 | 12.989 | 2563840 | 2482469 | 5/23/1998 | 22:46:37.59 | 5.454 | 7.723 |
| **571** | 45.087 | 17.531 | 0.563 | 34.701 | 12.989 | 2557546 | 2482790 | 5/23/1998 | 22:52:38.39 | 5.411 | 7.724 |
| **572** | 45.081 | 17.521 | 0.523 | 34.705 | 12.989 | 2554226 | 2482937 | 5/23/1998 | 22:58:39.19 | 5.388 | 7.725 |
| **573** | 45.086 | 17.519 | 0.499 | 34.711 | 12.989 | 2555007 | 2483189 | 5/23/1998 | 23:04:39.99 | 5.393 | 7.726 |
| **574** | 45.086 | 17.513 | 0.412 | 34.716 | 12.988 | 2556514 | 2483846 | 5/23/1998 | 23:10:40.79 | 5.404 | 7.729 |
| **575** | 45.079 | 17.52 | 0.366 | 34.705 | 12.989 | 2543696 | 2483116 | 5/23/1998 | 23:16:41.59 | 5.316 | 7.726 |
| **576** | 45.086 | 17.522 | 0.31 | 34.709 | 12.988 | 2558715 | 2482789 | 5/23/1998 | 23:22:42.39 | 5.419 | 7.724 |
| **577** | 45.093 | 17.527 | 0.286 | 34.71 | 12.989 | 2522378 | 2483076 | 5/23/1998 | 23:28:43.19 | 5.170 | 7.726 |
| **578** | 45.101 | 17.534 | 0.256 | 34.711 | 12.988 | 2547002 | 2483104 | 5/23/1998 | 23:34:43.99 | 5.339 | 7.726 |
| **579** | 45.108 | 17.543 | 0.198 | 34.71 | 12.988 | 2523847 | 2482955 | 5/23/1998 | 23:40:44.79 | 5.180 | 7.725 |
| **580** | 45.105 | 17.537 | 0.128 | 34.712 | 12.987 | 2558518 | 2483796 | 5/23/1998 | 23:46:45.59 | 5.418 | 7.729 |
| **581** | 45.115 | 17.556 | 0.086 | 34.705 | 12.986 | 2556187 | 2483044 | 5/23/1998 | 23:52:46.39 | 5.402 | 7.725 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **582** | 45.129 | 17.566 | 0.03 | 34.709 | 12.987 | 2500909 | 2483400 | 5/23/1998 | 23:58:47.19 | 5.022 | 7.727 |
| **583** | 45.137 | 17.573 | -0.008 | 34.709 | 12.987 | 2540087 | 2483205 | 5/24/1998 | 00:04:47.99 | 5.291 | 7.726 |
| **584** | 45.142 | 17.589 | -0.057 | 34.7 | 12.987 | 2557522 | 2482857 | 5/24/1998 | 00:10:48.79 | 5.411 | 7.725 |
| **585** | 45.156 | 17.586 | -0.112 | 34.715 | 12.988 | 2544295 | 2483388 | 5/24/1998 | 00:16:49.59 | 5.320 | 7.727 |
| **586** | 45.164 | 17.595 | -0.152 | 34.714 | 12.986 | 2512824 | 2483547 | 5/24/1998 | 00:22:50.39 | 5.104 | 7.728 |
| **587** | 45.172 | 17.609 | -0.208 | 34.709 | 12.986 | 2583169 | 2483441 | 5/24/1998 | 00:28:51.19 | 5.587 | 7.727 |
| **588** | 45.202 | 17.638 | -0.239 | 34.71 | 12.986 | 2545343 | 2483371 | 5/24/1998 | 00:34:51.99 | 5.327 | 7.727 |
| **589** | 45.221 | 17.66 | -0.313 | 34.707 | 12.986 | 2567448 | 2483139 | 5/24/1998 | 00:40:52.79 | 5.479 | 7.726 |
| **590** | 45.251 | 17.683 | -0.336 | 34.714 | 12.987 | 2542378 | 2483583 | 5/24/1998 | 00:46:53.59 | 5.307 | 7.728 |
| **591** | 45.279 | 17.717 | -0.372 | 34.708 | 12.988 | 2565647 | 2483039 | 5/24/1998 | 00:52:54.39 | 5.466 | 7.725 |
| **592** | 45.318 | 17.75 | -0.389 | 34.713 | 12.988 | 2528270 | 2483811 | 5/24/1998 | 00:58:55.19 | 5.210 | 7.729 |
| **593** | 45.352 | 17.784 | -0.422 | 34.714 | 12.989 | 2553815 | 2483501 | 5/24/1998 | 01:04:55.99 | 5.385 | 7.727 |
| **594** | 45.39 | 17.828 | -0.459 | 34.709 | 12.988 | 2547765 | 2483306 | 5/24/1998 | 01:10:56.79 | 5.344 | 7.727 |
| **595** | 45.436 | 17.887 | -0.478 | 34.698 | 12.988 | 2570320 | 2483246 | 5/24/1998 | 01:16:57.59 | 5.499 | 7.726 |
| **596** | 45.487 | 17.922 | -0.506 | 34.712 | 12.989 | 2580803 | 2483211 | 5/24/1998 | 01:22:58.39 | 5.571 | 7.726 |
| **597** | 45.529 | 17.966 | -0.523 | 34.71 | 12.99 | 2568912 | 2483041 | 5/24/1998 | 01:28:59.19 | 5.489 | 7.725 |
| **598** | 45.581 | 18.024 | -0.573 | 34.705 | 12.99 | 2533323 | 2482691 | 5/24/1998 | 01:34:59.99 | 5.245 | 7.724 |
| **599** | 45.616 | 18.063 | -0.605 | 34.702 | 12.99 | 2595121 | 2482810 | 5/24/1998 | 01:41:00.79 | 5.669 | 7.724 |
| **600** | 45.664 | 18.1 | -0.635 | 34.712 | 12.99 | 2546168 | 2482842 | 5/24/1998 | 01:47:01.59 | 5.333 | 7.725 |
| **601** | 45.711 | 18.159 | -0.648 | 34.702 | 12.991 | 2534781 | 2482967 | 5/24/1998 | 01:53:02.39 | 5.255 | 7.725 |
| **602** | 45.748 | 18.192 | -0.665 | 34.706 | 12.992 | 2552269 | 2483090 | 5/24/1998 | 01:59:03.19 | 5.375 | 7.726 |
| **603** | 45.786 | 18.235 | -0.701 | 34.701 | 12.99 | 2568990 | 2482724 | 5/24/1998 | 02:05:03.99 | 5.489 | 7.724 |
| **604** | 45.82 | 18.298 | -0.684 | 34.676 | 12.991 | 2525259 | 2482959 | 5/24/1998 | 02:11:04.79 | 5.189 | 7.725 |
| **605** | 45.854 | 18.311 | -0.714 | 34.694 | 12.991 | 2538785 | 2483365 | 5/24/1998 | 02:17:05.59 | 5.282 | 7.727 |
| **606** | 45.893 | 18.344 | -0.699 | 34.699 | 12.989 | 2567812 | 2483468 | 5/24/1998 | 02:23:06.39 | 5.481 | 7.727 |
| **607** | 45.935 | 18.391 | -0.725 | 34.695 | 12.99 | 2541899 | 2483093 | 5/24/1998 | 02:29:07.19 | 5.304 | 7.726 |
| **608** | 45.964 | 18.42 | -0.719 | 34.695 | 12.992 | 2540393 | 2482727 | 5/24/1998 | 02:35:07.99 | 5.293 | 7.724 |
| **609** | 45.992 | 18.449 | -0.739 | 34.695 | 12.991 | 2540277 | 2482763 | 5/24/1998 | 02:41:08.79 | 5.292 | 7.724 |
| **610** | 46.023 | 18.474 | -0.73 | 34.7 | 12.993 | 2537097 | 2482703 | 5/24/1998 | 02:47:09.59 | 5.271 | 7.724 |
| **611** | 46.043 | 18.493 | -0.754 | 34.701 | 12.992 | 2576601 | 2482464 | 5/24/1998 | 02:53:10.39 | 5.542 | 7.723 |
| **612** | 46.068 | 18.519 | -0.751 | 34.699 | 12.992 | 2558954 | 2482937 | 5/24/1998 | 02:59:11.19 | 5.421 | 7.725 |
| **613** | 46.088 | 18.542 | -0.737 | 34.697 | 12.991 | 2541793 | 2481986 | 5/24/1998 | 03:05:11.99 | 5.303 | 7.721 |
| **614** | 46.115 | 18.572 | -0.723 | 34.695 | 12.992 | 2587505 | 2482243 | 5/24/1998 | 03:11:12.79 | 5.616 | 7.722 |
| **615** | 46.146 | 18.592 | -0.715 | 34.704 | 12.993 | 2575389 | 2482031 | 5/24/1998 | 03:17:13.59 | 5.533 | 7.721 |
| **616** | 46.166 | 18.627 | -0.71 | 34.692 | 12.991 | 2563601 | 2483049 | 5/24/1998 | 03:23:14.39 | 5.452 | 7.725 |
| **617** | 46.191 | 18.654 | -0.686 | 34.689 | 12.991 | 2577697 | 2481794 | 5/24/1998 | 03:29:15.19 | 5.549 | 7.720 |
| **618** | 46.219 | 18.675 | -0.661 | 34.696 | 12.99 | 2537695 | 2482100 | 5/24/1998 | 03:35:15.99 | 5.275 | 7.721 |
| **619** | 46.245 | 18.706 | -0.645 | 34.692 | 12.992 | 2545402 | 2482519 | 5/24/1998 | 03:41:16.79 | 5.328 | 7.723 |
| **620** | 46.269 | 18.737 | -0.62 | 34.685 | 12.991 | 2536966 | 2482121 | 5/24/1998 | 03:47:17.59 | 5.270 | 7.721 |
| **621** | 46.296 | 18.754 | -0.594 | 34.694 | 12.99 | 2579232 | 2482448 | 5/24/1998 | 03:53:18.39 | 5.560 | 7.723 |
| **622** | 46.316 | 18.782 | -0.555 | 34.687 | 12.99 | 2520219 | 2482138 | 5/24/1998 | 03:59:19.19 | 5.155 | 7.722 |
| **623** | 46.346 | 18.798 | -0.519 | 34.699 | 12.991 | 2569504 | 2482001 | 5/24/1998 | 04:05:19.99 | 5.493 | 7.721 |
| **624** | 46.376 | 18.836 | -0.49 | 34.692 | 12.991 | 2581072 | 2481781 | 5/24/1998 | 04:11:20.79 | 5.572 | 7.720 |
| **625** | 46.397 | 18.861 | -0.465 | 34.688 | 12.991 | 2533552 | 2481614 | 5/24/1998 | 04:17:21.59 | 5.246 | 7.719 |
| **626** | 46.421 | 18.884 | -0.448 | 34.689 | 12.991 | 2596221 | 2481413 | 5/24/1998 | 04:23:22.39 | 5.676 | 7.718 |
| **627** | 46.437 | 18.902 | -0.44 | 34.687 | 12.991 | 2538500 | 2481251 | 5/24/1998 | 04:29:23.19 | 5.280 | 7.718 |
| **628** | 46.461 | 18.928 | -0.391 | 34.686 | 12.991 | 2604953 | 2481362 | 5/24/1998 | 04:35:23.99 | 5.736 | 7.718 |
| **629** | 46.476 | 18.945 | -0.366 | 34.685 | 12.991 | 2585740 | 2481356 | 5/24/1998 | 04:41:24.79 | 5.604 | 7.718 |
| **630** | 46.491 | 18.959 | -0.308 | 34.686 | 12.99 | 2567337 | 2481101 | 5/24/1998 | 04:47:25.59 | 5.478 | 7.717 |
| **631** | 46.513 | 18.978 | -0.275 | 34.687 | 12.99 | 2529637 | 2480978 | 5/24/1998 | 04:53:26.39 | 5.219 | 7.717 |
| **632** | 46.526 | 18.992 | -0.233 | 34.687 | 12.99 | 2543221 | 2480621 | 5/24/1998 | 05:00:08.47 | 5.313 | 7.715 |
| **633** | 46.538 | 19.008 | -0.19 | 34.684 | 12.989 | 2592995 | 2480589 | 5/24/1998 | 05:06:09.27 | 5.654 | 7.715 |
| **634** | 46.553 | 19.021 | -0.14 | 34.686 | 12.992 | 2569245 | 2481033 | 5/24/1998 | 05:12:10.07 | 5.491 | 7.717 |
| **635** | 46.562 | 19.033 | -0.097 | 34.683 | 12.989 | 2547902 | 2480931 | 5/24/1998 | 05:18:10.87 | 5.345 | 7.716 |
| **636** | 46.567 | 19.04 | -0.081 | 34.68 | 12.99 | 2574859 | 2481231 | 5/24/1998 | 05:24:11.67 | 5.530 | 7.718 |
| **637** | 46.572 | 19.043 | -0.044 | 34.683 | 12.989 | 2567125 | 2480746 | 5/24/1998 | 05:30:12.47 | 5.477 | 7.716 |
| **638** | 46.561 | 19.035 | 0 | 34.679 | 12.99 | 2540199 | 2480925 | 5/24/1998 | 05:36:13.27 | 5.292 | 7.716 |
| **639** | 46.555 | 19.02 | 0.045 | 34.687 | 12.989 | 2593297 | 2481167 | 5/24/1998 | 05:42:14.07 | 5.656 | 7.717 |
| **640** | 46.537 | 19.019 | 0.046 | 34.673 | 12.989 | 2541115 | 2481025 | 5/24/1998 | 05:48:14.87 | 5.298 | 7.717 |
| **641** | 46.535 | 18.995 | 0.088 | 34.692 | 12.99 | 2588694 | 2480306 | 5/24/1998 | 05:54:15.67 | 5.625 | 7.714 |
| **642** | 46.519 | 18.987 | 0.133 | 34.685 | 12.989 | 2581442 | 2480319 | 5/24/1998 | 06:00:16.47 | 5.575 | 7.714 |
| **643** | 46.495 | 18.971 | 0.179 | 34.679 | 12.988 | 2556843 | 2480428 | 5/24/1998 | 06:06:17.27 | 5.406 | 7.714 |
| **644** | 46.484 | 18.949 | 0.202 | 34.687 | 12.99 | 2623828 | 2480374 | 5/24/1998 | 06:12:18.07 | 5.866 | 7.714 |
| **645** | 46.463 | 18.928 | 0.247 | 34.687 | 12.988 | 2553731 | 2480736 | 5/24/1998 | 06:18:18.87 | 5.385 | 7.715 |
| **646** | 46.444 | 18.913 | 0.293 | 34.684 | 12.988 | 2598748 | 2480040 | 5/24/1998 | 06:24:19.67 | 5.694 | 7.712 |
| **647** | 46.422 | 18.889 | 0.331 | 34.686 | 12.989 | 2534929 | 2480518 | 5/24/1998 | 06:30:20.47 | 5.256 | 7.715 |
| **648** | 46.393 | 18.863 | 0.384 | 34.684 | 12.986 | 2568590 | 2480127 | 5/24/1998 | 06:36:21.27 | 5.487 | 7.713 |
| **649** | 46.37 | 18.836 | 0.396 | 34.686 | 12.984 | 2591569 | 2480807 | 5/24/1998 | 06:42:22.07 | 5.644 | 7.716 |
| **650** | 46.35 | 18.811 | 0.414 | 34.69 | 12.985 | 2518750 | 2480723 | 5/24/1998 | 06:48:22.87 | 5.145 | 7.715 |
| **651** | 46.326 | 18.788 | 0.445 | 34.69 | 12.986 | 2569182 | 2480286 | 5/24/1998 | 06:54:23.67 | 5.491 | 7.714 |
| **652** | 46.296 | 18.758 | 0.497 | 34.69 | 12.984 | 2589712 | 2479956 | 5/24/1998 | 07:00:24.47 | 5.632 | 7.712 |
| **653** | 46.264 | 18.727 | 0.528 | 34.69 | 12.985 | 2615226 | 2480044 | 5/24/1998 | 07:06:25.27 | 5.807 | 7.712 |
| **654** | 46.236 | 18.698 | 0.531 | 34.69 | 12.982 | 2577135 | 2481169 | 5/24/1998 | 07:12:26.07 | 5.545 | 7.717 |
| **655** | 46.212 | 18.67 | 0.545 | 34.693 | 12.982 | 2546537 | 2479903 | 5/24/1998 | 07:18:26.87 | 5.335 | 7.712 |
| **656** | 46.189 | 18.648 | 0.578 | 34.692 | 12.982 | 2577851 | 2479914 | 5/24/1998 | 07:24:27.67 | 5.550 | 7.712 |
| **657** | 46.163 | 18.623 | 0.64 | 34.692 | 12.981 | 2569404 | 2480390 | 5/24/1998 | 07:30:28.47 | 5.492 | 7.714 |
| **658** | 46.138 | 18.582 | 0.691 | 34.705 | 12.981 | 2548668 | 2479683 | 5/24/1998 | 07:36:29.27 | 5.350 | 7.711 |
| **659** | 46.114 | 18.568 | 0.676 | 34.696 | 12.981 | 2599476 | 2480805 | 5/24/1998 | 07:42:30.07 | 5.699 | 7.716 |
| **660** | 46.093 | 18.556 | 0.68 | 34.689 | 12.98 | 2584971 | 2480287 | 5/24/1998 | 07:48:30.87 | 5.599 | 7.714 |
| **661** | 46.075 | 18.535 | 0.735 | 34.692 | 12.981 | 2552176 | 2481159 | 5/24/1998 | 07:54:31.67 | 5.374 | 7.717 |
| **662** | 46.057 | 18.508 | 0.76 | 34.699 | 12.98 | 2577478 | 2479673 | 5/24/1998 | 08:00:32.47 | 5.548 | 7.711 |
| **663** | 46.037 | 18.492 | 0.73 | 34.696 | 12.981 | 2512271 | 2480312 | 5/24/1998 | 08:06:33.27 | 5.100 | 7.714 |
| **664** | 46.016 | 18.475 | 0.759 | 34.692 | 12.979 | 2561416 | 2480509 | 5/24/1998 | 08:12:34.07 | 5.437 | 7.714 |
| **665** | 45.983 | 18.437 | 0.784 | 34.696 | 12.978 | 2587310 | 2479662 | 5/24/1998 | 08:18:34.87 | 5.615 | 7.711 |
| **666** | 45.957 | 18.41 | 0.804 | 34.697 | 12.979 | 2524612 | 2480053 | 5/24/1998 | 08:24:35.67 | 5.185 | 7.713 |
| **667** | 45.93 | 18.384 | 0.833 | 34.697 | 12.977 | 2547238 | 2480214 | 5/24/1998 | 08:30:36.47 | 5.340 | 7.713 |
| **668** | 45.898 | 18.349 | 0.809 | 34.7 | 12.978 | 2509149 | 2479837 | 5/24/1998 | 08:36:37.27 | 5.079 | 7.712 |
| **669** | 45.873 | 18.317 | 0.808 | 34.704 | 12.977 | 2499807 | 2480035 | 5/24/1998 | 08:42:38.07 | 5.015 | 7.712 |
| **670** | 45.848 | 18.295 | 0.817 | 34.702 | 12.978 | 2586391 | 2479196 | 5/24/1998 | 08:48:38.87 | 5.609 | 7.709 |
| **671** | 45.813 | 18.271 | 0.821 | 34.693 | 12.976 | 2545989 | 2479758 | 5/24/1998 | 08:54:39.67 | 5.332 | 7.711 |
| **672** | 45.801 | 18.252 | 0.798 | 34.699 | 12.976 | 2531883 | 2479912 | 5/24/1998 | 09:00:40.47 | 5.235 | 7.712 |
| **673** | 45.774 | 18.224 | 0.81 | 34.7 | 12.975 | 2552643 | 2479717 | 5/24/1998 | 09:06:41.27 | 5.377 | 7.711 |
| **674** | 45.759 | 18.21 | 0.843 | 34.698 | 12.975 | 2570936 | 2479692 | 5/24/1998 | 09:12:42.07 | 5.503 | 7.711 |
| **675** | 45.744 | 18.187 | 0.814 | 34.706 | 12.977 | 2548121 | 2479790 | 5/24/1998 | 09:18:42.87 | 5.346 | 7.711 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **676** | 45.736 | 18.176 | 0.823 | 34.708 | 12.975 | 2528995 | 2479496 | 5/24/1998 | 09:24:43.67 | 5.215 | 7.710 |
| **677** | 45.718 | 18.159 | 0.81 | 34.707 | 12.974 | 2532611 | 2480202 | 5/24/1998 | 09:30:44.47 | 5.240 | 7.713 |
| **678** | 45.708 | 18.152 | 0.753 | 34.704 | 12.975 | 2540490 | 2479465 | 5/24/1998 | 09:36:45.27 | 5.294 | 7.710 |
| **679** | 45.696 | 18.149 | 0.708 | 34.697 | 12.974 | 2560060 | 2479524 | 5/24/1998 | 09:42:46.07 | 5.428 | 7.710 |
| **680** | 45.692 | 18.132 | 0.723 | 34.708 | 12.973 | 2560181 | 2480266 | 5/24/1998 | 09:48:46.87 | 5.429 | 7.713 |
| **681** | 45.68 | 18.116 | 0.698 | 34.711 | 12.974 | 2537599 | 2479712 | 5/24/1998 | 09:54:47.67 | 5.274 | 7.711 |
| **682** | 45.663 | 18.103 | 0.657 | 34.708 | 12.972 | 2538305 | 2479775 | 5/24/1998 | 10:00:48.47 | 5.279 | 7.711 |
| **683** | 45.65 | 18.086 | 0.651 | 34.711 | 12.972 | 2526122 | 2480495 | 5/24/1998 | 10:06:49.27 | 5.195 | 7.714 |
| **684** | 45.634 | 18.066 | 0.649 | 34.715 | 12.971 | 2537052 | 2480465 | 5/24/1998 | 10:12:50.07 | 5.270 | 7.714 |
| **685** | 45.621 | 18.07 | 0.662 | 34.7 | 12.971 | 2571463 | 2480276 | 5/24/1998 | 10:18:50.87 | 5.506 | 7.713 |
| **686** | 45.609 | 18.046 | 0.567 | 34.71 | 12.97 | 2570091 | 2479485 | 5/24/1998 | 10:24:51.67 | 5.497 | 7.710 |
| **687** | 45.594 | 18.032 | 0.55 | 34.709 | 12.97 | 2576956 | 2480144 | 5/24/1998 | 10:30:52.47 | 5.544 | 7.713 |
| **688** | 45.585 | 18.024 | 0.512 | 34.708 | 12.97 | 2549565 | 2479847 | 5/24/1998 | 10:36:53.27 | 5.356 | 7.712 |
| **689** | 45.581 | 18.02 | 0.509 | 34.709 | 12.969 | 2540772 | 2480086 | 5/24/1998 | 10:42:54.07 | 5.296 | 7.713 |
| **690** | 45.574 | 18.019 | 0.486 | 34.704 | 12.97 | 2560019 | 2479711 | 5/24/1998 | 10:48:54.87 | 5.428 | 7.711 |
| **691** | 45.568 | 18.008 | 0.424 | 34.708 | 12.968 | 2561840 | 2479781 | 5/24/1998 | 10:54:55.67 | 5.440 | 7.711 |
| **692** | 45.559 | 17.995 | 0.402 | 34.711 | 12.968 | 2553935 | 2479301 | 5/24/1998 | 11:00:56.47 | 5.386 | 7.709 |
| **693** | 45.553 | 17.997 | 0.371 | 34.704 | 12.966 | 2555828 | 2479552 | 5/24/1998 | 11:06:57.27 | 5.399 | 7.710 |
| **694** | 45.554 | 17.994 | 0.331 | 34.708 | 12.968 | 2525852 | 2479064 | 5/24/1998 | 11:12:58.07 | 5.193 | 7.708 |
| **695** | 45.542 | 17.984 | 0.284 | 34.706 | 12.969 | 2558633 | 2479656 | 5/24/1998 | 11:18:58.87 | 5.418 | 7.711 |
| **696** | 45.546 | 17.99 | 0.252 | 34.704 | 12.969 | 2534397 | 2478554 | 5/24/1998 | 11:24:59.67 | 5.252 | 7.706 |
| **697** | 45.534 | 17.988 | 0.244 | 34.696 | 12.969 | 2550951 | 2479299 | 5/24/1998 | 11:31:00.47 | 5.366 | 7.709 |
| **698** | 45.538 | 17.981 | 0.211 | 34.705 | 12.97 | 2564371 | 2478272 | 5/24/1998 | 11:37:01.27 | 5.458 | 7.705 |
| **699** | 45.552 | 17.989 | 0.191 | 34.71 | 12.969 | 2540574 | 2479039 | 5/24/1998 | 11:43:02.07 | 5.294 | 7.708 |
| **700** | 45.557 | 17.999 | 0.135 | 34.706 | 12.968 | 2549046 | 2479188 | 5/24/1998 | 11:49:02.87 | 5.353 | 7.709 |
| **701** | 45.573 | 18.008 | 0.124 | 34.711 | 12.969 | 2521176 | 2478542 | 5/24/1998 | 11:55:03.67 | 5.161 | 7.706 |

## Blank Test #3 Sensor Data

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 45.815 | 18.716 | 1.364 | 34.32 | 13.006 | 2290723 | 2452020 | 5/28/1998 | 09:28:05.56 | 3.580 | 7.591 |
| **2** | 45.925 | 18.688 | 1.382 | 34.436 | 13.015 | 2223053 | 2462045 | 5/28/1998 | 09:34:47.56 | 3.115 | 7.635 |
| **3** | 45.99 | 18.683 | 1.404 | 34.495 | 12.967 | 2293106 | 2465218 | 5/28/1998 | 09:40:48.37 | 3.596 | 7.648 |
| **4** | 46.056 | 18.669 | 1.456 | 34.563 | 13.001 | 2236476 | 2466725 | 5/28/1998 | 09:46:49.16 | 3.207 | 7.655 |
| **5** | 46.083 | 18.653 | 1.469 | 34.598 | 13.01 | 2238362 | 2467832 | 5/28/1998 | 09:52:49.96 | 3.220 | 7.660 |
| **6** | 46.096 | 18.634 | 1.486 | 34.626 | 13.016 | 2245414 | 2469430 | 5/28/1998 | 09:58:50.76 | 3.269 | 7.667 |
| **7** | 46.113 | 18.621 | 1.497 | 34.651 | 13.017 | 2206619 | 2469853 | 5/28/1998 | 10:04:51.56 | 3.002 | 7.668 |
| **8** | 46.12 | 18.609 | 1.537 | 34.667 | 13.02 | 2186797 | 2470326 | 5/28/1998 | 10:10:52.36 | 2.866 | 7.670 |
| **9** | 46.109 | 18.59 | 1.566 | 34.673 | 13.019 | 2213549 | 2470326 | 5/28/1998 | 10:16:53.16 | 3.050 | 7.670 |
| **10** | 46.093 | 18.569 | 1.616 | 34.678 | 13.02 | 2222627 | 2472133 | 5/28/1998 | 10:22:53.96 | 3.112 | 7.678 |
| **11** | 46.071 | 18.52 | 1.666 | 34.7 | 13.019 | 2158621 | 2472106 | 5/28/1998 | 10:28:54.76 | 2.673 | 7.678 |
| **12** | **46.028** | **18.485** | **1.627** | **34.694** | **13.018** | **2229338** | **2472252** | **5/28/1998** | **10:34:55.56** | **3.158** | **7.679** |
| **13** | 45.974 | 18.431 | 1.63 | 34.694 | 13.017 | 2273754 | 2472350 | 5/28/1998 | 10:40:56.36 | 3.463 | 7.679 |
| **14** | 45.909 | 18.363 | 1.691 | 34.696 | 13.016 | 2257372 | 2473658 | 5/28/1998 | 10:46:57.16 | 3.351 | 7.685 |
| **15** | 45.844 | 18.287 | 1.698 | 34.706 | 13.014 | 2232544 | 2473818 | 5/28/1998 | 10:52:57.96 | 3.180 | 7.686 |
| **16** | 45.787 | 18.235 | 1.734 | 34.702 | 13.014 | 2205787 | 2474933 | 5/28/1998 | 10:58:58.76 | 2.997 | 7.690 |
| **17** | 45.729 | 18.165 | 1.798 | 34.711 | 13.013 | 2207467 | 2474394 | 5/28/1998 | 11:04:59.56 | 3.008 | 7.688 |
| **18** | 45.668 | 18.097 | 1.792 | 34.717 | 13.011 | 2206701 | 2474872 | 5/28/1998 | 11:11:00.36 | 3.003 | 7.690 |
| **19** | 45.612 | 18.033 | 1.824 | 34.723 | 13.01 | 2154618 | 2474108 | 5/28/1998 | 11:17:01.16 | 2.646 | 7.687 |
| **20** | 45.552 | 17.966 | 1.816 | 34.729 | 13.008 | 2156546 | 2474537 | 5/28/1998 | 11:23:01.96 | 2.659 | 7.689 |
| **21** | 45.485 | 17.906 | 1.871 | 34.723 | 13.007 | 2302887 | 2474953 | 5/28/1998 | 11:29:02.76 | 3.663 | 7.690 |
| **22** | 45.426 | 17.855 | 1.867 | 34.716 | 13.007 | 2175133 | 2474923 | 5/28/1998 | 11:35:03.56 | 2.786 | 7.690 |
| **23** | 45.397 | 17.813 | 1.852 | 34.727 | 13.005 | 2151673 | 2475793 | 5/28/1998 | 11:41:04.36 | 2.625 | 7.694 |
| **24** | 45.341 | 17.76 | 1.816 | 34.724 | 13.005 | 2195048 | 2475315 | 5/28/1998 | 11:47:05.16 | 2.923 | 7.692 |
| **25** | 45.287 | 17.701 | 1.878 | 34.728 | 13.003 | 2170562 | 2475311 | 5/28/1998 | 11:53:05.96 | 2.755 | 7.692 |
| **26** | 45.254 | 17.669 | 1.904 | 34.727 | 13.002 | 2224754 | 2475966 | 5/28/1998 | 11:59:06.76 | 3.127 | 7.695 |
| **27** | 45.225 | 17.63 | 1.949 | 34.735 | 13.002 | 2236781 | 2476073 | 5/28/1998 | 12:05:07.56 | 3.209 | 7.695 |
| **28** | 45.188 | 17.592 | 1.943 | 34.736 | 13.001 | 2171152 | 2476342 | 5/28/1998 | 12:11:08.36 | 2.759 | 7.696 |
| **29** | 45.153 | 17.555 | 1.931 | 34.738 | 12.999 | 2205415 | 2476254 | 5/28/1998 | 12:17:09.16 | 2.994 | 7.696 |
| **30** | 45.123 | 17.529 | 1.964 | 34.734 | 12.999 | 2192285 | 2476613 | 5/28/1998 | 12:23:09.96 | 2.904 | 7.698 |
| **31** | 45.088 | 17.492 | 1.883 | 34.736 | 12.998 | 2176514 | 2476551 | 5/28/1998 | 12:29:10.76 | 2.796 | 7.697 |
| **32** | 45.061 | 17.464 | 1.939 | 34.736 | 12.998 | 2197530 | 2476934 | 5/28/1998 | 12:35:11.56 | 2.940 | 7.699 |
| **33** | 45.022 | 17.429 | 1.936 | 34.733 | 12.997 | 2210250 | 2477219 | 5/28/1998 | 12:41:12.36 | 3.027 | 7.700 |
| **34** | 44.997 | 17.399 | 1.902 | 34.737 | 12.997 | 2167761 | 2477830 | 5/28/1998 | 12:47:13.16 | 2.736 | 7.703 |
| **35** | 44.97 | 17.373 | 1.927 | 34.736 | 12.994 | 2240925 | 2477797 | 5/28/1998 | 12:53:13.96 | 3.238 | 7.703 |
| **36** | 44.932 | 17.331 | 1.882 | 34.739 | 12.994 | 2208959 | 2476901 | 5/28/1998 | 12:59:14.76 | 3.019 | 7.699 |
| **37** | 44.902 | 17.294 | 1.879 | 34.745 | 12.994 | 2183254 | 2477105 | 5/28/1998 | 13:05:15.56 | 2.842 | 7.700 |
| **38** | 44.863 | 17.275 | 1.85 | 34.728 | 12.991 | 2211296 | 2477412 | 5/28/1998 | 13:11:16.36 | 3.035 | 7.701 |
| **39** | 44.834 | 17.225 | 1.855 | 34.745 | 12.991 | 2191683 | 2477101 | 5/28/1998 | 13:17:17.16 | 2.900 | 7.700 |
| **40** | 44.786 | 17.171 | 1.821 | 34.75 | 12.99 | 2185387 | 2478957 | 5/28/1998 | 13:23:17.96 | 2.857 | 7.708 |
| **41** | 44.744 | 17.134 | 1.823 | 34.745 | 12.989 | 2270538 | 2478453 | 5/28/1998 | 13:29:18.76 | 3.441 | 7.706 |
| **42** | 44.717 | 17.112 | 1.785 | 34.741 | 12.989 | 2226386 | 2477935 | 5/28/1998 | 13:35:19.56 | 3.138 | 7.703 |
| **43** | 44.697 | 17.081 | 1.784 | 34.75 | 12.987 | 2287064 | 2478254 | 5/28/1998 | 13:41:20.36 | 3.555 | 7.705 |
| **44** | 44.679 | 17.066 | 1.803 | 34.747 | 12.99 | 2167817 | 2478587 | 5/28/1998 | 13:47:21.16 | 2.736 | 7.706 |
| **45** | 44.663 | 17.048 | 1.768 | 34.75 | 12.987 | 2231016 | 2478824 | 5/28/1998 | 13:53:21.96 | 3.170 | 7.707 |
| **46** | 44.658 | 17.034 | 1.769 | 34.756 | 12.987 | 2184851 | 2478275 | 5/28/1998 | 13:59:22.76 | 2.853 | 7.705 |
| **47** | 44.635 | 17.02 | 1.706 | 34.749 | 12.986 | 2225184 | 2478505 | 5/28/1998 | 14:05:23.56 | 3.130 | 7.706 |
| **48** | 44.616 | 16.991 | 1.698 | 34.758 | 12.985 | 2280386 | 2479179 | 5/28/1998 | 14:11:24.36 | 3.509 | 7.709 |
| **49** | 44.596 | 16.98 | 1.716 | 34.75 | 12.984 | 2169856 | 2478613 | 5/28/1998 | 14:17:25.16 | 2.750 | 7.706 |
| **50** | 44.576 | 16.963 | 1.652 | 34.747 | 12.984 | 2181731 | 2480505 | 5/28/1998 | 14:23:25.96 | 2.832 | 7.714 |
| **51** | 44.558 | 16.937 | 1.638 | 34.754 | 12.985 | 2296427 | 2478729 | 5/28/1998 | 14:29:26.76 | 3.619 | 7.707 |
| **52** | 44.535 | 16.933 | 1.61 | 34.738 | 12.983 | 2169892 | 2478429 | 5/28/1998 | 14:35:27.56 | 2.750 | 7.706 |
| **53** | 44.531 | 16.923 | 1.6 | 34.742 | 12.983 | 2253349 | 2479582 | 5/28/1998 | 14:41:28.36 | 3.323 | 7.710 |
| **54** | 44.533 | 16.918 | 1.581 | 34.748 | 12.982 | 2256639 | 2479462 | 5/28/1998 | 14:47:29.16 | 3.346 | 7.710 |
| **55** | 44.528 | 16.908 | 1.557 | 34.753 | 12.981 | 2226991 | 2480557 | 5/28/1998 | 14:53:29.96 | 3.142 | 7.715 |
| **56** | 44.518 | 16.899 | 1.571 | 34.752 | 12.983 | 2241897 | 2480650 | 5/28/1998 | 14:59:30.76 | 3.245 | 7.715 |
| **57** | 44.527 | 16.915 | 1.504 | 34.745 | 12.958 | 2316993 | 2480476 | 5/28/1998 | 15:05:31.56 | 3.760 | 7.714 |
| **58** | 44.549 | 16.925 | 1.489 | 34.756 | 12.969 | 2308439 | 2480391 | 5/28/1998 | 15:11:32.36 | 3.701 | 7.714 |
| **59** | 44.571 | 16.949 | 1.482 | 34.754 | 12.974 | 2298706 | 2479076 | 5/28/1998 | 15:17:33.16 | 3.634 | 7.708 |
| **60** | 44.584 | 16.968 | 1.454 | 34.75 | 12.975 | 2188520 | 2480158 | 5/28/1998 | 15:23:33.96 | 2.878 | 7.713 |
| **61** | 44.611 | 16.993 | 1.49 | 34.751 | 12.976 | 2281052 | 2480822 | 5/28/1998 | 15:29:34.76 | 3.513 | 7.716 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | 44.652 | 17.032 | 1.461 | 34.753 | 12.977 | 2232378 | 2480235 | 5/28/1998 | 15:35:35.56 | 3.179 | 7.713 |
| 63 | 44.698 | 17.07 | 1.431 | 34.76 | 12.977 | 2227837 | 2481468 | 5/28/1998 | 15:41:36.36 | 3.148 | 7.719 |
| 64 | 44.732 | 17.124 | 1.423 | 34.744 | 12.978 | 2310947 | 2481383 | 5/28/1998 | 15:47:37.16 | 3.718 | 7.718 |
| 65 | 44.76 | 17.135 | 1.393 | 34.759 | 12.978 | 2269562 | 2481657 | 5/28/1998 | 15:53:37.96 | 3.434 | 7.719 |
| 66 | 44.793 | 17.184 | 1.387 | 34.745 | 12.978 | 2142602 | 2481480 | 5/28/1998 | 15:59:38.76 | 2.563 | 7.719 |
| 67 | 44.836 | 17.218 | 1.397 | 34.753 | 12.978 | 2359776 | 2481416 | 5/28/1998 | 16:05:39.56 | 4.054 | 7.718 |
| 68 | 44.885 | 17.26 | 1.37 | 34.759 | 12.978 | 2187769 | 2481843 | 5/28/1998 | 16:11:40.36 | 2.873 | 7.720 |
| 69 | 44.938 | 17.327 | 1.325 | 34.748 | 12.98 | 2264049 | 2481391 | 5/28/1998 | 16:17:41.16 | 3.397 | 7.718 |
| 70 | 44.979 | 17.371 | 1.32 | 34.745 | 12.98 | 2257395 | 2483061 | 5/28/1998 | 16:23:41.96 | 3.351 | 7.726 |
| 71 | 45.027 | 17.412 | 1.361 | 34.752 | 12.979 | 2255995 | 2483105 | 5/28/1998 | 16:29:42.76 | 3.341 | 7.726 |
| 72 | 45.075 | 17.466 | 1.344 | 34.747 | 12.978 | 2179090 | 2482225 | 5/28/1998 | 16:36:24.77 | 2.814 | 7.722 |
| 73 | 45.12 | 17.505 | 1.357 | 34.752 | 12.979 | 2306360 | 2482959 | 5/28/1998 | 16:42:25.57 | 3.687 | 7.725 |
| 74 | 45.163 | 17.553 | 1.318 | 34.748 | 12.98 | 2216848 | 2482842 | 5/28/1998 | 16:48:26.37 | 3.073 | 7.725 |
| 75 | 45.206 | 17.602 | 1.312 | 34.743 | 12.982 | 2299811 | 2483179 | 5/28/1998 | 16:54:27.17 | 3.642 | 7.726 |
| 76 | 45.248 | 17.647 | 1.346 | 34.741 | 12.978 | 2347777 | 2482750 | 5/28/1998 | 17:00:27.97 | 3.971 | 7.724 |
| 77 | 45.294 | 17.686 | 1.295 | 34.747 | 12.979 | 2270299 | 2483758 | 5/28/1998 | 17:06:28.77 | 3.440 | 7.729 |
| 78 | 45.341 | 17.736 | 1.28 | 34.745 | 12.979 | 2326224 | 2483566 | 5/28/1998 | 17:12:29.57 | 3.823 | 7.728 |
| 79 | 45.379 | 17.773 | 1.276 | 34.746 | 12.978 | 2330116 | 2483555 | 5/28/1998 | 17:18:30.37 | 3.850 | 7.728 |
| 80 | 45.411 | 17.809 | 1.258 | 34.743 | 12.979 | 2194439 | 2484385 | 5/28/1998 | 17:24:31.17 | 2.919 | 7.731 |
| 81 | 45.44 | 17.832 | 1.294 | 34.748 | 12.977 | 2257972 | 2484310 | 5/28/1998 | 17:30:31.97 | 3.355 | 7.731 |
| 82 | 45.455 | 17.862 | 1.269 | 34.735 | 12.979 | 2273135 | 2484298 | 5/28/1998 | 17:36:32.77 | 3.459 | 7.731 |
| 83 | 45.47 | 17.867 | 1.276 | 34.744 | 12.977 | 2226056 | 2484261 | 5/28/1998 | 17:42:33.57 | 3.136 | 7.731 |
| 84 | 45.503 | 17.894 | 1.251 | 34.749 | 12.976 | 2264866 | 2484409 | 5/28/1998 | 17:48:34.37 | 3.402 | 7.731 |
| 85 | 45.524 | 17.918 | 1.303 | 34.746 | 12.974 | 2191887 | 2485034 | 5/28/1998 | 17:54:35.17 | 2.901 | 7.734 |
| 86 | 45.537 | 17.94 | 1.311 | 34.739 | 12.975 | 2206129 | 2484422 | 5/28/1998 | 18:00:35.97 | 2.999 | 7.731 |
| 87 | 45.551 | 17.949 | 1.279 | 34.743 | 12.974 | 2305341 | 2484806 | 5/28/1998 | 18:06:36.77 | 3.680 | 7.733 |
| 88 | 45.57 | 17.957 | 1.311 | 34.752 | 12.975 | 2331995 | 2485314 | 5/28/1998 | 18:12:37.57 | 3.863 | 7.735 |
| 89 | 45.578 | 17.982 | 1.308 | 34.738 | 12.976 | 2260783 | 2485226 | 5/28/1998 | 18:18:38.37 | 3.374 | 7.735 |
| 90 | 45.588 | 17.987 | 1.31 | 34.742 | 12.975 | 2344333 | 2485342 | 5/28/1998 | 18:24:39.17 | 3.948 | 7.735 |
| 91 | 45.599 | 17.997 | 1.345 | 34.743 | 12.975 | 2346424 | 2485206 | 5/28/1998 | 18:30:39.97 | 3.962 | 7.735 |
| 92 | 45.597 | 17.996 | 1.348 | 34.742 | 12.973 | 2196651 | 2485632 | 5/28/1998 | 18:36:40.77 | 2.934 | 7.737 |
| 93 | 45.598 | 17.996 | 1.324 | 34.744 | 12.972 | 2296295 | 2485061 | 5/28/1998 | 18:42:41.57 | 3.618 | 7.734 |
| 94 | 45.607 | 18.002 | 1.336 | 34.746 | 12.972 | 2319592 | 2485361 | 5/28/1998 | 18:48:42.37 | 3.778 | 7.735 |
| 95 | 45.613 | 17.996 | 1.325 | 34.756 | 12.97 | 2243620 | 2486595 | 5/28/1998 | 18:54:43.17 | 3.256 | 7.741 |
| 96 | 45.604 | 18 | 1.376 | 34.745 | 12.968 | 2275180 | 2486285 | 5/28/1998 | 19:00:43.97 | 3.473 | 7.739 |
| 97 | 45.592 | 17.994 | 1.381 | 34.74 | 12.969 | 2370584 | 2486850 | 5/28/1998 | 19:06:44.77 | 4.128 | 7.742 |
| 98 | 45.579 | 17.97 | 1.459 | 34.749 | 12.967 | 2337242 | 2487006 | 5/28/1998 | 19:12:45.57 | 3.899 | 7.743 |
| 99 | 45.571 | 17.962 | 1.459 | 34.749 | 12.969 | 2324875 | 2486095 | 5/28/1998 | 19:18:46.37 | 3.814 | 7.739 |
| 100 | 45.549 | 17.947 | 1.538 | 34.743 | 12.969 | 2238043 | 2486748 | 5/28/1998 | 19:24:47.17 | 3.218 | 7.741 |
| 101 | 45.53 | 17.929 | 1.519 | 34.742 | 12.962 | 2223320 | 2486805 | 5/28/1998 | 19:30:47.97 | 3.117 | 7.742 |
| 102 | 45.515 | 17.902 | 1.518 | 34.752 | 12.962 | 2278924 | 2486859 | 5/28/1998 | 19:36:48.77 | 3.499 | 7.742 |
| 103 | 45.5 | 17.888 | 1.515 | 34.751 | 12.964 | 2348339 | 2487286 | 5/28/1998 | 19:42:49.57 | 3.975 | 7.744 |
| 104 | 45.489 | 17.873 | 1.542 | 34.755 | 12.966 | 2312372 | 2487225 | 5/28/1998 | 19:48:50.37 | 3.728 | 7.744 |
| 105 | 45.478 | 17.865 | 1.587 | 34.752 | 12.967 | 2254922 | 2486864 | 5/28/1998 | 19:54:51.17 | 3.334 | 7.742 |
| 106 | 45.448 | 17.844 | 1.594 | 34.745 | 12.966 | 2314330 | 2486693 | 5/28/1998 | 20:00:51.97 | 3.742 | 7.741 |
| 107 | 45.425 | 17.817 | 1.618 | 34.748 | 12.967 | 2387819 | 2487259 | 5/28/1998 | 20:06:52.77 | 4.246 | 7.744 |
| 108 | 45.403 | 17.792 | 1.62 | 34.75 | 12.966 | 2296862 | 2486566 | 5/28/1998 | 20:12:53.57 | 3.622 | 7.741 |
| 109 | 45.37 | 17.763 | 1.68 | 34.747 | 12.965 | 2339111 | 2486866 | 5/28/1998 | 20:18:54.37 | 3.912 | 7.742 |
| 110 | 45.341 | 17.729 | 1.736 | 34.751 | 12.966 | 2329803 | 2486786 | 5/28/1998 | 20:24:55.17 | 3.848 | 7.742 |
| 111 | 45.294 | 17.679 | 1.705 | 34.753 | 12.964 | 2358646 | 2487401 | 5/28/1998 | 20:30:55.97 | 4.046 | 7.744 |
| 112 | 45.264 | 17.654 | 1.731 | 34.748 | 12.965 | 2330498 | 2487117 | 5/28/1998 | 20:36:56.77 | 3.853 | 7.743 |
| 113 | 45.214 | 17.594 | 1.786 | 34.757 | 12.963 | 2314874 | 2487420 | 5/28/1998 | 20:42:57.57 | 3.745 | 7.744 |
| 114 | 45.168 | 17.555 | 1.775 | 34.751 | 12.962 | 2308275 | 2487907 | 5/28/1998 | 20:48:58.37 | 3.700 | 7.746 |
| 115 | 45.116 | 17.505 | 1.811 | 34.748 | 12.962 | 2344272 | 2487680 | 5/28/1998 | 20:54:59.17 | 3.947 | 7.745 |
| 116 | 45.073 | 17.457 | 1.837 | 34.753 | 12.961 | 2317267 | 2487876 | 5/28/1998 | 21:00:59.97 | 3.762 | 7.746 |
| 117 | 45.029 | 17.413 | 1.858 | 34.752 | 12.963 | 2300178 | 2487405 | 5/28/1998 | 21:07:00.77 | 3.645 | 7.744 |
| 118 | 44.99 | 17.358 | 1.924 | 34.766 | 12.96 | 2331624 | 2488023 | 5/28/1998 | 21:13:01.57 | 3.860 | 7.747 |
| 119 | 44.958 | 17.33 | 1.878 | 34.762 | 12.96 | 2329359 | 2487137 | 5/28/1998 | 21:19:02.37 | 3.845 | 7.743 |
| 120 | 44.915 | 17.294 | 1.953 | 34.757 | 12.959 | 2262493 | 2488073 | 5/28/1998 | 21:25:03.17 | 3.386 | 7.747 |
| 121 | 44.881 | 17.258 | 1.938 | 34.757 | 12.959 | 2240792 | 2488232 | 5/28/1998 | 21:31:03.97 | 3.237 | 7.748 |
| 122 | 44.846 | 17.223 | 1.958 | 34.757 | 12.958 | 2298574 | 2488113 | 5/28/1998 | 21:37:04.77 | 3.634 | 7.747 |
| 123 | 44.809 | 17.183 | 1.98 | 34.76 | 12.957 | 2262848 | 2488095 | 5/28/1998 | 21:43:05.57 | 3.388 | 7.747 |
| 124 | 44.778 | 17.139 | 1.945 | 34.771 | 12.957 | 2331855 | 2487752 | 5/28/1998 | 21:49:06.37 | 3.862 | 7.746 |
| 125 | 44.744 | 17.119 | 2.03 | 34.758 | 12.956 | 2280193 | 2488258 | 5/28/1998 | 21:55:07.17 | 3.507 | 7.748 |
| 126 | 44.708 | 17.078 | 2.065 | 34.762 | 12.955 | 2294880 | 2487701 | 5/28/1998 | 22:01:07.97 | 3.608 | 7.746 |
| 127 | 44.681 | 17.045 | 2.079 | 34.768 | 12.955 | 2308214 | 2488757 | 5/28/1998 | 22:07:08.77 | 3.700 | 7.750 |
| 128 | 44.664 | 17.005 | 2.063 | 34.787 | 12.955 | 2315095 | 2487847 | 5/28/1998 | 22:13:09.57 | 3.747 | 7.746 |
| 129 | 44.651 | 17.013 | 2.068 | 34.769 | 12.955 | 2289608 | 2487275 | 5/28/1998 | 22:19:10.37 | 3.572 | 7.744 |
| 130 | 44.617 | 16.977 | 2.087 | 34.771 | 12.953 | 2297307 | 2488295 | 5/28/1998 | 22:25:11.17 | 3.625 | 7.748 |
| 131 | 44.597 | 16.964 | 2.123 | 34.764 | 12.952 | 2336293 | 2487711 | 5/28/1998 | 22:31:11.97 | 3.892 | 7.746 |
| 132 | 44.581 | 16.941 | 2.11 | 34.77 | 12.953 | 2304030 | 2487121 | 5/28/1998 | 22:37:12.77 | 3.671 | 7.743 |
| 133 | 44.558 | 16.922 | 2.155 | 34.767 | 12.951 | 2351956 | 2487332 | 5/28/1998 | 22:43:13.57 | 4.000 | 7.744 |
| 134 | 44.525 | 16.881 | 2.177 | 34.773 | 12.951 | 2328506 | 2488363 | 5/28/1998 | 22:49:14.37 | 3.839 | 7.748 |
| 135 | 44.519 | 16.867 | 2.184 | 34.78 | 12.952 | 2332990 | 2488786 | 5/28/1998 | 22:55:15.17 | 3.870 | 7.750 |
| 136 | 44.51 | 16.869 | 2.167 | 34.771 | 12.95 | 2325469 | 2487748 | 5/28/1998 | 23:01:15.97 | 3.818 | 7.746 |
| 137 | 44.492 | 16.837 | 2.093 | 34.782 | 12.95 | 2257370 | 2488290 | 5/28/1998 | 23:07:16.77 | 3.351 | 7.748 |
| 138 | 44.472 | 16.82 | 2.202 | 34.779 | 12.95 | 2319133 | 2487317 | 5/28/1998 | 23:13:17.57 | 3.775 | 7.744 |
| 139 | 44.455 | 16.818 | 2.154 | 34.766 | 12.951 | 2305456 | 2488250 | 5/28/1998 | 23:19:18.37 | 3.681 | 7.748 |
| 140 | 44.432 | 16.787 | 2.194 | 34.773 | 12.949 | 2309781 | 2487183 | 5/28/1998 | 23:25:19.17 | 3.710 | 7.743 |
| 141 | 44.415 | 16.776 | 2.247 | 34.768 | 12.949 | 2319015 | 2487101 | 5/28/1998 | 23:31:19.97 | 3.774 | 7.743 |
| 142 | 44.394 | 16.751 | 2.193 | 34.771 | 12.948 | 2289664 | 2487559 | 5/28/1998 | 23:38:01.99 | 3.572 | 7.745 |
| 143 | 44.37 | 16.717 | 2.19 | 34.78 | 12.948 | 2263307 | 2487832 | 5/28/1998 | 23:44:02.79 | 3.392 | 7.746 |
| 144 | 44.351 | 16.709 | 2.147 | 34.77 | 12.946 | 2311462 | 2487816 | 5/28/1998 | 23:50:03.59 | 3.722 | 7.746 |
| 145 | 44.331 | 16.673 | 2.127 | 34.783 | 12.947 | 2320541 | 2487357 | 5/28/1998 | 23:56:04.39 | 3.784 | 7.744 |
| 146 | 44.306 | 16.65 | 2.17 | 34.781 | 12.946 | 2294127 | 2487148 | 5/29/1998 | 00:02:05.19 | 3.603 | 7.743 |
| 147 | 44.273 | 16.621 | 2.141 | 34.778 | 12.947 | 2332644 | 2487030 | 5/29/1998 | 00:08:05.99 | 3.867 | 7.743 |
| 148 | 44.254 | 16.6 | 2.127 | 34.779 | 12.945 | 2323867 | 2487469 | 5/29/1998 | 00:14:06.79 | 3.807 | 7.745 |
| 149 | 44.211 | 16.558 | 2.099 | 34.778 | 12.944 | 2300681 | 2487058 | 5/29/1998 | 00:20:07.59 | 3.648 | 7.743 |
| 150 | 44.188 | 16.526 | 2.067 | 34.786 | 12.943 | 2278551 | 2487306 | 5/29/1998 | 00:26:08.39 | 3.496 | 7.744 |
| 151 | 44.165 | 16.503 | 2.034 | 34.786 | 12.942 | 2287298 | 2487392 | 5/29/1998 | 00:32:09.19 | 3.556 | 7.744 |
| 152 | 44.135 | 16.469 | 2.06 | 34.789 | 12.941 | 2331387 | 2487051 | 5/29/1998 | 00:38:09.99 | 3.859 | 7.743 |
| 153 | 44.105 | 16.452 | 2.018 | 34.777 | 12.942 | 2295985 | 2487200 | 5/29/1998 | 00:44:10.79 | 3.616 | 7.743 |
| 154 | 44.088 | 16.426 | 1.986 | 34.784 | 12.942 | 2316765 | 2487424 | 5/29/1998 | 00:50:11.59 | 3.758 | 7.744 |
| 155 | 44.081 | 16.409 | 1.998 | 34.793 | 12.939 | 2304255 | 287212 | 5/29/1998 | 00:56:12.39 | 3.673 | 7.743 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **156** | 44.068 | 16.398 | 1.903 | 34.791 | 12.94 | 2228353 | 2487888 | 5/29/1998 | 01:02:13.19 | 3.152 | 7.746 |
| **157** | 44.057 | 16.389 | 1.925 | 34.789 | 12.94 | 2314425 | 2487251 | 5/29/1998 | 01:08:13.99 | 3.742 | 7.744 |
| **158** | 44.051 | 16.381 | 1.876 | 34.791 | 12.939 | 2319702 | 2488199 | 5/29/1998 | 01:14:14.79 | 3.779 | 7.748 |
| **159** | 44.046 | 16.384 | 1.839 | 34.784 | 12.939 | 2336415 | 2487387 | 5/29/1998 | 01:20:15.59 | 3.893 | 7.744 |
| **160** | 44.045 | 16.383 | 1.79 | 34.785 | 12.938 | 2317515 | 2488181 | 5/29/1998 | 01:26:16.39 | 3.764 | 7.748 |
| **161** | 44.045 | 16.382 | 1.783 | 34.785 | 12.938 | 2298769 | 2487598 | 5/29/1998 | 01:32:17.19 | 3.635 | 7.745 |
| **162** | 44.051 | 16.378 | 1.777 | 34.793 | 12.94 | 2317622 | 2487845 | 5/29/1998 | 01:38:17.99 | 3.764 | 7.746 |
| **163** | 44.061 | 16.385 | 1.689 | 34.797 | 12.938 | 2309962 | 2488155 | 5/29/1998 | 01:44:18.79 | 3.712 | 7.748 |
| **164** | 44.069 | 16.401 | 1.641 | 34.79 | 12.938 | 2313037 | 2488007 | 5/29/1998 | 01:50:19.59 | 3.733 | 7.747 |
| **165** | 44.086 | 16.425 | 1.592 | 34.784 | 12.938 | 2291199 | 2487798 | 5/29/1998 | 01:56:20.39 | 3.583 | 7.746 |
| **166** | 44.099 | 16.429 | 1.587 | 34.792 | 12.937 | 2301553 | 2489464 | 5/29/1998 | 02:02:21.19 | 3.654 | 7.753 |
| **167** | 44.117 | 16.453 | 1.537 | 34.787 | 12.938 | 2285801 | 2488157 | 5/29/1998 | 02:08:21.99 | 3.546 | 7.748 |
| **168** | 44.137 | 16.47 | 1.532 | 34.79 | 12.938 | 2299845 | 2488837 | 5/29/1998 | 02:14:22.79 | 3.642 | 7.750 |
| **169** | 44.161 | 16.497 | 1.441 | 34.787 | 12.938 | 2330472 | 2488705 | 5/29/1998 | 02:20:23.59 | 3.852 | 7.750 |
| **170** | 44.189 | 16.521 | 1.404 | 34.79 | 12.938 | 2291325 | 2489317 | 5/29/1998 | 02:26:24.39 | 3.584 | 7.753 |
| **171** | 44.205 | 16.544 | 1.414 | 34.786 | 12.938 | 2313383 | 2488472 | 5/29/1998 | 02:32:25.19 | 3.735 | 7.749 |
| **172** | 44.224 | 16.561 | 1.335 | 34.787 | 12.938 | 2284055 | 2488580 | 5/29/1998 | 02:38:25.99 | 3.534 | 7.749 |
| **173** | 44.246 | 16.582 | 1.343 | 34.788 | 12.936 | 2302788 | 2489789 | 5/29/1998 | 02:44:26.79 | 3.662 | 7.755 |
| **174** | 44.261 | 16.599 | 1.257 | 34.787 | 12.937 | 2234953 | 2489218 | 5/29/1998 | 02:50:27.59 | 3.197 | 7.752 |
| **175** | 44.269 | 16.613 | 1.192 | 34.782 | 12.935 | 2320161 | 2489082 | 5/29/1998 | 02:56:28.39 | 3.782 | 7.752 |
| **176** | 44.285 | 16.618 | 1.218 | 34.791 | 12.937 | 2297834 | 2489306 | 5/29/1998 | 03:02:29.19 | 3.628 | 7.752 |
| **177** | 44.293 | 16.635 | 1.162 | 34.783 | 12.937 | 2314185 | 2489379 | 5/29/1998 | 03:08:29.99 | 3.741 | 7.753 |
| **178** | 44.305 | 16.64 | 1.103 | 34.789 | 12.935 | 2282847 | 2488953 | 5/29/1998 | 03:14:30.79 | 3.526 | 7.751 |
| **179** | 44.317 | 16.659 | 1.051 | 34.784 | 12.935 | 2313239 | 2489215 | 5/29/1998 | 03:20:31.59 | 3.734 | 7.752 |
| **180** | 44.334 | 16.658 | 1.045 | 34.8 | 12.934 | 2327753 | 2489356 | 5/29/1998 | 03:26:32.39 | 3.834 | 7.753 |
| **181** | 44.342 | 16.681 | 0.969 | 34.787 | 12.934 | 2323343 | 2488751 | 5/29/1998 | 03:32:33.19 | 3.804 | 7.750 |
| **182** | 44.372 | 16.713 | 0.928 | 34.785 | 12.937 | 2273363 | 2488426 | 5/29/1998 | 03:38:33.99 | 3.461 | 7.749 |
| **183** | 44.413 | 16.751 | 0.857 | 34.788 | 12.935 | 2298671 | 2489384 | 5/29/1998 | 03:44:34.79 | 3.634 | 7.753 |
| **184** | 44.451 | 16.797 | 0.837 | 34.782 | 12.936 | 2283134 | 2488974 | 5/29/1998 | 03:50:35.59 | 3.528 | 7.751 |
| **185** | 44.487 | 16.83 | 0.795 | 34.784 | 12.935 | 2299437 | 2488495 | 5/29/1998 | 03:56:36.39 | 3.639 | 7.749 |
| **186** | 44.516 | 16.855 | 0.766 | 34.788 | 12.935 | 2318111 | 2488873 | 5/29/1998 | 04:02:37.19 | 3.768 | 7.751 |
| **187** | 44.561 | 16.898 | 0.719 | 34.79 | 12.936 | 2285798 | 2489263 | 5/29/1998 | 04:08:37.99 | 3.546 | 7.752 |
| **188** | 44.604 | 16.947 | 0.684 | 34.785 | 12.935 | 2304356 | 2488959 | 5/29/1998 | 04:14:38.79 | 3.673 | 7.751 |
| **189** | 44.624 | 16.97 | 0.622 | 34.782 | 12.937 | 2333743 | 2488811 | 5/29/1998 | 04:20:39.59 | 3.875 | 7.750 |
| **190** | 44.646 | 16.999 | 0.599 | 34.778 | 12.935 | 2327689 | 2488726 | 5/29/1998 | 04:26:40.39 | 3.833 | 7.750 |
| **191** | 44.689 | 17.023 | 0.563 | 34.794 | 12.935 | 2326769 | 2489019 | 5/29/1998 | 04:32:41.19 | 3.827 | 7.751 |
| **192** | 44.735 | 17.089 | 0.538 | 34.777 | 12.936 | 2280251 | 2489107 | 5/29/1998 | 04:38:41.99 | 3.508 | 7.752 |
| **193** | 44.778 | 17.119 | 0.527 | 34.789 | 12.935 | 2288164 | 2488836 | 5/29/1998 | 04:44:42.79 | 3.562 | 7.750 |
| **194** | 44.815 | 17.162 | 0.453 | 34.784 | 12.936 | 2354815 | 2489096 | 5/29/1998 | 04:50:43.59 | 4.020 | 7.752 |
| **195** | 44.858 | 17.201 | 0.432 | 34.787 | 12.936 | 2327043 | 2489481 | 5/29/1998 | 04:56:44.39 | 3.829 | 7.753 |
| **196** | 44.901 | 17.252 | 0.405 | 34.78 | 12.937 | 2193583 | 2488516 | 5/29/1998 | 05:02:45.19 | 2.913 | 7.749 |
| **197** | 44.955 | 17.308 | 0.372 | 34.779 | 12.936 | 2283462 | 2489276 | 5/29/1998 | 05:08:45.99 | 3.530 | 7.752 |
| **198** | 44.983 | 17.337 | 0.347 | 34.779 | 12.936 | 2331071 | 2488929 | 5/29/1998 | 05:14:46.79 | 3.857 | 7.751 |
| **199** | 44.983 | 17.351 | 0.316 | 34.767 | 12.934 | 2326903 | 2488973 | 5/29/1998 | 05:20:47.59 | 3.828 | 7.751 |
| **200** | 45.026 | 17.391 | 0.317 | 34.769 | 12.935 | 2299905 | 2488970 | 5/29/1998 | 05:26:48.39 | 3.643 | 7.751 |
| **201** | 45.074 | 17.43 | 0.274 | 34.777 | 12.935 | 2297999 | 2489074 | 5/29/1998 | 05:32:49.19 | 3.630 | 7.751 |
| **202** | 45.111 | 17.468 | 0.274 | 34.777 | 12.936 | 2331391 | 2488920 | 5/29/1998 | 05:38:49.99 | 3.859 | 7.751 |
| **203** | 45.156 | 17.504 | 0.201 | 34.785 | 12.937 | 2296867 | 2489300 | 5/29/1998 | 05:44:50.79 | 3.622 | 7.752 |
| **204** | 45.195 | 17.561 | 0.209 | 34.769 | 12.939 | 2321373 | 2488326 | 5/29/1998 | 05:50:51.59 | 3.790 | 7.748 |
| **205** | 45.243 | 17.598 | 0.216 | 34.779 | 12.937 | 2322803 | 2488669 | 5/29/1998 | 05:56:52.39 | 3.800 | 7.750 |
| **206** | 45.28 | 17.64 | 0.201 | 34.775 | 12.938 | 2344243 | 2489041 | 5/29/1998 | 06:02:53.19 | 3.947 | 7.751 |
| **207** | 45.321 | 17.679 | 0.156 | 34.776 | 12.936 | 2378781 | 2487804 | 5/29/1998 | 06:08:53.99 | 4.184 | 7.746 |
| **208** | 45.348 | 17.705 | 0.179 | 34.778 | 12.938 | 2366713 | 2488640 | 5/29/1998 | 06:14:54.79 | 4.101 | 7.750 |
| **209** | 45.388 | 17.747 | 0.172 | 34.776 | 12.936 | 2334393 | 2488707 | 5/29/1998 | 06:20:55.59 | 3.879 | 7.750 |
| **210** | 45.422 | 17.791 | 0.159 | 34.767 | 12.937 | 2255886 | 2487790 | 5/29/1998 | 06:26:56.39 | 3.341 | 7.746 |
| **211** | 45.462 | 17.83 | 0.169 | 34.769 | 12.94 | 2349147 | 2487964 | 5/29/1998 | 06:32:57.19 | 3.981 | 7.747 |
| **212** | 45.51 | 17.866 | 0.145 | 34.779 | 12.937 | 2347306 | 2488192 | 5/29/1998 | 06:39:39.22 | 3.968 | 7.748 |
| **213** | 45.538 | 17.905 | 0.138 | 34.77 | 12.936 | 2291856 | 2487561 | 5/29/1998 | 06:45:40.02 | 3.587 | 7.745 |
| **214** | 45.576 | 17.945 | 0.143 | 34.768 | 12.936 | 2222965 | 2487628 | 5/29/1998 | 06:51:40.82 | 3.115 | 7.745 |
| **215** | 45.616 | 17.983 | 0.17 | 34.77 | 12.94 | 2330958 | 2487773 | 5/29/1998 | 06:57:41.62 | 3.856 | 7.746 |
| **216** | 45.654 | 18.03 | 0.152 | 34.763 | 12.937 | 2322395 | 2487670 | 5/29/1998 | 07:03:42.42 | 3.797 | 7.745 |
| **217** | 45.686 | 18.057 | 0.166 | 34.766 | 12.939 | 2297551 | 2487695 | 5/29/1998 | 07:09:43.22 | 3.627 | 7.746 |
| **218** | 45.721 | 18.102 | 0.156 | 34.758 | 12.936 | 2334395 | 2487626 | 5/29/1998 | 07:15:44.02 | 3.879 | 7.745 |
| **219** | 45.766 | 18.14 | 0.185 | 34.765 | 12.939 | 2357319 | 2487050 | 5/29/1998 | 07:21:44.82 | 4.037 | 7.743 |
| **220** | 45.802 | 18.177 | 0.195 | 34.764 | 12.939 | 2310795 | 2487153 | 5/29/1998 | 07:27:45.62 | 3.717 | 7.743 |
| **221** | 45.838 | 18.217 | 0.221 | 34.76 | 12.938 | 2304781 | 2486748 | 5/29/1998 | 07:33:46.42 | 3.676 | 7.741 |
| **222** | 45.881 | 18.255 | 0.237 | 34.765 | 12.937 | 2374486 | 2486894 | 5/29/1998 | 07:39:47.22 | 4.155 | 7.742 |
| **223** | 45.91 | 18.293 | 0.255 | 34.757 | 12.94 | 2358374 | 2486404 | 5/29/1998 | 07:45:48.02 | 4.044 | 7.740 |
| **224** | 45.943 | 18.326 | 0.254 | 34.758 | 12.939 | 2355086 | 2486334 | 5/29/1998 | 07:51:48.82 | 4.021 | 7.740 |
| **225** | 45.976 | 18.356 | 0.27 | 34.759 | 12.94 | 2289219 | 2486584 | 5/29/1998 | 07:57:49.62 | 3.569 | 7.741 |
| **226** | 46.006 | 18.39 | 0.296 | 34.756 | 12.937 | 2331209 | 2486612 | 5/29/1998 | 08:03:50.42 | 3.858 | 7.741 |
| **227** | 46.037 | 18.426 | 0.316 | 34.751 | 12.939 | 2348303 | 2486396 | 5/29/1998 | 08:09:51.22 | 3.975 | 7.740 |
| **228** | 46.055 | 18.446 | 0.312 | 34.75 | 12.937 | 2260793 | 2486816 | 5/29/1998 | 08:15:52.02 | 3.374 | 7.742 |
| **229** | 46.087 | 18.47 | 0.341 | 34.757 | 12.938 | 2361113 | 2486006 | 5/29/1998 | 08:21:52.82 | 4.063 | 7.738 |
| **230** | 46.116 | 18.501 | 0.397 | 34.755 | 12.937 | 2242313 | 2486667 | 5/29/1998 | 08:27:53.62 | 3.247 | 7.741 |
| **231** | 46.141 | 18.525 | 0.396 | 34.756 | 12.935 | 2325640 | 2486151 | 5/29/1998 | 08:33:54.42 | 3.819 | 7.739 |
| **232** | 46.16 | 18.543 | 0.402 | 34.756 | 12.937 | 2334223 | 2486496 | 5/29/1998 | 08:39:55.22 | 3.878 | 7.740 |
| **233** | 46.174 | 18.564 | 0.483 | 34.751 | 12.936 | 2352298 | 2486551 | 5/29/1998 | 08:45:56.02 | 4.002 | 7.741 |
| **234** | 46.194 | 18.577 | 0.461 | 34.757 | 12.936 | 2334808 | 2486328 | 5/29/1998 | 08:51:56.82 | 3.882 | 7.740 |
| **235** | 46.198 | 18.582 | 0.484 | 34.756 | 12.936 | 2320176 | 2485657 | 5/29/1998 | 08:57:57.62 | 3.782 | 7.737 |
| **236** | 46.196 | 18.577 | 0.515 | 34.758 | 12.935 | 2273956 | 2485540 | 5/29/1998 | 09:03:58.42 | 3.465 | 7.736 |
| **237** | 46.188 | 18.582 | 0.542 | 34.747 | 12.934 | 2371515 | 2485166 | 5/29/1998 | 09:09:59.22 | 4.134 | 7.735 |
| **238** | 46.179 | 18.563 | 0.528 | 34.755 | 12.934 | 2359711 | 2485938 | 5/29/1998 | 09:16:00.02 | 4.053 | 7.738 |
| **239** | 46.16 | 18.544 | 0.592 | 34.756 | 12.933 | 2390262 | 2485802 | 5/29/1998 | 09:22:00.82 | 4.263 | 7.737 |
| **240** | 46.146 | 18.524 | 0.607 | 34.761 | 12.936 | 2376076 | 2484909 | 5/29/1998 | 09:28:01.62 | 4.165 | 7.734 |
| **241** | 46.122 | 18.508 | 0.608 | 34.754 | 12.932 | 2346540 | 2485726 | 5/29/1998 | 09:34:02.42 | 3.963 | 7.737 |
| **242** | 46.11 | 18.494 | 0.679 | 34.756 | 12.931 | 2271082 | 2485496 | 5/29/1998 | 09:40:03.22 | 3.445 | 7.736 |
| **243** | 46.098 | 18.49 | 0.659 | 34.748 | 12.931 | 2342790 | 2484503 | 5/29/1998 | 09:46:04.02 | 3.937 | 7.732 |
| **244** | 46.083 | 18.473 | 0.689 | 34.751 | 12.932 | 2360399 | 2484808 | 5/29/1998 | 09:52:04.82 | 4.058 | 7.733 |
| **245** | 46.071 | 18.451 | 0.764 | 34.759 | 12.93 | 2359366 | 2485051 | 5/29/1998 | 09:58:05.62 | 4.051 | 7.734 |
| **246** | 46.057 | 18.44 | 0.802 | 34.757 | 12.93 | 2339065 | 2485960 | 5/29/1998 | 10:04:06.42 | 3.911 | 7.738 |
| **247** | 46.039 | 18.429 | 0.778 | 34.751 | 12.929 | 2374929 | 2485450 | 5/29/1998 | 10:10:07.22 | 4.158 | 7.736 |
| **248** | 46.033 | 18.419 | 0.823 | 34.755 | 12.931 | 2380206 | 2485436 | 5/29/1998 | 10:16:08.02 | 4.194 | 7.736 |
| **249** | 46.026 | 18.406 | 0.877 | 34.759 | 12.931 | 2347044 | 2484886 | 5/29/1998 | 10:22:08.82 | 3.966 | 7.733 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **250** | 46.012 | 18.396 | 0.896 | 34.756 | 12.928 | 2355055 | 2485252 | 5/29/1998 | 10:28:09.62 | 4.021 | 7.735 |
| **251** | 45.995 | 18.378 | 0.951 | 34.756 | 12.928 | 2327764 | 2485243 | 5/29/1998 | 10:34:10.42 | 3.834 | 7.735 |
| **252** | 45.973 | 18.355 | 0.923 | 34.757 | 12.927 | 2380058 | 2484446 | 5/29/1998 | 10:40:11.22 | 4.193 | 7.732 |
| **253** | 45.948 | 18.336 | 0.969 | 34.752 | 12.906 | 2359418 | 2483853 | 5/29/1998 | 10:46:12.02 | 4.051 | 7.729 |
| **254** | 45.93 | 18.307 | 0.962 | 34.762 | 12.919 | 2348663 | 2485031 | 5/29/1998 | 10:52:12.82 | 3.977 | 7.734 |
| **255** | 45.892 | 18.271 | 1.029 | 34.759 | 12.918 | 2350833 | 2484387 | 5/29/1998 | 10:58:13.62 | 3.992 | 7.731 |
| **256** | 45.858 | 18.234 | 1.051 | 34.762 | 12.919 | 2329614 | 2484429 | 5/29/1998 | 11:04:14.42 | 3.847 | 7.731 |
| **257** | 45.822 | 18.198 | 1.064 | 34.762 | 12.92 | 2372916 | 2484444 | 5/29/1998 | 11:10:15.22 | 4.144 | 7.731 |
| **258** | 45.801 | 18.173 | 1.079 | 34.765 | 12.919 | 2342223 | 2484663 | 5/29/1998 | 11:16:16.02 | 3.933 | 7.732 |
| **259** | 45.77 | 18.143 | 1.107 | 34.764 | 12.918 | 2350212 | 2484551 | 5/29/1998 | 11:22:16.82 | 3.988 | 7.732 |
| **260** | 45.725 | 18.102 | 1.137 | 34.762 | 12.918 | 2295768 | 2484156 | 5/29/1998 | 11:28:17.62 | 3.614 | 7.730 |
| **261** | 45.672 | 18.049 | 1.166 | 34.761 | 12.918 | 2360195 | 2484763 | 5/29/1998 | 11:34:18.42 | 4.056 | 7.733 |
| **262** | 45.623 | 17.988 | 1.152 | 34.772 | 12.918 | 2325052 | 2484259 | 5/29/1998 | 11:40:19.22 | 3.815 | 7.731 |
| **263** | 45.567 | 17.947 | 1.168 | 34.758 | 12.915 | 2360377 | 2484336 | 5/29/1998 | 11:46:20.02 | 4.058 | 7.731 |
| **264** | 45.498 | 17.867 | 1.2 | 34.768 | 12.915 | 2345574 | 2484232 | 5/29/1998 | 11:52:20.82 | 3.956 | 7.731 |
| **265** | 45.429 | 17.793 | 1.221 | 34.772 | 12.913 | 2335963 | 2484171 | 5/29/1998 | 11:58:21.62 | 3.890 | 7.730 |
| **266** | 45.386 | 17.752 | 1.233 | 34.77 | 12.914 | 2372696 | 2484228 | 5/29/1998 | 12:04:22.42 | 4.142 | 7.731 |
| **267** | 45.334 | 17.698 | 1.292 | 34.772 | 12.913 | 2228506 | 2483885 | 5/29/1998 | 12:10:23.22 | 3.153 | 7.729 |
| **268** | 45.285 | 17.653 | 1.265 | 34.768 | 12.912 | 2321059 | 2484050 | 5/29/1998 | 12:16:24.02 | 3.788 | 7.730 |
| **269** | 45.252 | 17.609 | 1.294 | 34.777 | 12.912 | 2344872 | 2484538 | 5/29/1998 | 12:22:24.82 | 3.951 | 7.732 |
| **270** | 45.214 | 17.566 | 1.278 | 34.781 | 12.911 | 2370115 | 2484017 | 5/29/1998 | 12:28:25.62 | 4.125 | 7.730 |
| **271** | 45.163 | 17.518 | 1.302 | 34.779 | 12.911 | 2323027 | 2484582 | 5/29/1998 | 12:34:26.42 | 3.801 | 7.732 |
| **272** | 45.115 | 17.482 | 1.279 | 34.768 | 12.909 | 2343015 | 2484452 | 5/29/1998 | 12:40:27.22 | 3.939 | 7.732 |
| **273** | 45.081 | 17.447 | 1.299 | 34.768 | 12.908 | 2339927 | 2484048 | 5/29/1998 | 12:46:28.02 | 3.917 | 7.730 |
| **274** | 45.049 | 17.416 | 1.3 | 34.767 | 12.909 | 2336933 | 2484086 | 5/29/1998 | 12:52:28.82 | 3.897 | 7.730 |
| **275** | 45.034 | 17.385 | 1.287 | 34.781 | 12.909 | 2342602 | 2484079 | 5/29/1998 | 12:58:29.62 | 3.936 | 7.730 |
| **276** | 45.007 | 17.356 | 1.356 | 34.782 | 12.908 | 2301207 | 2483829 | 5/29/1998 | 13:04:30.42 | 3.652 | 7.729 |
| **277** | 44.977 | 17.326 | 1.372 | 34.783 | 12.908 | 2319952 | 2483977 | 5/29/1998 | 13:10:31.22 | 3.780 | 7.729 |
| **278** | 44.946 | 17.296 | 1.333 | 34.782 | 12.907 | 2332314 | 2484063 | 5/29/1998 | 13:16:32.02 | 3.865 | 7.730 |
| **279** | 44.918 | 17.271 | 1.364 | 34.779 | 12.907 | 2338066 | 2483642 | 5/29/1998 | 13:22:32.82 | 3.905 | 7.728 |
| **280** | 44.89 | 17.239 | 1.328 | 34.782 | 12.905 | 2340330 | 2484771 | 5/29/1998 | 13:28:33.62 | 3.920 | 7.733 |
| **281** | 44.851 | 17.202 | 1.309 | 34.781 | 12.905 | 2297767 | 2484638 | 5/29/1998 | 13:34:34.42 | 3.628 | 7.732 |
| **282** | 44.811 | 17.158 | 1.289 | 34.784 | 12.902 | 2337772 | 2484419 | 5/29/1998 | 13:41:16.46 | 3.903 | 7.731 |
| **283** | 44.786 | 17.13 | 1.28 | 34.786 | 12.903 | 2332777 | 2483267 | 5/29/1998 | 13:47:17.26 | 3.868 | 7.726 |
| **284** | 44.761 | 17.117 | 1.305 | 34.775 | 12.903 | 2343545 | 2483895 | 5/29/1998 | 13:53:18.06 | 3.942 | 7.729 |
| **285** | 44.712 | 17.05 | 1.31 | 34.791 | 12.902 | 2339659 | 2483953 | 5/29/1998 | 13:59:18.86 | 3.916 | 7.729 |
| **286** | 44.673 | 17.009 | 1.298 | 34.792 | 12.901 | 2321547 | 2484309 | 5/29/1998 | 14:05:19.66 | 3.791 | 7.731 |
| **287** | 44.639 | 16.982 | 1.33 | 34.786 | 12.903 | 2327921 | 2483368 | 5/29/1998 | 14:11:20.46 | 3.835 | 7.727 |
| **288** | 44.607 | 16.95 | 1.256 | 34.785 | 12.9 | 2312211 | 2484264 | 5/29/1998 | 14:17:21.26 | 3.727 | 7.731 |
| **289** | 44.598 | 16.924 | 1.228 | 34.8 | 12.901 | 2327343 | 2484037 | 5/29/1998 | 14:23:22.06 | 3.831 | 7.730 |
| **290** | 44.564 | 16.908 | 1.224 | 34.784 | 12.901 | 2341677 | 2483301 | 5/29/1998 | 14:29:22.86 | 3.929 | 7.727 |
| **291** | 44.536 | 16.867 | 1.17 | 34.795 | 12.899 | 2315049 | 2483388 | 5/29/1998 | 14:35:23.66 | 3.747 | 7.727 |
| **292** | 44.513 | 16.851 | 1.198 | 34.789 | 12.898 | 2329209 | 2483680 | 5/29/1998 | 14:41:24.46 | 3.844 | 7.728 |
| **293** | 44.478 | 16.822 | 1.231 | 34.783 | 12.9 | 2335562 | 2483394 | 5/29/1998 | 14:47:25.26 | 3.887 | 7.727 |
| **294** | 44.451 | 16.792 | 1.222 | 34.786 | 12.897 | 2338998 | 2483843 | 5/29/1998 | 14:53:26.06 | 3.911 | 7.729 |
| **295** | 44.42 | 16.75 | 1.193 | 34.795 | 12.9 | 2324411 | 2483427 | 5/29/1998 | 14:59:26.86 | 3.811 | 7.727 |
| **296** | 44.399 | 16.732 | 1.145 | 34.793 | 12.898 | 2304612 | 2484513 | 5/29/1998 | 15:05:27.66 | 3.675 | 7.732 |
| **297** | 44.364 | 16.703 | 1.1 | 34.786 | 12.883 | 2292713 | 2484593 | 5/29/1998 | 15:11:28.46 | 3.593 | 7.732 |
| **298** | 44.357 | 16.668 | 1.042 | 34.811 | 12.888 | 2308925 | 2484349 | 5/29/1998 | 15:17:29.26 | 3.705 | 7.731 |
| **299** | 44.349 | 16.674 | 1.108 | 34.799 | 12.89 | 2327934 | 2484425 | 5/29/1998 | 15:23:30.06 | 3.835 | 7.731 |
| **300** | 44.34 | 16.665 | 1.097 | 34.798 | 12.891 | 2282372 | 2483891 | 5/29/1998 | 15:29:30.86 | 3.522 | 7.729 |
| **301** | 44.316 | 16.646 | 1.05 | 34.795 | 12.892 | 2315451 | 2483857 | 5/29/1998 | 15:35:31.66 | 3.749 | 7.729 |
| **302** | 44.3 | 16.619 | 1.033 | 34.804 | 12.893 | 2251383 | 2483779 | 5/29/1998 | 15:41:32.46 | 3.310 | 7.729 |
| **303** | 44.283 | 16.606 | 1.085 | 34.8 | 12.891 | 2307209 | 2484265 | 5/29/1998 | 15:47:33.26 | 3.693 | 7.731 |
| **304** | 44.272 | 16.592 | 1.042 | 34.803 | 12.891 | 2332659 | 2483848 | 5/29/1998 | 15:53:34.06 | 3.867 | 7.729 |
| **305** | 44.257 | 16.582 | 0.982 | 34.798 | 12.89 | 2341376 | 2484169 | 5/29/1998 | 15:59:34.86 | 3.927 | 7.730 |
| **306** | 44.228 | 16.553 | 0.977 | 34.798 | 12.89 | 2313749 | 2483931 | 5/29/1998 | 16:05:35.66 | 3.738 | 7.729 |
| **307** | 44.201 | 16.521 | 0.959 | 34.802 | 12.89 | 2330583 | 2484105 | 5/29/1998 | 16:11:36.46 | 3.853 | 7.730 |
| **308** | 44.187 | 16.509 | 0.923 | 34.8 | 12.889 | 2303860 | 2484190 | 5/29/1998 | 16:17:37.26 | 3.670 | 7.730 |
| **309** | 44.176 | 16.493 | 0.932 | 34.804 | 12.89 | 2343082 | 2484519 | 5/29/1998 | 16:23:38.06 | 3.939 | 7.732 |
| **310** | 44.151 | 16.467 | 0.888 | 34.805 | 12.888 | 2343922 | 2484486 | 5/29/1998 | 16:29:38.86 | 3.945 | 7.732 |
| **311** | 44.128 | 16.456 | 0.881 | 34.794 | 12.888 | 2312010 | 2485232 | 5/29/1998 | 16:35:39.66 | 3.726 | 7.735 |
| **312** | 44.127 | 16.449 | 0.912 | 34.799 | 12.887 | 2322480 | 2484327 | 5/29/1998 | 16:41:40.46 | 3.798 | 7.731 |
| **313** | 44.142 | 16.468 | 0.873 | 34.796 | 12.889 | 2315096 | 2485002 | 5/29/1998 | 16:47:41.26 | 3.747 | 7.734 |
| **314** | 44.173 | 16.499 | 0.837 | 34.796 | 12.889 | 2348395 | 2485131 | 5/29/1998 | 16:53:42.06 | 3.975 | 7.734 |
| **315** | 44.191 | 16.515 | 0.87 | 34.798 | 12.891 | 2335403 | 2485378 | 5/29/1998 | 16:59:42.86 | 3.886 | 7.736 |
| **316** | 44.208 | 16.533 | 0.83 | 34.798 | 12.891 | 2330302 | 2486136 | 5/29/1998 | 17:05:43.66 | 3.851 | 7.739 |
| **317** | 44.25 | 16.573 | 0.852 | 34.799 | 12.892 | 2307566 | 2486248 | 5/29/1998 | 17:11:44.46 | 3.695 | 7.739 |
| **318** | 44.286 | 16.61 | 0.825 | 34.8 | 12.891 | 2330960 | 2486217 | 5/29/1998 | 17:17:45.26 | 3.856 | 7.739 |
| **319** | 44.32 | 16.644 | 0.8 | 34.8 | 12.892 | 2332307 | 2486066 | 5/29/1998 | 17:23:46.06 | 3.865 | 7.738 |
| **320** | 44.359 | 16.685 | 0.741 | 34.798 | 12.892 | 2320140 | 2486059 | 5/29/1998 | 17:29:46.86 | 3.782 | 7.738 |
| **321** | 44.393 | 16.731 | 0.788 | 34.789 | 12.892 | 2257174 | 2486583 | 5/29/1998 | 17:35:47.66 | 3.349 | 7.741 |
| **322** | 44.446 | 16.761 | 0.774 | 34.808 | 12.891 | 2338630 | 2485621 | 5/29/1998 | 17:41:48.46 | 3.908 | 7.737 |
| **323** | 44.483 | 16.804 | 0.821 | 34.803 | 12.891 | 2327171 | 2486514 | 5/29/1998 | 17:47:49.26 | 3.830 | 7.740 |
| **324** | 44.519 | 16.85 | 0.808 | 34.796 | 12.893 | 2338304 | 2486065 | 5/29/1998 | 17:53:50.06 | 3.906 | 7.738 |
| **325** | 44.557 | 16.884 | 0.787 | 34.798 | 12.892 | 2343962 | 2486671 | 5/29/1998 | 17:59:50.86 | 3.945 | 7.741 |
| **326** | 44.604 | 16.923 | 0.815 | 34.807 | 12.892 | 2355998 | 2486419 | 5/29/1998 | 18:05:51.66 | 4.028 | 7.740 |
| **327** | 44.638 | 16.979 | 0.782 | 34.787 | 12.895 | 2341730 | 2486646 | 5/29/1998 | 18:11:52.46 | 3.930 | 7.741 |
| **328** | 44.674 | 17.01 | 0.787 | 34.793 | 12.893 | 2296214 | 2487235 | 5/29/1998 | 18:17:53.26 | 3.617 | 7.744 |
| **329** | 44.711 | 17.052 | 0.762 | 34.788 | 12.892 | 2331940 | 2487590 | 5/29/1998 | 18:23:54.06 | 3.863 | 7.745 |
| **330** | 44.742 | 17.087 | 0.794 | 34.785 | 12.892 | 2348959 | 2487156 | 5/29/1998 | 18:29:54.86 | 3.979 | 7.743 |
| **331** | 44.771 | 17.113 | 0.81 | 34.787 | 12.892 | 2320873 | 2487392 | 5/29/1998 | 18:35:55.66 | 3.787 | 7.744 |
| **332** | 44.783 | 17.12 | 0.776 | 34.792 | 12.892 | 2322974 | 2486786 | 5/29/1998 | 18:41:56.46 | 3.801 | 7.742 |
| **333** | 44.794 | 17.136 | 0.795 | 34.788 | 12.892 | 2336199 | 2486699 | 5/29/1998 | 18:47:57.26 | 3.892 | 7.741 |
| **334** | 44.809 | 17.151 | 0.777 | 34.787 | 12.892 | 2321517 | 2487226 | 5/29/1998 | 18:53:58.06 | 3.791 | 7.744 |
| **335** | 44.835 | 17.179 | 0.82 | 34.786 | 12.892 | 2204881 | 2487495 | 5/29/1998 | 18:59:58.86 | 2.991 | 7.745 |
| **336** | 44.849 | 17.205 | 0.796 | 34.776 | 12.892 | 2327373 | 2487420 | 5/29/1998 | 19:05:59.66 | 3.831 | 7.744 |
| **337** | 44.861 | 17.208 | 0.765 | 34.784 | 12.893 | 2343211 | 2487378 | 5/29/1998 | 19:12:00.46 | 3.940 | 7.744 |
| **338** | 44.869 | 17.225 | 0.749 | 34.776 | 12.893 | 2334512 | 2487949 | 5/29/1998 | 19:18:01.26 | 3.880 | 7.747 |
| **339** | 44.901 | 17.238 | 0.768 | 34.793 | 12.89 | 2301201 | 2488307 | 5/29/1998 | 19:24:02.06 | 3.652 | 7.748 |
| **340** | 44.929 | 17.266 | 0.828 | 34.793 | 12.891 | 2348669 | 2487450 | 5/29/1998 | 19:30:02.86 | 3.977 | 7.744 |
| **341** | 44.925 | 17.282 | 0.876 | 34.776 | 12.891 | 2337543 | 2488202 | 5/29/1998 | 19:36:03.66 | 3.901 | 7.748 |
| **342** | 44.923 | 17.27 | 0.874 | 34.784 | 12.889 | 2326310 | 2487967 | 5/29/1998 | 19:42:04.46 | 3.824 | 7.747 |
| **343** | 44.929 | 17.262 | 0.9 | 34.796 | 12.889 | 2313199 | 2487320 | 5/29/1998 | 19:48:05.26 | 3.734 | 7.744 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **344** | 44.934 | 17.277 | 0.838 | 34.788 | 12.89 | 2352186 | 2487869 | 5/29/1998 | 19:54:06.06 | 4.002 | 7.746 |
| **345** | 44.939 | 17.277 | 0.9 | 34.792 | 12.888 | 2315448 | 2487883 | 5/29/1998 | 20:00:06.86 | 3.749 | 7.746 |
| **346** | 44.919 | 17.267 | 0.909 | 34.783 | 12.889 | 2353717 | 2487396 | 5/29/1998 | 20:06:07.66 | 4.012 | 7.744 |
| **347** | 44.913 | 17.253 | 0.88 | 34.79 | 12.888 | 2346549 | 2488178 | 5/29/1998 | 20:12:08.46 | 3.963 | 7.748 |
| **348** | 44.919 | 17.255 | 0.869 | 34.793 | 12.888 | 2336872 | 2487929 | 5/29/1998 | 20:18:09.26 | 3.896 | 7.747 |
| **349** | 44.917 | 17.254 | 0.894 | 34.793 | 12.889 | 2325632 | 2488405 | 5/29/1998 | 20:24:10.06 | 3.819 | 7.749 |
| **350** | 44.896 | 17.244 | 0.95 | 34.783 | 12.889 | 2334058 | 2488291 | 5/29/1998 | 20:30:10.86 | 3.877 | 7.748 |
| **351** | 44.879 | 17.226 | 0.984 | 34.784 | 12.887 | 2311488 | 2488567 | 5/29/1998 | 20:36:11.66 | 3.722 | 7.749 |
| **352** | 44.859 | 17.194 | 1.012 | 34.794 | 12.886 | 2341039 | 2487927 | 5/29/1998 | 20:42:53.70 | 3.925 | 7.747 |
| **353** | 44.844 | 17.181 | 0.997 | 34.792 | 12.885 | 2344434 | 2487600 | 5/29/1998 | 20:48:54.50 | 3.948 | 7.745 |
| **354** | 44.831 | 17.16 | 1.025 | 34.799 | 12.886 | 2337312 | 2488011 | 5/29/1998 | 20:54:55.30 | 3.899 | 7.747 |
| **355** | 44.813 | 17.153 | 1.01 | 34.789 | 12.886 | 2338198 | 2487658 | 5/29/1998 | 21:00:56.10 | 3.906 | 7.745 |
| **356** | 44.794 | 17.127 | 1.052 | 34.796 | 12.884 | 2344105 | 2488237 | 5/29/1998 | 21:06:56.90 | 3.946 | 7.748 |
| **357** | 44.783 | 17.118 | 1.028 | 34.794 | 12.886 | 2325453 | 2487986 | 5/29/1998 | 21:12:57.70 | 3.818 | 7.747 |
| **358** | 44.77 | 17.102 | 1.037 | 34.796 | 12.884 | 2331893 | 2488251 | 5/29/1998 | 21:18:58.50 | 3.862 | 7.748 |
| **359** | 44.742 | 17.079 | 1.109 | 34.791 | 12.883 | 2340829 | 2488391 | 5/29/1998 | 21:24:59.30 | 3.924 | 7.749 |
| **360** | 44.712 | 17.041 | 1.096 | 34.798 | 12.883 | 2321772 | 2488392 | 5/29/1998 | 21:31:00.10 | 3.793 | 7.749 |
| **361** | 44.673 | 17.014 | 1.13 | 34.788 | 12.882 | 2309981 | 2487718 | 5/29/1998 | 21:37:00.90 | 3.712 | 7.746 |
| **362** | 44.657 | 16.995 | 1.073 | 34.79 | 12.881 | 2339121 | 2487849 | 5/29/1998 | 21:43:01.70 | 3.912 | 7.746 |
| **363** | 44.637 | 16.974 | 1.173 | 34.791 | 12.881 | 2342414 | 2488280 | 5/29/1998 | 21:49:02.50 | 3.934 | 7.748 |
| **364** | 44.597 | 16.914 | 1.143 | 34.808 | 12.882 | 2315806 | 2487417 | 5/29/1998 | 21:55:03.30 | 3.752 | 7.744 |
| **365** | 44.551 | 16.87 | 1.17 | 34.806 | 12.879 | 2307752 | 2487611 | 5/29/1998 | 22:01:04.10 | 3.697 | 7.745 |
| **366** | 44.518 | 16.842 | 1.205 | 34.801 | 12.88 | 2361652 | 2487055 | 5/29/1998 | 22:07:04.90 | 4.066 | 7.743 |
| **367** | 44.492 | 16.802 | 1.156 | 34.814 | 12.878 | 2303127 | 2487274 | 5/29/1998 | 22:13:05.70 | 3.665 | 7.744 |
| **368** | 44.449 | 16.774 | 1.224 | 34.8 | 12.88 | 2330282 | 2486967 | 5/29/1998 | 22:19:06.50 | 3.851 | 7.742 |
| **369** | 44.407 | 16.728 | 1.246 | 34.802 | 12.877 | 2314107 | 2486463 | 5/29/1998 | 22:25:07.30 | 3.740 | 7.740 |
| **370** | 44.371 | 16.693 | 1.24 | 34.802 | 12.878 | 2323078 | 2487037 | 5/29/1998 | 22:31:08.10 | 3.802 | 7.743 |
| **371** | 44.34 | 16.665 | 1.237 | 34.799 | 12.876 | 2336920 | 2487277 | 5/29/1998 | 22:37:08.90 | 3.897 | 7.744 |
| **372** | 44.317 | 16.632 | 1.307 | 34.807 | 12.877 | 2293848 | 2487169 | 5/29/1998 | 22:43:09.70 | 3.601 | 7.743 |
| **373** | 44.281 | 16.605 | 1.295 | 34.799 | 12.875 | 2322162 | 2486511 | 5/29/1998 | 22:49:10.50 | 3.795 | 7.740 |
| **374** | 44.237 | 16.564 | 1.335 | 34.796 | 12.878 | 2329379 | 2486668 | 5/29/1998 | 22:55:11.30 | 3.845 | 7.741 |
| **375** | 44.221 | 16.536 | 1.283 | 34.806 | 12.875 | 2342634 | 2486745 | 5/29/1998 | 23:01:12.10 | 3.936 | 7.741 |
| **376** | 44.209 | 16.522 | 1.326 | 34.808 | 12.876 | 2322352 | 2486988 | 5/29/1998 | 23:07:12.90 | 3.797 | 7.742 |
| **377** | 44.179 | 16.504 | 1.307 | 34.798 | 12.874 | 2328236 | 2486675 | 5/29/1998 | 23:13:13.70 | 3.837 | 7.741 |
| **378** | 44.162 | 16.468 | 1.334 | 34.813 | 12.873 | 2314743 | 2486843 | 5/29/1998 | 23:19:14.50 | 3.745 | 7.742 |
| **379** | 44.149 | 16.471 | 1.319 | 34.799 | 12.874 | 2332417 | 2487581 | 5/29/1998 | 23:25:15.30 | 3.866 | 7.745 |
| **380** | 44.145 | 16.456 | 1.334 | 34.809 | 12.873 | 2307129 | 2486943 | 5/29/1998 | 23:31:16.10 | 3.692 | 7.742 |
| **381** | 44.131 | 16.441 | 1.366 | 34.81 | 12.873 | 2318263 | 2486990 | 5/29/1998 | 23:37:16.90 | 3.769 | 7.742 |
| **382** | 44.113 | 16.423 | 1.386 | 34.809 | 12.873 | 2307490 | 2486819 | 5/29/1998 | 23:43:17.70 | 3.695 | 7.742 |
| **383** | 44.104 | 16.419 | 1.387 | 34.805 | 12.872 | 2313981 | 2486828 | 5/29/1998 | 23:49:18.50 | 3.739 | 7.742 |
| **384** | 44.094 | 16.409 | 1.371 | 34.805 | 12.873 | 2319829 | 2486829 | 5/29/1998 | 23:55:19.30 | 3.779 | 7.742 |
| **385** | 44.085 | 16.394 | 1.402 | 34.811 | 12.873 | 2305087 | 2486923 | 5/30/1998 | 00:01:20.10 | 3.678 | 7.742 |
| **386** | 44.086 | 16.395 | 1.377 | 34.81 | 12.874 | 2316024 | 2486774 | 5/30/1998 | 00:07:20.90 | 3.753 | 7.742 |
| **387** | 44.08 | 16.384 | 1.409 | 34.815 | 12.872 | 2319964 | 2486620 | 5/30/1998 | 00:13:21.70 | 3.780 | 7.741 |
| **388** | 44.068 | 16.385 | 1.369 | 34.803 | 12.87 | 2334457 | 2486747 | 5/30/1998 | 00:19:22.50 | 3.880 | 7.741 |
| **389** | 44.071 | 16.377 | 1.432 | 34.812 | 12.871 | 2312238 | 2487028 | 5/30/1998 | 00:25:23.30 | 3.727 | 7.743 |
| **390** | 44.064 | 16.376 | 1.384 | 34.807 | 12.871 | 2325207 | 2486925 | 5/30/1998 | 00:31:24.10 | 3.816 | 7.742 |
| **391** | 44.062 | 16.366 | 1.468 | 34.815 | 12.87 | 2326876 | 2486570 | 5/30/1998 | 00:37:24.90 | 3.828 | 7.741 |
| **392** | 44.042 | 16.339 | 1.408 | 34.82 | 12.869 | 2328580 | 2486519 | 5/30/1998 | 00:43:25.70 | 3.839 | 7.740 |
| **393** | 44.029 | 16.338 | 1.329 | 34.81 | 12.869 | 2310907 | 2486439 | 5/30/1998 | 00:49:26.50 | 3.718 | 7.740 |
| **394** | 44.016 | 16.322 | 1.368 | 34.812 | 12.868 | 2293417 | 2486540 | 5/30/1998 | 00:55:27.30 | 3.598 | 7.741 |
| **395** | 44.009 | 16.32 | 1.374 | 34.807 | 12.868 | 2333263 | 2486925 | 5/30/1998 | 01:01:28.10 | 3.872 | 7.742 |
| **396** | 44.002 | 16.306 | 1.333 | 34.814 | 12.867 | 2326284 | 2486499 | 5/30/1998 | 01:07:28.90 | 3.824 | 7.740 |
| **397** | 43.996 | 16.298 | 1.346 | 34.815 | 12.867 | 2293722 | 2486428 | 5/30/1998 | 01:13:29.70 | 3.600 | 7.740 |
| **398** | 43.977 | 16.281 | 1.36 | 34.814 | 12.866 | 2305563 | 2486510 | 5/30/1998 | 01:19:30.50 | 3.682 | 7.740 |
| **399** | 43.965 | 16.269 | 1.286 | 34.813 | 12.866 | 2315140 | 2486732 | 5/30/1998 | 01:25:31.30 | 3.747 | 7.741 |
| **400** | 43.965 | 16.264 | 1.314 | 34.818 | 12.865 | 2287957 | 2486861 | 5/30/1998 | 01:31:32.10 | 3.561 | 7.742 |
| **401** | 43.952 | 16.253 | 1.196 | 34.815 | 12.866 | 2324126 | 2486300 | 5/30/1998 | 01:37:32.90 | 3.809 | 7.740 |
| **402** | 43.94 | 16.248 | 1.21 | 34.81 | 12.865 | 2301704 | 2487269 | 5/30/1998 | 01:43:33.70 | 3.655 | 7.744 |
| **403** | 43.934 | 16.233 | 1.171 | 34.818 | 12.865 | 2332119 | 2486575 | 5/30/1998 | 01:49:34.50 | 3.864 | 7.741 |
| **404** | 43.923 | 16.222 | 1.166 | 34.817 | 12.865 | 2283408 | 2486310 | 5/30/1998 | 01:55:35.30 | 3.529 | 7.740 |
| **405** | 43.913 | 16.215 | 1.127 | 34.814 | 12.865 | 2307587 | 2486227 | 5/30/1998 | 02:01:36.10 | 3.695 | 7.739 |
| **406** | 43.904 | 16.201 | 1.14 | 34.818 | 12.866 | 2267912 | 2486592 | 5/30/1998 | 02:07:36.90 | 3.423 | 7.741 |
| **407** | 43.888 | 16.187 | 1.092 | 34.816 | 12.866 | 2313204 | 2486313 | 5/30/1998 | 02:13:37.70 | 3.734 | 7.740 |
| **408** | 43.886 | 16.185 | 1.067 | 34.816 | 12.863 | 2326112 | 2486193 | 5/30/1998 | 02:19:38.50 | 3.823 | 7.739 |
| **409** | 43.882 | 16.173 | 1.018 | 34.824 | 12.864 | 2325764 | 2486166 | 5/30/1998 | 02:25:39.30 | 3.820 | 7.739 |
| **410** | 43.875 | 16.165 | 1.034 | 34.825 | 12.863 | 2293219 | 2486536 | 5/30/1998 | 02:31:40.10 | 3.597 | 7.741 |
| **411** | 43.871 | 16.171 | 0.956 | 34.816 | 12.862 | 2296363 | 2486374 | 5/30/1998 | 02:37:40.90 | 3.618 | 7.740 |
| **412** | 43.867 | 16.168 | 0.914 | 34.814 | 12.864 | 2313071 | 2486533 | 5/30/1998 | 02:43:41.70 | 3.733 | 7.741 |
| **413** | 43.874 | 16.169 | 0.913 | 34.819 | 12.864 | 2312193 | 2486292 | 5/30/1998 | 02:49:42.50 | 3.727 | 7.739 |
| **414** | 43.881 | 16.176 | 0.883 | 34.821 | 12.864 | 2301838 | 2486400 | 5/30/1998 | 02:55:43.30 | 3.656 | 7.740 |
| **415** | 43.892 | 16.187 | 0.889 | 34.821 | 12.864 | 2321676 | 2486633 | 5/30/1998 | 03:01:44.10 | 3.792 | 7.741 |
| **416** | 43.9 | 16.2 | 0.794 | 34.816 | 12.863 | 2316388 | 2486546 | 5/30/1998 | 03:07:44.90 | 3.756 | 7.741 |
| **417** | 43.906 | 16.204 | 0.678 | 34.818 | 12.864 | 2293921 | 2486201 | 5/30/1998 | 03:13:45.70 | 3.602 | 7.739 |
| **418** | 43.917 | 16.223 | 0.677 | 34.812 | 12.861 | 2305287 | 2487239 | 5/30/1998 | 03:19:46.50 | 3.680 | 7.744 |
| **419** | 43.932 | 16.225 | 0.72 | 34.822 | 12.86 | 2298005 | 2486506 | 5/30/1998 | 03:25:47.30 | 3.630 | 7.740 |
| **420** | 43.962 | 16.262 | 0.666 | 34.817 | 12.862 | 2326747 | 2487258 | 5/30/1998 | 03:31:48.10 | 3.827 | 7.744 |
| **421** | 43.997 | 16.306 | 0.616 | 34.81 | 12.864 | 2302305 | 2486826 | 5/30/1998 | 03:37:48.90 | 3.659 | 7.742 |
| **422** | 44.009 | 16.319 | 0.564 | 34.809 | 12.861 | 2322062 | 2488345 | 5/30/1998 | 03:44:30.95 | 3.795 | 7.748 |
| **423** | 44.026 | 16.337 | 0.556 | 34.808 | 12.861 | 2306504 | 2486669 | 5/30/1998 | 03:50:31.75 | 3.688 | 7.741 |
| **424** | 44.061 | 16.362 | 0.572 | 34.817 | 12.862 | 2314844 | 2487926 | 5/30/1998 | 03:56:32.55 | 3.745 | 7.747 |
| **425** | 44.095 | 16.398 | 0.486 | 34.815 | 12.862 | 2310070 | 2487092 | 5/30/1998 | 04:02:33.35 | 3.712 | 7.743 |
| **426** | 44.116 | 16.423 | 0.442 | 34.813 | 12.861 | 2296476 | 2487592 | 5/30/1998 | 04:08:34.15 | 3.619 | 7.745 |
| **427** | 44.119 | 16.414 | 0.365 | 34.824 | 12.861 | 2318347 | 2487428 | 5/30/1998 | 04:14:34.95 | 3.769 | 7.744 |
| **428** | 44.145 | 16.434 | 0.397 | 34.829 | 12.861 | 2307337 | 2486583 | 5/30/1998 | 04:20:35.75 | 3.694 | 7.741 |
| **429** | 44.174 | 16.475 | 0.383 | 34.819 | 12.862 | 2294535 | 2487564 | 5/30/1998 | 04:26:36.55 | 3.606 | 7.745 |
| **430** | 44.191 | 16.491 | 0.36 | 34.819 | 12.862 | 2300837 | 2487137 | 5/30/1998 | 04:32:37.35 | 3.649 | 7.743 |
| **431** | 44.203 | 16.495 | 0.288 | 34.827 | 12.862 | 2318227 | 2487116 | 5/30/1998 | 04:38:38.15 | 3.768 | 7.743 |
| **432** | 44.212 | 16.517 | 0.237 | 34.815 | 12.862 | 2289925 | 2486807 | 5/30/1998 | 04:44:38.95 | 3.574 | 7.742 |
| **433** | 44.218 | 16.511 | 0.252 | 34.826 | 12.861 | 2304591 | 2487024 | 5/30/1998 | 04:50:39.75 | 3.675 | 7.743 |
| **434** | 44.245 | 16.555 | 0.206 | 34.811 | 12.862 | 2324413 | 2487383 | 5/30/1998 | 04:56:40.55 | 3.811 | 7.744 |
| **435** | 44.265 | 16.557 | 0.177 | 34.826 | 12.861 | 2317846 | 2486946 | 5/30/1998 | 05:02:41.35 | 3.766 | 7.742 |
| **436** | 44.277 | 16.588 | 0.15 | 34.811 | 12.861 | 2308299 | 2487312 | 5/30/1998 | 05:08:42.15 | 3.700 | 7.744 |
| **437** | 44.279 | 16.593 | 0.122 | 34.808 | 12.861 | 2314803 | 2487202 | 5/30/1998 | 05:14:42.95 | 3.745 | 7.743 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **438** | 44.305 | 16.613 | 0.072 | 34.813 | 12.86 | 2309705 | 2488027 | 5/30/1998 | 05:20:43.75 | 3.710 | 7.747 |
| **439** | 44.337 | 16.648 | 0.058 | 34.811 | 12.863 | 2312600 | 2486801 | 5/30/1998 | 05:26:44.55 | 3.730 | 7.742 |
| **440** | 44.37 | 16.683 | 0.013 | 34.81 | 12.862 | 2319516 | 2487222 | 5/30/1998 | 05:32:45.35 | 3.777 | 7.743 |
| **441** | 44.39 | 16.691 | 0.003 | 34.82 | 12.861 | 2330909 | 2487368 | 5/30/1998 | 05:38:46.15 | 3.855 | 7.744 |
| **442** | 44.417 | 16.727 | -0.102 | 34.813 | 12.861 | 2315582 | 2486676 | 5/30/1998 | 05:44:46.95 | 3.750 | 7.741 |
| **443** | 44.456 | 16.764 | -0.029 | 34.814 | 12.862 | 2328682 | 2487264 | 5/30/1998 | 05:50:47.75 | 3.840 | 7.744 |
| **444** | 44.491 | 16.812 | -0.061 | 34.804 | 12.861 | 2327159 | 2486847 | 5/30/1998 | 05:56:48.55 | 3.830 | 7.742 |
| **445** | 44.533 | 16.851 | -0.082 | 34.808 | 12.861 | 2319389 | 2486671 | 5/30/1998 | 06:02:49.35 | 3.776 | 7.741 |
| **446** | 44.579 | 16.904 | -0.11 | 34.802 | 12.862 | 2340800 | 2486539 | 5/30/1998 | 06:08:50.15 | 3.923 | 7.741 |
| **447** | 44.617 | 16.936 | -0.13 | 34.807 | 12.863 | 2246282 | 2486725 | 5/30/1998 | 06:14:50.95 | 3.275 | 7.741 |
| **448** | 44.657 | 16.974 | -0.157 | 34.809 | 12.862 | 2331076 | 2486679 | 5/30/1998 | 06:20:51.75 | 3.857 | 7.741 |
| **449** | 44.697 | 17.016 | -0.144 | 34.807 | 12.863 | 2307462 | 2486032 | 5/30/1998 | 06:26:52.55 | 3.695 | 7.738 |
| **450** | 44.733 | 17.06 | -0.206 | 34.801 | 12.863 | 2336385 | 2486240 | 5/30/1998 | 06:32:53.35 | 3.893 | 7.739 |
| **451** | 44.776 | 17.098 | -0.196 | 34.805 | 12.863 | 2335998 | 2486472 | 5/30/1998 | 06:38:54.15 | 3.890 | 7.740 |
| **452** | 44.811 | 17.13 | -0.192 | 34.808 | 12.864 | 2330003 | 2485547 | 5/30/1998 | 06:44:54.95 | 3.849 | 7.736 |
| **453** | 44.843 | 17.169 | -0.2 | 34.802 | 12.863 | 2326793 | 2485960 | 5/30/1998 | 06:50:55.75 | 3.827 | 7.738 |
| **454** | 44.882 | 17.208 | -0.233 | 34.802 | 12.862 | 2298696 | 2486696 | 5/30/1998 | 06:56:56.55 | 3.634 | 7.741 |
| **455** | 44.921 | 17.25 | -0.22 | 34.801 | 12.864 | 2316551 | 2485880 | 5/30/1998 | 07:02:57.35 | 3.757 | 7.738 |
| **456** | 44.957 | 17.295 | -0.223 | 34.793 | 12.864 | 2342717 | 2486263 | 5/30/1998 | 07:08:58.15 | 3.937 | 7.739 |
| **457** | 44.988 | 17.324 | -0.272 | 34.795 | 12.864 | 2330527 | 2485781 | 5/30/1998 | 07:14:58.95 | 3.853 | 7.737 |
| **458** | 45.027 | 17.362 | -0.259 | 34.796 | 12.864 | 2332861 | 2485152 | 5/30/1998 | 07:20:59.75 | 3.869 | 7.735 |
| **459** | 45.06 | 17.388 | -0.261 | 34.802 | 12.864 | 2341392 | 2484661 | 5/30/1998 | 07:27:00.55 | 3.927 | 7.732 |
| **460** | 45.081 | 17.419 | -0.244 | 34.793 | 12.864 | 2330915 | 2484858 | 5/30/1998 | 07:33:01.35 | 3.856 | 7.733 |
| **461** | 45.125 | 17.449 | -0.26 | 34.805 | 12.864 | 2343651 | 2484480 | 5/30/1998 | 07:39:02.15 | 3.943 | 7.732 |
| **462** | 45.164 | 17.494 | -0.278 | 34.801 | 12.865 | 2347319 | 2483959 | 5/30/1998 | 07:45:02.95 | 3.968 | 7.729 |
| **463** | 45.201 | 17.531 | -0.253 | 34.8 | 12.864 | 2345763 | 2484574 | 5/30/1998 | 07:51:03.75 | 3.957 | 7.732 |
| **464** | 45.229 | 17.567 | -0.213 | 34.794 | 12.865 | 2333827 | 2485000 | 5/30/1998 | 07:57:04.55 | 3.876 | 7.734 |
| **465** | 45.269 | 17.613 | -0.222 | 34.789 | 12.865 | 2330157 | 2484141 | 5/30/1998 | 08:03:05.35 | 3.850 | 7.730 |
| **466** | 45.3 | 17.641 | -0.229 | 34.791 | 12.864 | 2336285 | 2484280 | 5/30/1998 | 08:09:06.15 | 3.892 | 7.731 |
| **467** | 45.337 | 17.67 | -0.201 | 34.799 | 12.864 | 2331750 | 2484503 | 5/30/1998 | 08:15:06.95 | 3.861 | 7.732 |
| **468** | 45.354 | 17.691 | -0.207 | 34.795 | 12.865 | 2348329 | 2484304 | 5/30/1998 | 08:21:07.75 | 3.975 | 7.731 |
| **469** | 45.392 | 17.736 | -0.203 | 34.788 | 12.865 | 2360376 | 2483506 | 5/30/1998 | 08:27:08.55 | 4.058 | 7.727 |
| **470** | 45.421 | 17.764 | -0.168 | 34.79 | 12.865 | 2352150 | 2483437 | 5/30/1998 | 08:33:09.35 | 4.001 | 7.727 |
| **471** | 45.446 | 17.794 | -0.152 | 34.786 | 12.867 | 2343306 | 2483485 | 5/30/1998 | 08:39:10.15 | 3.941 | 7.727 |
| **472** | 45.48 | 17.821 | -0.144 | 34.792 | 12.865 | 2321326 | 2483656 | 5/30/1998 | 08:45:10.95 | 3.790 | 7.728 |
| **473** | 45.51 | 17.856 | -0.144 | 34.787 | 12.867 | 2372649 | 2483256 | 5/30/1998 | 08:51:11.75 | 4.142 | 7.726 |
| **474** | 45.537 | 17.877 | -0.081 | 34.793 | 12.865 | 2337480 | 2483380 | 5/30/1998 | 08:57:12.55 | 3.901 | 7.727 |
| **475** | 45.559 | 17.903 | -0.106 | 34.79 | 12.865 | 2356705 | 2482860 | 5/30/1998 | 09:03:13.35 | 4.033 | 7.725 |
| **476** | 45.584 | 17.93 | -0.075 | 34.788 | 12.865 | 2343080 | 2483003 | 5/30/1998 | 09:09:14.15 | 3.939 | 7.725 |
| **477** | 45.601 | 17.954 | -0.076 | 34.782 | 12.866 | 2357706 | 2483258 | 5/30/1998 | 09:15:14.95 | 4.039 | 7.726 |
| **478** | 45.621 | 17.97 | -0.035 | 34.785 | 12.866 | 2342494 | 2483321 | 5/30/1998 | 09:21:15.75 | 3.935 | 7.727 |
| **479** | 45.636 | 17.978 | -0.017 | 34.792 | 12.867 | 2343084 | 2483467 | 5/30/1998 | 09:27:16.55 | 3.939 | 7.727 |
| **480** | 45.642 | 17.989 | 0.008 | 34.787 | 12.866 | 2345917 | 2483405 | 5/30/1998 | 09:33:17.35 | 3.958 | 7.727 |
| **481** | 45.65 | 17.996 | 0.004 | 34.788 | 12.864 | 2324748 | 2483245 | 5/30/1998 | 09:39:18.15 | 3.813 | 7.726 |
| **482** | 45.652 | 18.004 | 0.014 | 34.783 | 12.868 | 2351747 | 2483031 | 5/30/1998 | 09:45:18.95 | 3.998 | 7.725 |
| **483** | 45.66 | 18.009 | 0.081 | 34.786 | 12.863 | 2345949 | 2483732 | 5/30/1998 | 09:51:19.75 | 3.959 | 7.728 |
| **484** | 45.662 | 18.018 | 0.08 | 34.779 | 12.864 | 2362031 | 2483083 | 5/30/1998 | 09:57:20.55 | 4.069 | 7.726 |
| **485** | 45.666 | 18.017 | 0.092 | 34.784 | 12.865 | 2374991 | 2483133 | 5/30/1998 | 10:03:21.35 | 4.158 | 7.726 |
| **486** | 45.684 | 18.029 | 0.115 | 34.789 | 12.864 | 2366854 | 2482706 | 5/30/1998 | 10:09:22.15 | 4.102 | 7.724 |
| **487** | 45.692 | 18.046 | 0.149 | 34.781 | 12.863 | 2338731 | 2482179 | 5/30/1998 | 10:15:22.95 | 3.909 | 7.722 |
| **488** | 45.703 | 18.051 | 0.176 | 34.786 | 12.865 | 2354646 | 2482331 | 5/30/1998 | 10:21:23.75 | 4.018 | 7.722 |
| **489** | 45.707 | 18.058 | 0.207 | 34.784 | 12.864 | 2353211 | 2482325 | 5/30/1998 | 10:27:24.55 | 4.009 | 7.722 |
| **490** | 45.714 | 18.063 | 0.236 | 34.785 | 12.863 | 2348101 | 2482263 | 5/30/1998 | 10:33:25.35 | 3.973 | 7.722 |
| **491** | 45.705 | 18.051 | 0.197 | 34.788 | 12.865 | 2359616 | 2481648 | 5/30/1998 | 10:39:26.15 | 4.052 | 7.719 |
| **492** | 45.684 | 18.035 | 0.25 | 34.783 | 12.865 | 2251659 | 2481928 | 5/30/1998 | 10:46:08.20 | 3.312 | 7.721 |
| **493** | 45.669 | 18.016 | 0.327 | 34.787 | 12.861 | 2356701 | 2482500 | 5/30/1998 | 10:52:09.00 | 4.032 | 7.723 |
| **494** | 45.643 | 17.987 | 0.339 | 34.79 | 12.861 | 2327437 | 2481881 | 5/30/1998 | 10:58:09.80 | 3.832 | 7.720 |
| **495** | 45.625 | 17.973 | 0.34 | 34.786 | 12.86 | 2344082 | 2482078 | 5/30/1998 | 11:04:10.60 | 3.946 | 7.721 |
| **496** | 45.608 | 17.952 | 0.372 | 34.789 | 12.859 | 2331848 | 2482260 | 5/30/1998 | 11:10:11.40 | 3.862 | 7.722 |
| **497** | 45.587 | 17.938 | 0.341 | 34.784 | 12.859 | 2280028 | 2482564 | 5/30/1998 | 11:16:12.20 | 3.506 | 7.723 |
| **498** | 45.57 | 17.914 | 0.4 | 34.789 | 12.859 | 2332656 | 2481978 | 5/30/1998 | 11:22:13.00 | 3.867 | 7.721 |
| **499** | 45.549 | 17.9 | 0.418 | 34.783 | 12.86 | 2357642 | 2481849 | 5/30/1998 | 11:28:13.80 | 4.039 | 7.720 |
| **500** | 45.538 | 17.882 | 0.444 | 34.789 | 12.859 | 2330851 | 2481623 | 5/30/1998 | 11:34:14.60 | 3.855 | 7.719 |
| **501** | 45.521 | 17.871 | 0.452 | 34.784 | 12.859 | 2344205 | 2481926 | 5/30/1998 | 11:40:15.40 | 3.947 | 7.721 |
| **502** | 45.5 | 17.84 | 0.488 | 34.793 | 12.857 | 2342044 | 2481678 | 5/30/1998 | 11:46:16.20 | 3.932 | 7.720 |
| **503** | 45.469 | 17.819 | 0.55 | 34.783 | 12.858 | 2353370 | 2481840 | 5/30/1998 | 11:52:17.00 | 4.010 | 7.720 |
| **504** | 45.444 | 17.789 | 0.534 | 34.788 | 12.857 | 2334722 | 2481668 | 5/30/1998 | 11:58:17.80 | 3.882 | 7.719 |
| **505** | 45.424 | 17.767 | 0.555 | 34.789 | 12.858 | 2341054 | 2481409 | 5/30/1998 | 12:04:18.60 | 3.925 | 7.718 |
| **506** | 45.4 | 17.738 | 0.568 | 34.795 | 12.856 | 2319566 | 2482194 | 5/30/1998 | 12:10:19.40 | 3.778 | 7.722 |
| **507** | 45.388 | 17.736 | 0.581 | 34.786 | 12.856 | 2368102 | 2482065 | 5/30/1998 | 12:16:20.20 | 4.111 | 7.721 |
| **508** | 45.374 | 17.713 | 0.63 | 34.793 | 12.856 | 2336151 | 2481421 | 5/30/1998 | 12:22:21.00 | 3.891 | 7.718 |
| **509** | 45.356 | 17.694 | 0.65 | 34.794 | 12.856 | 2330657 | 2481885 | 5/30/1998 | 12:28:21.80 | 3.854 | 7.720 |
| **510** | 45.334 | 17.675 | 0.635 | 34.791 | 12.855 | 2338667 | 2481710 | 5/30/1998 | 12:34:22.60 | 3.909 | 7.720 |
| **511** | 45.328 | 17.665 | 0.679 | 34.794 | 12.855 | 2338739 | 2481293 | 5/30/1998 | 12:40:23.40 | 3.909 | 7.718 |
| **512** | 45.322 | 17.668 | 0.678 | 34.787 | 12.854 | 2341819 | 2481339 | 5/30/1998 | 12:46:24.20 | 3.930 | 7.718 |
| **513** | 45.312 | 17.654 | 0.706 | 34.79 | 12.855 | 2305778 | 2481554 | 5/30/1998 | 12:52:25.00 | 3.683 | 7.719 |
| **514** | 45.306 | 17.651 | 0.719 | 34.787 | 12.854 | 2355741 | 2480928 | 5/30/1998 | 12:58:25.80 | 4.026 | 7.716 |
| **515** | 45.296 | 17.631 | 0.747 | 34.796 | 12.854 | 2352447 | 2481637 | 5/30/1998 | 13:04:26.60 | 4.003 | 7.719 |
| **516** | 45.276 | 17.613 | 0.785 | 34.795 | 12.853 | 2345655 | 2481495 | 5/30/1998 | 13:10:27.40 | 3.957 | 7.719 |
| **517** | 45.232 | 17.569 | 0.769 | 34.794 | 12.852 | 2343949 | 2481561 | 5/30/1998 | 13:16:28.20 | 3.945 | 7.719 |
| **518** | 45.194 | 17.536 | 0.767 | 34.789 | 12.852 | 2316763 | 2482495 | 5/30/1998 | 13:22:29.00 | 3.758 | 7.723 |
| **519** | 45.162 | 17.493 | 0.813 | 34.799 | 12.85 | 2339920 | 2481985 | 5/30/1998 | 13:28:29.80 | 3.917 | 7.721 |
| **520** | 45.135 | 17.474 | 0.769 | 34.793 | 12.851 | 2320630 | 2481709 | 5/30/1998 | 13:34:30.60 | 3.785 | 7.720 |
| **521** | 45.108 | 17.451 | 0.78 | 34.788 | 12.85 | 2338579 | 2481695 | 5/30/1998 | 13:40:31.40 | 3.908 | 7.720 |
| **522** | 45.085 | 17.417 | 0.789 | 34.798 | 12.851 | 2340791 | 2481806 | 5/30/1998 | 13:46:32.20 | 3.923 | 7.720 |
| **523** | 45.063 | 17.399 | 0.774 | 34.794 | 12.849 | 2338455 | 2481271 | 5/30/1998 | 13:52:33.00 | 3.907 | 7.718 |
| **524** | 45.043 | 17.381 | 0.796 | 34.793 | 12.85 | 2343934 | 2481408 | 5/30/1998 | 13:58:33.80 | 3.945 | 7.718 |
| **525** | 45.01 | 17.347 | 0.834 | 34.793 | 12.848 | 2324896 | 2482038 | 5/30/1998 | 14:04:34.60 | 3.814 | 7.721 |
| **526** | 44.972 | 17.313 | 0.861 | 34.79 | 12.848 | 2326023 | 2481267 | 5/30/1998 | 14:10:35.40 | 3.822 | 7.718 |
| **527** | 44.953 | 17.27 | 0.796 | 34.81 | 12.847 | 2349034 | 2481626 | 5/30/1998 | 14:16:36.20 | 3.980 | 7.719 |
| **528** | 44.901 | 17.236 | 0.847 | 34.794 | 12.847 | 2327044 | 2481361 | 5/30/1998 | 14:22:37.00 | 3.829 | 7.718 |
| **529** | 44.86 | 17.197 | 0.812 | 34.792 | 12.846 | 2291170 | 2481187 | 5/30/1998 | 14:28:37.80 | 3.583 | 7.717 |
| **530** | 44.829 | 17.152 | 0.797 | 34.804 | 12.844 | 2323168 | 2481856 | 5/30/1998 | 14:34:38.60 | 3.802 | 7.720 |
| **531** | 44.801 | 17.13 | 0.793 | 34.799 | 12.846 | 2316254 | 2481883 | 5/30/1998 | 14:40:39.40 | 3.755 | 7.720 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **532** | 44.788 | 17.111 | 0.79 | 34.804 | 12.846 | 2316198 | 2481208 | 5/30/1998 | 14:46:40.20 | 3.755 | 7.718 |
| **533** | 44.76 | 17.092 | 0.789 | 34.797 | 12.845 | 2328209 | 2480747 | 5/30/1998 | 14:52:41.00 | 3.837 | 7.716 |
| **534** | 44.723 | 17.059 | 0.761 | 34.792 | 12.843 | 2317699 | 2481637 | 5/30/1998 | 14:58:41.80 | 3.765 | 7.719 |
| **535** | 44.699 | 17.011 | 0.803 | 34.812 | 12.848 | 2338119 | 2480879 | 5/30/1998 | 15:04:42.60 | 3.905 | 7.716 |
| **536** | 44.661 | 16.977 | 0.737 | 34.809 | 12.846 | 2306482 | 2480838 | 5/30/1998 | 15:10:43.40 | 3.688 | 7.716 |
| **537** | 44.62 | 16.937 | 0.752 | 34.809 | 12.843 | 2335119 | 2481446 | 5/30/1998 | 15:16:44.20 | 3.884 | 7.719 |
| **538** | 44.589 | 16.908 | 0.706 | 34.806 | 12.841 | 2337976 | 2480970 | 5/30/1998 | 15:22:45.00 | 3.904 | 7.716 |
| **539** | 44.545 | 16.861 | 0.702 | 34.809 | 12.842 | 2326859 | 2480761 | 5/30/1998 | 15:28:45.80 | 3.828 | 7.716 |
| **540** | 44.522 | 16.833 | 0.71 | 34.813 | 12.841 | 2309443 | 2480819 | 5/30/1998 | 15:34:46.60 | 3.708 | 7.716 |
| **541** | 44.495 | 16.81 | 0.7 | 34.809 | 12.84 | 2308420 | 2480918 | 5/30/1998 | 15:40:47.40 | 3.701 | 7.716 |
| **542** | 44.465 | 16.785 | 0.68 | 34.804 | 12.84 | 2321747 | 2480805 | 5/30/1998 | 15:46:48.20 | 3.793 | 7.716 |
| **543** | 44.438 | 16.749 | 0.639 | 34.812 | 12.84 | 2325451 | 2481435 | 5/30/1998 | 15:52:49.00 | 3.818 | 7.718 |
| **544** | 44.415 | 16.717 | 0.648 | 34.82 | 12.843 | 2339895 | 2481379 | 5/30/1998 | 15:58:49.80 | 3.917 | 7.718 |
| **545** | 44.39 | 16.7 | 0.702 | 34.813 | 12.841 | 2310956 | 2481340 | 5/30/1998 | 16:04:50.60 | 3.719 | 7.718 |
| **546** | 44.365 | 16.675 | 0.667 | 34.813 | 12.839 | 2334141 | 2480805 | 5/30/1998 | 16:10:51.40 | 3.878 | 7.716 |
| **547** | 44.345 | 16.646 | 0.554 | 34.82 | 12.838 | 2345454 | 2481588 | 5/30/1998 | 16:16:52.20 | 3.955 | 7.719 |
| **548** | 44.321 | 16.628 | 0.616 | 34.815 | 12.838 | 2297626 | 2481229 | 5/30/1998 | 16:22:53.00 | 3.627 | 7.718 |
| **549** | 44.319 | 16.644 | 0.605 | 34.799 | 12.837 | 2300696 | 2481329 | 5/30/1998 | 16:28:53.80 | 3.648 | 7.718 |
| **550** | 44.339 | 16.647 | 0.628 | 34.814 | 12.844 | 2322034 | 2481895 | 5/30/1998 | 16:34:54.60 | 3.795 | 7.720 |
| **551** | 44.338 | 16.643 | 0.605 | 34.816 | 12.839 | 2328282 | 2481681 | 5/30/1998 | 16:40:55.40 | 3.837 | 7.720 |
| **552** | 44.328 | 16.634 | 0.553 | 34.815 | 12.84 | 2327137 | 2481625 | 5/30/1998 | 16:46:56.20 | 3.830 | 7.719 |
| **553** | 44.324 | 16.637 | 0.535 | 34.81 | 12.836 | 2297017 | 2482205 | 5/30/1998 | 16:52:57.00 | 3.623 | 7.722 |
| **554** | 44.333 | 16.645 | 0.54 | 34.811 | 12.837 | 2314413 | 2483107 | 5/30/1998 | 16:58:57.80 | 3.742 | 7.726 |
| **555** | 44.352 | 16.648 | 0.532 | 34.824 | 12.837 | 2320040 | 2482904 | 5/30/1998 | 17:04:58.60 | 3.781 | 7.725 |
| **556** | 44.365 | 16.663 | 0.505 | 34.823 | 12.837 | 2336185 | 2482267 | 5/30/1998 | 17:10:59.40 | 3.892 | 7.722 |
| **557** | 44.36 | 16.66 | 0.507 | 34.822 | 12.837 | 2319845 | 2483847 | 5/30/1998 | 17:17:00.20 | 3.780 | 7.729 |
| **558** | 44.371 | 16.687 | 0.504 | 34.807 | 12.837 | 2335070 | 2482923 | 5/30/1998 | 17:23:01.00 | 3.884 | 7.725 |
| **559** | 44.388 | 16.693 | 0.461 | 34.817 | 12.837 | 2309966 | 2483494 | 5/30/1998 | 17:29:01.80 | 3.712 | 7.727 |
| **560** | 44.408 | 16.709 | 0.504 | 34.821 | 12.837 | 2322082 | 2483483 | 5/30/1998 | 17:35:02.60 | 3.795 | 7.727 |
| **561** | 44.419 | 16.722 | 0.449 | 34.819 | 12.836 | 2327049 | 2483191 | 5/30/1998 | 17:41:03.40 | 3.829 | 7.726 |
| **562** | 44.423 | 16.737 | 0.424 | 34.81 | 12.836 | 2307450 | 2483219 | 5/30/1998 | 17:47:45.47 | 3.694 | 7.726 |
| **563** | 44.448 | 16.755 | 0.472 | 34.815 | 12.837 | 2316704 | 2483429 | 5/30/1998 | 17:53:46.27 | 3.758 | 7.727 |
| **564** | 44.467 | 16.776 | 0.439 | 34.814 | 12.837 | 2325010 | 2483311 | 5/30/1998 | 17:59:47.07 | 3.815 | 7.727 |
| **565** | 44.495 | 16.803 | 0.416 | 34.815 | 12.838 | 2313522 | 2483618 | 5/30/1998 | 18:05:47.87 | 3.736 | 7.728 |
| **566** | 44.517 | 16.829 | 0.412 | 34.812 | 12.838 | 2323538 | 2483754 | 5/30/1998 | 18:11:48.67 | 3.805 | 7.729 |
| **567** | 44.541 | 16.854 | 0.483 | 34.811 | 12.837 | 2331270 | 2483912 | 5/30/1998 | 18:17:49.47 | 3.858 | 7.729 |
| **568** | 44.573 | 16.885 | 0.424 | 34.812 | 12.838 | 2352604 | 2484172 | 5/30/1998 | 18:23:50.27 | 4.004 | 7.730 |
| **569** | 44.598 | 16.916 | 0.437 | 34.807 | 12.837 | 2313026 | 2483971 | 5/30/1998 | 18:29:51.07 | 3.733 | 7.729 |
| **570** | 44.634 | 16.943 | 0.357 | 34.815 | 12.836 | 2314830 | 2484002 | 5/30/1998 | 18:35:51.87 | 3.745 | 7.730 |
| **571** | 44.655 | 16.969 | 0.343 | 34.812 | 12.836 | 2316661 | 2483852 | 5/30/1998 | 18:41:52.67 | 3.758 | 7.729 |
| **572** | 44.682 | 16.991 | 0.411 | 34.816 | 12.838 | 2321050 | 2484249 | 5/30/1998 | 18:47:53.47 | 3.788 | 7.731 |
| **573** | 44.71 | 17.03 | 0.43 | 34.806 | 12.838 | 2305945 | 2484439 | 5/30/1998 | 18:53:54.27 | 3.684 | 7.731 |
| **574** | 44.734 | 17.052 | 0.379 | 34.808 | 12.838 | 2332542 | 2484144 | 5/30/1998 | 18:59:55.07 | 3.867 | 7.730 |
| **575** | 44.757 | 17.075 | 0.343 | 34.808 | 12.839 | 2332975 | 2484085 | 5/30/1998 | 19:05:55.87 | 3.870 | 7.730 |
| **576** | 44.769 | 17.084 | 0.357 | 34.811 | 12.836 | 2324107 | 2484439 | 5/30/1998 | 19:11:56.67 | 3.809 | 7.731 |
| **577** | 44.792 | 17.11 | 0.318 | 34.808 | 12.839 | 2331388 | 2484106 | 5/30/1998 | 19:17:57.47 | 3.859 | 7.730 |
| **578** | 44.81 | 17.127 | 0.313 | 34.809 | 12.839 | 2313910 | 2484145 | 5/30/1998 | 19:23:58.27 | 3.739 | 7.730 |
| **579** | 44.833 | 17.152 | 0.408 | 34.807 | 12.837 | 2328078 | 2484842 | 5/30/1998 | 19:29:59.07 | 3.836 | 7.733 |
| **580** | 44.855 | 17.171 | 0.355 | 34.811 | 12.838 | 2344090 | 2484449 | 5/30/1998 | 19:35:59.87 | 3.946 | 7.732 |
| **581** | 44.871 | 17.194 | 0.359 | 34.805 | 12.837 | 2339624 | 2484332 | 5/30/1998 | 19:42:00.67 | 3.915 | 7.731 |
| **582** | 44.888 | 17.21 | 0.38 | 34.805 | 12.837 | 2344343 | 2484705 | 5/30/1998 | 19:48:01.47 | 3.948 | 7.733 |
| **583** | 44.899 | 17.216 | 0.373 | 34.81 | 12.837 | 2310087 | 2484878 | 5/30/1998 | 19:54:02.27 | 3.713 | 7.733 |
| **584** | 44.904 | 17.222 | 0.337 | 34.809 | 12.839 | 2333516 | 2484756 | 5/30/1998 | 20:00:03.07 | 3.873 | 7.733 |
| **585** | 44.92 | 17.234 | 0.378 | 34.813 | 12.837 | 2316273 | 2485380 | 5/30/1998 | 20:06:03.87 | 3.755 | 7.736 |
| **586** | 44.93 | 17.252 | 0.355 | 34.806 | 12.837 | 2332862 | 2484519 | 5/30/1998 | 20:12:04.67 | 3.869 | 7.732 |
| **587** | 44.942 | 17.263 | 0.391 | 34.807 | 12.837 | 2304159 | 2484443 | 5/30/1998 | 20:18:05.47 | 3.672 | 7.731 |
| **588** | 44.949 | 17.269 | 0.347 | 34.808 | 12.838 | 2337755 | 2484307 | 5/30/1998 | 20:24:06.27 | 3.902 | 7.731 |
| **589** | 44.947 | 17.273 | 0.403 | 34.802 | 12.835 | 2324849 | 2484961 | 5/30/1998 | 20:30:07.07 | 3.814 | 7.734 |
| **590** | 44.957 | 17.286 | 0.375 | 34.8 | 12.837 | 2316579 | 2484758 | 5/30/1998 | 20:36:07.87 | 3.757 | 7.733 |
| **591** | 44.973 | 17.294 | 0.408 | 34.807 | 12.836 | 2340176 | 2484531 | 5/30/1998 | 20:42:08.67 | 3.919 | 7.732 |
| **592** | 44.974 | 17.294 | 0.409 | 34.807 | 12.836 | 2305631 | 2484242 | 5/30/1998 | 20:48:09.47 | 3.682 | 7.731 |
| **593** | 44.97 | 17.289 | 0.443 | 34.809 | 12.835 | 2350368 | 2484706 | 5/30/1998 | 20:54:10.27 | 3.989 | 7.733 |
| **594** | 44.978 | 17.31 | 0.368 | 34.797 | 12.835 | 2320151 | 2484715 | 5/30/1998 | 21:00:11.07 | 3.782 | 7.733 |
| **595** | 44.983 | 17.316 | 0.409 | 34.797 | 12.835 | 2374950 | 2484793 | 5/30/1998 | 21:06:11.87 | 4.158 | 7.733 |
| **596** | 44.992 | 17.316 | 0.498 | 34.805 | 12.835 | 2325091 | 2484815 | 5/30/1998 | 21:12:12.67 | 3.816 | 7.733 |
| **597** | 45 | 17.323 | 0.478 | 34.805 | 12.835 | 2330322 | 2484339 | 5/30/1998 | 21:18:13.47 | 3.851 | 7.731 |
| **598** | 44.999 | 17.321 | 0.49 | 34.806 | 12.835 | 2323568 | 2484905 | 5/30/1998 | 21:24:14.27 | 3.805 | 7.733 |
| **599** | 44.999 | 17.325 | 0.439 | 34.803 | 12.835 | 2312131 | 2484718 | 5/30/1998 | 21:30:15.07 | 3.727 | 7.733 |
| **600** | 44.999 | 17.325 | 0.504 | 34.803 | 12.833 | 2357488 | 2484551 | 5/30/1998 | 21:36:15.87 | 4.038 | 7.732 |
| **601** | 45.007 | 17.332 | 0.496 | 34.804 | 12.835 | 2356126 | 2484183 | 5/30/1998 | 21:42:16.67 | 4.029 | 7.730 |
| **602** | 45.008 | 17.336 | 0.5 | 34.8 | 12.834 | 2294992 | 2484451 | 5/30/1998 | 21:48:17.47 | 3.609 | 7.732 |
| **603** | 44.995 | 17.328 | 0.51 | 34.797 | 12.835 | 2344532 | 2484532 | 5/30/1998 | 21:54:18.27 | 3.949 | 7.732 |
| **604** | 44.995 | 17.318 | 0.464 | 34.805 | 12.833 | 2338993 | 2484706 | 5/30/1998 | 22:00:19.07 | 3.911 | 7.733 |
| **605** | 44.998 | 17.322 | 0.551 | 34.805 | 12.833 | 2336063 | 2484308 | 5/30/1998 | 22:06:19.87 | 3.891 | 7.731 |
| **606** | 44.988 | 17.324 | 0.485 | 34.794 | 12.833 | 2347245 | 2484718 | 5/30/1998 | 22:12:20.67 | 3.968 | 7.733 |
| **607** | 44.961 | 17.29 | 0.529 | 34.8 | 12.831 | 2327530 | 2484054 | 5/30/1998 | 22:18:21.47 | 3.832 | 7.730 |
| **608** | 44.942 | 17.261 | 0.601 | 34.809 | 12.831 | 2341420 | 2484308 | 5/30/1998 | 22:24:22.27 | 3.928 | 7.731 |
| **609** | 44.929 | 17.247 | 0.587 | 34.81 | 12.831 | 2320117 | 2484368 | 5/30/1998 | 22:30:23.07 | 3.781 | 7.731 |
| **610** | 44.897 | 17.211 | 0.624 | 34.813 | 12.832 | 2318803 | 2484852 | 5/30/1998 | 22:36:23.87 | 3.772 | 7.733 |
| **611** | 44.859 | 17.182 | 0.581 | 34.805 | 12.829 | 2300451 | 2484170 | 5/30/1998 | 22:42:24.67 | 3.646 | 7.730 |
| **612** | 44.842 | 17.159 | 0.673 | 34.81 | 12.829 | 2307613 | 2484224 | 5/30/1998 | 22:48:25.47 | 3.696 | 7.731 |
| **613** | 44.827 | 17.15 | 0.536 | 34.804 | 12.83 | 2342618 | 2484643 | 5/30/1998 | 22:54:26.27 | 3.936 | 7.732 |
| **614** | 44.815 | 17.131 | 0.656 | 34.811 | 12.83 | 2318363 | 2484742 | 5/30/1998 | 23:00:27.07 | 3.769 | 7.733 |
| **615** | 44.809 | 17.133 | 0.658 | 34.804 | 12.829 | 2327533 | 2484803 | 5/30/1998 | 23:06:27.87 | 3.832 | 7.733 |
| **616** | 44.78 | 17.102 | 0.651 | 34.805 | 12.828 | 2331690 | 2485428 | 5/30/1998 | 23:12:28.67 | 3.861 | 7.736 |
| **617** | 44.744 | 17.07 | 0.707 | 34.801 | 12.829 | 2302998 | 2484238 | 5/30/1998 | 23:18:29.47 | 3.664 | 7.731 |
| **618** | 44.72 | 17.046 | 0.725 | 34.801 | 12.827 | 2294114 | 2484737 | 5/30/1998 | 23:24:30.27 | 3.603 | 7.733 |
| **619** | 44.705 | 17.029 | 0.728 | 34.802 | 12.827 | 2331940 | 2484474 | 5/30/1998 | 23:30:31.07 | 3.863 | 7.732 |
| **620** | 44.684 | 16.994 | 0.73 | 34.814 | 12.827 | 2323665 | 2483807 | 5/30/1998 | 23:36:31.87 | 3.806 | 7.729 |
| **621** | 44.651 | 16.962 | 0.766 | 34.813 | 12.825 | 2307039 | 2483608 | 5/30/1998 | 23:42:32.67 | 3.692 | 7.728 |
| **622** | 44.628 | 16.949 | 0.732 | 34.804 | 12.825 | 2329842 | 2483527 | 5/30/1998 | 23:48:33.47 | 3.848 | 7.728 |
| **623** | 44.609 | 16.912 | 0.744 | 34.821 | 12.826 | 2310986 | 2484133 | 5/30/1998 | 23:54:34.27 | 3.719 | 7.730 |
| **624** | 44.583 | 16.889 | 0.662 | 34.817 | 12.826 | 2323973 | 2484025 | 5/31/1998 | 00:00:35.07 | 3.808 | 7.730 |
| **625** | 44.541 | 16.85 | 0.7 | 34.815 | 12.826 | 2314517 | 2483540 | 5/31/1998 | 00:06:35.87 | 3.743 | 7.728 |

| Record No. | Conductivity (mS/cm) | Temperature (Deg. C) | Pressure (dBar) | Salinity (PSU) | CTD Bat. (Vdc) | D.O. (Integer) | pH (Integer) | Date | Time | D.O. (ml/L) | pH (Value) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **626** | 44.514 | 16.81 | 0.718 | 34.826 | 12.825 | 2305950 | 2483341 | 5/31/1998 | 00:12:36.67 | 3.684 | 7.727 |
| **627** | 44.501 | 16.807 | 0.795 | 34.817 | 12.823 | 2318720 | 2484158 | 5/31/1998 | 00:18:37.47 | 3.772 | 7.730 |
| **628** | 44.482 | 16.791 | 0.716 | 34.814 | 12.823 | 2334235 | 2483380 | 5/31/1998 | 00:24:38.27 | 3.878 | 7.727 |
| **629** | 44.458 | 16.757 | 0.749 | 34.822 | 12.823 | 2303660 | 2482951 | 5/31/1998 | 00:30:39.07 | 3.668 | 7.725 |
| **630** | 44.449 | 16.762 | 0.773 | 34.81 | 12.823 | 2335158 | 2484032 | 5/31/1998 | 00:36:39.87 | 3.885 | 7.730 |
| **631** | 44.442 | 16.745 | 0.767 | 34.819 | 12.822 | 2317035 | 2483806 | 5/31/1998 | 00:42:40.67 | 3.760 | 7.729 |
| **632** | 44.411 | 16.72 | 0.716 | 34.814 | 12.822 | 2335917 | 2483119 | 5/31/1998 | 00:49:22.74 | 3.890 | 7.726 |
| **633** | 44.39 | 16.683 | 0.792 | 34.827 | 12.821 | 2300259 | 2483212 | 5/31/1998 | 00:55:23.54 | 3.645 | 7.726 |
| **634** | 44.382 | 16.683 | 0.748 | 34.819 | 12.821 | 2310443 | 2482885 | 5/31/1998 | 01:01:24.34 | 3.715 | 7.725 |
| **635** | 44.371 | 16.673 | 0.751 | 34.819 | 12.821 | 2310269 | 2483656 | 5/31/1998 | 01:07:25.14 | 3.714 | 7.728 |
| **636** | 44.357 | 16.656 | 0.692 | 34.822 | 12.82 | 2299976 | 2483270 | 5/31/1998 | 01:13:25.94 | 3.643 | 7.726 |
| **637** | 44.352 | 16.64 | 0.855 | 34.831 | 12.82 | 2303543 | 2483911 | 5/31/1998 | 01:19:26.74 | 3.668 | 7.729 |
| **638** | 44.35 | 16.65 | 0.689 | 34.821 | 12.819 | 2311595 | 2483846 | 5/31/1998 | 01:25:27.54 | 3.723 | 7.729 |
| **639** | 44.348 | 16.654 | 0.729 | 34.815 | 12.821 | 2286198 | 2482959 | 5/31/1998 | 01:31:28.34 | 3.549 | 7.725 |
| **640** | 44.335 | 16.644 | 0.741 | 34.813 | 12.819 | 2315982 | 2483572 | 5/31/1998 | 01:37:29.14 | 3.753 | 7.728 |
| **641** | 44.331 | 16.629 | 0.796 | 34.822 | 12.819 | 2308499 | 2483692 | 5/31/1998 | 01:43:29.94 | 3.702 | 7.728 |
| **642** | 44.32 | 16.607 | 0.786 | 34.833 | 12.819 | 2311654 | 2483279 | 5/31/1998 | 01:49:30.74 | 3.723 | 7.726 |
| **643** | 44.312 | 16.61 | 0.803 | 34.822 | 12.82 | 2323950 | 2484053 | 5/31/1998 | 01:55:31.54 | 3.808 | 7.730 |
| **644** | 44.299 | 16.592 | 0.811 | 34.826 | 12.819 | 2315010 | 2483069 | 5/31/1998 | 02:01:32.34 | 3.746 | 7.726 |
| **645** | 44.27 | 16.564 | 0.756 | 34.826 | 12.818 | 2325696 | 2482313 | 5/31/1998 | 02:07:33.14 | 3.820 | 7.722 |
| **646** | 44.238 | 16.531 | 0.67 | 34.826 | 12.818 | 2332486 | 2483377 | 5/31/1998 | 02:13:33.94 | 3.866 | 7.727 |
| **647** | 44.216 | 16.517 | 0.72 | 34.819 | 12.817 | 2304895 | 2483002 | 5/31/1998 | 02:19:34.74 | 3.677 | 7.725 |
| **648** | 44.201 | 16.497 | 0.666 | 34.822 | 12.819 | 2316913 | 2483223 | 5/31/1998 | 02:25:35.54 | 3.759 | 7.726 |
| **649** | 44.179 | 16.472 | 0.599 | 34.825 | 12.819 | 2300896 | 2483244 | 5/31/1998 | 02:31:36.34 | 3.649 | 7.726 |
| **650** | 44.164 | 16.461 | 0.591 | 34.822 | 12.818 | 2284959 | 2482831 | 5/31/1998 | 02:37:37.14 | 3.540 | 7.725 |
| **651** | 44.167 | 16.46 | 0.637 | 34.825 | 12.816 | 2300911 | 2482619 | 5/31/1998 | 02:43:37.94 | 3.650 | 7.724 |
| **652** | 44.166 | 16.459 | 0.65 | 34.825 | 12.816 | 2314387 | 2482802 | 5/31/1998 | 02:49:38.74 | 3.742 | 7.724 |
| **653** | 44.164 | 16.459 | 0.559 | 34.824 | 12.816 | 2299848 | 2482785 | 5/31/1998 | 02:55:39.54 | 3.642 | 7.724 |
| **654** | 44.177 | 16.45 | 0.539 | 34.843 | 12.817 | 2295863 | 2482534 | 5/31/1998 | 03:01:40.34 | 3.615 | 7.723 |
| **655** | 44.185 | 16.47 | 0.5 | 34.832 | 12.818 | 2295104 | 2484127 | 5/31/1998 | 03:07:41.14 | 3.610 | 7.730 |
| **656** | 44.19 | 16.487 | 0.563 | 34.822 | 12.815 | 2303198 | 2484003 | 5/31/1998 | 03:13:41.94 | 3.665 | 7.730 |
| **657** | 44.21 | 16.489 | 0.547 | 34.838 | 12.817 | 2302181 | 2484225 | 5/31/1998 | 03:19:42.74 | 3.658 | 7.731 |
| **658** | 44.218 | 16.519 | 0.514 | 34.818 | 12.815 | 2307547 | 2483527 | 5/31/1998 | 03:25:43.54 | 3.695 | 7.728 |
| **659** | 44.236 | 16.534 | 0.48 | 34.821 | 12.816 | 2302167 | 2483421 | 5/31/1998 | 03:31:44.34 | 3.658 | 7.727 |
| **660** | 44.252 | 16.544 | 0.422 | 34.826 | 12.816 | 2321940 | 2483373 | 5/31/1998 | 03:37:45.14 | 3.794 | 7.727 |
| **661** | 44.281 | 16.575 | 0.413 | 34.826 | 12.815 | 2286126 | 2483456 | 5/31/1998 | 03:43:45.94 | 3.548 | 7.727 |
| **662** | 44.302 | 16.603 | 0.435 | 34.82 | 12.818 | 2297277 | 2483741 | 5/31/1998 | 03:49:46.74 | 3.625 | 7.728 |
| **663** | 44.316 | 16.621 | 0.369 | 34.816 | 12.817 | 2301073 | 2483395 | 5/31/1998 | 03:55:47.54 | 3.651 | 7.727 |
| **664** | 44.336 | 16.631 | 0.395 | 34.825 | 12.816 | 2301366 | 2484162 | 5/31/1998 | 04:01:48.34 | 3.653 | 7.730 |
| **665** | 44.354 | 16.658 | 0.328 | 34.817 | 12.818 | 2308298 | 2483980 | 5/31/1998 | 04:07:49.14 | 3.700 | 7.729 |
| **666** | 44.386 | 16.676 | 0.344 | 34.83 | 12.817 | 2289449 | 2483188 | 5/31/1998 | 04:13:49.94 | 3.571 | 7.726 |
| **667** | 44.415 | 16.711 | 0.306 | 34.824 | 12.815 | 2293201 | 2483129 | 5/31/1998 | 04:19:50.74 | 3.597 | 7.726 |
| **668** | 44.441 | 16.736 | 0.275 | 34.827 | 12.816 | 2303105 | 2483821 | 5/31/1998 | 04:25:51.54 | 3.665 | 7.729 |
| **669** | 44.467 | 16.773 | 0.315 | 34.816 | 12.817 | 2327860 | 2483593 | 5/31/1998 | 04:31:52.34 | 3.835 | 7.728 |
| **670** | 44.492 | 16.797 | 0.179 | 34.818 | 12.817 | 2326132 | 2484109 | 5/31/1998 | 04:37:53.14 | 3.823 | 7.730 |
| **671** | 44.524 | 16.825 | 0.217 | 34.822 | 12.817 | 2306981 | 2483211 | 5/31/1998 | 04:43:53.94 | 3.691 | 7.726 |
| **672** | 44.56 | 16.865 | 0.18 | 34.819 | 12.816 | 2328597 | 2483898 | 5/31/1998 | 04:49:54.74 | 3.840 | 7.729 |
| **673** | 44.589 | 16.892 | 0.166 | 34.821 | 12.816 | 2336069 | 2483030 | 5/31/1998 | 04:55:55.54 | 3.891 | 7.725 |
| **674** | 44.618 | 16.924 | 0.098 | 34.818 | 12.816 | 2309710 | 2483795 | 5/31/1998 | 05:01:56.34 | 3.710 | 7.729 |
| **675** | 44.65 | 16.949 | 0.109 | 34.824 | 12.817 | 2302109 | 2483255 | 5/31/1998 | 05:07:57.14 | 3.658 | 7.726 |
| **676** | 44.68 | 16.986 | 0.072 | 34.818 | 12.817 | 2287068 | 2483245 | 5/31/1998 | 05:13:57.94 | 3.555 | 7.726 |
| **677** | 44.705 | 17.007 | 0.096 | 34.823 | 12.817 | 2315699 | 2483312 | 5/31/1998 | 05:19:58.74 | 3.751 | 7.727 |
| **678** | 44.73 | 17.034 | 0.003 | 34.82 | 12.817 | 2307496 | 2483303 | 5/31/1998 | 05:25:59.54 | 3.695 | 7.727 |
| **679** | 44.754 | 17.057 | 0.002 | 34.821 | 12.82 | 2322230 | 2483423 | 5/31/1998 | 05:32:00.34 | 3.796 | 7.727 |
| **680** | 44.765 | 17.066 | -0.034 | 34.823 | 12.817 | 2343106 | 2482430 | 5/31/1998 | 05:38:01.14 | 3.939 | 7.723 |
| **681** | 44.79 | 17.107 | -0.049 | 34.81 | 12.817 | 2322771 | 2482915 | 5/31/1998 | 05:44:01.94 | 3.800 | 7.725 |
| **682** | 44.822 | 17.131 | -0.092 | 34.817 | 12.818 | 2297749 | 2483116 | 5/31/1998 | 05:50:02.74 | 3.628 | 7.726 |
| **683** | 44.843 | 17.156 | -0.111 | 34.814 | 12.816 | 2326520 | 2482718 | 5/31/1998 | 05:56:03.54 | 3.825 | 7.724 |
| **684** | 44.874 | 17.183 | -0.094 | 34.817 | 12.817 | 2324705 | 2482674 | 5/31/1998 | 06:02:04.34 | 3.813 | 7.724 |
| **685** | 44.901 | 17.221 | -0.127 | 34.808 | 12.818 | 2329389 | 2482970 | 5/31/1998 | 06:08:05.14 | 3.845 | 7.725 |
| **686** | 44.934 | 17.248 | -0.181 | 34.814 | 12.819 | 2350961 | 2482526 | 5/31/1998 | 06:14:05.94 | 3.993 | 7.723 |
| **687** | 44.963 | 17.282 | -0.207 | 34.808 | 12.817 | 2322592 | 2483004 | 5/31/1998 | 06:20:06.74 | 3.798 | 7.725 |
| **688** | 44.994 | 17.31 | -0.186 | 34.812 | 12.817 | 2327741 | 2483266 | 5/31/1998 | 06:26:07.54 | 3.834 | 7.726 |
| **689** | 45.028 | 17.349 | -0.27 | 34.808 | 12.818 | 2311642 | 2482408 | 5/31/1998 | 06:32:08.34 | 3.723 | 7.723 |
| **690** | 45.059 | 17.375 | -0.296 | 34.812 | 12.818 | 2328969 | 2482993 | 5/31/1998 | 06:38:09.14 | 3.842 | 7.725 |
| **691** | 45.098 | 17.409 | -0.299 | 34.816 | 12.819 | 2312803 | 2482564 | 5/31/1998 | 06:44:09.94 | 3.731 | 7.723 |
| **692** | 45.122 | 17.431 | -0.313 | 34.818 | 12.82 | 2323874 | 2481855 | 5/31/1998 | 06:50:10.74 | 3.807 | 7.720 |
| **693** | 45.155 | 17.474 | -0.317 | 34.81 | 12.818 | 2315301 | 2482609 | 5/31/1998 | 06:56:11.54 | 3.748 | 7.724 |
| **694** | 45.188 | 17.509 | -0.296 | 34.808 | 12.818 | 2300552 | 2482936 | 5/31/1998 | 07:02:12.34 | 3.647 | 7.725 |
| **695** | 45.217 | 17.534 | -0.361 | 34.812 | 12.819 | 2316746 | 2481802 | 5/31/1998 | 07:08:13.14 | 3.758 | 7.720 |
| **696** | 45.245 | 17.565 | -0.345 | 34.81 | 12.819 | 2339566 | 2483458 | 5/31/1998 | 07:14:13.94 | 3.915 | 7.727 |
| **697** | 45.281 | 17.605 | -0.344 | 34.805 | 12.819 | 2328482 | 2481765 | 5/31/1998 | 07:20:14.74 | 3.839 | 7.720 |
| **698** | 45.318 | 17.649 | -0.374 | 34.8 | 12.821 | 2341276 | 2481853 | 5/31/1998 | 07:26:15.54 | 3.927 | 7.720 |
| **699** | 45.342 | 17.67 | -0.387 | 34.802 | 12.822 | 2331065 | 2481193 | 5/31/1998 | 07:32:16.34 | 3.857 | 7.717 |
| **700** | 45.354 | 17.68 | -0.423 | 34.804 | 12.82 | 2343198 | 2481314 | 5/31/1998 | 07:38:17.14 | 3.940 | 7.718 |
| **701** | 45.376 | 17.705 | -0.438 | 34.802 | 12.82 | 2342539 | 2481924 | 5/31/1998 | 07:44:17.94 | 3.935 | 7.721 |

## BFSD 2 Triplicate Blank Tests - PAHs
## Summary

| PAH | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| 1. Naphthalene | -243.5 | -448.1 | -629.3 | -440 | 218.4 | 193.0 |
| 2. Acenaphthene | -32.4 | ND | ND | -32.4 | n/a | n/a |
| 3. Acenaphthylene | -350.2 | 141.0 | 275.9 | 22.2 | 372.9 | 329.5 |
| 4. Fluorene | 125.5 | -69.3 | -84.2 | -9 | 132.4 | 117.0 |
| 5. Phenanthrene | 89.0 | -39.8 | -16.3 | 11 | 77.6 | 68.6 |
| 6. Anthracene | 182.3 | 53.1 | -324.8 | -30 | 298 | 263 |
| 7. Fluoranthene | -421.5 | -1539.0 | -1308.9 | -1089.8 | 667.8 | 590.1 |
| 8. Pyrene | 76.6 | -447.1 | -431.9 | -267.5 | 337.3 | 298.0 |
| 9. Benzo(a)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 10. Chrysene | 23.9 | -61.9 | ND | -19.0 | 84.2 | 60.7 |
| 11. Benzo(b)fluoranthene | ND | ND | -134.3 | -134.3 | n/a | n/a |
| 12. Benzo(k)fluoranthene | ND | ND | -9.8 | -9.8 | n/a | n/a |
| 13. Benzo(a)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 14.Indeno(1,2,3-c,d)pyrene | ND | ND | ND | n/a | n/a | n/a |
| 15. Dibenz(a,h)anthracene | ND | ND | ND | n/a | n/a | n/a |
| 16. Benzo(g,h,I)perylene | ND | 19.6 | ND | 19.6 | n/a | n/a |

## BFSD 2 Triplicate Blank Tests - PCBs
## Summary

| PCB | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| (8) 2,4'-Dichlorobiphenyl | -66.6 | ND | 47.8 | -9.4 | 112.2 | 80.9 |
| (18) 2,2',5-Trichlorobiphenyl | 205.2 | 23.3 | 27.0 | 85.2 | 117.6 | 104.0 |
| (28) 2,4,4'-Trichlorobiphenyl | -8.0 | ND | ND | -8.0 | n/a | n/a |
| (52) 2,2',5,5'-Tetrachlorobiphenyl | ND | 7.9 | 89.9 | 49 | 80.4 | 58.0 |
| (66) 2,3',4,4'-Tetrachlorobiphenyl | 53.6 | 16.6 | ND | 35 | 36.2 | 26.2 |
| (101) 2,2',4,5,5'-Pentachlorobiphenyl | 57.8 | 57.4 | -3.5 | 37 | 40 | 35 |
| (118) 2,3',4,4',5-Pentachlorobiphenyl | ND | 2.7 | 2.3 | 2.5 | 0.3 | 0.2 |
| (153) 2,2',4,4',5,5'-Hexachlorobiphenyl | ND | ND | 9.5 | 9.5 | n/a | n/a |
| (180) 2,2',3,4,4',5,5'-Heptachlorobiphenyl | ND | -9.6 | ND | -9.6 | n/a | n/a |
| (206) 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl | -2.8 | 247.0 | -17.0 | 75.7 | 168.0 | 148.5 |
| (209) 2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl | -18.5 | ND | ND | -18.5 | n/a | n/a |

## BFSD 2 Triplicate Blank Tests - Pesticides
## Summary

| Pesticide | Blank Flux (ng/m$^2$/day) | | | Repeatability (ng/m$^2$/day) | | |
|---|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Average Flux | +/- 95% C.L. | Std. Deviation |
| alpha-Chlordane | 7.0 | ND | ND | 7.0 | n/a | n/a |
| 2,4'-DDD | 7.0 | ND | ND | 7.0 | n/a | n/a |
| Methoxychlor | 25.7 | ND | ND | 25.7 | n/a | n/a |
| Endosulfan I | 48.8 | ND | ND | 48.8 | n/a | n/a |
| hexachlorobutadiene | ND | ND | 22.0 | 22.0 | n/a | n/a |
| Heptachlor | 304.5 | ND | ND | 304.5 | n/a | n/a |
| Heptachlor Epoxide | ND | ND | 8.8 | 8.8 | n/a | n/a |
| alpha-hexachlorocyclohexane | 3.3 | ND | ND | 3.3 | n/a | n/a |
| beta-hexachlorocyclohexane | 61.0 | ND | ND | 61.0 | n/a | n/a |
| lindane | 35.2 | 132.3 | 33.8 | 67.1 | 63.9 | 56.5 |
| trans-Nonachlor | 40.8 | ND | ND | 40.8 | n/a | n/a |

## BFSD 2
## Paleta Creek Demonstration Summary

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -6.57 | 17.74 | 80.7% | 2.82 | 8.73 | 165 | 1.46 |
| Cadmium (Cd) | 7.02 | 3.87 | 100.0% | -0.52 | 0.75 | 1.16 | 0.06897 |
| Lead (Pb) | 4.32 | 12.39 | 65.6% | 3.16 | 1.59 | 98.9 | 0.07879 |
| Nickel (Ni) | 19.44 | 8.75 | 99.8% | 10.28 | 7.34 | 19.1 | 0.8378 |
| Manganese (Mn) | 103.94 | 957.14 | 73.3% | -264.85 | 7.49 | 405 | 24.02 |
| Manganese (Mn)[1] | 4194.24 | 101841.76 | 99.9% | -264.85 | 7.49 | 405 | 24.02 |
| Zinc (Zn) | 574.26 | 274.14 | 100% | -3.38 | -68.61 | 356 | 8.38 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1341.12 | 160.18 | na | na | na | na | 4.7 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 28.75 | 15.63 | 100% | -1.97 | 2.88 | na | 0.79 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

## BFSD 2
## Paleta Creek Pre-Demo Summary

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | -1.75 | 19.71 | 38.1% | 2.82 | 8.73 | 165 | 1.54 |
| Cadmium (Cd) | 9.64 | 4.14 | 100.0% | -0.52 | 0.75 | 1.16 | 0.148 |
| Lead (Pb) | 11.06 | 7.94 | 100.0% | 3.16 | 1.59 | 98.9 | 0.1561 |
| Nickel (Ni) | 25.24 | 4.62 | 100.0% | 10.28 | 7.34 | 19.1 | 0.9262 |
| Manganese (Mn) | 71.33 | 701.54 | 80.7% | -264.85 | 7.49 | 405 | 28.12 |
| Manganese (Mn)[1] | 5763.99 | 23621.84 | 100.0% | -264.85 | 7.49 | 405 | 28.12 |
| Zinc (Zn) | 715.02 | 257.38 | 100.0% | -3.38 | 65.22 | 356 | 8.90 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1050.87 | 86.25 | na | na | na | na | 5.2 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 30.29 | 11.33 | 100% | -1.97 | 2.88 | na | 0.81 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

## BFSD 2
## Pearl Harbor Bishop Point Site Summary

| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 112.46 | 17.60 | 100.0% | 2.82 | 8.73 | 241 | 0.36 |
| Cadmium (Cd) | 1.85 | 1.96 | 99.4% | -0.52 | 0.75 | 0.3 | 0.009 |
| Lead (Pb) | 0.71 | 1.11 | 78.7% | 3.16 | 1.59 | 93 | 0.06519 |
| Nickel (Ni) | 21.04 | 15.41 | 96.3% | 10.28 | 7.34 | 42.9 | 0.3934 |
| Manganese (Mn) | 223.33 | 284.79 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Manganese (Mn)[1] | 2177.45 | 192.60 | 100.0% | -264.85 | 7.49 | 324 | 1.78 |
| Zinc (Zn) | 191.18 | 54.07 | 100.0% | -3.38 | 65.22 | 304 | 1.43 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -567.12 | 54.96 | na | na | na | na | 6.5 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 118.61 | 27.62 | 100% | -1.97 | 2.88 | na | 0.31 |

1. Mn flux calculated on the basis of first three samples due to non-linearity

## BFSD 2
## Pearl Harbor Middle Loch Summary

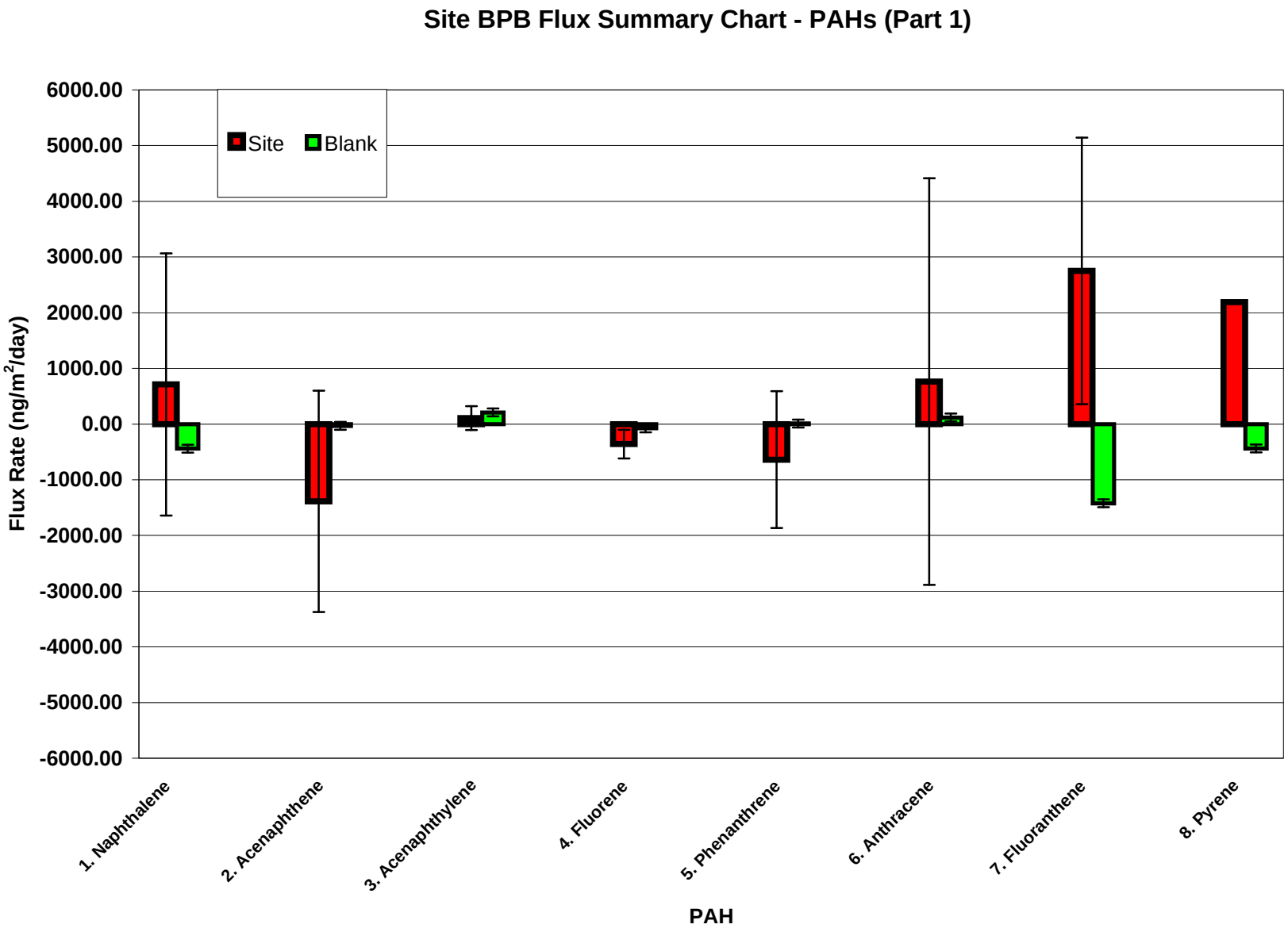
| Metal | Flux ($\mu g/m^2/day$) | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Copper (Cu) | 14.79 | 3.46 | 99.9% | 2.82 | 8.73 | 195 | 0.80 |
| Cadmium (Cd) | 1.80 | 0.31 | 100.0% | -0.52 | 0.75 | 0.2 | 0.02277 |
| Lead (Pb) | -0.12 | 0.43 | 95.2% | 3.16 | 1.59 | 34 | 0.03879 |
| Nickel (Ni) | 27.17 | 15.91 | 100.0% | 10.28 | 7.34 | 214 | 0.9472 |
| Manganese (Mn) | -468.18 | 683.35 | 97.9% | -264.85 | 7.49 | 1180 | 52.19 |
| Manganese (Mn)[1] | 2131.59 | 904.57 | 100.0% | -264.85 | 7.49 | 1180 | 52.19 |
| Zinc (Zn) | 49.74 | 17.25 | 93.5% | -3.38 | 65.22 | 314 | 2.28 |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1085.52 | 64.84 | na | na | na | na | 4.17 |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 65.03 | 42.43 | 100% | -1.97 | 2.88 | na | 1.19 |

1. Mn flux calculated on the basis of first five samples due to non-linearity

## BFSD 2 12/9/2002
## BPB Site Summary

| Metal | Flux ($\mu g/m^2/day$)* | +/- 95% C.L. ($\mu g/m^2/day$) | Flux rate Confidence (%) | Triplicate Blank Flux ($\mu g/m^2/day$) Average | Triplicate Blank Flux ($\mu g/m^2/day$) +/- 95% C.L. | Bulk Sediment ($\mu g/g$) | Overlying Water ($\mu g/L$) |
|---|---|---|---|---|---|---|---|
| Arsenic (As) | 23.48 | 6.94 | 100% | -5.16 | 2.10 | | |
| Copper (Cu) | -71.30 | 39.43 | 100.0% | 2.82 | 8.73 | | |
| Cadmium (Cd) | 1.31 | 1.63 | 98.1% | -0.52 | 0.75 | | |
| Lead (Pb) | 17.40 | 24.63 | 99.0% | 3.16 | 1.59 | | |
| Nickel (Ni) | 59.18 | 55.96 | 100.0% | 10.28 | 7.34 | | |
| Manganese (Mn) | 427.65 | 238.42 | 100.0% | -264.85 | 7.49 | | |
| Manganese (Mn)[1] | 1940.13 | 3853.41 | 100.0% | -264.85 | 7.49 | | |
| Silver (Ag) | -0.36 | 0.88 | 86.1% | 0.64 | 0.68 | | |
| Zinc (Zn) | 374.36 | 133.74 | 100.0% | -3.38 | 65.22 | | |
| **Other** | | | | | | | |
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -1457.09 | 48.92 | na | na | na | | |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | 0.00 | 0.00 | 48% | -1.97 | 2.88 | | |

1. Mn flux calculated on the first three samples due to non-linearity and to compare with metals-only demonstration


Site BPB Flux Summary Chart - PAHs (Part 1)
Site
Blank
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
-1000.00
-2000.00
-3000.00
-4000.00
-5000.00
-6000.00
Flux Rate (ng/m2/day)
1. Naphthalene
2. Acenaphthene
3. Acenaphthylene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
PAH

**BFSD 2 - 12/9/2003**
**BPB Site Summary- PAHs (Part 2)**

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | 152.67 | 140.49 | NA | NA | NA | | |
| 10. CHRYSENE | 286.65 | 341.92 | 94.7% | 23.94 | 22.32 | | |
| 11. BENZO(B)FLUORANTHENE | 561.07 | 376.08 | 97.9% | -134.30 | 297.91 | | |
| 12. BENZO(K)FLUORANTHENE | 452.24 | 465.75 | 82.8% | -9.71 | 36.30 | | |
| 13. BENZO(A)PYRENE | 383.46 | 603.38 | NA | NA | NA | | |
| 14. INDENO(1,2,3-C,D)PYRENE | 8.68 | 10.98 | NA | NA | NA | | |
| 15. DIBENZ(A,H)ANTHRACENE | -1.97 | 7.69 | NA | NA | NA | | |
| 16. BENZO(G,H,I)PERYLENE | 8.77 | 10.59 | 12.9% | 20.15 | 65.15 | | |

## BFSD 2
## BPB Site Summary- PAHs (Part 1)

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. | Bulk Sediment (ng/g) | Overlying Water (ng/L) |
|---|---|---|---|---|---|---|---|
| 1. Naphthalene | 2456.72 | 13211.62 | 100.0% | -440.30 | 458.38 | | |
| 2. Acenaphthene | 9222.27 | 6867.34 | 100.0% | -32.40 | 50.34 | | |
| 3. Acenaphthylene | 778.37 | 880.29 | 100.0% | 208.47 | 112.60 | | |
| 4. Fluorene | 285.70 | 2021.66 | 100.0% | -76.74 | 28.38 | | |
| 5. Phenanthrene | -3555.98 | 7892.27 | 100.0% | 10.95 | 10.95 | | |
| 6. Anthracene | 2874.10 | 1330.22 | 100.0% | 117.68 | 64.62 | | |
| 7. Fluoranthene | 19696.65 | 3869.67 | 100.0% | -1423.95 | 178.41 | | |
| 8. Pyrene | 12101.21 | 3884.64 | 100.0% | -439.51 | 70.73 | | |

**Other**
(See Metals Analysis in combined deployments for these data)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*ml/m$^2$/day) | 0.00 | 0.00 | na | na | na | | |
| Silica ($SiO_2$)* (*mg/m$^2$/day) | 0.00 | 0.00 | 48% | -1.97 | 2.88 | | |

# BFSD2
## BPB Site - 12/9/2002
## PAH Flux Analysis

### BFSD 2 - Site BPB (12/9/2002) - PAHs (Part 2)
**First 4 samples only**

**Site:** Site BPB (21 19.815 N X 157 58.000W)
**Date:** 12/9/2003

**Start time:**
**Interval:** 7 hr
**End time:**

**Bottle Volume =** 0.25 liters
**Chamber Volume =** 30 liters
**Chamber Area =** 1701.4 $cm^2$

| Sample id | BFSD 2 Data: Measured Concentration (pptr)** | Sample No.* | Elapsed Time (hrs) | Dilution Correction: Measured Concentration (pptr)** | Corrected Concentration (pptr)** | # of Dilutions | Intercept Corrected Concentration (pptr) | From Regression Concentration (pptr)** | Lower 95% Conf. Int. | Upper 95% Conf. Int. |
|---|---|---|---|---|---|---|---|---|---|---|
| **BENZO(A)ANTHRACENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.72 | T-#0 | 0 | 2.720 | | n/a | | | | |
| BFSD2-BPB-2 | 4.50 | #1 | 0.3 | 4.500 | 4.5000 | 0 | 0.237 | 0.054 | -2.783 | 2.891 |
| BFSD2-BPB-3 | 5.62 | #2 | 7.3 | 5.620 | 5.6348 | 1 | 1.371 | 1.313 | -1.524 | 4.149 |
| BFSD2-BPB-4 | 6.13 | #3 | 14.3 | 6.130 | 6.1690 | 2 | 1.906 | 2.571 | -0.266 | 5.408 |
| BFSD2-BPB-5 | 8.45 | #4 | 21.3 | 8.450 | 8.5174 | 3 | 4.254 | 3.830 | 0.993 | 6.667 |
| BFSD2-BPB-6 | 6.77 | #5 | 28.3 | 6.770 | 6.8852 | 4 | 2.622 | 5.089 | 2.252 | 7.925 |
| BFSD2-BPB-7 | 6.99 | #6 | 35.3 | 6.990 | 7.1389 | 5 | 2.876 | 6.347 | 3.510 | 9.184 |
| BFSD2-BPB-8 | 7.56 | #7 | 42.3 | 7.560 | 7.745 | 6 | 3.481 | 7.606 | 4.769 | 10.443 |
| BFSD2-BPB-10 | 6.51 | #9 | 56.3 | 6.510 | 6.9162 | 8 | 2.653 | 10.123 | 7.286 | 12.960 |
| BFSD2-BPB-11 | 8.43 | #10 | 63.3 | 8.430 | 8.8904 | 9 | 4.627 | 11.382 | 8.545 | 14.219 |
| BFSD2-BPB-12 | 6.70 | #11 | 70.3 | 6.700 | 7.2307 | 10 | 2.967 | 12.640 | 9.803 | 15.477 |
| **CHRYSENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.18 | T-#0 | 0 | 1.180 | | n/a | | | | |
| BFSD2-BPB-2 | 7.90 | #1 | 0.3 | 7.900 | 7.9000 | 0 | 0.797 | 0.138 | -5.671 | 5.947 |
| BFSD2-BPB-3 | 10.0 | #2 | 7.3 | 10.000 | 10.0560 | 1 | 2.953 | 3.362 | -2.447 | 9.171 |
| BFSD2-BPB-4 | 12.4 | #3 | 14.3 | 12.400 | 12.5295 | 2 | 5.427 | 6.587 | 0.778 | 12.396 |
| BFSD2-BPB-5 | 17.6 | #4 | 21.3 | 17.600 | 17.8230 | 3 | 10.720 | 9.811 | 4.002 | 15.620 |
| BFSD2-BPB-6 | 11.5 | #5 | 28.3 | 11.500 | 11.8598 | 4 | 4.757 | 13.035 | 7.226 | 18.844 |
| BFSD2-BPB-7 | 12.8 | #6 | 35.3 | 12.800 | 13.2458 | 5 | 6.143 | 16.259 | 10.450 | 22.068 |
| BFSD2-BPB-8 | 13.2 | #7 | 42.3 | 13.200 | 13.743 | 6 | 6.640 | 19.484 | 13.675 | 25.293 |
| BFSD2-BPB-9 | 11 | #8 | 49.3 | 10.500 | 11.1428 | 7 | 4.040 | 22.708 | 16.899 | 28.517 |
| BFSD2-BPB-10 | 16.4 | #9 | 56.3 | 16.400 | 17.1205 | 8 | 10.018 | 25.932 | 20.123 | 31.741 |
| BFSD2-BPB-11 | 14.6 | #10 | 63.3 | 14.600 | 15.4473 | 9 | 8.345 | 29.156 | 23.347 | 34.965 |
| BFSD2-BPB-12 | 12.6 | #11 | 70.3 | 12.600 | 13.5592 | 10 | 6.457 | 32.381 | 26.572 | 38.190 |
| **BENZO(B)FLUORANTHENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.32 | T-#0 | 0 | 2.320 | | n/a | | | | |
| BFSD2-BPB-2 | 8.99 | #1 | 0.3 | 8.990 | 8.9900 | 0 | 0.706 | 0.133 | -12.291 | 12.558 |
| BFSD2-BPB-3 | 9.32 | #2 | 7.3 | 9.320 | 9.3756 | 1 | 1.092 | 3.241 | -9.183 | 15.665 |
| BFSD2-BPB-4 | 17.1 | #3 | 14.3 | 17.100 | 17.2139 | 2 | 8.930 | 6.349 | -6.075 | 18.773 |
| BFSD2-BPB-5 | 16.5 | #4 | 21.3 | 16.500 | 16.7371 | 3 | 8.453 | 9.457 | -2.967 | 21.881 |
| BFSD2-BPB-6 | 16.3 | #5 | 28.3 | 16.300 | 16.6553 | 4 | 8.371 | 12.565 | 0.141 | 24.989 |
| BFSD2-BPB-7 | 14.8 | #6 | 35.3 | 14.800 | 15.2718 | 5 | 6.988 | 15.673 | 3.249 | 28.097 |
| BFSD2-BPB-8 | 18.4 | #7 | 42.3 | 18.400 | 18.976 | 6 | 10.692 | 18.781 | 6.357 | 31.205 |
| BFSD2-BPB-11 | 18.7 | #10 | 63.3 | 18.700 | 19.5644 | 9 | 11.280 | 28.105 | 15.680 | 40.529 |
| BFSD2-BPB-12 | 18.1 | #11 | 70.3 | 18.100 | 19.1203 | 10 | 10.836 | 31.213 | 18.788 | 43.637 |
| **BENZO(K)FLUORANTHENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.62 | T-#0 | 0 | 2.620 | | n/a | | | | |
| BFSD2-BPB-2 | 7.42 | #1 | 0.3 | 7.420 | 7.4200 | 0 | 0.951 | 0.134 | -6.356 | 6.624 |
| BFSD2-BPB-3 | 8.15 | #2 | 7.3 | 8.150 | 8.1900 | 1 | 1.721 | 3.260 | -3.230 | 9.751 |
| BFSD2-BPB-4 | 13.4 | #3 | 14.3 | 13.400 | 13.4861 | 2 | 7.017 | 6.387 | -0.104 | 12.877 |
| BFSD2-BPB-5 | 15.9 | #4 | 21.3 | 15.900 | 16.0759 | 3 | 9.606 | 9.513 | 3.023 | 16.004 |
| BFSD2-BPB-6 | 10.9 | #5 | 28.3 | 10.900 | 11.1866 | 4 | 4.717 | 12.640 | 6.149 | 19.130 |
| BFSD2-BPB-7 | 12.9 | #6 | 35.3 | 12.900 | 13.2556 | 5 | 6.786 | 15.766 | 9.275 | 22.256 |
| BFSD2-BPB-8 | 17.9 | #7 | 42.3 | 17.900 | 18.341 | 6 | 11.872 | 18.892 | 12.402 | 25.383 |
| BFSD2-BPB-11 | 17.5 | #10 | 63.3 | 17.500 | 18.2433 | 9 | 11.774 | 28.271 | 21.781 | 34.762 |
| BFSD2-BPB-12 | 12.4 | #11 | 70.3 | 12.400 | 13.2891 | 10 | 6.820 | 31.398 | 24.907 | 37.888 |

**BENZO(A)ANTHRACENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.1798 | slope= | #REF! |
| intercept= | 4.2634 | | |
| St. Err of Slope= | 0.0367 | | |
| St Err of Int= | 0.4894 | | |
| R2= | 0.9231 | | |
| St Err of Y= | 0.5744 | St Err of Y= | #REF! |
| F= | 24.01044943 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 7.920894225 | | |
| ResSS= | 0.659787252 | ResSS= | #REF! |
| Sumx2= | 16666.5 | Sumx2= | #REF! |
| Average Conc. | 6.474 | | |
| Initial Conc | 4.500 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = #REF!
$S_{(y1-x2)}$ = #REF!
t = #REF!
p = #REF!

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **760.90** | **ng/m²/day** |
| **95% CI (low) =** | **92.77** | **ng/m²/day** |
| **95% CI (high) =** | **1429.04** | **ng/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **−134.29613** | **ng/m²/day** |
| **95% CI (low) =** | **−432.20593** | **ng/m²/day** |
| **95% CI (high) =** | **163.613683** | **ng/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.1798 | 4.2634 |
| 0.0367 | 0.4894 |
| 0.9231 | 0.5744 |
| 24.01044943 | 2 |
| 7.920894225 | 0.659787252 |

**Notes**

**CHRYSENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.4606 | slope= | 0.003950364 |
| intercept= | 7.1026 | | |
| St. Err of Slope= | 0.0752 | | |
| St Err of Int= | 1.0035 | | |
| R2= | 0.9493 | | |
| St Err of Y= | 1.1777 | St Err of Y= | 0.003681693 |
| F= | 37.47442787 | | |
| DF= | 2 | DF= | 7 |
| RegSS= | 51.97894031 | | |
| ResSS= | 2.774101875 | ResSS= | 0.511425087 |
| Sumx2= | 19096.99 | Sumx2= | 5390 |
| Average Conc. | 12.034 | | |
| Initial Conc | 7.900 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = 0.365058551
$S_{(y1-x2)}$ = 0.00931906
t = 49.00244917
p = 3.07797E-12

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1949.20** | **µg/m²/day** |
| **95% CI (low) =** | **579.19** | **µg/m²/day** |
| **95% CI (high) =** | **3319.22** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **100%** | |
| **Blank Flux=** | **−9.710954** | **µg/m²/day** |
| **95% CI (low) =** | **−46.008488** | **µg/m²/day** |
| **95% CI (high) =** | **26.5865797** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.4606 | 7.1026 |
| 0.0752 | 1.0035 |
| 0.9493 | 1.1777 |
| 37.47442787 | 2 |
| 51.97894031 | 2.774101875 |

**Notes**

**BENZO(B)FLUORANTHENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.4440 | slope= | -0.0221561 |
| intercept= | 8.2840 | | |
| St. Err of Slope= | 0.1605 | | |
| St Err of Int= | 2.1402 | | |
| R2= | 0.7929 | | |
| St Err of Y= | 2.5117 | St Err of Y= | 0.049148994 |
| F= | 7.655682812 | | |
| DF= | 2 | DF= | 4 |
| RegSS= | 48.29702501 | | |
| ResSS= | 12.61730043 | ResSS= | 19.88541378 |
| Sumx2= | 13496.81 | Sumx2= | 2058 |
| Average Conc. | 13.794 | | |
| Initial Conc | 8.990 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = 5.417119035
$S_{(y1-x2)}$ = 0.055078017
t = 8.463451966
p = 0.00014867

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1878.90** | **µg/m²/day** |
| **95% CI (low) =** | **-1042.88** | **µg/m²/day** |
| **95% CI (high) =** | **4800.68** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **100%** | |
| **Blank Flux=** | **#PB0!** | **µg/m²/day** |
| **95% CI (low) =** | **#PB0!** | **µg/m²/day** |
| **95% CI (high) =** | **#PB0!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.4440 | 8.2840 |
| 0.1605 | 2.1402 |
| 0.7929 | 2.5117 |
| 7.655682812 | 2 |
| 48.29702501 | 12.61730043 |

**Notes**

**BENZO(K)FLUORANTHENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.4466 | slope= | -0.001602108 |
| intercept= | 6.4694 | | |
| St. Err of Slope= | 0.0838 | | |
| St Err of Int= | 1.1181 | | |
| R2= | 0.9342 | | |
| St Err of Y= | 1.3121 | St Err of Y= | 0.005988347 |
| F= | 28.3865123 | | |
| DF= | 2 | DF= | 2 |
| RegSS= | 48.87136373 | | |
| ResSS= | 3.443280613 | ResSS= | 0.117143642 |
| Sumx2= | 13496.81 | Sumx2= | 1633.333333 |
| Average Conc. | 11.272 | | |
| Initial Conc | 7.420 | | |

**Comparitive Statistics**
$S^2_{(y-x)}$ = 0.890106064
$S_{(y1-x2)}$ = 0.024716639
t = 18.13467808
p = 5.43699E-05

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1890.04** | **µg/m²/day** |
| **95% CI (low) =** | **363.70** | **µg/m²/day** |
| **95% CI (high) =** | **3416.37** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **100%** | |
| **Blank Flux=** | **#PB0!** | **µg/m²/day** |
| **95% CI (low) =** | **#PB0!** | **µg/m²/day** |
| **95% CI (high) =** | **#PB0!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.4466 | 6.4694 |
| 0.0838 | 1.1181 |
| 0.9342 | 1.3121 |
| 28.3865123 | 2 |
| 48.87136373 | 3.443280613 |

**Notes**

**BFSD2-SPL-10-1**
**BFSD2-SPL-10-2**
**BFSD2-SPL-10-3**
**BFSD2-SPL-10-4**
**BFSD2-SPL-10-5**
**BFSD2-SPL-10-6**
**BFSD2-SPL-10-7**
**BFSD2-SPL-10-8**
**BFSD2-SPL-10-10**
**BFSD2-SPL-10-11**

# BFSD2
## BPB Site - 12/9/2002
## PAH Flux Analysis

| Sample id | BFSD 2 Data: Measured Concentration (pptr)** | Sample No.* | Elapsed Time (hrs) | Dilution Correction: Measured Concentration (pptr)** | Corrected Concentration (pptr)** | # of Dilutions | Intercept Corrected Concentration (pptr) | From Regression Concentration (pptr)** | Lower 95% Conf. Int. | Upper 95% Conf. Int. |
|---|---|---|---|---|---|---|---|---|---|---|
| **BENZO(A)PYRENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 2.00 | T-#0 | 0 | 2.000 | | n/a | | | | |
| BFSD2-BPB-2 | 2.00 | #1 | 0.3 | 2.000 | 2.0000 | 0 | 0.794 | 0.100 | -7.469 | 7.669 |
| BFSD2-BPB-3 | 2.00 | #2 | 7.3 | 2.000 | 2.0000 | 1 | 0.794 | 2.438 | -5.131 | 10.007 |
| BFSD2-BPB-4 | 7.19 | #3 | 14.3 | 7.190 | 7.1900 | 2 | 5.984 | 4.776 | -2.793 | 12.345 |
| BFSD2-BPB-5 | 8.02 | #4 | 21.3 | 8.020 | 8.0633 | 3 | 6.857 | 7.114 | -0.455 | 14.683 |
| BFSD2-BPB-6 | 2.00 | #5 | 28.3 | 2.000 | 2.0934 | 4 | 0.887 | 9.452 | 1.883 | 17.021 |
| BFSD2-BPB-7 | 6.23 | #6 | 35.3 | 6.230 | 6.3234 | 5 | 5.117 | 11.790 | 4.221 | 19.359 |
| BFSD2-BPB-8 | 7.16 | #7 | 42.3 | 7.160 | 7.289 | 6 | 6.083 | 14.128 | 6.559 | 21.697 |
| BFSD2-BPB-9 | 18.3 | #8 | 49.3 | 18.300 | 18.4717 | 7 | 17.266 | 16.466 | 8.897 | 24.035 |
| BFSD2-BPB-10 | 2.00 | #9 | 56.3 | 2.000 | 2.3075 | 8 | 1.101 | 18.804 | 11.235 | 26.373 |
| BFSD2-BPB-11 | 9.68 | #10 | 63.3 | 9.680 | 9.9875 | 9 | 8.781 | 21.142 | 13.573 | 28.711 |
| BFSD2-BPB-12 | 6.92 | #11 | 70.3 | 6.920 | 7.2915 | 10 | 6.085 | 23.480 | 15.911 | 31.049 |
| **INDENO(1,2,3-C,D)PYRENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.98 | T-#0 | 0 | 1.98 | | n/a | | | | |
| BFSD2-BPB-2 | 1.98 | #1 | 0.3 | 1.98 | 1.9800 | 0 | 0.049 | 0.003 | -0.437 | 0.443 |
| BFSD2-BPB-3 | 1.98 | #2 | 7.3 | 1.98 | 1.9800 | 1 | 0.049 | 0.072 | -0.368 | 0.512 |
| BFSD2-BPB-4 | 1.98 | #3 | 14.3 | 1.98 | 1.9800 | 2 | 0.049 | 0.141 | -0.299 | 0.581 |
| BFSD2-BPB-5 | 2.21 | #4 | 21.3 | 2.21 | 2.2100 | 3 | 0.279 | 0.210 | -0.230 | 0.650 |
| BFSD2-BPB-6 | 1.98 | #5 | 28.3 | 1.98 | 1.9819 | 4 | 0.051 | 0.279 | -0.161 | 0.719 |
| BFSD2-BPB-7 | 1.98 | #6 | 35.3 | 1.98 | 1.9819 | 5 | 0.051 | 0.348 | -0.092 | 0.788 |
| BFSD2-BPB-8 | 1.98 | #7 | 42.3 | 1.980 | 1.982 | 6 | 0.051 | 0.417 | -0.023 | 0.857 |
| BFSD2-BPB-10 | 1.98 | #9 | 56.3 | 1.98 | 2.1139 | 8 | 0.183 | 0.555 | 0.115 | 0.995 |
| BFSD2-BPB-11 | 1.98 | #10 | 63.3 | 1.98 | 2.1304 | 9 | 0.199 | 0.624 | 0.184 | 1.064 |
| BFSD2-BPB-12 | 1.98 | #11 | 70.3 | 1.98 | 2.1469 | 10 | 0.216 | 0.693 | 0.253 | 1.133 |
| **DIBENZ(A,H)ANTHRACENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.67 | T-#0 | 0 | 1.67 | | n/a | | | | |
| BFSD2-BPB-2 | 1.67 | #1 | 0.3 | 1.67 | 1.6700 | 0 | 0.040 | 0.002 | -0.361 | 0.365 |
| BFSD2-BPB-3 | 1.67 | #2 | 7.3 | 1.67 | 1.6700 | 1 | 0.040 | 0.059 | -0.304 | 0.422 |
| BFSD2-BPB-4 | 1.67 | #3 | 14.3 | 1.67 | 1.6700 | 2 | 0.040 | 0.116 | -0.247 | 0.479 |
| BFSD2-BPB-5 | 1.86 | #4 | 21.3 | 1.86 | 1.8600 | 3 | 0.230 | 0.173 | -0.190 | 0.536 |
| BFSD2-BPB-6 | 1.67 | #5 | 28.3 | 1.67 | 1.6716 | 4 | 0.042 | 0.230 | -0.133 | 0.593 |
| BFSD2-BPB-7 | 1.67 | #6 | 35.3 | 1.67 | 1.6716 | 5 | 0.042 | 0.287 | -0.076 | 0.650 |
| BFSD2-BPB-8 | 1.67 | #7 | 42.3 | 1.670 | 1.672 | 6 | 0.042 | 0.344 | -0.019 | 0.707 |
| BFSD2-BPB-9 | 1.67 | #8 | 49.3 | 1.67 | 1.6716 | 7 | 0.042 | 0.401 | 0.038 | 0.764 |
| BFSD2-BPB-10 | 1.67 | #9 | 56.3 | 1.67 | 1.6716 | 8 | 0.042 | 0.458 | 0.095 | 0.821 |
| BFSD2-BPB-11 | 1.67 | #10 | 63.3 | 1.67 | 1.6716 | 9 | 0.042 | 0.515 | 0.152 | 0.878 |
| BFSD2-BPB-12 | 1.67 | #11 | 70.3 | 1.67 | 1.6716 | 10 | 0.042 | 0.572 | 0.209 | 0.935 |
| **BENZO(G,H,I)PERYLENE** | | | | | | | | | | |
| BFSD2-BPB-1 | 1.98 | T-#0 | 0 | 1.9800 | | n/a | | | | |
| BFSD2-BPB-2 | 1.98 | #1 | 0.3 | 1.9800 | 1.9800 | 0 | 0.047 | 0.003 | -0.418 | 0.424 |
| BFSD2-BPB-3 | 1.98 | #2 | 7.3 | 1.9800 | 1.9800 | 1 | 0.047 | 0.069 | -0.352 | 0.490 |
| BFSD2-BPB-4 | 1.98 | #3 | 14.3 | 1.9800 | 1.9800 | 2 | 0.047 | 0.135 | -0.286 | 0.556 |
| BFSD2-BPB-5 | 2.20 | #4 | 21.3 | 2.2000 | 2.2000 | 3 | 0.267 | 0.201 | -0.220 | 0.622 |
| BFSD2-BPB-6 | 1.98 | #5 | 28.3 | 1.9800 | 1.9818 | 4 | 0.049 | 0.267 | -0.154 | 0.688 |
| BFSD2-BPB-7 | 1.98 | #6 | 35.3 | 1.9800 | 1.9818 | 5 | 0.049 | 0.333 | -0.088 | 0.754 |
| BFSD2-BPB-8 | 1.98 | #7 | 42.3 | 1.980 | 1.982 | 6 | 0.049 | 0.399 | -0.022 | 0.820 |
| BFSD2-BPB-10 | 1.98 | #9 | 56.3 | 1.9800 | 2.1138 | 8 | 0.181 | 0.531 | 0.110 | 0.952 |
| BFSD2-BPB-11 | 1.98 | #10 | 63.3 | 1.9800 | 2.1303 | 9 | 0.197 | 0.597 | 0.176 | 1.018 |
| BFSD2-BPB-12 | 1.98 | #11 | 70.3 | 1.9800 | 2.1468 | 10 | 0.214 | 0.663 | 0.242 | 1.084 |

| | | |
|---|---|---|
| **Bottle Volume =** | 0.25 | liters |
| **Chamber Volume =** | 30 | liters |
| **Chamber Area =** | 1701.4 | $cm^2$ |

**BENZO(A)PYRENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.3340 | slope= | #REF! |
| intercept= | 1.2062 | | |
| St. Err of Slope= | 0.0980 | | |
| St Err of Int= | 1.3076 | | |
| R2= | 0.8530 | | |
| St Err of Y= | 1.5345 | St Err of Y= | #REF! |
| F= | 11.60645909 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 27.3306355 | | |
| ResSS= | 4.709556169 | ResSS= | #REF! |
| Sumx2= | 19096.99 | Sumx2= | #REF! |
| Average Conc. | 4.269 | | |
| Initial Conc | 2.000 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | #REF! |
| $S_{(b1-b2)}$ = | #REF! |
| t = | #REF! |
| p = | #REF! |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **1413.41** | **µg/m²/day** |
| **95% CI (low) =** | **-371.66** | **µg/m²/day** |
| **95% CI (high) =** | **3198.48** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **#PBO!** | **µg/m²/day** |
| **95% CI (low) =** | **#PBO!** | **µg/m²/day** |
| **95% CI (high) =** | **#PBO!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.3340 | 1.2062 |
| 0.0980 | 1.3076 |
| 0.8530 | 1.5345 |
| 11.60645909 | 2 |
| 27.3306355 | 4.709556169 |

**Notes**

**INDENO(1,2,3-C,D)PYRENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.0099 | slope= | #REF! |
| intercept= | 1.9310 | | |
| St. Err of Slope= | 0.0057 | | |
| St Err of Int= | 0.0759 | | |
| R2= | 0.6000 | | |
| St Err of Y= | 0.0891 | St Err of Y= | #REF! |
| F= | 3 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 0.023805 | | |
| ResSS= | 0.01587 | ResSS= | #REF! |
| Sumx2= | 16666.5 | Sumx2= | #REF! |
| Average Conc. | 2.026 | | |
| Initial Conc | 1.980 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | #REF! |
| $S_{(b1-b2)}$ = | #REF! |
| t = | #REF! |
| p = | #REF! |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **41.71** | **µg/m²/day** |
| **95% CI (low) =** | **-61.91** | **µg/m²/day** |
| **95% CI (high) =** | **145.34** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **0** | **µg/m²/day** |
| **95% CI (low) =** | **0** | **µg/m²/day** |
| **95% CI (high) =** | **0** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.0099 | 1.9310 |
| 0.0057 | 0.0759 |
| 0.6000 | 0.0891 |
| 3 | 2 |
| 0.023805 | 0.01587 |

**Notes**

**DIBENZ(A,H)ANTHRACENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.0081 | slope= | #REF! |
| intercept= | 1.6296 | | |
| St. Err of Slope= | 0.0047 | | |
| St Err of Int= | 0.0627 | | |
| R2= | 0.6000 | | |
| St Err of Y= | 0.0736 | St Err of Y= | #REF! |
| F= | 3 | | |
| DF= | 2 | DF= | #REF! |
| RegSS= | 0.016245 | | |
| ResSS= | 0.01083 | ResSS= | #REF! |
| Sumx2= | 19096.99 | Sumx2= | #REF! |
| Average Conc. | 1.708 | | |
| Initial Conc | 1.670 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | #REF! |
| $S_{(b1-b2)}$ = | #REF! |
| t = | #REF! |
| p = | #REF! |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **34.46** | **µg/m²/day** |
| **95% CI (low) =** | **-51.14** | **µg/m²/day** |
| **95% CI (high) =** | **120.06** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **#REF!** | |
| **Blank Flux=** | **23.9445835** | **µg/m²/day** |
| **95% CI (low) =** | **1.6285102** | **µg/m²/day** |
| **95% CI (high) =** | **46.2606567** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.0081 | 1.6296 |
| 0.0047 | 0.0627 |
| 0.6000 | 0.0736 |
| 3 | 2 |
| 0.016245 | 0.01083 |

**Notes**

**BENZO(G,H,I)PERYLENE**

| Flux Statistics | | Blank Statistics | |
|---|---|---|---|
| slope= | 0.0094 | slope= | 0.003324437 |
| intercept= | 1.9332 | | |
| St. Err of Slope= | 0.0054 | | |
| St Err of Int= | 0.0726 | | |
| R2= | 0.6000 | | |
| St Err of Y= | 0.0852 | St Err of Y= | 0.01074885 |
| F= | 3 | | |
| DF= | 2 | DF= | 5 |
| RegSS= | 0.02178 | | |
| ResSS= | 0.01452 | ResSS= | 2.434381089 |
| Sumx2= | 16666.5 | Sumx2= | 4214 |
| Average Conc. | 2.024 | | |
| Initial Conc | 1.980 | | |

**Comparitive Statistics**

| | |
|---|---|
| $S^2_{(y-x)}$ = | 0.349843013 |
| $S_{(b1-b2)}$ = | 0.01019853 |
| t = | 0.598530821 |
| p = | 0.568339569 |

**Final Results**

| | | |
|---|---|---|
| **Flux =** | **39.90** | **µg/m²/day** |
| **95% CI (low) =** | **-59.22** | **µg/m²/day** |
| **95% CI (high) =** | **139.02** | **µg/m²/day** |
| **% Conf (dif from blank)=** | **43%** | |
| **Blank Flux=** | **#PBO!** | **µg/m²/day** |
| **95% CI (low) =** | **#PBO!** | **µg/m²/day** |
| **95% CI (high) =** | **#PBO!** | **µg/m²/day** |

LINEST statistics

| | |
|---|---|
| 0.0094 | 1.9332 |
| 0.0054 | 0.0726 |
| 0.6000 | 0.0852 |
| 3 | 2 |
| 0.02178 | 0.01452 |

**Notes**

## BFSD 2
## Bishop Point Summary- PAHs (Part 1)

| PAH | Flux (ng/m$^2$/day)* | +/- 95% C.L. (ng/m$^2$/day) | Flux Rate Confidence (%) | Triplicate Blank Flux (ng/m$^2$/day) Average | Triplicate Blank Flux (ng/m$^2$/day) +/- 95% C.L. | Bulk Sediment (ng/g) | Overlying Water (ng/L) |
|---|---|---|---|---|---|---|---|
| 1. Naphthalene | -110.07 | 596.59 | 38.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 2680.41 | 10124.61 | 51.2% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 627.85 | 1483.64 | 82.7% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 75.17 | 1894.31 | 23.4% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | -552.72 | 1305.06 | 98.2% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 4053.72 | 3094.52 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 4435.81 | 10157.65 | 97.4% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 38.99 | 4132.12 | 28.5% | -439.51 | 70.73 | 150,000 | 20 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*ml/m$^2$/day) | -2518.63 | 152.07 | na | na | na | na | na |
| Silica ($SiO_2$)* (*mg/m$^2$/day) | na | na | na | -1.97 | 2.88 | na | na |

## BFSD 2
## Bishop Point Summary- PAHs (Part 1, First 4 Samples)

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 1,848 | 4,406 | 59.1% | -440.30 | 458.38 | 44 | 13 |
| 2. Acenaphthene | 71,053 | 327,575 | 100.0% | -32.40 | 50.34 | 3,800 | 37 |
| 3. Acenaphthylene | 6,862 | 14,388 | 100.0% | 208.47 | 112.60 | 1,200 | 5.6 |
| 4. Fluorene | 10,387 | 110,973 | 100.0% | -76.74 | 28.38 | 4,800 | 19 |
| 5. Phenanthrene | 3,031 | 106,690 | 99.4% | 10.95 | 10.95 | 54,000 | 32 |
| 6. Anthracene | 26,955 | 27,293 | 100.0% | 117.68 | 64.62 | 10,000 | 13 |
| 7. Fluoranthene | 69,812 | 380,981 | 100.0% | -1423.95 | 178.41 | 270,000 | 52 |
| 8. Pyrene | 24,512 | 190,723 | 100.0% | -439.51 | 70.73 | 150,000 | 20 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -2518.63 | 152.07 | na | na | na | na | na |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | na | na | na | -1.97 | 2.88 | na | na |

## BFSD 2
## Bishop Point Summary- PAHs (Part 1, Last 8 Samples)

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 27.23 | 1,194.31 | 58.0% | -440.30 | 458.38 | 44.00 | 13 |
| 2. Acenaphthene | -4,815.36 | 12,199.50 | 93.5% | -32.40 | 50.34 | 3,800.00 | 37 |
| 3. Acenaphthylene | -1,236.56 | 1,738.17 | 100.0% | 208.47 | 112.60 | 1,200.00 | 5.6 |
| 4. Fluorene | -175.37 | 2,790.40 | 29.9% | -76.74 | 28.38 | 4,800.00 | 19 |
| 5. Phenanthrene | 101.84 | 1,841.97 | 43.9% | 10.95 | 10.95 | 54,000.00 | 32 |
| 6. Anthracene | 803.06 | 2,237.54 | 99.0% | 117.68 | 64.62 | 10,000.00 | 13 |
| 7. Fluoranthene | -332.26 | 14,269.51 | 31.6% | -1423.95 | 178.41 | 270,000.00 | 52 |
| 8. Pyrene | -2,125.92 | 5,818.50 | 99.0% | -439.51 | 70.73 | 150,000.00 | 20 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -2518.63 | 152.07 | na | na | na | na | na |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | na | na | na | -1.97 | 2.88 | na | na |

## BFSD 2
## Bishop Point Site Summary- PAHs (Part 2)

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | 75.00 | 306.84 | NA | NA | NA | 16,000 | Non-Detect |
| 10. CHRYSENE | 1048.91 | 1012.24 | 98.5% | 23.94 | 22.32 | 48,000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 919.89 | 375.56 | 99.8% | -134.30 | 297.91 | 36,000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 234.99 | 156.43 | 93.3% | -9.71 | 36.30 | 10,000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12,000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 6.72 | 67.06 | NA | NA | NA | 7,400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1,500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 7.91 | 64.14 | 11.6% | 20.15 | 65.15 | 5,300 | 1.7 |

## BFSD 2
## Bishop Point Site Summary- PAHs (Part 2, First 4 Samples)

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 16000 | Non-Detect |
| 10. CHRYSENE | 8792.74 | 10650.21 | 100.0% | 23.94 | 22.32 | 48000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 3080.74 | 17862.28 | 99.4% | -134.30 | 297.91 | 36000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 977.52 | 3135.54 | 99.7% | -9.71 | 36.30 | 10000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 122.97 | 7142.02 | NA | NA | NA | 7400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 33.19 | 5249.50 | 7.0% | 20.15 | 65.15 | 5300 | 1.7 |

## BFSD 2
## Bishop Point Site Summary- PAHs (Part 2, Last 8 Samples)

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 16,000 | Non-Detect |
| 10. CHRYSENE | 75.45 | 780.02 | 29.4% | 23.94 | 22.32 | 48,000 | 5.1 |
| 11. BENZO(B)FLUORANTHENE | 810.32 | 561.62 | 99.7% | -134.30 | 297.91 | 36,000 | 6.2 |
| 12. BENZO(K)FLUORANTHENE | 155.56 | 270.41 | 81.2% | -9.71 | 36.30 | 10,000 | 2.5 |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 12,000 | Non-Detect |
| 14. INDENO(1,2,3-C,D)PYRENE | 44.68 | 59.36 | NA | NA | NA | 7,400 | 1.6 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 1,500 | 1.5 |
| 16. BENZO(G,H,I)PERYLENE | 35.55 | 101.15 | 38.6% | 20.15 | 65.15 | 5,300 | 1.7 |

**BFSD 2**
**Bishop Point Demonstration Summary-PCBs**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | -2.62 | 93.70 | 4% | 57.59 | 31.49 | Non Detect | 2.1 |

**BFSD 2**
**Bishop Point Demonstration Summary-Pesticides**

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| Mirex | 61.81 | 110.60 | NA | NA | Non Detect | 1.00 |

## BFSD 2
## Paleta Creek Demonstration Summary- PAHs

| PAH | Flux | +/- 95% C.L. | Flux Rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 1. Naphthalene | 459.20 | 429.58 | 94.5% | -440.30 | 458.38 | 13 | 6.7 |
| 2. Acenaphthene | 337.58 | 178.97 | 100.0% | -32.40 | 50.34 | 19 | 9.7 |
| 3. Acenaphthylene | 105.51 | 183.82 | 33.8% | 208.47 | 112.60 | 220 | 7.6 |
| 4. Fluorene | 173.17 | 149.76 | 100.0% | -76.74 | 28.38 | 34 | 2.3 |
| 5. Phenanthrene | 489.25 | 659.77 | 100.0% | 10.95 | 10.95 | 240 | 8.2 |
| 6. Anthracene | 569.42 | 260.29 | 100.0% | 117.68 | 64.62 | 470 | 5.3 |
| 7. Fluoranthene | 365.55 | 397.63 | 100.0% | -1423.95 | 178.41 | 890 | 37 |
| 8. Pyrene | 951.97 | 755.67 | 100.0% | -439.51 | 70.73 | 740 | 13 |

| Other | | | | | | | |
|---|---|---|---|---|---|---|---|
| Oxygen ($O_2$)* (*$ml/m^2/day$) | -2193.62 | 146.52 | na | na | na | na | na |
| Silica ($SiO_2$)* (*$mg/m^2/day$) | na | na | na | -1.97 | 2.88 | na | na |

**BFSD 2**
**Paleta Creek Demonstration Summary- PAHs (Part 2)**

| PAH | Flux | +/- 95% C.L. | Flux rate Confidence | Triplicate Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Average | +/- 95% C.L. | (ng/g) | (ng/L) |
| 9. BENZO(A)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 500 | |
| 10. CHRYSENE | Non-Detect | NA | NA | 23.94 | 22.32 | 830 | |
| 11. BENZO(B)FLUORANTHENE | Non-Detect | NA | NA | -134.30 | 297.91 | 1400 | |
| 12. BENZO(K)FLUORANTHENE | Non-Detect | NA | NA | -9.71 | 36.30 | 470 | |
| 13. BENZO(A)PYRENE | Non-Detect | NA | NA | NA | NA | 790 | |
| 14. INDENO(1,2,3-C,D)PYRENE | -65.35 | 906.77 | NA | NA | NA | 470 | 1.40 |
| 15. DIBENZ(A,H)ANTHRACENE | Non-Detect | NA | NA | NA | NA | 120 | |
| 16. BENZO(G,H,I)PERYLENE | -46.63 | 263.97 | 67.7% | 20.15 | 65.15 | 400 | 1.40 |

**BFSD 2**
**Paleta Creek Demonstration Summary-PCBs**

| PCB | Flux | +/- 95% C.L. | Flux rate Confidence | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | (%) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 18 - 2,2',5-Trichlorobiphenyl | 52.21 | 103.93 | 4% | 76.82 | 36.49 | 2.6 | ND |
| 28 - 2,4,4'-Trichlorobiphenyl | 41.52 | 80.03 | 61% | -8.05 | 82.03 | 2.2 | 1.1 |
| 52 - 2,2',5,5'-Tetrachlorobiphenyl | 9.44 | 105.28 | 77% | 72.74 | 28.12 | 4.9 | 3 |
| 66 - 2,3',4,4'-Tetrachlorobiphenyl | -19.94 | 62.01 | 96% | 37.74 | 25.45 | 5.3 | ND |
| 101 - 2,2',4,5,5'-Pentachlorobiphenyl | 45.99 | 84.58 | 17% | 57.59 | 31.49 | 13 | ND |
| 118 - 2,3',4,4',5-Pentachlorobiphenyl | -2.34 | 123.95 | 9% | 2.51 | 15.40 | 13 | ND |
| 153 - 2,2',4,4',5,5'-Hexachlorobiphenyl | 22.26 | 78.55 | 43% | 9.45 | 11.71 | 23 | 0.11 |

## BFSD 2
## Paleta Creek Demonstration Summary-Pesticides

| Pesticide | Flux | +/- 95% C.L. | Blank Flux ($ng/m^2/day$) | | Bulk Sediment | Overlying Water |
|---|---|---|---|---|---|---|
| | ($ng/m^2/day$)* | ($ng/m^2/day$) | Flux | +/- 95% C.L. | (ng/g) | (ng/L) |
| 2,4'-DDT | 57.49 | 95.75 | NA | NA | 3.6 | 0.88 |
| 4,4'-DDT | 31.23 | 55.47 | NA | NA | 14 | ND |
| Dieldrin | -23.48 | 45.68 | NA | NA | 2 | ND |
| Hexachlorobenzene | 23.76 | 35.20 | NA | NA | 0.61 | ND |
| Mirex | 36.23 | 154.93 | NA | NA | ND | ND |

# Appendix C

**Standard Procedures and Checklists**

**********

## BFSD 2
## ON DECK FINAL CHECKLIST

1. **Establish Laptop communications and verify "Sensor Check/$Br^-$ Injection" program file is loaded.**

2. **Oxygen Tank - Turn Valve ON**

3. **$Br^-$ Injection Valve OPEN (in-line position)**

4. **Sensor Caps - Slide CTD back and REMOVE $O_2$ & pH storage solution caps (reinstall CTD)**

5. **Vacuum Check - Assure bottles #2- #12 have >25 in-Hg**

6. **INSTALL Check Valve plugs in bottles #2 - #12 (hand tight + ½ turn)**

7. **Check each insertion lever movement and light function**

8. **Check Camera FOV – Coverage of Insertion lights, lid closure, collection chamber & $Br^-$ Injection vent bubbles**

9. **Open & latch lid - set rotary latch for ½ turn**

10. Evacuate Bottle #1 to >25 in-Hg and install check valve plug

11. Rig release hasp and proceed to <u>water entry</u>

## <u>BFSD 2</u>
## <u>IN WATER FINAL PROCEDURE/CHECKLIST</u>

1. Lift BFSD, remove wheels and suspend over water

2. Submerge fully, stop and inspect for evidence of leakage

3. Lower to within view of bottom and inspect surface for adequate landing and seal potential

4. Execute bottom landing/chamber insertion by either
   a. slowly descending and assuring insertion light function with minimum loss of visibility, or
   b. rapidly descending and assuring insertion light function with possible impaired visibility.

   <u>IMPORTANT</u> – Surface vessel must be able to hold position (+/- ~50 feet) for next 30 minutes (max). Overboard cables must not be allowed to tighten and disturb BFSD insertion.

5. Run "Sensor Check/$Br^-$ Injection" program and visually verify lid closure followed by vent bubbles ($Br^-$ Injection). Verify commands for CTD, pump and sensor operation by evidence of laptop computer data. After ~10 minutes, upload data, paste into Excel template and establish ambient $O_2$ level and control values.

6. Modify final test program with selected $O_2$ control limits and download to CTD - <u>verify</u> all loops

7. Run final test program and if surface vessel position hold allows, verify operation from laptop data.

8. Important – *First* close Laptop communications interface and *then* disconnect cables

9. Install and tape watertight connectors, bundle cables and cast overboard - clear of BFSD location

10. Record location, weather conditions, etc, and secure for departure

## BFSD 2
## SHORESIDE DEPLOYMENT PREPARATIONS

1. Batteries checked/replaced/refreshed:
   a. Gel cell charged to 24 Vdc @ 25 ma rate
   b. 14 new D-Cells - pump
   c. 6 new 9 Vdc batts - acoustic receiver
   d. 1 new D-Cell - landing lights
   e. CTD checked for 10+ Vdc

2. All components cleaned:
   a. Sample bottles cleaned, assembled and vacuum checked (with slow leakers identified for early positions)
   b. Pneumatic syringe cleaned and loaded w/52 ml $Br^-$ concentrate
   c. Valves/tubing fully rinsed and dried
   d. Chamber cleaned (and "bagged" if req'd)

3. Check loops confirm all subsystems operational

4. Rotary valves in "start" position

5. **Bottles installed and >25 in-Hg applied (any slow leakers in early positions).**

6. **$O_2$ pressure checked and adequate for deployment**

7. **Pneumatic syringe installed**

8. **Acoustic Receiver prepared:**
   **a. Ground plate sanded/buffed clean of deposits**
   **b. Switch in "ON" position**
   **c. Burn wire (with one wire removed) installed**
   **d. Function test performed**

8. **Sensors Calibrated**

9. **Laptop Status**
   a. **Loops designed & checked**
   b. **File structure set up (Operations: Loops Library/Data)**
   c. **Template functions adjusted for calibrations**

**BFSD 2**
**DEPLOYMENT EQUIPMENT LIST**

1. **Cables**
   - **one 75’ primary underwater 3-cable set (Comm, Video, light)**
   - **three Pigtail cables for Laptop comm, TV/VCR, Light**
   - **Underwater connector plugs**

2. **Computer Case**
   - **Laptop computer**
   - **AC Power supply**
   - **Log book**
   - **Check lists, cheat sheets, etc**
   - **Floppy drive w/data discs**
   - **Mouse w/pad**

3. **TV/VCR, controller, VHS Tape(s)**

4. **Video camera power supply**

5. **Tool box**

6. **Extension cord/power strip**

7. **Hand vacuum pump**

**BFSD 2**
**RETRIEVAL/RECOVERY CHECKLIST**

1. **Stand off from deployment location > 100' and transmit coded sonar pulse using EdgeTech deck unit (2 series of pulses). Allow 15 min (max) for buoy to deploy and reach surface.**

2. **Prepare deck hoist equipment and attach to buoy line**

3. **Raise to a visible depth and inspect/clear any fouling.**

4. **Raise above surface, open and secure lid, and washdown over water. Clear cables and haul onboard**

5. **Haul over deck, install pneumatic wheels and lower to deck**

6. **Turn Oxygen tank valve "off"**

7. **Verify system is shut down (ie, pump off). Inspect for damage, leakage and/or other abnormalities**

8. **Inspect and note bottle fill conditions, $Br^-$ syringe injection condition, and measure "scum" line location**

9. **Slide CTD back and install pH and $O_2$ storage caps**

10. **Disconnect "comm" cable plug and upload data to prepared file location. Record copy of data to floppy disc.**

11. **Remove and label sample bottles one at a time, capping inlet port immediately upon removal of teflon fill tube.**

12. **Disconnect cables and plug open connectors. Secure cables.**

13. **Thoroughly wash down with fresh water and flush valves/tubing with fresh/DI water without delay**

## BFSD 2

### Sample Bottle Cleaning and Preparation

1. **Disassembly for cleaning (After sample removed)**
   a. **By hand, unscrew and remove lid from bottle. Avoid gripping and turning filter holder. Set bottle aside.**
   b. **By hand, unscrew filter holder halves. Avoid gripping and turning bottle lid. Using tweezers, remove membrane filter and store in marked Petre dish (if required). Remove orange O-ring and, using blunt object, dislodge and remove black filter support. Set lid/lower filter holder, O-ring and support assembly aside.**
   c. **Using crescent wrench, unscrew and remove plug from top of check valve (if still there), then unscrew and remove spring retainer from top of check valve. Remove spring and valve plunger. Set parts aside.**
   d. **Using crescent wrench, unscrew and remove tubing plug from upper filter holder/tee assembly. Set parts aside.**

2. **Cleaning**
   a. **Rinse all parts in tap water to remove loose material.**
   b. **Rinse all parts thoroughly in deionized water.**
   c. **Soak all parts in 4% RBS solution for 4 hours minimum (24 hours preferred)**
   d. **Rinse all parts in deionized water**
   e. **Soak sample bottles and teflon tubing plugs in 25% nitric acid solution for 4 hours minimum (24 hours preferred)**
   f. **Soak Upper and lower filter holder assemblies, orange O-rings and black filter supports in 10% nitric acid for 4 hrs (24 hours is OK but NOT preferred).**
   g. **Rinse all parts in deionized water followed by thorough rinsing with 18meg-ohm water.**

h. **Set all parts in vented hood and allow to thoroughly air dry (overnight is preferred).**

3. **Assembly and preservation**
   a. **Assemble in the reverse the order of 1. above, with the following additions:**
      - **Apply a very thin layer of silicon grease to the check valve O-ring. Using the attached spring, lower the assembly into the check valve body and fully rotate it several times against the mating seat. Secure the spring with the retainer and tighten with a crescent wrench.**
      - **Snap a black filter support into the lower filter holder/lid assembly. Using tweezers, secure a membrane filter and position it on top of the filter support. Position an orange O-ring on top of the membrane filter and hand tighten the upper filter holder assembly in place. Securely tighten the assembly taking care not to grip and/or rotate the lid.**
      - **Assemble a tube plug and tighten with a crescent wrench.**
      - **Install a teflon gasket into the sample bottle lid (if used) and securely tighten the lid assembly to the sample bottle. Avoid gripping and/or turning the filter holder.**
      - **Using a hand vacuum pump, evacuate the finished assemble to 25 in-Hg and set aside for 4 hours minimum (24 hours is preferred).**
      - **If no leakage occurs, sample bottles may be used. If slight leakage occurs on a few, they may be labled and used early in sample sequence. Leakage may be resolved by further tightening of sample bottle lid. Any leakage resolution requiring disassembly shall include cleaning as above.**