44. Several alternative upland soil and ground water cleanup levels for the site were evaluated by PTI including (1) no action (2) cleanup to background levels, (3) cleanup to Bays and Estuaries water quality objectives and (4) an intermediate cleanup level between background and Bays and Estuaries water quality objectives. The PTI SI/CAR report considers six alternatives for the remediation of the contaminated soil and five alternatives for the remediation of the contaminated ground water for various levels. On May 2, 1995 PTI submitted supplemental data for remedial actions for cleanup to background, water quality objectives and a level in between background and water quality objectives. These alternatives and costs are summarized below:

SUMMARY OF ESTIMATED REMEDIAL ACTION COSTS

SOIL

Alternative		Cost ($in millions)			
		Background	Mid - Level	Water Quality Obj.	Human Health
S5 -	Removal and Offsite Disposal	$7.9	$7.9	$7.9	$1.5
S6 -	Thermal Desorption	$5.82	$5.82	$5.82	$1.1

GROUNDWATER

Alternative		Cost ($in millions)			
		Background	Mid - Level	Water Quality Obj.	Free product removal
GW4-	Soil Excavation/ Removal of Floating Product	--	--	--	$0.015
GW5-	Recovery Wells and Soil Excavation/ Removal of Floating Product	--	--	--	$0.055
GW5A-	Ground water extraction and treatment	$4.83	$2.68	$1.75	--
GW5B-	Ground water and NAPL extraction and treatment	$5.47	$3.07	$2.02	--

45. The PTI SI/CAR report recommended a method for treatment and disposal of the contamination at the site based on SI/CAR Alternative S6 and Alternative GW4. This recommended alternative has several components:

a) Removal and Treatment of Floating Product - Floating product in wells adjacent to the seawall will be removed either using recovery wells or by excavating pits to the ground water table and skimming the floating product off the ground water surface. The recovered product will be transported offsite to a treatment/recycling facility.

b) Removal and Treatment of Soil - Soil containing elevated levels of TPH in the south parking lot and in the vicinity of the seawall will be excavated and treated by thermal desorption to remove petroleum hydrocarbons. The diesel pipelines underlying the site will also be removed, and associated TPH affected soil exceeding the remediation level will be treated.

c) Capping of the East Parking Lot - Soil in the east parking lot contains elevated concentrations of TPH and PAHs; however, migration of TPH constituents (including PAHs and VOCs) in the direction of San Diego Bay via ground water was demonstrated to be negligible. The east parking lot will be capped with paving, structures, and landscaping during redevelopment and will not require additional remedial action.

d) Installation of a New Seawall/Bulkhead - A new seawall/bulkhead will be installed to replace the existing seawall. To the extent possible, this construction effort will be coordinated with the removal of the diesel pipelines, floating product, and TPH affected soil in the vicinity of the existing seawall.

e) Monitoring - Monitoring will be conducted during remediation to ensure that no unacceptable adverse human health or environmental effects occur. Confirmational monitoring will be conducted following completion of remediation to ensure that remedial action objectives have been met.

REGIONAL BOARD SELECTED CLEANUP LEVELS

46. In setting cleanup levels at any site the Regional Board must consider the terms and conditions of State Board Resolution No. 92-49 (Polices and Procedures For Investigation and Cleanup and Abatement of Discharges), under Water Code Section 13304. These conditions includes 1) site-specific characteristics; 2) applicable state and federal statutes and regulations; 3) the Basin Plan; and 4) State Board Resolution No. 68-16 (Statement of Policy with Respect to Maintaining High Quality Waters in California). The Regional Board has selected the following cleanup levels for San Diego Bay sediments, ground water, and soil at the Campbell Shipyard site in conformance with the requirements of State Board Resolution No. 92-49:

a) San Diego Bay **sediments** at the Campbell Shipyards site.

Constituent	Level (mg/kg dry wt.)
Copper	810
Zinc	820
Lead	231
Total Petroleum Hydrocarbons	4300
HPAHs	44
PCBs	0.95
Tributyltin	5.75

b) **Ground water** along the seawall as described in Figure 5 of the May 1995 PTI Supplemental Soil and Ground Water report.

Constituent	Level (mg/l)
PAHs	0.000031
Benzene	0.021
Toluene	300
Ethylbenzene	29
Fluoranthene	0.042
Free Product	Recover all free product from the affected ground water zone.

c) **Soil** at the Campbell Shipyards site. No cleanup required for soil at the East Parking Lot provided Parking Lot Cap conditions exist.

Constituent	Level (mg/kg)
PAHs	3.9
TPH	1000

47. The cleanup levels for soil, ground water and bay sediment are based on the following considerations:

a) Ensuring that the dischargers are required to cleanup the site to levels as close to background conditions as is technically or economically feasible;

b) The need to provide assimilative capacity for possible future waste discharges;

c) PTI's bay sediment toxicity data on amphipod mortality, polychaete growth depressions, depression in total benthic infauna abundance and depression in amphipod abundance;

d) PTI's bay sediment pore water and partition coefficient data;

e) The pattern of higher mercury concentrations in bay sediments lie within the cleanup area defined by the copper cleanup level;

f) PTI's analysis of risk based concentrations for soil and ground water contaminants; and

g) The need to prevent exceedances of San Diego Bay water quality goals due to migration of contaminants from soil, ground water, and bay sediments.

CEQA EXEMPTION

48. This enforcement action is exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000 et. seq.) in accordance with Section 15321, Chapter 3, Title 14, California Code of Regulations.

IT IS HEREBY ORDERED, that pursuant to Section 13304 of the California Water Code, Campbell Industries and Marine Construction and Design Company Holding, Inc. of Seattle (hereinafter dischargers) shall comply with the following directives:

1. The dischargers shall forthwith achieve and maintain compliance with Prohibition A.2, Discharge Specifications B.3, and Provisions D.1 and D.11 of Order No. 85-01.

2. The dischargers shall submit a technical report by September 1, 1995 demonstrating, to the satisfaction of the Regional Board Executive Officer, that the best management practices plan currently used at Campbell Shipyards is in full conformance with the requirements set forth in "Title 40, Code of Federal Regulations, Part 125, Subpart K-Criteria and Standards for Best Management Practices Authorized Under Section 304(e) of the Clean Water Act". If the best management practices plan is not in conformance with 40 CFR 125, the technical report shall identify any changes needed to the best management practices plan to achieve conformance.

3. The dischargers shall cleanup contaminated bay sediment at the Campbell Shipyards site to the levels specified below:

CONSTITUENT	BAY SEDIMENT (mg/kg) Dry Weight
Copper	810
Zinc	820
Lead	231
Tributyltin (TBT)	5.75
HPAH'S	44
PCB's	0.95
Total Petroleum Hydrocarbons	4300

4. The dischargers shall cleanup contaminated soils in the upland portion of the site as summarized on page 6-13 of the SI/CAR report and Finding 45 of this Order in all areas except the east parking lot area. Contaminated soils shall be cleaned to the levels specified below:

CONSTITUENT	UPLAND SOILS (mg/kg) (Dry Weight)
Polynuclear Aromatic Hydrocarbons	3.9
Total Petroleum Hydrocarbons (TPH)	1000

5. The dischargers shall cleanup soils at the east parking lot portion of the site as summarized on page 6-13 of the PTI's SI/CAR Report and Finding 45 of this Order.

6. The dischargers shall cleanup ground water, adjacent to the seawall as described in Figure 5 of the May 1995 PTI Supplemental Soil and Ground Water report, to the levels specified below:

CONSTITUENT	Ground Water (mg/l)
Polynuclear Aromatic Hydrocarbons	0.000031
Benzene	0.021
Toluene	300
Ethylbenzene	29
Fluoranthene	0.042
Free Product	Recover all free product

7. The dischargers shall achieve compliance with directives 3,4,5, and 6 in accordance with the following schedule and prior to initiation of construction of any portion of the proposed site redevelopment project:

	Task	Date of Compliance
a)	Submit a preliminary design plan including a description of all remediation activities to be conducted, a map depicting the area to be cleaned up, the permits and other governmental approvals needed, and a time schedule for completion of each task.	October 1, 1995
b)	Complete ground water cleanup in conformance with Directive No 6.	June 1, 1996
c)	Submit all necessary applications for permits and other governmental approvals necessary to complete the cleanup project.	February 1, 1998
d)	Submit a final design plan for the cleanup project.	March 1, 1998
e)	Submit a post cleanup sampling plan to verify conformance with the cleanup levels required in Directives 3, 4, and 5.	May 1, 1998
f)	Complete bidding and award of a contract for the cleanup project.	September 1, 1998
g)	Complete cleanup of the site in conformance with Directives 3, 4, and 5.	June 1, 1999
h)	Submit the results of a post cleanup sampling plan.	July 1, 1999

8. The dischargers shall submit a technical report by October 1, 1995 comparing soil leachate concentration values for copper, lead, and zinc in the area south of Gull street with the following water quality goals for San Diego Bay (see Finding 25):

Copper	2.9 µg/l
Lead	5.6 µg/l
Zinc	86 µg/l

If the soil leachate values exceed the above water quality goals for San Diego Bay, additional information should be provided describing the degree of expected attenuation at the site. The attenuation must be sufficient to ensure that constituents from the site will not ultimately migrate to ground water in amounts sufficient to cause or contribute to an exceedance of the water quality goals. Appropriate attenuation factors to be considered include processes such as absorption of constituents to clay particles and organic material in the soil, ionic or covalent binding of the constituents to soil components, filtration of larger constituents by fine grained soils, and chemical or biochemical degradation. These attenuation processes may be enhanced by an engineered impervious cap.

If analysis of the soil leachate shows that the soluble constituent concentrations are equal or greater than the quantity (environmental attenuation factor) x (water quality goals) mg/l, constituents migrating from the soil will not receive sufficient attenuation as they migrate to ground water and the resulting concentration in ground water may exceed the water quality goals.

Based upon the information described above the Regional Board Executive Officer may amend this cleanup and abatement order to require soil remediation for copper, lead, and zinc in the area south of Gull Street.

9. The dischargers shall submit a technical report by July 10, 1995 demonstrating that no significant migration of contaminants from soil or ground water in the east parking lot area of the site to San Diego Bay will occur. The report shall include the following information:

a) An analysis based on technically sound principles demonstrating that soil fuel product contaminants will be reduced by natural biodegradation over time. This analysis shall also include actual on - site sample data verifying that the natural degradation processes are occurring.

b) An analysis based on technically sound principles demonstrating that soil fuel product contaminants will not generate free product due to ambient, or anticipated fluctuations in, ground water elevations at the site;

c) An analysis demonstrating that no significant migration of contaminants to San Diego Bay will occur due to hydrogeological or chemical characteristics. The demonstration shall be based on aquifer characteristics, fate and transport characteristics, soil leachability analysis or other technically sound principles.

10. The discharger shall submit quarterly progress reports on the cleanup to the Regional Board in accordance with the following reporting schedule:

Reporting Period	Report Due
January, February, March	April 30
April, May, June	July 30
July, August, September	October 30
October, November, December	January 30

11. The dischargers shall dispose of contaminated bay sediment, soil and ground water in accordance with applicable federal, state, and local regulations. Prior to disposal in California of contaminated bay sediments and soils, the discharger shall submit a Report of Waste Discharge (RWD) to the Executive Officer pursuant to California Code of Regulations, Title 23, Division 3, Chapter 15. Upon determining the RWD to be complete, the Regional Board may issue either waste discharge requirements (WDRs) or a waiver of WDRs.

12. The dischargers shall ensure that:

a) All reports required by this cleanup and abatement order are prepared by professionals qualified to prepare such reports. Professionals should be qualified, licensed where applicable, and competent and proficient in the fields pertinent to the required activities. California Business and Professions Code

Sections 6735, 7835, and 7835.1 require that engineering and geologic evaluations and judgements be performed by or under the direction of registered professionals.

b) All components of investigative and cleanup and abatement actions required under this order are conducted under the direction of appropriately qualified professionals.

c) A statement of qualifications of the responsible lead professionals shall be included in all plans and reports submitted to the Regional Board. Plans and reports which do not contain this statement will be deemed incomplete by the Regional Board Executive Officer for the purpose of compliance with this cleanup and abatement order.

PROVISIONS

1. Failure to submit technical reports required under this Cleanup and Abatement Order may result in the imposition of civil liabilities, under California Water Code section 13350(f), in an amount not to exceed ten thousand dollars ($10,000) for each day in which the violation occurs.

2. The cleanup levels in this order are applicable for cleanup at the Campbell Shipyard site and shall not be construed to be applicable or transferable to any other location.

ARTHUR L. COE
Executive Officer

Date Order No. 95-21 issued: May 24, 1995

Revised at Regional Board meeting
June 8, 1995

Campbell\CAO\95'21-1.U95

ITEM 15-2

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ADDENDUM NO. 1 TO
CLEANUP AND ABATEMENT ORDER NO. 95-21

CAMPBELL INDUSTRIES
MARINE CONSTRUCTION AND DESIGN COMPANY

CAMPBELL SHIPYARDS
501 EAST HARBOR DRIVE
SAN DIEGO, CALIFORNIA

SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

1. On May 24, 1995, the Executive Officer issued Cleanup and Abatement Order (CAO) No. 95-21 to Campbell Industries and Marine Construction and Design Company Holding, Inc. The order requires the cleanup of approximately 17,000 cubic yards of contaminated bay sediment containing elevated concentrations of metals and other contaminants that have accumulated in San Diego bay sediments over the years. The order also requires the cleanup of soil and ground water located at the Campbell Shipyards site.

2. Directive 7.b of CAO No. 95-21 requires Campbell Industries and Marine Construction and Design Company to complete ground water cleanup in conformance with Directive 6 of CAO No. 95-21 by June 1, 1996.

3. Directive 7.e of CAO No. 95-21 requires Campbell Industries and Marine Construction and Design Company to submit a post cleanup sampling plan to verify conformance with the cleanup levels required in Directives 3, 4, and 5 of CAO No. 95-21 by May 1, 1998.

4. Directive 7.g of CAO No. 95-21 requires Campbell Industries and Marine Construction and Design Company to complete cleanup of the site in conformance with Directives 3, 4, and 5 of CAO No. 95-21 by June 1, 1999.

5. On January 31, 1996, Campbell Industries and Marine Construction and Design Company requested that the compliance date in Directive No. 7.b be extended to coincide with Directive 7.g of June 1, 1999. This extension is requested because the ground water cleanup compliance date is out of sequence with the soil and bay sediments cleanup compliance date. Allowing cleanup of the soil and ground water to proceed concurrently would be the most cost effective procedure.

6. The compliance date of Directive 7.b (June 1, 1996) was originally selected to address the cleanup of petroleum free floating product. The Regional Board staff did not intend that ground water cleanup of dissolved contaminants be completed by this date. Directive 7.b should be revised to require cleanup of only petroleum free floating product by June 1, 1996.

7. Directives 7.e and 7.g should be revised to include completion of ground water cleanup in conformance with Directive 6.

8. This enforcement action is exempt from the provisions of the California Environmental Quality Act in accordance with Section 15321, Chapter 3, Title 14 of the California Administrative Code.

IT IS HEREBY ORDERED That pursuant to Section 13304 of the California Water Code, Campbell Industries and Marine Construction and Design Company shall comply with the following directives:

1. Directive 7.b of CAO No. 95-21 is changed to the following:

   7. b) Complete cleanup of petroleum free floating product. Date of Compliance - June 1, 1996.

2. Directive 7.e of CAO No. 95-21 is changed to the following:

   7. e) Submit a post cleanup sampling plan to verify conformance with the cleanup levels required in

Directives 3, 4, 5, and 6. Date of Compliance - May 1, 1998.

3. Directive 7.g of CAO No. 95-21 is changed to the following:

7. g) Complete cleanup of the site in conformance with Directives 3, 4, 5, and 6. Date of Compliance - June 1, 1999.

PROVISIONS

1. The compliance dates and tasks contained in Directive 7.b, 7.e, and 7.g of Cleanup and Abatement Order No. 95-21 are superseded by this addendum.

Issued by: John H. Robertus

John H. Robertus
Executive Officer

Date: February 29, 1996

95-21A01.M96

ITEM 15-3

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ADDENDUM NO. 2 TO
CLEANUP AND ABATEMENT ORDER NO. 95-21

CAMPBELL INDUSTRIES
MARINE CONSTRUCTION AND DESIGN COMPANY

CAMPBELL SHIPYARDS
501 EAST HARBOR DRIVE
SAN DIEGO, CALIFORNIA

SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

1. On May 24, 1995, the Executive Officer issued Cleanup and Abatement Order (CAO) No. 95-21 to Campbell Industries and Marine Construction and Design Company Holding, Inc. The order requires the cleanup of approximately 17,000 cubic yards of contaminated bay sediment containing elevated concentrations of metals and other contaminants that have accumulated in San Diego Bay sediments over the years. The order also requires the cleanup of soil and groundwater located at the Campbell Shipyards site.

2. In a letter dated September 10, 1997, Campbell Industries and Marine Construction and Design Company requested an extension of the compliance dates for tasks 7.c through 7.h outlined in Directive 7 of the CAO in order to coincide with the proposed redevelopment of the shipyard facilities.

3. The Regional Board has determined that tasks 7.c through 7.e (all necessary applications, approvals, the final design plan, and post cleanup sampling plan) shall still be submitted according to the schedule in Directive 7 of the CAO. An extension for tasks 7.f through 7.h (the contract award date, completion of the cleanup, and submittal of the results of the post sampling plan) should be granted for one year to allow remediation activities to proceed concurrently with redevelopment in order to be most cost effective. However, remediation shall not be delayed beyond one year, regardless of the status of redevelopment activities.

4. The final design report required under task 1.d of this addendum shall contain two separate design plans, one based on the scenario that the shipyard will be developed into a hotel and marina, and one based on the scenario that the shipyard will continue operations and that redevelopment will not occur. This requirement will ensure that cleanup activities will proceed without delay regardless of the final disposition of Campbell Shipyards.

5. This enforcement action is exempt from the provisions of the California Environmental Quality Act in accordance with Section 15321, Chapter 3, Title 14 of the California Administrative Code.

IT IS HEREBY ORDERED That pursuant to section 13304 of the California Water Code, Campbell Industries and Marine Construction and Design Company shall comply with the following directive:

1. Directive 7.c through 7.h are revised as follows:

Task		Date of Compliance
c)	Submit all necessary applications for permits and other governmental approvals necessary to complete the cleanup project	February 1, 1999
d)	Submit final design report including two design plans for the cleanup project	March 1, 1998
e)	Submit a post cleanup sampling plan to verify conformance with the cleanup levels required in Directives 3, 4, 5, and 6	May 1, 1998
f)	Complete bidding and award contract for the cleanup project	September 1, 1999
g)	Complete cleanup of the site in conformance with Directives 3, 4, 5, and 6	June 1, 2000
h)	Submit the results of a post cleanup sampling plan	July 1, 2000

PROVISIONS

1. The compliance dates and tasks contained in Directive 7.c through 7.h of Cleanup and Abatement Order No. 95-21 and Addendum No. 1 to Order No. 95-21 are superseded by this addendum.

Issued by:
JOHN H. ROBERTUS
Executive Officer

Date: November 12, 1997

ITEM 15-4

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

ADDENDUM NO. 3 TO
CLEANUP AND ABATEMENT ORDER NO. 95-21

CAMPBELL INDUSTRIES
MARINE CONSTRUCTION AND DESIGN COMPANY
PORT OF SAN DIEGO

CAMPBELL SHIPYARDS
501 EAST HARBOR DRIVE
SAN DIEGO, CALIFORNIA

SAN DIEGO COUNTY

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board) finds that:

1. Cleanup and Abatement Order No. 95-21 requires Campbell Industries to clean up approximately 17,000 cubic yards of sediment containing elevated concentrations of metals and other contaminants that have accumulated in San Diego Bay at the Campbell shipyard sediments over the years. The order also requires the cleanup of soil and ground water located at the Campbell Shipyards site. Currently, shipyard operations have ceased and existing structures have been removed and demolished.

2. Addenda Nos. 1 and 2 to Cleanup and Abatement Order No. 95-21 modified compliance dates.

3. The Port of San Diego is the trustee of all sites currently known to the Regional Board where ship construction, modification, repair, and maintenance facilities are operated by commercial entities. The Port of San Diego is ultimately responsible for the consequences (e.g. cleanup and abatement) of all discharges associated with ship construction, modification, repair, and maintenance activities at sites for which it is the trustee. The Port of San Diego may also be responsible for the consequences (e.g. cleanup and abatement) of all discharges within and from such sites, including those discharges which are not subject to NPDES requirements pursuant to 40 CFR 122.3. The Port of San Diego may be responsible for the failure of its tenants to comply with Cleanup and Abatement Order No. 95-21.

4. The Port of San Diego has assumed direct responsibility for all remaining remediation and demolition actions required under the terms of the Lease Termination Agreement between the Port of San Diego and Campbell Industries as of August 8, 2000.

5. Campbell Industries and Marine and Construction Design Company have violated Directives 3, 4, 5, 6, and 7 of Cleanup and Abatement Order No. 95-21 by failing to complete cleanup of soil containing wastes, polluted groundwater, and bay sediment containing wastes at the Campbell Shipyard site by June 1, 2000.

'S HEREBY ORDERED that, pursuant to California Water Code Section 13304:

1. Cleanup and Abatement Order No. 95-21 and Addenda are amended to add the Port of San Diego as a responsible party. The directives of Cleanup and Abatement Order No. 95-21 and Addenda shall be construed hereafter to refer to Campbell Industries, Marine Construction and Design Company Holding, Inc., and the Port of San Diego unless otherwise stated. The title headings of Cleanup and Abatement Order No. 95-21 and Addenda are amended to read:

   CAMPBELL INDUSTRIES
   MARINE CONSTRUCTION AND DESIGN COMPANY
   PORT OF SAN DIEGO

   CAMPBELL SHIPYARDS
   501 EAST HARBOR DRIVE
   SAN DIEGO, CALIFORNIA

   SAN DIEGO COUNTY

2. Port of San Diego shall comply with all requirements for cleanup and abatement of wastes at the Campbell Industries shipyard site as set forth in Cleanup and Abatement Order No. 95-21, as amended, to the same extent, and according to the same time schedule, as other persons identified as persons responsible for causing or permitting discharges or deposition of waste at or from the site in this order.

   Campbell Industries, Marine Construction and Design Company Holding, Inc., and the Port of San Diego shall reimburse the state for all reasonable costs actually incurred by the Regional Board to investigate unauthorized discharges or deposition of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by Cleanup and Abatement Order No. 95-21, as amended after October 27, 2000. The billing statements for such costs will be generated by the State Water Resources Control Board. Upon receipt of a billing statement, Campbell Industries, Marine Construction and Design Company Holding, Inc., and the Port of San Diego shall submit a check or money order payable to the State Water Resources Control Board.

Issued by: John H Robertus
John H. Robertus
Executive Officer

Date Addendum No. 3 to
Cleanup and Abatement Order issued: October 27, 2000

File No.: 03-0041.05
CAO 95-21 Addendum 3 Add Port.8Nov2000RBmtg.tca.doc

ITEM 15-5

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

IN THE MATTER OF H. Allen Fernstrom MARCO Seattle 2300 W. Commodore Way Seattle, WA 98199 William R. Boyles Campbell Industries Eighth Avenue at Harbor Drive P.O. Box 121870 San Diego, CA 92112-1870	**NOTICE OF VIOLATION NO. 2000-137**

YOU ARE HEREBY NOTIFIED THAT:

1. Campbell Industries and MARCO are in violation of Directives 3, 4, 5, 6, and 7 of Cleanup and Abatement Order No. 95-21 in that Campbell Industries and MARCO have failed to complete cleanup of soil containing wastes, polluted groundwater, and bay sediment containing wastes at the Campbell Shipyard site by June 1, 2000.

2. As a result of this failure, the Regional Board may impose civil liability on Campbell Industries and MARCO in an amount not exceeding $10,000 per day of violation for each violation.

3. This Notice of Violation is based on the following specific circumstances:

   a. As of May 25, 2000, cleanup and abatement activities pertaining to soil, groundwater, and bay sediment had not commenced at the site. Demolition activities and additional site investigations were being performed throughout the site. It would not have been possible for Campbell Industries and MARCO to have completed cleanup and abatement activities set forth in Order No. 95-21 between May 25, 2000 and June 1, 2000.

   b. On July 18, 2000, approximately 6 weeks after all cleanup and abatement activities were required to be completed, Hart Crowser, Inc. (consultant to Campbell Industries and MARCO) submitted a cleanup and abatement schedule for Campbell Shipyard to the Regional Board. The projected cleanup completion dates listed in the schedule are as follows:

- Soil – February 19, 2001
- Groundwater – February 19, 2001
- Bay Sediment – February 14, 2001

c. On July 27, 2000, William Boyles, Vice President/General Manager of Campbell Industries, verified the cleanup and abatement schedule submitted to the Regional Board for Campbell Industries. Mr. Boyles, stated that cleanup and abatement activities would commence in October 2000 and end in February 2001. Furthermore, Mr. Boyles confirmed that the soil containing wastes, polluted groundwater, and sediment containing wastes remain in-place at Campbell Shipyard.

d. Paul Brown, a Hazardous Materials Specialist of the San Diego Unified Port District, and Allen Fernstrom, Executive Vice President & Chief Operating Officer of MARCO, stated that, as of August 11, 2000, demolition of the shipyard facilities were basically completed, but cleanup and abatement activities had not yet started. Alistaire Callender, Regional Manager of Hart Crowser, Inc. (consultant to Campbell Industries and MARCO), provided several site maps with chemical concentrations showing historic and present conditions of Campbell Shipyard. These site maps did not depict any cleanup and abatement activities and confirmed continued presence of wastes in soil, ground water, and bay sediment at the Campbell Shipyard site in excess of established cleanup levels.

David T Barker
for

JOHN H. ROBERTUS
Executive Officer

Date: August 24, 2000

[illegible]

ITEM 15-6

OFFICE OF THE
EXECUTIVE DIRECTOR

Port of San Diego
and Lindbergh Field Air Terminal
(619) 686-6201 • P. O. Box 120488, San Diego, California 92112-0488
www.portofsandiego.org

8 August 2000

NATURE SAVER™ FAX MEMO 01616

	Date 10/18/00 # of pages ▶ 1
To Vincente Rodriguez	From Paul Bouey
Co./Dept.	Co.
Phone #	Phone #
Fax # 858 971-6972	Fax #

**VIA FACSIMILE AND
REGISTERED MAIL
RETURN RECEIPT REQUESTED**

**H. Allen Fernstrom
Vice President
Campbell Industries
Post Office Box 1870
San Diego, California 92112-1870**

Dear Mr. Fernstrom:

As you were advised by letter dated May 8, 2000, as supplemented by a letter dated June 6, 2000, you have failed to perform a series of obligations set forth in the Work Plan included as part of the Lease Termination Agreement (Agreement) by the Milestones Schedule set forth as Exhibit "D" of the Agreement. You were given 30 days to cure these failures. You have failed to do so and, indeed, have missed additional Milestone dates since the May 8th and June 6th letters.

Pursuant to the provisions of Section 5.3.6 of the Agreement, this shall serve as notice that the San Diego Unified Port District elects to perform all remaining remediation and demolition actions required under the terms of the Agreement.

Sincerely,

Dennis P. Bouey

DENNIS P. BOUEY

DPB:sw

ITEM 15-7

San Diego Union-Tribune

Officials unite to clean up bayfront site

January 31, 2001
By Ronald W. Powell
STAFF WRITER

San Diego Unified Port District officials believe there is strength in unity, at least when it comes to cleaning up the former Campbell Industries shipyard.

The Port Commission voted yesterday to authorize an agreement with the city of San Diego's redevelopment department to form a joint powers agency. The agency would hold a hammer over the environmental cleanup of the bayfront site.

The move allows the port to find the responsible parties for contamination and hand them the cleanup bill, sparing taxpayers the expense.

The melding of agencies for the Campbell decontamination is important because the port wants a developer to build a 1,200-room hotel on the property.

Because of authority granted by the state to joint powers agencies, the port, its hotel developer and the project's lender would be insulated from lawsuits if environmental problems surface after the hotel is completed.

Yesterday's 7-0 vote by the Port Commission sealed the agreement with the city. The City Council recently endorsed the joint powers agency.

The 10.8-acre site is adjacent to the San Diego Convention Center, which is nearing the end of a construction project that doubles its size. Port officials want the hotel to accommodate conventioneers.

But the site is contaminated with petrochemicals, toxic metals and other substances. The port has a cleanup plan under review by the state Regional Water Quality Control Board.

The port has $13 million from the former owner, Campbell Industries, to pay for cleanup. It is also combing historical records to determine which other companies did business at the site so that the joint powers agency may pursue them for decontamination costs.

Commissioners said it is urgent that cleanup and hotel construction proceed quickly. The city expects room tax from the hotel to fill a major portion of the financing for the stalled Padres ballpark project.

Under the city's plan, the room tax revenue would provide $25 million to $30 million annually for debt service on bonds that would be issued to pay the city's portion of ballpark construction costs.

And with the conclusion of a federal probe that led to Monday's resignation of San Diego City Councilwoman Valerie Stallings, commissioners said clearing the Campbell site for development is a priority. The probe and Stalling's refusal to step down had delayed progress on the ballpark construction.

"We don't have any time to waste," said Commissioner David Malcolm.

From: Keri Cole
To: Alan Monji; David Barker; Deborah Jayne; Tom Alo; Vicente Rodriguez
Date: 2/23/2001 1:29 PM
Subject: Fwd: RE: AET information
Attachments: RE: AET information

Hey guys,
Very timely. I just received this email today when we returned from lunch.
-KC

Message Id:	3A96D644.F53 : 6 : 62768
Subject:	Fwd: RE: AET information
Created By:	colek@rb9.swrcb.ca.gov
Scheduled Date:	
Creation Date:	2/23/2001 1:29 PM
From:	Ken Cole

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: David Barker (barkd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Deborah Jayne (jaynd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Vicente Rodriguez (rodrv.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	672	2/23/2001 1:29 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Gries, Tom" <tgri461@ECY.WA.GOV>
To: "'Keri Cole'" <colek@rb9.swrcb.ca.gov>
CC: "Betts, Brett" <bbet461@ECY.WA.GOV>
Date: 2/23/2001 11:30 AM
Subject: RE: AET information

Keri (et al);

One of my thoughts, after talking with various San Diego folks last summer, was to recommend combining ALL synoptic data for San Diego Harbor, including any bioassay/benthic community samples from the recent SCCWRP monitoring efforts, into one basin-wide AET database analogous to the one we compiled for Puget Sound. E.g., don't focus on site-specific AETs unless there is reason to believe each site is unique. This would probably result in a much larger AET data set, reducing the need to worry about AET safety factors. The idea would be to calculate "San Diego Harbor AETs" and use them appropriately for source control, cleanup, dredging, etc UNLESS any of them differ substantially from individual Puget Sound AETs. In that case, use the latter, justified by a draft EPA document on "West Coast AETs". PTI/Exponent and PLPs should have more difficulty denying this as a valid approach, as long as the database does become larger and there is no reason to expect much in the way of site-to-site differences. Let the PLPs generate the data to support their contention/prove to you that these San Diego Harbor and Puget Sound AETs are not valid. Just my thoughts ...

Again, if you have more questions, I'd be happy to try and answer them.

Tom (360) 407-7536

-----Original Message-----
From: Keri Cole [mailto:colek@rb9.swrcb.ca.gov]
Sent: Tuesday, February 13, 2001 1:02 PM
To: Gries, Tom
Subject: AET information

Hello Dr. Gries,

John Malek gave me your name as the person to contact regarding some of my questions regarding AETs. We are looking at AETs for sediment cleanup for a shipyard in San Diego. My questions are with respect to factors of safety in the AET approach. After reading through Malek's paper on AET Approach, and speaking to him there are factors of safety built into the approach with respect to both multiple chemicals and multiple organisms. There is also mention of an "additional safety factor" that may be applied. Are there other documents/papers which describe such FOSs and explain their application further? We are looking for something that can be scientifically defensible.

John explained that looking at individual AETs often result in a low reliability and that applying such safety factors to individual AETs are often not real useful.

Any information/insight you can provide would be helpful. You can email me or call me at address/number below.

Thank you in advance for your assistance.

Keri Cole, P.E.
Water Resource Control Engineer
Regional Water Quality Control Board
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124-1324
(858) 467-2798

Message Id: 3A96BA50.CFE : 12 : 56574
Subject: RE: AET information
Created By: "tgri461@ECY.WA.GOV".mime.Internet
Scheduled Date:
Creation Date: 2/23/2001 11:33 AM
From: "Gries, Tom" <tgri461@ECY.WA.GOV>

Recipients

Recipient	Action	Date & Time	Comment
ECY.WA.GOV			
CC: Betts, Brett (bbet461@ECY.WA.GOV)			
RB9Post.Region9			
To: Keri Cole (colek@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
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RB9Post.Region9		rb9.swrcb.ca.gov

Files

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MESSAGE	2632	2/23/2001 11:33 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Keri Cole
To: Alan Monji; David Barker; Deborah Jayne; Tom Alo; Vicente Rodriguez
Date: 2/23/2001 1:29 PM
Subject: Fwd: RE: AET information
Attachments: RE: AET information

Hey guys,
Very timely. I just received this email today when we returned from lunch.
-KC

Message Id: 3A96D644.F53 : 6 : 62768
Subject: Fwd: RE: AET information
Created By: colek@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 2/23/2001 1:29 PM
From: Ken Cole

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: David Barker (barkd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Deborah Jayne (jaynd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Vicente Rodriguez (rodrv.RB9Post.Region9@rb9.swrcb.ca.gov)			

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RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	672	2/23/2001 1:29 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Gries, Tom" <tgri461@ECY.WA.GOV>
To: "'Keri Cole'" <colek@rb9.swrcb.ca.gov>
CC: "Betts, Brett" <bbet461@ECY.WA.GOV>
Date: 2/23/2001 11:30 AM
Subject: RE: AET information

Keri (et al);

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Tom (360) 407-7536

-----Original Message-----
From: Keri Cole [mailto:colek@rb9.swrcb.ca.gov]
Sent: Tuesday, February 13, 2001 1:02 PM
To: Gries, Tom
Subject: AET information

Hello Dr. Gries,

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Thank you in advance for your assistance.

Keri Cole, P.E.
Water Resource Control Engineer
Regional Water Quality Control Board
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124-1324
(858) 467-2798

Message Id: 3A96BA50.CFE : 12 : 56574
Subject: RE: AET information
Created By: "tgri461@ECY.WA.GOV".mime.Internet
Scheduled Date:
Creation Date: 2/23/2001 11:33 AM
From: "Gries, Tom" <tgri461@ECY.WA.GOV>

Recipients

Recipient	Action	Date & Time	Comment
ECY.WA.GOV			
CC: Betts, Brett (bbet461@ECY.WA.GOV)			
RB9Post.Region9			
To: Keri Cole (colek@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
ECY.WA.GOV		ECY.WA.GOV
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	821	
MESSAGE	2632	2/23/2001 11:33 AM

Options

Concealed Subject: No
Expiration Date: None
Priority: Standard
Reply requested by None
Security: Standard
To Be Delivered: Immediate

From: Rusty Fairey <fairey@mlml.calstate.edu>
To: <alot@rb9.swrcb.ca.gov>
Date: 4/12/2001 10:08 AM
Subject: Quotient Paper
Attachments: Revised SQGQ Manuscript 2001.doc; SQGQ Tables and Figure 2001.xls; Part.003

Hi Tom- I was hoping I would have time to talk to you, but had to leave before we had a chance, because the meeting ran long. I am waiting for the ET&C printing proofs for the manuscript, so the final publication date is still probably a couple months away. I am attaching an advance copy of the manuscript and associated tables for you to use in the interim. Give me a call if you have any questions.

Rusty

At 11:43 AM 4/11/2001 -0700, you wrote:
>good morning rusty. i attended the task force workshop on apr 4 in long
>beach and was wondering if you could tell me the publication date of the
>paper that you referenced ("an evaluation of methods for calculating mean
>sediment quality guideline quotients as indicators of contamination and
>acute toxicity to amphipods by chemical mixtures"). we have a
>subscription to environmental toxicology and chemistry, setac press here
>at the regional board. better yet, if you have time, could you fax the
>paper to me? thanks.
>--tom alo
>
>
>
>Tom C. Alo
>Water Resources Control Engineer
>CA Regional Water Quality Control Board
>9771 Clairemont Mesa Blvd., Suite A
>San Diego, CA 92124-1324
>Main: (858) 467-2952
>Direct: (858) 636-3154
>Fax: (858) 571-6972
><alot@rb9.swrcb.ca.gov>
>
>**
>"The energy challenge facing California is real. Every Californian needs to
>take immediate action to reduce energy consumption. For a list of simple
>ways you can reduce demand and cut your energy costs,
>see our Web-site at http://www.swrcb.ca.gov ."
>
>**

Message Id: 3AD5E117.CA9 : 1 : 11433
Subject: Quotient Paper
Created By: "fairey@mlml.calstate.edu".mime.Internet
Scheduled Date:
Creation Date: 4/12/2001 10:09 AM
From: Rusty Fairey <fairey@mlml.calstate.edu>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
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MESSAGE	1798	4/12/2001 10:09 AM
Part.003	183	
Revised SQGQ Manuscript 2001.doc	78848	
SQGQ Tables and Figure 2001.xls	75776	

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

HARTCROWSER

Final Phase [illegible]
Sediment Characterization Report
Campbell Shipyard
San Diego, California

Prepared for

Campbell Industries

May 25, [illegible]

[illegible]

CAMPBELL INDUSTRIES
CAMPBELL SHIPYARD
NPDES
ENF. REPORT **FILE:** 8 03/2001-05/2001
03-0041.051 STATUS: C

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Long Beach
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2001 MAY 29 A 7:25

Letter of Transmittal

To: Regional Water Quality Control Board
9771 Clairemont Mesa Blvd, Suite A
San Diego, CA 92124-1331

Date 5/25/01

Job No.: 6897-01

Attn: Tom Alo

Re: Campbell Shipyard

We are sending the following items:

Date	Copies	Description
5/25/01	2 (of each)	Final Phase II Sediment Characterization Report & Appendices

These are transmitted:

☐ *For your information* ☐ *For action specified below* ☐ *For review and comment* ☒ *For your use* ☐ *As requested*

Remarks
For your use.

By: Art Huber
Art Huber

Title: Project Assistant

Copies to:

1910 Fairview Avenue East
Seattle, Washington 98102-3699
Fax 206.328.5581
Tel 206.324.9530

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Delivering smarter solutions

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FINAL PHASE II
SEDIMENT CHARACTERIZATION REPORT
CAMPBELL SHIPYARD
SAN DIEGO, CALIFORNIA

CERTIFICATION

This Report was prepared by the staff of Hart Crowser, Inc., under the supervision of the Sediment Division Manager and reviewed by the Professional Engineer, whose signatures and license appears hereon.

The services performed by Hart Crowser have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in California. No other warranty is expressed or implied.

JOHN M. HERZOG, PH.D
Waterfront Services Division Manager

Eugene C Lacey
EUGENE C. LACEY, JR., P.E. **#C-48388**
Senior Associate Engineer

EUGENE C. LACEY, JR.
No. C-48388
Exp. 6/30/04
Eugene C Lacey

Project Number: 6897-01

Final Sediment Characterization Report:
Campbell Shipyard,
Eighth Avenue at
Harbor Drive,
San Diego, California

Issued: May 25, 2001

Anchorage
Boston
Chicago
Denver
Fairbanks
Jersey City
Juneau
Long Beach
Portland
Seattle

One World Trade Center, Suite 2460
Long Beach, California 90831-2460
Fax 562.495.6361
Tel 562.495.6360

Sediment [illegible]

San Diego [illegible]

CONTENTS

CONTENTS (Continued)

ABBREVIATIONS/ACRONYMS

CAO	Cleanup and Abatement Order
COC	Constituent of Concern
cy	cubic yards
EMA	Ecosystems Management Associates, Inc.
HPAH	high molecular weight polycyclic aromatic hydrocarbon
mg/kg	milligrams per kilogram
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PTI	PTI Environmental Services
QA/QC	Quality Assurance/Quality Control
SDG&E	San Diego Gas and Electric
SDRWQCB	Regional Water Quality Control Board
SDUPD	San Diego Unified Port District
TBT	Tributyltin
TPH	Total Petroleum Hydrocarbon
VOC	Volatile Organic Compound

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Executive Summary

PHASE II SEDIMENT CHARACTERIZATION REPORT
CAMPBELL SHIPYARD, SAN DIEGO, CALIFORNIA

EXECUTIVE SUMMARY

This document, prepared for Campbell Industries, owned by Marine Construction and Design Company (Marco), presents data collected during the Phase II Sediment Characterization Study, as well as data from previous sediment studies of the former Campbell Shipyard (Campbell Shipyard) in San Diego, California. Included in this document is a synthesis of existing assessment data and a delineation of sediment areas exceeding sediment chemical cleanup criteria as established by Cleanup and Abatement Order (CAO) 95-21 for the site. Data from this Phase II Sediment Characterization supplement previous sediment quality data for the Campbell Shipyard generated by Hart Crowser 1999 (Phase I), Ecosystems Management Associates, Inc. (EMA) in 1999, and PTI Environmental Services (PTI) in 1991.

Impacted sediments situated north of the concrete ramps leading to the harbor (launchways) are characterized primarily by the presence of metals (copper, lead, and zinc). In this area of the site, sediment contamination extends laterally from the bulkhead to approximately 250 feet offshore. The known vertical extent of contamination ranges from 0.3 to 14 feet below mudline. However, depths of sediment impacts are typically in the range of 2 to 5 feet below mudline.

South of the launchways, impacted sediments are characterized primarily by lead, PCBs, and to a lesser extent, copper, zinc, and HPAH. In this area, sediment impacts extend to the 10th Avenue Marine Terminal. South of the launchways, chemicals exceeding CAO criteria extend from the bulkhead to approximately 450 feet offshore. The vertical extent ranges from 0.3 to 11 feet below mudline.

Currently, the sediment quality condition in the immediate vicinity of the launchways is unknown because of limited sampling data.

To estimate the volume of sediment exceeding the CAO, the depth of contamination identified by the analytical data was used and interpolated between sampling locations. On this basis, the identified total *in situ* volume of sediment exceeding the CAO levels is estimated to be approximately 116,848 cubic yards (cy). Note that these are the identified *in situ* volumes and actual volumes could be greater because the maximum extent of sediments exceeding cleanup criteria (particularly in the southwest portion of the site) has not been precisely defined. Note that the volumetric estimates presented in this report represent the currently identified total *in situ* volume estimates based on the data sources identified above, and probably would be altered based on the actual dredge volume. Dredging volumes may be greater due to factors such as sediment bulking, removal of overburden, and overdredge allowances.

1.0 INTRODUCTION

This document, prepared for Campbell Industries, owned by Marine Construction and Design Company (Marco), presents data collected during the Phase II sediment characterization study as well as data from previous studies of the Campbell Shipyard in San Diego, California. Included in this document is a synthesis of existing assessment data and delineation of sediment areas exceeding sediment chemical cleanup criteria as established by the San Diego Regional Water Quality Control Board (SDRWQCB) Cleanup and Abatement Order (CAO) 95-21 for the site. The location of the Campbell Shipyard site is shown on Figure 1. Plate 1s presents the general layout of the sediment characterization study area and confirmed (actual) sampling locations for Phase I and Phase II Sediment Studies data used in this report.

Data for the Phase II study were collected to further characterize Campbell Shipyard sediment as delineated in the CAO cleanup levels established by the SDRWQCB.

This Phase II study was completed in general accordance with the Campbell Shipyard Phase II Sediment Sampling and Analysis Work Plan (Hart Crowser, 2000a). Geological and chemical sediment data, as well as sediment quantities exceeding cleanup levels presented in this report, serve as a basis for the site sediment remedial work plan as required by the CAO. This sediment characterization study was performed in conjunction with investigations of the upland soil portions of the Campbell Shipyard. Results of the upland soil investigations were reported in a separate document entitled Final Phase II Soils Characterization Report, Campbell Shipyard, Eighth Avenue and Harbor Drive, San Diego, California, dated February 2001.

Data from the Phase II sediment characterization supplement the previous sediment quality data for the Campbell Shipyard generated by Hart Crowser 1999 (Phase I), Ecosystems Management Associates, Inc. (EMA) in 1999, and PTI Environmental Services (PTI) in 1991. Descriptions of these studies as they apply to Campbell Shipyard are presented below. Plate 2s presents a summary of the previous sediment quality data (PTI and EMA surveys) collected prior to the Hart Crowser Phase I and Phase II studies. Sediment cleanup criteria for the constituents of concern (COC) at the Campbell Shipyard site, as specified by CAO 95-21, are shown in Table 1.

1.1 Purpose and Scope of the Phase II Sediment Characterization Study

The sampling, analysis, and data evaluation efforts conducted during the Phase II sediment characterization study were designed to build on the findings of the Phase I study. Specifically, additional data were collected to better delineate sediment areas exceeding the CAO cleanup criteria. To meet this objective, the following tasks were accomplished:

- Sampling and analysis were completed to fill data gaps in the previous investigations of the site;
- Sampling and analysis were completed in areas where Phase I sampling efforts met refusal before clean material was clearly encountered;
- Discrete sediment samples were collected from areas previously characterized by composite samples, or where a complete suite analysis for CAO constituents of concern was not available; and
- Subsurface explorations were completed to the approximate depth of the native sediment underlying the site to identify the interface between native sediment and recently deposited sediment.

To achieve the project objectives, sediment samples were collected at the locations shown on Plate 1s and submitted for chemical analytical testing. These data are intended to be used in conjunction with existing sediment quality data to delineate *in situ* sediment areas that will require cleanup under the CAO.

1.2 Background Information

1.2.1 Historical Overview

Campbell Industries was founded in 1906 by George and David Campbell. According to Marco, the firm was known as Campbell Machine Company from its inception until approximately 1971, and was initially involved in machine repair. Sometime prior to the early 1920s, the Campbell brothers expanded into the shipbuilding industry and by 1925, they had located their operations onto a small landfilled area just bayward of the intersection of 8th Avenue and what was to become Harbor Drive (Figure 2).

Historical photographs indicate that railway lines were present in the area now occupied by Harbor Drive from at least as early as 1914. Between 1925 and 1926, a major period of filling and shoreline expansion occurred along the section of bayshore from the Campbell site to the northwest. During this period, the present bulkhead was emplaced (Figure 3). Discussions with former Campbell Shipyard personnel have indicated that the area behind the bulkhead was filled with dredged and other materials.

As a part of ongoing site demolition activities, Triton Engineers (Triton) was engaged to provide an engineering report of the bulkhead and other site frontage (Triton, 2000). Triton reported that 1,000 feet of concrete bulkhead exist from the northwestern extent of the site to the former vicinity of the large rollers, and 200 feet of debris-fill revetment exist from that point southeast to the boundary with the 10th Avenue Marine Terminal. Historical photographs indicate that the bulkhead terminated at a point along the northernmost of a pair of what appear to be rock jetties extending from the bayshore out into the bay. These rock jetties appear to be related to a pair of saltwater circulation pipelines, an 8-inch pumped cooling water feed line and a 24-inch hot water return, which emanated from San Diego Consolidated Gas and Electric (SDCG&E) Company's "Station A" manufactured gas plant. The distance between these pipelines has been measured as approximately 104 feet (San Diego Unified Port District, 1967). Figure 2 shows the locations of the two jetties from which photogrammetric measurements indicate that the distance between the jetties was approximately 75 feet.

The SDCG&E saltwater circulation pipelines were installed in 1905 to 1906 based on historical data reviews (IT Corporation, 2000). Figure 3 shows the southeastern terminus of the bulkhead constructed in 1925 to 1926 was at the (northernmost) jetty. The region north of (and behind) the bulkhead was reportedly filled with materials dredged from the bay and hydraulically emplaced. Sedimentation would therefore have ceased in the areas behind the bulkhead after it was filled. Because the bulkhead terminated at the northernmost jetty, which may have included the 8-inch pipeline, the Campbell Machine Company site became the northern boundary of what appears to have become a channel between the two pipelines that existed until approximately 1947 (Figure 4).

Between the late 1920s and 1940s, the area from the southern jetty (which may have been above the 24-inch SDCG&E pipeline) south to the Benson Lumber Company parcel was primarily used as the 8th Avenue Tidelands Dump according to aerial photographs (Figure 4) (Ninyo & Moore, 1999). During this period, waste and perhaps other materials accumulated in the direction of the bay forming the southern bank of the channel between the two SDCG&E pipelines/jetties.

Based on aerial photographic interpretations by Hart Crowser, the Socony/Mobil Oil tank farm (also referred to as the General Petroleum Corporation) appears to have been built between 1935 and 1937 on fill materials comprising the south bank of the SDCG&E channel (**Figures** 5 and 6). Initially, the tank farm appears to have consisted of five vertical above-ground storage tanks parallel to the south bank of the SDG&E channel (Figure 6). A vessel fueling station is believed to have been supplied by this bulk facility by way of pipelines that crossed over the channel and ran along the bulkhead (**Figure** 6). Coal gasification at SDCG&E's Station A ceased in 1905 with the conversion of the plant to an oil-gas process (SDG&E, 2001). By 1932 the plant used natural gas (IT Corporation, 2000).

By 1941, the entrance to the SDCG&E channel had begun to accumulate what appear to be tidal sedimentary deposits (**Figure** 7). By September 1941, construction of a spit to the southeast of the former channel entrance had begun (**Figure** 7). Also visible in the 1941 photographs are three additional vertical storage tanks in the Socony/Mobil Oil tank farm. At some time between 1947 and 1955 (according to aerial photographs), a kerosene tank, the largest noted in the tank farm, was added. Addition of the kerosene tank accompanied doubling of the bermed area of the tank farm, with this last tank located closer to the southern bank of the former channel. In addition, at some time between 1941 and 1947, the SDCG&E channel was filled.

Although it is not yet known with what, and how, the SDCG&E channel was filled in, three of the Hart Crowser Phase I and four of the Hart Crowser Phase II borings positioned along the location of the initial spit visible on Figure 7 were terminated due to refusal. In each case, the borings encountered large blocks of concrete, wood, and other construction debris-type materials. During the course of the Phase II program, it became clear that the revetment probably served as both a conduit and reservoir for floating product migrating from the Socony/Mobil Oil tank farm to the bulkhead (Hart Crowser, 2001).

Soon after completion of the bayshore bulkhead, aerial photographs indicate that the northeastern portion of the 10th Avenue Marine Terminal was functioning as a rubbish reduction plant, also referred to as the 8th Avenue Tidelands Dump. In addition to disposal, the waste was also burned. By 1953, information from aerial photographs indicates that construction of the 10th Avenue Marine Terminal had begun (**Figure** 8). Filling of the bay to create this site appears to have been mostly completed by late 1957 (Ninyo & Moore, 1999).

The upland portion of the site underwent demolition in 2000. Demolition of in water structures (support piers and pilings) was completed in March 2001.

1.2.2 Site Geology

Sediment stratigraphy in the offshore portion of the site is characterized by recently deposited silts and sands overlying the native Pleistocene Age Bay Point Formation. Recent sedimentation at the site is primarily the result of sediment transport from areas adjacent to the site (including San Diego Bay) and the nearby Switzer Creek. As shown on the generalized site cross sections (Plates 6a through 9a) and the Phase II boring logs (Appendix C), recently deposited sands and silts generally comprise the upper 6 to 25 feet of the sediment column. In many portions of the site, a shell hash layer is present within the recently deposited sediments. Sands and gravels typify the upper sediment column at sampling locations in the vicinity of the 10th Avenue Marine Terminal. These materials are suspected to be the result of berthing activities at the terminal (e.g., propeller scour, barge losses, and maintenance dredging). Native sediments (Baypoint Formation) underlie the recent material and is identified as a consolidated mottled silt. Typically, this silt was encountered on between 6 and 24.5 feet below the mudline.

Much of the upland portion of the Campbell Shipyard site is characterized by fill materials overlying Holocene marine deposits. Fill materials at the site are typically heterogeneous in nature and are the result of shoreline modifications that occurred over time.

1.3 Summary of Previous Sediment Characterization Studies

Previous sediment quality studies of the Campbell Shipyard site include PTI (1991) and EMA (1999). Data from these studies are presented in this report. Documentation of the sampling and analysis protocols was identified for these studies. Sediment chemistry data from these studies are summarized on Plate 2s. Other, limited historical sediment quality data were identified for the site; however, these data were determined to be technically unacceptable for use in this report because appropriate supporting documentation (e.g., contractor identity, quality control/assurance supportive data, analytical reports) was not available.

Aged data (approximately 8 to 10 years old) are considered not to be representative of current conditions at the site because of various *in situ* processes that may affect the sediment quality condition (e.g., sedimentation, scour and tidal movements). Therefore, only recently acquired data (Phase I, Phase II, and EMA 1999) are used to delineate sediment areas exceeding the CAO sediment cleanup criteria. Data generated by PTI are considered aged. These data are presented primarily because they served as the basis for the sediment cleanup criteria of CAO 95-21. PTI data are not, however, utilized to delineate sediment areas exceeding cleanup criteria. (See Section 3.0) Note only the latest EMA study results (1999) are used in this report as these data are considered to be most representative of the recent site condition.

The PTI and EMA sediment characterization studies are summarized below.

PTI (1991). Extensive sediment sampling and analysis to characterize the surface and subsurface sediment quality at the site were performed by PTI between 1989 and 1991. In addition to sediment bulk chemistry, toxicity testing, benthic infaunal assessment, and bioaccumulation testing were performed.

Sediment samples were submitted for analysis of metals (copper, cadmium, chromium, zinc, lead, silver, nickel, and mercury) using EPA Method SW-846, tributyltin (method unknown), high molecular weight polycyclic aromatic hydrocarbon (HPAH) by EPA Method 8310, polychlorinated biphenyl (PCB) by EPA Method 8080, and total petroleum hydrocarbon (TPH) by EPA Method 8015-modified. Note only the CAO sediment constituents are presented on Plate 2s.

The PTI data indicated that the highest surface sediment concentrations of COCs are located adjacent to and immediately west of the bulkhead. Concentrations of COCs in surface sediment were noted to generally decrease with distance from the bulkhead. Sediment toxicity testing showed that exposure to these materials did not result in adverse toxicological effects to test organisms; benthic infauna testing showed that healthy communities exist throughout the site. Analysis of tissue samples showed no indication of significant localized concentrations of bioaccumulative chemicals.

Similarly, subsurface investigations showed the highest concentrations of COCs to be generally located in the upper 2 to 3 feet of sediment at sampling locations nearest the bulkhead. Subsurface data indicate that sediment exceeding the CAO extend to 7 feet below mudline. Deepest subsurface impacts relative to the CAO were identified at sampling locations in the vicinity of Pier 4. Coring data also indicated oily sediment extending 3 to 7 feet below mudline at several sampling locations in this same area.

EMA (1999). As a requirement for maintenance of the Campbell Shipyard National Pollutant Discharge Elimination System Permit (NPDES), Campbell Industries performed routine sediment sampling and analysis within the project site. Data were collected for ten rounds of sampling from December 1992 through August 1999. Fifteen surface sediment samples were collected and analyzed for bulk chemistry during each round of sediment monitoring. Only the August 1999 data are included in this report because these results are the most recent and are thus considered to be most representative of the current site conditions.

Sediment samples were submitted for analysis of copper (by EPA 3050), cadmium (by EPA 3050), chromium (by EPA 3050), zinc (by EPA 3050), lead (by EPA 3050), mercury (by EPA Method 7471), tributyltin (by method GCFDP), HPAH (by EPA Method 8100/8270), PCBs (by EPA Method 8080), and TPH (by EPA Method 8015). Note only the CAO sediment constituents are presented on Plate 2s.

The August 1999 data indicate that the highest surface sediment concentrations of COCs were detected at sampling locations nearest the bulkhead between Pier 0 and Pier 5. Concentrations of COCs in surface sediment were noted to generally decrease with distance from the bulkhead.

2.0 PHASE I AND PHASE II SEDIMENT QUALITY CHARACTERIZATION STUDIES

This section presents the results of the Phase I and Phase II characterization studies of Campbell Shipyard sediment performed by Hart Crowser in 1999 and 2000.

2.1 Summary of Hart Crowser Phase I and Phase II Studies

Hart Crowser completed two phases of sediment quality characterization at the Campbell Shipyard. Phase I was completed in November of 1999. Phase II was completed in May of 2000. A summary of these studies is provided below. Confirmed (those completed in the field) sampling locations and analytical results for the COCs listed in the CAO for both Phase I and Phase II sampling are presented on Plate 3s. Laboratory analytical data reports are presented in Appendix A.

2.1.1 Phase I

Detailed description of the Phase I study, including a summary of field activities, boring logs, and data quality review are presented in the Campbell Shipyard Sediment Characterization Report (Hart Crowser, 2000b). Phase I sediment sampling and analyses were performed in general accordance with the project-specific Sampling and Analysis Plan (Hart Crowser (1999). Phase I sediment analytical results are presented in Table 2 and discussed in Section 2.2. Analytical results for COCs listed in the CAO screened relative to their respective cleanup levels, are presented on Plate 3s.

Initial Phase I sampling included sampling 29 subsurface locations (A1 through A5, B1 through B5, C1 through C5, D1 through D5, and V1 through V9) and 12 surface locations (1 through 12). Core samples to a maximum of 10 feet in length were collected from within each of the sediment dredge management areas (Areas A, B, C, and D, including the 'V' sampling locations) established for the site (Plate 1s). Additionally, surface sediment samples (1 through 12) were collected at locations along the perimeter of the area previously identified (PTI, 1991) as exceeding the CAO. The subsurface sediment quality samples were collected using a Vibracore sampler. Due to refusal of the sampling device, borings were achieved only to a maximum depth of 10 feet below mudline. The surface sediment quality sampling was performed using a van Veen sampler.

Initially, composite samples of areas A and B (located nearest to the bulkhead), selected discrete subsurface samples representative of areas C and D, and surface samples were submitted for analysis of copper (by EPA 6010), zinc (by EPA Method 6010), lead (by EPA Method 6010), tributyltin (by method GCFDP), HPAH (by EPA Method 8100/8270), PCBs (by EPA Method 8080), and TPH (by EPA Method 8015).

Based on the results of the initial analysis and field observation of dark, oily appearing sediments, select discrete subsurface samples of areas A and B (collected from the same core samples as the composite samples) and supplemental discrete subsurface samples ('V' sampling locations collected as part of a second round) were submitted for analysis. These discrete samples were not, however, analyzed for the complete suite of CAO constituents.

To further characterize potential impacted sediment areas identified near the bulkhead during the initial sampling event, a second round of sampling was performed as part of the Phase I study. Several hand-augered and hollow-stem explorations (B31 through B34) were completed along the bulkhead in the vicinity of the South Wharf in December 1999. Hand-augered explorations focused on nearshore sections of Area A, which could be sampled from the bulkhead. This supplementary sampling focused on characterization of the dark, oily sediment observed in the subsurface samples collected from the vicinity of the bulkhead in Area A. Boring B31 was completed using a hollow-stem auger rig operating from the access plank to the south wharf. The purpose of this boring was to establish the maximum vertical extent of sediment impacts in this portion of the site.

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A third round of sampling was also performed as part of the Phase I study. Additional sampling was conducted in sediment areas where initial analytical results differed from historical data collected in the same vicinity, or where discrete surficial sediment samples were previously not analyzed. Discrete sediment samples were collected at five previously sampled locations (B1 through B5) from the surface to 1.5 feet below mudline in March 2000. The sediment samples were collected using a 2-inch-diameter sampling core.

2.1.2 Phase II Sediment Sampling and Analysis

Description of the Phase II study field activities and methods are presented in Appendix B of this report. Sediment boring logs are presented in Appendix C. Quality Assurance/Quality Control (QA/QC) of the Phase II analytical results and laboratory certificates of analysis are presented in Appendix D. Sampling and analysis activities were performed in general accordance with the Phase II Sediment Sampling and Analysis Work Plan (Hart Crowser 2000a). Phase II sediment analytical results are presented in Table 3 and are discussed in Section 2.2. Phase II analytical results, screened relative to the CAO cleanup levels, are presented on Plate 3s.

Phase II sampling was completed by Hart Crowser between May 15 and 25, 2000. Borings were completed at 21 sampling locations (13, 14, 15, 16, 17, 18, 19, 20, A6, A7, B6, B7, B7X, C6, C7, D6, D7, M1, M2, M3, and M4) as shown on Plate 1s. Sediment borings were accomplished using rotary drilling equipment. Samples were collected continuously (where sample recovery permitted) until refusal or native, dense silt was encountered. Subsequent to the Phase II drilling program, near-surface 0- to 1.5-foot samples were collected by diver at locations 17, 18, and 19. Resampling of the near-surface sediments at these locations was performed based on poor recovery in the initial samples collected.

Sediment samples were submitted for analysis of copper (by EPA 6010), zinc (by EPA Method 6010), lead (by EPA Method 6010), tributyltin (by Method GCFDP), HPAH (by EPA Method 8100/8270), PCBs (by EPA Method 8080), and TPH (by EPA Method 8015).

2.2 Phase I and Phase II Results

Analytical results of the Hart Crowser Phase I and Phase II studies for COCs listed in the CAO are summarized below (Table 1 presents the Campbell Shipyard CAO 95-21 Cleanup Criteria). Phase I and Phase II sediment analytical results are presented in Tables 2 and 3. Laboratory analytical data reports are presented in Appendix A. Both composite and discrete sample data generated during the Phase I and Phase II studies are discussed below. Plates 6a, 7a, 8a, and 9a show typical cross sectional distributions of cleanup criteria exceedences at the site. Cross section locations and chemical exceedences below mudline at their respective depth intervals are displayed on Plate 5s.

2.2.1 Data Quality Review

Overall, the data quality and control objectives, as set forth in the Phase I (Hart Crowser, 1999) and Phase II (Hart Crowser, 2000b) sediment characterization sampling and analysis plans were met and the data for this project are acceptable for use as reported except three organotin analyses, which were rejected as a result of the QA/QC review as described below. Complete data quality review including explanation of rejected and qualified results, prepared by Laboratory Data Consultants is presented in Appendix D.

For sediments from Sample Identification Nos. STA. 17, 18, 19, and D-7 (Pacific Treatment Analytical Services, Inc.), the data set had no rejected results. Some detected results for pyrene were qualified as estimated (J) in the PAH analyses as described below. The estimated data are considered usable for meeting the objectives of this investigation. No other data required qualification.

For sediments from American Analytics, Inc., the data set had no rejected results. Estimated non-detects and detects of selected PAH and TPH constituents were qualified with (J) and (UJ) as described below. The estimated data were considered usable for meeting the objectives of this investigation.

For sediments from Sample Identification Nos. A7/S1, A7/S2, A7/S3, A7/S4, A7/S5, A7/S6, C7/S-1, C7/S-2, C7/S-3 and, C7/S-4 (Pacific Treatment Analytical Services, Inc.), the data set had rejected results in three organotin analyses. These results were eliminated in the data set used for decision making in this investigation. Additionally, estimated non-detects and detects of selected organotin, PAH, PCB, and TPH constituents were qualified with (J) and (UJ) as described below. The estimated data were considered usable for meeting the objectives of this investigation. No trace metal results required qualification.

Organotin results for three samples were rejected as a result of the QA/QC data review. Non-detected results for samples A7/S-3, A7/S-4, and M4/S-2 were qualified as rejected due to low (0 %) surrogate compound recoveries. Specifically, dibutyltin and monobutyl tin results were rejected for samples A7/S-3 and M4/S-4. Tributyltin, dibutyltin, and monobutyltin results were qualified as rejected in sample A7/S-4 due to low (0 %) surrogate compound recovery. Organotin results for a number of samples were qualified as estimated (J) due to high surrogate compound recoveries and high monobutyltin recoveries in laboratory control samples. Reported results for these samples are acceptable for use since concentrations are conservative and may exhibit a high bias. Results and reporting limits for a smaller number of samples were qualified as estimated (J/UJ) due to exceeding holding times by four days. Since samples were appropriately preserved, there is no significant impact to data quality and results are acceptable for use.

PCB results for two samples were qualified as estimated (J) due to high surrogate compound recoveries. Reported results for these samples are acceptable for use since concentrations are conservative and may exhibit a high bias. Results and reporting limits for two additional samples were qualified as estimated (J/UJ) because sample holding time was exceeded by one day. Since samples were appropriately preserved, there is no significant impact to data quality and results are acceptable for use.

PAH results and reporting limits for a number of samples were qualified as estimated (J/UJ) due to minor exceedences of continuing calibration or internal standards criteria. Reported results for these samples are acceptable for use since QC results were typically within five percent of acceptance values. Results and reporting limits for a smaller number of samples were qualified as estimated (J/UJ) due to exceeding holding times by four days. Since samples were appropriately preserved, there is no significant impact to data quality and results are acceptable for use.

Total petroleum hydrocarbon results and reporting limits for two samples were qualified as estimated (J/UJ) due to a slight exceedence of QC criteria for duplicate results for one sample and for slightly low surrogate compound recovery in the second sample. Reported results for these samples are acceptable for use since QC results were within five percent of acceptance values.

2.2.2 Copper

In total, 213 Phase I and Phase II sediment samples were analyzed for copper. Copper was detected in 207 of the 213 samples analyzed and ranged in concentration from 1 to 2,190 milligrams per kilogram (mg/kg). The highest copper concentration (2,190 mg/kg) was detected in the 0- to 2-foot sample collected at location C4. Copper was detected above the CAO criteria (810 mg/kg dry wt.) in seven of the Phase I and Phase II sediment samples analyzed.

Generally, detected copper concentrations exceed CAO cleanup criteria at sampling locations near the bulkhead between the northwest property line and Pier 1, and in the vicinity of Piers 4 and 5 (Plate 3s). Copper exceedences typically occur in the upper 6 feet of sediment in these areas.

2.2.3 Zinc

In total, 214 Phase I and Phase II sediment samples were analyzed for zinc. Zinc was detected in the samples analyzed at concentrations ranging from 4 to 3,460 mg/kg. The highest zinc concentration (3,460 mg/kg) was detected in the 4- to 6-foot sample interval at location A2. Zinc was detected above the CAO criteria (820 mg/kg dry wt.) in 13 of the Phase I and Phase II sediment samples analyzed.

Generally, detected zinc concentrations exceed CAO cleanup criteria at sampling locations near the bulkhead between the west property line and Pier 4, and in the vicinity of Pier 4 and the southeast property line (Plate 3s). Zinc exceedences typically occur in the upper 6 feet of sediment between the northwest property line and Pier 4 and in the vicinity of Pier 4 and extend to approximately 11 feet below mudline near the east property line.

2.2.4 Lead

In total, 232 Phase I and Phase II sediment samples were analyzed for lead. Lead was detected in 181 of the 232 samples at concentrations ranging from 3 to 3,960 mg/kg. The highest lead concentration (3,960 mg/kg) was detected in the 4- to 6-foot sample interval at location B7. Lead was detected above the CAO criteria (231 mg/kg dry wt.) in 31 of the Phase I and Phase II sediment samples analyzed.

Generally, detected lead concentrations exceed CAO cleanup criteria at sampling locations near the bulkhead between the launchways and the 10th Avenue Marine Terminal (Plate 3s). In this area, lead exceedences extend to a maximum depth of 12 feet below mudline. Other limited exceedences of lead occur along the bulkhead in the vicinity of the northwest property line and Pier 1. Here exceedences are limited to the upper 4 feet of the sediment column.

2.2.5 Tributyltin

In total, 213 Phase I and Phase II sediment samples were analyzed for tributyltin. Tributyltin was detected in 71 of the 213 samples at concentrations ranging from 0.012 to 1.28 mg/kg. The highest tributyltin concentration (1.28 mg/kg) was detected in the 6- to 7-foot sample interval at location M4. Tributyltin was not detected above the CAO criteria (5.75 mg/kg) in any of the Phase I and Phase II sediment samples analyzed.

2.2.6 High-Molecular Weight Polycyclic Aromatic Hydrocarbon (HPAH)

In total, 115 Phase I and Phase II sediment samples were analyzed for HPAH. Note that only the high molecular weight fraction of the PAH compounds (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene) were used to determine the concentration of total HPAHs. HPAH was detected in the samples analyzed at concentrations ranging from 0.02 to 86.35 mg/kg. The highest HPAH concentration (86.35 mg/kg) was detected in the 9- to 10.5-foot sample interval at location A7. HPAH was detected above the CAO criteria (44 mg/kg dry wt.) in eight of the Phase I and Phase II sediment samples analyzed.

Generally, detected HPAH concentrations exceed CAO cleanup criteria at sampling locations near the bulkhead in the vicinity of Pier 4 and the southeast property boundary (Plate 3s). In this area, HPAH exceedences extend to a maximum depth of 12 feet below mudline. Other limited exceedence of the HPAH criterion occurs at sampling location D-7. Here exceedences are limited to the 12- to 14-foot sample interval.

2.2.7 Polychlorinated Biphenyls (PCBs)

In total, 122 Phase I and Phase II sediment samples were analyzed for PCBs. PCBs were detected at concentrations ranging from 0.03 to 13.93 mg/kg. Highest PCB concentrations (13.93 mg/kg) were detected in the 7.5- to 9-foot sample interval at location A7. PCBs were detected above the CAO criteria (0.95 mg/kg dry wt.) in 39 of the Phase I and Phase II sediment samples analyzed.

Generally, detected PCB concentrations exceed CAO cleanup criteria at sampling locations between the launchways and the southeast property boundary (Plate 3s). In this area, PCB exceedences are typical in the subsurface sediments and extend to maximum depth of 12 feet below mudline. Other limited exceedence of the PCB criterion occurs at sampling location B-7X. Here exceedences are limited to the 2- to 4-foot sample interval.

2.2.8 Total Petroleum Hydrocarbon (TPH)

In total, 76 Phase I and Phase II sediment samples were analyzed for TPH. TPH was detected in the samples analyzed at concentrations ranging from 6 to 1,458 mg/kg. Highest TPH concentration (1,458 mg/kg) was detected in the 10- to 12-foot sample interval at location D7. TPH was not detected above the CAO criteria (4,300 mg/kg dry wt.) in any of the Phase I and Phase II sediment samples analyzed.

3.0 DELINEATION OF SEDIMENT AREAS EXCEEDING CAO CLEANUP CRITERIA

This section describes the distribution of chemical constituents exceeding the CAO cleanup criteria and presents a delineation of sediment areas exceeding CAO criteria based on the analytical results generated by the Phase I, Phase II, and EMA sediment characterization studies. The lateral extent of sediment areas exceeding sediment cleanup criteria is shown on Plate 4s. Plate 5s presents a cross section location map for the offshore portion of the Campbell Shipyard. Cross sections showing the vertical extent of sediment exceeding the CAO sediment cleanup criteria are shown on Plates 6a through 9a. Note that the extent of sediment contamination shown in cross section is based on the lateral extent delineation shown on Plate 4s. Lateral extent delineations considered overall chemical distribution trends in addition to location specific results and do not match actual analytical results at all locations. In these cases the extent of contamination is queried and delineated as the suspected extent of CAO exceedence.

3.1 Distribution of Constituents Exceeding the CAO Cleanup Criteria

The extent of chemicals exceeding the CAO criteria is described below and shown in plan view on Plate 4s and in cross section on Plates 6a through 9a. Sediment CAO exceedence area delineations are based on sediment sampling locations at which any of the detected COCs exceeding the CAO sediment cleanup criteria were reported. In certain areas of the site (e.g., in the vicinity of former Piers 4 and 5) the significant number of exceedences occurred in the subsurface sediment. Sediment area boundaries that exceeded CAO cleanup criteria were determined by linear interpolation between sampling locations with data at a given depth interval. In instances where sampling locations were in proximity, only the most recent sampling data were utilized for contouring as these data are assumed to be most representative of site conditions. Because they do not give location-specific information, composite samples (collected during Phase I) were not used in the delineation of exceedence areas.

Impacted sediments situated north of the concrete ramps leading to the harbor (launchways) (Plate 4s) are characterized primarily by the presence of metals (copper, lead, and zinc). Typically, elevated concentrations of copper, lead, and zinc are present in shipyard environments and are the result of shipbuilding and repair activities (e.g., painting). In this area of the site, sediment contamination extends laterally from the bulkhead to approximately 250 feet offshore. This pattern is consistent with the location of the former drydocks at the site.

North of the launchways the known vertical extent of contamination ranges from 0.3 to 14 feet below mudline as depicted on Cross Sections B-B′ and C-C′ (Plates 7a and 8a). However, depths of sediment impacts are typically in the range of 2 to 5 feet below mudline. As shown in these cross sections, significant deposits of sediment exceeding CAO cleanup criteria are located in the subsurface and are isolated from the water column by non-impacted sediment.

South of the launchways (Plate 4s), impacted sediments are characterized primarily by lead, PCBs, and to a lesser extent, copper, zinc, and HPAH. In this area, sediment impacts extend to the 10th Avenue Marine Terminal. South of the launchways, chemicals exceeding CAO criteria extend from the bulkhead to approximately 450 feet offshore. The vertical extent ranges from 0.3 to 11 feet below mudline as depicted on cross sections A-A′ and D-D′ (Plates 6a and 9a). As shown in these cross sections, significant deposits of sediment exceeding the CAO cleanup criteria are located in the subsurface and are isolated from the water column by non-impacted sediment.

South of the launchways, exceedences of copper and zinc are typically in the upper 6 feet of sediment whereas, exceedences of lead, HPAH, and PCBs are typically in sediments deeper than 6 feet, but do occur at shallower depths. The distribution of chemical exceedences within this area suggest the following:

- Sediment impacts resulting from copper and zinc constituents south of the launchways are relatively consistent with the distribution pattern north of the launchways thus indicating that shipyard activities may have contributed to contamination of the upper 6 feet of the sediment column along the bulkhead within the property boundary.

- Deeper exceedences (greater than 6 feet) of lead, HPAH, and PCBs appear to be the result of historical sources (such as Switzer Creek which drains into this area) and are not likely to be associated with shipyard activities.

- Occurrence of lead, HPAH, and PCBs at depths less than 6 feet are likely the product of ongoing uncontrolled sources (such as Switzer Creek or redistribution of deeper sediments by propeller scour or dredging activities. This conclusion is consistent with analyses performed as part of the characterization of the onshore portion of the Campbell Shipyard site, which showed that PCBs are not associated with upland contaminants.

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Currently, the sediment quality condition in the immediate vicinity of the launchways is unknown because of limited sampling data. Contamination is however, expected in this area because sediments located directly adjacent (both north and south) to the launchways exceed cleanup criteria. This area is likely subject to the same sediment contaminants as the adjoining areas due to concurrent shipyard activities and other ongoing uncontrolled sources to the site. After these concrete structures have been demolished, additional sediment sampling and analysis may be required to further characterize this area.

3.2 Estimated In Situ Volume of Sediment Exceeding CAO Cleanup Criteria

Volumetric estimates of sediment identified to exceed the CAO sediment cleanup criteria are based on the analytical data resulting from the Hart Crowser Phase I and Phase II studies, and the data generated by EMA (1999). The identified volume of sediment exceeding cleanup criteria are delineated on Plate 4s. Note that the volumetric estimates presented in this report represent the currently identified *in situ* volume estimates based on the data sources identified above and may not be representative of the actual volume, as discussed below.

To estimate the volume of sediment exceeding the CAO, the depth of contamination identified by the analytical data was used and interpolated between sampling locations using the following conditions:

1. For a given 2-foot below mudline depth interval, only sampling locations containing analytical data for that interval were used to delineate the horizontal extent of contamination;

2. For each 2-foot depth interval, the extent of contamination was assessed as approximately half the horizontal distance between a given sample location containing a CAO exceedence and adjacent sampling location(s) with no exceedences; and

3. Along bulkheads, limits of CAO exceedence were extended directly to the bulkhead where no data exist.

On this basis, the estimated *in situ* volume sediment exceeding the CAO levels are as summarized below based on Computer Aided Design (CAD) calculations.

Offshore Areas Excluding Launchways:

Depth Interval in Feet below Mudline	Estimated Areal Extent of Sediment Contamination in ft^2	Estimated Volume of Contaminated Sediment in yd^3
0 to 2	266,736	19,758
2 to 4	301,409	22,327
4 to 6	283,688	21,014
6 to 8	138,412	10,253
8 to 10	167,710	12,423
10 to 12	119,370	8,842
12 to 14	26,387	1,955
Total	**1,303,712**	**96,572**

Launchway Area:

Depth Interval in Feet below Mudline	Estimated Areal Extent of Contaminated Launchway Sediment in ft^2	Estimated Volume of Contaminated Launchway Sediment in yd^3
0 to 2	44,723	3,313
2 to 4	63,710	4,719
4 to 6	54,650	4,048
6 to 8	23,166	1,716
8 to 10	50,645	3,751
10 to 12	22,875	1,694
12 to 14	13,966	1,035
Total	**273,735**	**20,276**

Actual volumes could be greater because the maximum extent of sediments exceeding cleanup criteria (particularly in the southern portion of the site) has not been precisely defined.

Additionally, dredging sediment volumes (if sediments are to be removed from the marine environment) are expected to be different from the *in situ* volumes for the following reasons:

- The final volume of sediment is affected by the degree and efficiency to which sediments are dewatered.
- Dredging designs provide over-dredge allowances to prevent dredging instructions from becoming overly complex, to account for dredging

equipment operational limitations, and to ensure removal of material above required dredge elevations. Even in very straightforward (e.g., flat) dredging environments, the contractor is typically provided with an over-dredge allowance of at least 1 foot for mechanical dredging with a standard bucket.

- Dredging depths adjacent to the bulkhead may be limited based on structural integrity and support concerns. Maximum dredge cuts may be limited because of slope stability concerns associated with the bulkhead.
- Removal of non-contaminated sediments overlying (overburden) contaminated material may be necessary and will subsequently increase dredging volumes.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of Campbell Industries and Marine Construction and Design Company (Marco) and its authorized agents. Any other use of this document, or any of its contents, would constitute unauthorized use. In any case, Hart Crowser is not responsible for misinterpretation of this report, or any of its contents. This report was prepared at the specific direction of Campbell Industries.

The results contained in this report are based upon the information acquired during the various investigations. It is possible that variations at the property could exist beyond or between points explored during the course of the investigation. Also, changes in conditions found could occur at some time in the future due to possible contaminant migration, variations in rainfall, temperature, and/or other factors not apparent at the time of the various field activities.

The services performed by Hart Crowser have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in California. Hart Crowser's findings and conclusions must not be considered as scientific certainties but rather as a professional opinion concerning the significance of the data gathered during the course of the site assessment. No other warranty is expressed or implied.

5.0 REFERENCES

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Tables

Table 1 - Campbell Shipyard CAO 95-21 Cleanup Criteria

Constituent of Concern	Cleanup Level (mg/kg dry wt.)
Copper	810
Zinc	820
Lead	231
TPH	4300
HPAHs	44
PCBs	0.95
Tributyltin	5.75

CAO - Cleanup and Abatement Order
mg/kg - milligram per kilogram
TPH - Total Petroleum Hydrocarbons
HPAHs - High Molecular Weight Polyaromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls

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Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	A-1-46	A-2-46	A-3-46	A-C-24	A-C-46	A-C-U
Sampling Date	Criteria	11/17/99	11/17/99	11/17/99	11/17/99	11/17/99	11/17/99
Depth in Feet		4-6	4-6	4-6	2-4	4-6	0-2
TBT in mg/kg (dry wt.)							
Dibutyltin		0.009 U	0.009 U	0.019 U	0.009 U	0.018 U	0.009 U
Monobutyltin		0.009 U	0.009 U	0.019 U	0.009 U	0.018 U	0.009 U
Tributyltin	5.75	0.009 U	0.009 U	0.019 U	0.099	0.018 U	0.118
Metals in in mg/kg (dry wt.)							
Antimony							17 U
Arsenic							14.4
Barium							99
Beryllium							2 U
Cadmium							1.6
Chromium							60
Cobalt							17 U
Copper	810	794	296	758	369	572	380
Lead	231	382	400	452	315	426	240
Mercury							0.89
Molybdenum							28
Nickel							15
Selenium							0.8
Silver							0.9
Thallium							17 U
Vanadium							55
Zinc	820	653	3460	1050	583	1080	531
TPH in in mg/kg (dry wt.)							
Diesel		92	55	206	75	168	18 U
Gasoline		17 U	17 U	19 U	17 U	18 U	18 U
Waste Oil		674	674	766	240	358	NA
Total TPH		766	729	972	315	526	ND
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							0.035 U
2,4'-DDE							0.035 U
2,4'-DDT							0.035 U
4,4'-DDD							0.035 U
4,4'-DDE							0.035 U
4,4'-DDT							0.035 U
Total DDT							0.035 U
Aldrin							0.035 U
Alpha-BHC							0.035 U
Beta-BHC							0.035 U
Chlordane							0.348 U
Delta-BHC							0.035 U
Dieldrin							0.035 U
Endosulfan sulfate							0.035 U
Endrin							0.035 U
Endrin aldehyde							0.035 U
Endusulfan I							0.035 U

Table 2 - Analytical Results for Sediment Samples - Phase I

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Sample ID	Screening	A-1-46	A-2-46	A-3-46	A-C-24	A-C-46	A-C-U
Sampling Date	Criteria	11/17/99	11/17/99	11/17/99	11/17/99	11/17/99	11/17/99
Depth in Feet		4-6	4-6	4-6	2-4	4-6	0-2
Endusulfan II							0.035 U
Gamma-BHC							0.035 U
Heptachlor							0.035 U
Heptachlor epoxide							0.035 U
Methoxychlor							0.348 U
Toxaphene							0.435 U
Aroclor-1016		0.691 U	0.691 U	0.748 U	0.034 U	0.705 U	0.035 U
Aroclor-1221		0.691 U	0.691 U	0.748 U	0.034 U	0.705 U	0.035 U
Aroclor-1232		0.691 U	0.691 U	0.748 U	0.034 U	0.705 U	0.035 U
Aroclor-1242		0.691 U	0.691 U	0.748 U	0.034 U	0.705 U	0.035 U
Aroclor-1248		0.691 U	0.691 U	0.748 U	0.034 U	0.705 U	0.035 U
Aroclor-1254		9.95	12.6	4.49	1.41	7.35	0.725
Aroclor-1260		0.691 U	0.691 U	0.748 U	0.034 U	0.705 U	0.035 U
Total PCBs	0.95	$\boxed{9.95}$	$\boxed{12.6}$	$\boxed{4.49}$	$\boxed{1.41}$	$\boxed{7.35}$	0.725
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	A1-PLUG 1999 NA	B-1 3/2/2000 0-1.5	B-2 3/2/2000 0-1.5	B-3 3/2/2000 0-1.5	B-4 3/2/2000 0-1.5	B-5 3/2/2000 0-1.5
TBT in mg/kg (dry wt.)							
Dibutyltin			0.008	0.005	0.005 U	0.004 U	0.004 U
Monobutyltin			0.003 U	0.005 U	0.005 U	0.004 U	0.004 U
Tributyltin	5.75		0.068	0.088	0.05	0.015	0.014
Metals in in mg/kg (dry wt.)							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Chromium							
Cobalt							
Copper	810		264	647	590	665	1650
Lead	231		51	191	119	441	346
Mercury							
Molybdenum							
Nickel							
Selenium							
Silver							
Thallium							
Vanadium							
Zinc	820		270	818	490	854	1720
TPH in in mg/kg (dry wt.)							
Diesel		17 U	14 U	22 U	25 U	20 U	21 U
Gasoline		17 U	14 U	22 U	25 U	20 U	21 U
Waste Oil		721	14 U	22 U	25 U	20 U	21 U
Total TPH		721	ND	ND	ND	ND	ND
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							
2,4'-DDE							
2,4'-DDT							
4,4'-DDD							
4,4'-DDE							
4,4'-DDT							
Total DDT							
Aldrin							
Alpha-BHC							
Beta-BHC							
Chlordane							
Delta-BHC							
Dieldrin							
Endosulfan sulfate							
Endrin							
Endrin aldehyde							
Endusulfan I							

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening Criteria	A1-PLUG	B-1	B-2	B-3	B-4	B-5
Sampling Date		1999	3/2/2000	3/2/2000	3/2/2000	3/2/2000	3/2/2000
Depth in Feet		NA	0-1.5	0-1.5	0-1.5	0-1.5	0-1.5
Endusulfan II							
Gamma-BHC							
Heptachlor							
Heptachlor epoxide							
Methoxychlor							
Toxaphene							
Aroclor-1016			0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Aroclor-1221			0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Aroclor-1232			0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Aroclor-1242			0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Aroclor-1248			0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Aroclor-1254			0.584	0.365	0.301	0.717	0.358
Aroclor-1260			0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Total PCBs	0.95		0.584	0.365	0.301	0.717	0.358
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.173 U	0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Acenaphthylene		0.879	0.048	0.241	0.471	0.098	0.12
Anthracene		1.29	0.079	0.419	0.643	0.136	0.282
Fluorene		0.173 U	0.028 U	0.092	0.078	0.04 U	0.047
Naphthalene		0.173 U	0.028 U	0.045 U	0.051 U	0.04 U	0.041 U
Phenanthrene		1.05	0.062	0.453	0.529	0.2	0.222
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		4.43	0.149	0.912	1.04	0.353	0.533
Benzo(a)pyrene		4.15	0.456	3.04	4.18	0.804	1.48
Benzo(b)fluoranthene		2.87	0.617	3.69	8.08	0.982	1.87
Benzo(k)fluoranthene		2.53	0.175	1.33	1.78	0.325	0.659
Benzo(g,h,i)perylene		2.29	0.22	1.49	1.49	0.535	0.694
Chrysene		4.65	0.354	1.75	2.42	0.589	1.21
Dibenz(a,h)anthracene		0.291	0.066	0.453	0.499	0.142	0.325
Fluoranthene		6.94	0.162	0.815	1.21	0.607	0.604
Indeno(1,2,3-cd)pyrene		2.02	0.254	1.8	1.89	0.569	0.904
Pyrene		13.1	0.391	3.38	10.3	0.862	1.31
Total HPAHs	44	43.27	2.844	18.66	32.89	5.768	9.589

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	B-31 1999 5.0-5.5	B-32 1999 1	B-33 1999 4.5	B-34 1999 4.5	B-C-U 11/17/99 0-2	C-1-U 11/19/99 0-2
TBT in mg/kg (dry wt.)							
Dibutyltin						0.002 U	0.004 U
Monobutyltin						0.002 U	0.004 U
Tributyltin	5.75					0.035	0.047
Metals in in mg/kg (dry wt.)							
Antimony						18 U	18 U
Arsenic						11.9	10
Barium						155	85
Beryllium						2 U	2 U
Cadmium						1.1	1.2
Chromium						151	64
Cobalt						18 U	18 U
Copper	810					440	252
Lead	231					129	465
Mercury						1.04	0.7
Molybdenum						51	18 U
Nickel						18	14
Selenium						0.7	0.8
Silver						1.2	1
Thallium						18 U	18 U
Vanadium						70	52
Zinc	820					704	431
TPH in in mg/kg (dry wt.)							
Diesel		12 U	15 U	12 U	12 U	18 U	18 U
Gasoline		12 U	15 U	12 U	12 U	18 U	18 U
Waste Oil		112	53	527	137	NA	177
Total TPH		112	53	527	137	ND	177
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD						0.004 U	0.004 U
2,4'-DDE						0.004 U	0.004 U
2,4'-DDT						0.004 U	0.004 U
4,4'-DDD						0.004 U	0.004 U
4,4'-DDE						0.004 U	0.004 U
4,4'-DDT						0.004 U	0.004 U
Total DDT						0.004 U	0.004 U
Aldrin						0.004 U	0.004 U
Alpha-BHC						0.004 U	0.004 U
Beta-BHC						0.004 U	0.004 U
Chlordane						0.037 U	0.036 U
Delta-BHC						0.004 U	0.004 U
Dieldrin						0.004 U	0.004 U
Endosulfan sulfate						0.004 U	0.004 U
Endrin						0.004 U	0.004 U
Endrin aldehyde						0.004 U	0.004 U
Endusulfan I						0.004 U	0.004 U

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	B-31	B-32	B-33	B-34	B-C-U	C-1-U
Sampling Date	Criteria	1999	1999	1999	1999	11/17/99	11/19/99
Depth in Feet		5.0-5.5	1	4.5	4.5	0-2	0-2
Endusulfan II						0.004 U	0.004 U
Gamma-BHC						0.004 U	0.004 U
Heptachlor						0.004 U	0.004 U
Heptachlor epoxide						0.004 U	0.004 U
Methoxychlor						0.037 U	0.036 U
Toxaphene						0.046 U	0.045 U
Aroclor-1016						0.037 U	0.036 U
Aroclor-1221						0.037 U	0.036 U
Aroclor-1232						0.037 U	0.036 U
Aroclor-1242						0.037 U	0.036 U
Aroclor-1248						0.037 U	0.036 U
Aroclor-1254						0.703	0.573
Aroclor-1260						0.037 U	0.036 U
Total PCBs	0.95					0.703	0.573
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.012 U	0.147 U	0.058 U	0.121 U		
Acenaphthylene		0.061	0.147 U	0.058 U	0.121 U		
Anthracene		0.047	0.295	0.058 U	0.181		
Fluorene		0.012 U	0.147 U	0.058 U	0.121 U		
Naphthalene		0.033	0.147 U	0.058 U	0.121 U		
Phenanthrene		0.121	0.419	0.063	0.166		
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.279	0.571	0.306	0.852		
Benzo(a)pyrene		0.874	0.868	0.222	1.84		
Benzo(b)fluoranthene		0.673	1.23	0.268	1.66		
Benzo(k)fluoranthene		0.38	0.695	0.242	1.74		
Benzo(g,h,i)perylene		0.872	0.493	0.123	0.574		
Chrysene		0.188	0.862	0.383	1.1		
Dibenz(a,h)anthracene		0.105	0.147 U	0.058 U	0.189		
Fluoranthene		0.578	1.03	0.137	0.466		
Indeno(1,2,3-cd)pyrene		0.743	0.533	0.139	0.794		
Pyrene		3.32	3.38	1.25	11.5		
Total HPAHs	44	8.012	9.662	3.07	20.72		

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	C-1-24 11/19/99 2-4	C-2-U 11/19/99 0-2	C-2-46 11/19/99 4-6	C-3-U 11/19/99 0-2	C-3-46 11/19/99 4-6	C-4-U 11/19/99 0-2
TBT in mg/kg (dry wt.)							
Dibutyltin		0.008 U	0.002 U	0.003 U	0.01 U	0.003 U	0.011 U
Monobutyltin		0.008 U	0.002 U	0.003 U	0.01 U	0.003 U	0.011 U
Tributyltin	5.75	0.008 U	0.031	0.003 U	0.01 U	0.003 U	0.164
Metals in in mg/kg (dry wt.)							
Antimony		16 U	17 U		20 U		21 U
Arsenic		5.5	8.7		24.5		26.2
Barium		82	89		165		325
Beryllium		2 U	2 U		2 U		2 U
Cadmium		0.8	1		1.5		1.6
Chromium		76	55		76		142
Cobalt		16 U	17 U		20 U		69
Copper	810	137	198	188	568	293	$\boxed{2190}$
Lead	231	171	164	$\boxed{324}$	189	$\boxed{260}$	$\boxed{285}$
Mercury		0.39	0.66		0.98		1
Molybdenum		16 U	17 U		44		142
Nickel		16	21		20		46
Selenium		0.4	0.6		1		1.1
Silver		0.4	1		1.4		1.4
Thallium		16 U	17 U		20 U		210 U
Vanadium		50	52		65		75
Zinc	820	381	354	602	$\boxed{1160}$	798	$\boxed{2180}$
TPH in in mg/kg (dry wt.)							
Diesel		16 U	17 U	17 U	20 U	190	19 U
Gasoline		16 U	17 U	17 U	20 U	17 U	19 U
Waste Oil		147	214	1270	161	358	179
Total TPH		147	214	1270	161	548	179
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD			0.003 U		0.041 U		0.021 U
2,4'-DDE			0.003 U		0.041 U		0.021 U
2,4'-DDT			0.003 U		0.041 U		0.021 U
4,4'-DDD			0.003 U		0.041 U		0.021 U
4,4'-DDE			0.003 U		0.041 U		0.021 U
4,4'-DDT			0.003 U		0.041 U		0.021 U
Total DDT			0.003 U		0.041 U		0.021 U
Aldrin			0.003 U		0.041 U		0.021 U
Alpha-BHC			0.003 U		0.041 U		0.021 U
Beta-BHC			0.003 U		0.041 U		0.021 U
Chlordane			0.034 U		0.408 U		0.213 U
Delta-BHC			0.003 U		0.041 U		0.021 U
Dieldrin			0.003 U		0.041 U		0.021 U
Endosulfan sulfate			0.003 U		0.041 U		0.021 U
Endrin			0.003 U		0.041 U		0.021 U
Endrin aldehyde			0.003 U		0.041 U		0.021 U
Endusulfan I			0.003 U		0.041 U		0.021 U

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	C-1-24	C-2-U	C-2-46	C-3-U	C-3-46	C-4-U
Sampling Date	Criteria	11/19/99	11/19/99	11/19/99	11/19/99	11/19/99	11/19/99
Depth in Feet		2-4	0-2	4-6	0-2	4-6	0-2
Endusulfan II			0.003 U		0.041 U		0.021 U
Gamma-BHC			0.003 U		0.041 U		0.021 U
Heptachlor			0.003 U		0.041 U		0.021 U
Heptachlor epoxide			0.003 U		0.041 U		0.021 U
Methoxychlor			0.034 U		0.408 U		0.213 U
Toxaphene			0.043 U		0.51 U		0.226 U
Aroclor-1016		0.163 U	0.034 U	0.338 U	0.082 U	0.171 U	0.085 U
Aroclor-1221		0.163 U	0.034 U	0.338 U	0.082 U	0.171 U	0.085 U
Aroclor-1232		0.163 U	0.034 U	0.338 U	0.082 U	0.171 U	0.085 U
Aroclor-1242		0.163 U	0.034 U	0.338 U	0.082 U	0.171 U	0.085 U
Aroclor-1248		0.163 U	0.034 U	0.338 U	0.082 U	0.171 U	0.085 U
Aroclor-1254		1.73	0.559	0.983	0.28	1.85	0.533
Aroclor-1260		0.163 U	0.034 U	0.338 U	0.082 U	0.171 U	0.085 U
Total PCBs	0.95	1.73	0.559	0.983	0.28	1.85	0.533
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening Criteria	C-4-24	C-5-U	C-5-24	D-1-U	D-1-46	D-2-U
Sampling Date		1999	11/19/99	11/19/99	11/19/99	11/19/99	11/19/99
Depth in Feet		2-4	0-2	2-4	0-2	4-6	0-2
TBT in mg/kg (dry wt.)							
Dibutyltin			0.002 U	0.002 U	0.003	0.001 U	0.002 U
Monobutyltin			0.002 U	0.002 U	0.002 U	0.001 U	0.002 U
Tributyltin	5.75		0.029	0.015	0.076	0.001 U	0.032
Metals in in mg/kg (dry wt.)							
Antimony			21 U		16 U		16 U
Arsenic			12.5		4.5		31.6
Barium			107		117		158
Beryllium			2 U		2 U		2 U
Cadmium			1.6		0.2		1.1
Chromium			84		30		196
Cobalt			21 U		16 U		23
Copper	810		445	349	138	8	831
Lead	231		187	910	35	7	200
Mercury			2.21		0.4		0.76
Molybdenum			21 U		16 U		67
Nickel			18		10		18
Selenium			0.9		0.6		1.2
Silver			1.4		0.3		1.1
Thallium			21 U		16 U		16 U
Vanadium			71		51		56
Zinc	820		439	779	130	18	2230
TPH in in mg/kg (dry wt.)							
Diesel		23 U	17 U	77	16 U	12 U	17 U
Gasoline		23 U	17 U	16 U	16 U	12 U	17 U
Waste Oil		255	372	480	16 U	12 U	17 U
Total TPH		255	372	557	ND	ND	
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD			0.004 U		0.003 U		0.003 U
2,4'-DDE			0.004 U		0.003 U		0.003 U
2,4'-DDT			0.004 U		0.003 U		0.003 U
4,4'-DDD			0.004 U		0.003 U		0.003 U
4,4'-DDE			0.004 U		0.003 U		0.003 U
4,4'-DDT			0.004 U		0.003 U		0.003 U
Total DDT			0.004 U		0.003 U		0.003 U
Aldrin			0.004 U		0.003 U		0.003 U
Alpha-BHC			0.004 U		0.003 U		0.003 U
Beta-BHC			0.004 U		0.003 U		0.003 U
Chlordane			0.042 U		0.032 U		0.033 U
Delta-BHC			0.004 U		0.003 U		0.003 U
Dieldrin			0.004 U		0.003 U		0.003 U
Endosulfan sulfate			0.004 U		0.003 U		0.003 U
Endrin			0.004 U		0.003 U		0.003 U
Endrin aldehyde			0.004 U		0.003 U		0.003 U
Endusulfan I			0.004 U		0.003 U		0.003 U

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	C-4-24 1999 2-4	C-5-U 11/19/99 0-2	C-5-24 11/19/99 2-4	D-1-U 11/19/99 0-2	D-1-46 11/19/99 4-6	D-2-U 11/19/99 0-2
Endusulfan II			0.004 U		0.003 U		0.003 U
Gamma-BHC			0.004 U		0.003 U		0.003 U
Heptachlor			0.004 U		0.003 U		0.003 U
Heptachlor epoxide			0.004 U		0.003 U		0.003 U
Methoxychlor			0.042 U		0.032 U		0.033 U
Toxaphene			0.052 U		0.04 U		0.041 U
Aroclor-1016			0.042 U	0.195 U	0.032 U	0.025 U	0.033 U
Aroclor-1221			0.042 U	0.195 U	0.032 U	0.025 U	0.033 U
Aroclor-1232			0.042 U	0.195 U	0.032 U	0.025 U	0.033 U
Aroclor-1242			0.042 U	0.195 U	0.032 U	0.025 U	0.033 U
Aroclor-1248			0.042 U	0.195 U	0.032 U	0.025 U	0.033 U
Aroclor-1254			1.13	6.29	0.085	0.025 U	0.203
Aroclor-1260			0.042 U	0.195 U	0.032 U	0.025 U	0.033 U
Total PCBs	0.95		$\boxed{1.13}$	$\boxed{6.29}$	0.085		0.203
LPAHs in mg/kg (dry wt.)							
Acenaphthene			0.209 U		0.016 U		0.017 U
Acenaphthylene			0.238		0.143		0.054
Anthracene			0.37		0.183		0.092
Fluorene			0.209 U		0.023		0.017 U
Naphthalene			0.209 U		0.016 U		0.017 U
Phenanthrene			0.305		0.461		0.069
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene			0.72		0.424		0.186
Benzo(a)pyrene			2.11		1.06		0.446
Benzo(b)fluoranthene			1.67		0.807		0.371
Benzo(k)fluoranthene			1.8		0.629		0.337
Benzo(g,h,i)perylene			1.27		0.759		0.29
Chrysene			1.01		0.645		0.257
Dibenz(a,h)anthracene			0.221		0.077		0.048
Fluoranthene			0.973		0.979		0.213
Indeno(1,2,3-cd)pyrene			1.21		0.728		0.267
Pyrene			3.47		2.06		0.475
Total HPAHs	44		14.45		8.168		2.89

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	D-3-U	D-3-810	D-4-U	D-4-24	D-5-U	D-5-24
Sampling Date	Criteria	11/19/99	11/19/99	11/19/99	1999	11/19/99	11/19/99
Depth in Feet		0-2	8-10	0-2	2-4	0-2	2-4
TBT in mg/kg (dry wt.)							
Dibutyltin		0.011 U	0.004 U	0.002 U		0.002 U	0.002 U
Monobutyltin		0.011 U	0.004 U	0.002 U		0.002 U	0.002 U
Tributyltin	5.75	0.252	0.004 U	0.004		0.002 U	0.002 U
Metals in in mg/kg (dry wt.)							
Antimony		22 U		19 U		17 U	
Arsenic		17.2		8.9		3.1	
Barium		156		132		108	
Beryllium		2 U		2 U		2 U	
Cadmium		1.1		0.7		0.2 U	
Chromium		91		60		34	
Cobalt		22 U		19 U		17 U	
Copper	810	787	403	239		40	31
Lead	231	149	176	82		24	26
Mercury		0.98		0.66		0.22	
Molybdenum		22 U		19		17 U	
Nickel		20		17		13	
Selenium		1.1		0.8		0.5	
Silver		1.9		0.9		0.2	
Thallium		22 U		19 U		17 U	
Vanadium		81		77		71	
Zinc	820	733	503	487		94	88
TPH in in mg/kg (dry wt.)							
Diesel		22 U	20 U	21 U	17 U	21 U	20 U
Gasoline		22 U	20 U	21 U	17 U	21 U	20 U
Waste Oil		22 U	20 U	81	25	33	32
Total TPH				81	25	33	32
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD		0.045 U		0.004 U		0.003 U	
2,4'-DDE		0.045 U		0.004 U		0.003 U	
2,4'-DDT		0.045 U		0.004 U		0.003 U	
4,4'-DDD		0.045 U		0.004 U		0.003 U	
4,4'-DDE		0.045 U		0.004 U		0.003 U	
4,4'-DDT		0.045 U		0.004 U		0.003 U	
Total DDT		0.045 U		0.004 U		0.003 U	
Aldrin		0.045 U		0.004 U		0.003 U	
Alpha-BHC		0.045 U		0.004 U		0.003 U	
Beta-BHC		0.045 U		0.004 U		0.003 U	
Chlordane		0.445 U		0.038 U		0.033 U	
Delta-BHC		0.045 U		0.004 U		0.003 U	
Dieldrin		0.045 U		0.004 U		0.003 U	
Endosulfan sulfate		0.045 U		0.004 U		0.003 U	
Endrin		0.045 U		0.004 U		0.003 U	
Endrin aldehyde		0.045 U		0.004 U		0.003 U	
Endusulfan I		0.045 U		0.004 U		0.003 U	

Table 2 - Analytical Results for Sediment Samples - Phase I

Sheet 12 of 22

Sample ID	Screening	D-3-U	D-3-810	D-4-U	D-4-24	D-5-U	D-5-24
Sampling Date	Criteria	11/19/99	11/19/99	11/19/99	1999	11/19/99	11/19/99
Depth in Feet		0-2	8-10	0-2	2-4	0-2	2-4
Endusulfan II		0.045 U		0.004 U		0.003 U	
Gamma-BHC		0.045 U		0.004 U		0.003 U	
Heptachlor		0.045 U		0.004 U		0.003 U	
Heptachlor epoxide		0.045 U		0.004 U		0.003 U	
Methoxychlor		0.445 U		0.038 U		0.033 U	
Toxaphene		0.557 U		0.047 U		0.042 U	
Aroclor-1016		0.044 U	0.406 U	0.038 U		0.042 U	0.032 U
Aroclor-1221		0.044 U	0.406 U	0.038 U		0.042 U	0.032 U
Aroclor-1232		0.044 U	0.406 U	0.038 U		0.042 U	0.032 U
Aroclor-1242		0.044 U	0.406 U	0.038 U		0.042 U	0.032 U
Aroclor-1248		0.044 U	0.406 U	0.038 U		0.042 U	0.032 U
Aroclor-1254		0.432	0.87	0.218		0.042 U	0.032 U
Aroclor-1260		0.044 U	0.406 U	0.038 U		0.042 U	0.032 U
Total PCBs	0.95	0.432	0.87	0.218			
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.223 U		0.019 U		0.017 U	
Acenaphthylene		0.223 U		0.053		0.017 U	
Anthracene		0.345		0.054		0.017 U	
Fluorene		0.223 U		0.019 U		0.017 U	
Naphthalene		0.223 U		0.019 U		0.017 U	
Phenanthrene		0.247		0.051		0.017 U	
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.579		0.131		0.038	
Benzo(a)pyrene		2.29		0.4		0.068	
Benzo(b)fluoranthene		1.68		0.308		0.051	
Benzo(k)fluoranthene		2.47		0.263		0.051	
Benzo(g,h,i)perylene		0.833		0.295		0.05	
Chrysene		0.92		0.191		0.058	
Dibenz(a,h)anthracene		0.223 U		0.051		0.017 U	
Fluoranthene		0.53		0.171		0.05	
Indeno(1,2,3-cd)pyrene		0.993		0.28		0.04	
Pyrene		5.79		0.538		0.123	
Total HPAHs	44	16.09		2.628		0.529	

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	1 11/18/99 0.3	2 11/18/99 0.3	3 11/18/99 0.3	4 11/18/99 0.3	5 11/18/99 0.3	6 11/18/99 0.3
TBT in mg/kg (dry wt.)							
Dibutyltin		0.002 U	0.002 U	0.002 U	0.003 U	0.003 U	0.003 U
Monobutyltin		0.002 U	0.002 U	0.002 U	0.003 U	0.003 U	0.003 U
Tributyltin	5.75	0.028	0.021	0.016	0.035	0.012	0.017
Metals in in mg/kg (dry wt.)							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Chromium							
Cobalt							
Copper	810	220	205	198	282	257	275
Lead	231	189	133	109	133	111	107
Mercury							
Molybdenum							
Nickel							
Selenium							
Silver							
Thallium							
Vanadium							
Zinc	820	301	352	310	408	326	353
TPH in in mg/kg (dry wt.)							
Diesel		16 U	24 U	24 U	31 U	30 U	31 U
Gasoline		16 U	24 U	24 U	31 U	30 U	31 U
Waste Oil		NA	NA	NA	NA	NA	NA
Total TPH		ND	ND	ND	ND	ND	ND
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							
2,4'-DDE							
2,4'-DDT							
4,4'-DDD							
4,4'-DDE							
4,4'-DDT							
Total DDT							
Aldrin							
Alpha-BHC							
Beta-BHC							
Chlordane							
Delta-BHC							
Dieldrin							
Endosulfan sulfate							
Endrin							
Endrin aldehyde							
Endusulfan I							

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	1	2	3	4	5	6
Sampling Date	Criteria	11/18/99	11/18/99	11/18/99	11/18/99	11/18/99	11/18/99
Depth in Feet		0.3	0.3	0.3	0.3	0.3	0.3
Endusulfan II							
Gamma-BHC							
Heptachlor							
Heptachlor epoxide							
Methoxychlor							
Toxaphene							
Aroclor-1016		0.032 U	0.047 U	0.049 U	0.061 U	0.061 U	0.061 U
Aroclor-1221		0.032 U	0.047 U	0.049 U	0.061 U	0.061 U	0.061 U
Aroclor-1232		0.032 U	0.047 U	0.049 U	0.061 U	0.061 U	0.061 U
Aroclor-1242		0.032 U	0.047 U	0.049 U	0.061 U	0.061 U	0.061 U
Aroclor-1248		0.032 U	0.047 U	0.049 U	0.061 U	0.061 U	0.061 U
Aroclor-1254		1.27	0.998	0.886	0.491	0.303	0.183
Aroclor-1260		0.032 U	0.047 U	0.049 U	0.061 U	0.061 U	0.061 U
Total PCBs	0.95	1.27	0.998	0.886	0.491	0.303	0.183
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	7 11/18/99 0.3	8 11/18/99 0.3	9 11/18/99 0.3	10 11/18/99 0.3	11 11/18/99 0.3	12 11/18/99 0.3
TBT in mg/kg (dry wt.)							
Dibutyltin		0.003 U	0.002 U	0.003 U	0.002 U	0.003 U	0.003 U
Monobutyltin		0.003 U	0.002 U	0.003 U	0.002 U	0.003 U	0.003 U
Tributyltin	5.75	0.007	0.008	0.005	0.006	0.014	0.004
Metals in in mg/kg (dry wt.)							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Chromium							
Cobalt							
Copper	810	258	187	167	163	349	255
Lead	231	103	85	76	68	127	206
Mercury							
Molybdenum							
Nickel							
Selenium							
Silver							
Thallium							
Vanadium							
Zinc	820	341	250	232	226	507	367
TPH in in mg/kg (dry wt.)							
Diesel		31 U	23 U	25 U	21 U	28 U	28 U
Gasoline		31 U	23 U	25 U	21 U	28 U	28 U
Waste Oil		NA	NA	NA	NA	NA	NA
Total TPH		ND	ND	ND	ND	ND	ND
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							
2,4'-DDE							
2,4'-DDT							
4,4'-DDD							
4,4'-DDE							
4,4'-DDT							
Total DDT							
Aldrin							
Alpha-BHC							
Beta-BHC							
Chlordane							
Delta-BHC							
Dieldrin							
Endosulfan sulfate							
Endrin							
Endrin aldehyde							
Endusulfan I							

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	7 11/18/99 0.3	8 11/18/99 0.3	9 11/18/99 0.3	10 11/18/99 0.3	11 11/18/99 0.3	12 11/18/99 0.3
Endusulfan II							
Gamma-BHC							
Heptachlor							
Heptachlor epoxide							
Methoxychlor							
Toxaphene							
Aroclor-1016		0.061 U	0.047 U	0.05 U	0.043 U	0.055 U	0.056 U
Aroclor-1221		0.061 U	0.047 U	0.05 U	0.043 U	0.055 U	0.056 U
Aroclor-1232		0.061 U	0.047 U	0.05 U	0.043 U	0.055 U	0.056 U
Aroclor-1242		0.061 U	0.047 U	0.05 U	0.043 U	0.055 U	0.056 U
Aroclor-1248		0.061 U	0.047 U	0.05 U	0.043 U	0.055 U	0.056 U
Aroclor-1254		0.251	0.211	0.136	0.149	0.211	0.225
Aroclor-1260		0.061 U	0.047 U	0.05 U	0.043 U	0.055 U	0.056 U
Total PCBs	0.95	0.251	0.211	0.136	0.149	0.211	0.225
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening Criteria	V1-U	V1-24	V2-U	V2-24	V-3-U	V3-24
Sampling Date		1999	1999	1999	1999	1999	1999
Depth in Feet		0-2	2-4	0-2	2-4	0-2	2-4
TBT in mg/kg (dry wt.)							
Dibutyltin							
Monobutyltin							
Tributyltin	5.75						
Metals in in mg/kg (dry wt.)							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Chromium							
Cobalt							
Copper	810						
Lead	231	$\boxed{291}$	67.3	168	229	$\boxed{330}$	3.1
Mercury							
Molybdenum							
Nickel							
Selenium							
Silver							
Thallium							
Vanadium							
Zinc	820						
TPH in in mg/kg (dry wt.)							
Diesel		22 U	14 U	18 U	18 U	16 U	14 U
Gasoline		22 U	14 U	18 U	18 U	16 U	14 U
Waste Oil		55	623	89	66	58	14 U
Total TPH		55	623	89	66	58	ND
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							
2,4'-DDE							
2,4'-DDT							
4,4'-DDD							
4,4'-DDE							
4,4'-DDT							
Total DDT							
Aldrin							
Alpha-BHC							
Beta-BHC							
Chlordane							
Delta-BHC							
Dieldrin							
Endosulfan sulfate							
Endrin							
Endrin aldehyde							
Endusulfan I							

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening Criteria	V1-U	V1-24	V2-U	V2-24	V-3-U	V3-24
Sampling Date		1999	1999	1999	1999	1999	1999
Depth in Feet		0-2	2-4	0-2	2-4	0-2	2-4
Endusulfan II							
Gamma-BHC							
Heptachlor							
Heptachlor epoxide							
Methoxychlor							
Toxaphene							
Aroclor-1016		0.044 U	0.028 U	0.036 U	0.036 U	0.033 U	0.027 U
Aroclor-1221		0.044 U	0.028 U	0.036 U	0.036 U	0.033 U	0.027 U
Aroclor-1232		0.044 U	0.028 U	0.036 U	0.036 U	0.033 U	0.027 U
Aroclor-1242		0.044 U	0.028 U	0.036 U	0.036 U	0.033 U	0.027 U
Aroclor-1248		0.044 U	0.028 U	0.036 U	0.036 U	0.033 U	0.027 U
Aroclor-1254		0.46	0.028 U	0.189	0.98	0.374	0.027 U
Aroclor-1260		0.044 U	0.028 U	0.036 U	0.036 U	0.033 U	0.027 U
Total PCBs	0.95	0.46		0.189	0.98	0.374	
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID Sampling Date Depth in Feet	Screening Criteria	V-4-U 1999 0-2	V4-24 1999 2-4	V-5-U 1999 0-2	V-5-24 1999 2-4	V-6-U 1999 0-2	V-6-24 1999 2-4
TBT in mg/kg (dry wt.)							
Dibutyltin							
Monobutyltin							
Tributyltin	5.75						
Metals in in mg/kg (dry wt.)							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Chromium							
Cobalt							
Copper	810						
Lead	231	159	156	182	147	158	253
Mercury							
Molybdenum							
Nickel							
Selenium							
Silver							
Thallium							
Vanadium							
Zinc	820						
TPH in in mg/kg (dry wt.)							
Diesel		17 U	106	16 U	13 U	23 U	20 U
Gasoline		17 U	14 U	16 U	13 U	23 U	20 U
Waste Oil		112	44	224	87	63	61
Total TPH		112	150	224	87	63	61
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							
2,4'-DDE							
2,4'-DDT							
4,4'-DDD							
4,4'-DDE							
4,4'-DDT							
Total DDT							
Aldrin							
Alpha-BHC							
Beta-BHC							
Chlordane							
Delta-BHC							
Dieldrin							
Endosulfan sulfate							
Endrin							
Endrin aldehyde							
Endusulfan I							

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	V-4-U	V4-24	V-5-U	V-5-24	V-6-U	V-6-24
Sampling Date	Criteria	1999	1999	1999	1999	1999	1999
Depth in Feet		0-2	2-4	0-2	2-4	0-2	2-4
Endusulfan II							
Gamma-BHC							
Heptachlor							
Heptachlor epoxide							
Methoxychlor							
Toxaphene							
Aroclor-1016		0.175 U	0.028 U	0.031 U	0.026 U	0.046 U	0.041 U
Aroclor-1221		0.175 U	0.028 U	0.031 U	0.026 U	0.046 U	0.041 U
Aroclor-1232		0.175 U	0.028 U	0.031 U	0.026 U	0.046 U	0.041 U
Aroclor-1242		0.175 U	0.028 U	0.031 U	0.026 U	0.046 U	0.041 U
Aroclor-1248		0.175 U	0.028 U	0.031 U	0.026 U	0.046 U	0.041 U
Aroclor-1254		0.319	0.203	0.203	0.111	0.332	0.416
Aroclor-1260		0.175 U	0.028 U	0.031 U	0.026 U	0.046 U	0.041 U
Total PCBs	0.95	0.319	0.203	0.203	0.111	0.332	0.416
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening Criteria	V-7-U	V-7-24	V8-U	V-8-24	V9-U	V9-24
Sampling Date		1999	1999	1999	1999	1999	1999
Depth in Feet		0-2	2-4	0-2	2-4	0-2	2-4
TBT in mg/kg (dry wt.)							
Dibutyltin							
Monobutyltin							
Tributyltin	5.75						
Metals in in mg/kg (dry wt.)							
Antimony							
Arsenic							
Barium							
Beryllium							
Cadmium							
Chromium							
Cobalt							
Copper	810						
Lead	231	509	473	151	171	224	26.5
Mercury							
Molybdenum							
Nickel							
Selenium							
Silver							
Thallium							
Vanadium							
Zinc	820						
TPH in in mg/kg (dry wt.)							
Diesel		19 U	19 U	22 U	22 U	24 U	20 U
Gasoline		19 U	19 U	22 U	22 U	24 U	20 U
Waste Oil		68	56	109	33	55	20 U
Total TPH		68	56	109	33	55	ND
Pesticides/PCBs in mg/kg (dry wt.)							
2,4'-DDD							
2,4'-DDE							
2,4'-DDT							
4,4'-DDD							
4,4'-DDE							
4,4'-DDT							
Total DDT							
Aldrin							
Alpha-BHC							
Beta-BHC							
Chlordane							
Delta-BHC							
Dieldrin							
Endosulfan sulfate							
Endrin							
Endrin aldehyde							
Endusulfan I							

Table 2 - Analytical Results for Sediment Samples - Phase I

Sample ID	Screening	V-7-U	V-7-24	V8-U	V-8-24	V9-U	V9-24
Sampling Date	Criteria	1999	1999	1999	1999	1999	1999
Depth in Feet		0-2	2-4	0-2	2-4	0-2	2-4
Endusulfan II							
Gamma-BHC							
Heptachlor							
Heptachlor epoxide							
Methoxychlor							
Toxaphene							
Aroclor-1016		0.039 U	0.192 U	0.044 U	0.044 U	0.048 U	0.04 U
Aroclor-1221		0.039 U	0.192 U	0.044 U	0.044 U	0.048 U	0.04 U
Aroclor-1232		0.039 U	0.192 U	0.044 U	0.044 U	0.048 U	0.04 U
Aroclor-1242		0.039 U	0.192 U	0.044 U	0.044 U	0.048 U	0.04 U
Aroclor-1248		0.039 U	0.192 U	0.044 U	0.044 U	0.048 U	0.04 U
Aroclor-1254		0.193	0.365	0.251	0.127	0.365	0.081
Aroclor-1260		0.039 U	0.192 U	0.044 U	0.044 U	0.048 U	0.04 U
Total PCBs	0.95	0.193	0.365	0.251	0.127	0.365	0.081
LPAHs in mg/kg (dry wt.)							
Acenaphthene							
Acenaphthylene							
Anthracene							
Fluorene							
Naphthalene							
Phenanthrene							
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene							
Benzo(a)pyrene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(g,h,i)perylene							
Chrysene							
Dibenz(a,h)anthracene							
Fluoranthene							
Indeno(1,2,3-cd)pyrene							
Pyrene							
Total HPAHs	44						

U = Not detected at indicated detection limit.
J = Estimated value.
Values exceeding screening criteria are boxed.

Table 2 - Analytical Results for Sediment Samples

Sample ID Sampling Date	Screening Criteria	CMB-01 8/30/99	CMB-02 8/30/99	CMB-03 8/30/99	CMB-04 8/30/99	CMB-05 8/30/99	CMB-06 8/30/99	CMB-07 8/30/99	CMB-08 8/30/99
TBT in mg/kg (dry wt.)									
Tributyltin	5.75	0.088	0.076	0.191	0.079	0.291	0.034	0.148	0.028
Metals in in mg/kg (dry wt.)									
Arsenic		12.3	95.1	20.5	21.4	14.3	9.7	44.2	9.6
Cadmium		0.5	5.8	0.8	1	0.4	0.3	1.5	0.7
Chromium		71.4	160	380	1090	50.7	49	163	55
Copper	810	338	$\boxed{3010}$	$\boxed{1070}$	$\boxed{1180}$	$\boxed{1150}$	345	$\boxed{1210}$	280
Lead	231	118	$\boxed{499}$	210	206	120	136	$\boxed{420}$	167
Mercury		0.65	0.79	1.12	1.29	1.24	1.82	3.47	0.69
Nickel		19.6	17.1	16.5	24.4	13.4	9.7	18	15.3
Silver		1.1	1	1.2	0.5	0.6	0.9	0.7	1
Zinc	820	426	$\boxed{6470}$	$\boxed{976}$	$\boxed{1270}$	468	263	$\boxed{3220}$	352
TPH in in mg/kg (dry wt.)									
Diesel		29 U			22 U				27 U
Gasoline		29 U			22 U				27 U
PCBs in mg/kg (dry wt.)									
Total PCBs	0.95	0.182			0.142				0.381
LPAHs in mg/kg (dry wt.)									
Acenaphthene		0.396			0.237				0.362
Acenaphthylene		0.113			0.16				0.236
Anthracene		0.563			2.84				0.852
Fluorene		0.39			0.557				0.373
Naphthalene		0.03 U			0.058				0.181
Phenanthrene		1.83			2.08				1.7
HPAHs in mg/kg (dry wt.)									
Benzo(a)anthracene		1.02			2.42				1.93
Benzo(a)pyrene		1.57			2.79				3.29
Benzo(b)fluoranthene		1.66			3.04				3.26
Benzo(k)fluoranthene		1.26			2.68				2.15
Benzo(g,h,i)perylene		0.94			1.11				2.26
Chrysene		1.91			4.12				3.34
Dibenz(a,h)anthracene		0.19			0.355				0.395
Fluoranthene		2.1			4.37				3.23
Indeno(1,2,3-cd)pyrene		1.16			1.5				2.47
Pyrene		2.79			3.81				4.77
Total HPAHs	44	14.6			26.2				27.1

Table 2 - Analytical Results for Sediment Samples

Sheet 2 of 2

Sample ID Sampling Date	CMB-09 8/30/99	CMB-09 Dup	CMB-10 8/30/99	CMB-11 8/30/99	CMB-STD-01 8/30/99	CMB-STD-02 8/30/99	CMB-STD-03 8/30/99	CMB-STD-04 8/30/99
TBT in mg/kg (dry wt.)								
Tributyltin	0.017		0.039	0.019	0.003	0.011	0.016	0.008
Metals in in mg/kg (dry wt.)								
Arsenic	8.1	9.2	6	6.4	5.6	9.5	9.9	2.1
Cadmium	0.5		0.4	0.5	0.3	0.6	1.3	0.3
Chromium	54.1		32.9	104	21.6	59	55.1	11
Copper	205		223	353	82	214	226	104
Lead	104		92.9	269	39.1	119	111	78.9
Mercury	0.65		0.8	3.19	0.04	0.33	0.32	0.03 U
Nickel	12.8		13.5	8.7	5.6	7.8	9.3	8.3
Silver	1.1		0.6	0.5	0.3	0.4	0.6	0.3
Zinc	283		240	364	151	393	321	141
TPH in in mg/kg (dry wt.)								
Diesel					16 U			
Gasoline					16 U			
PCBs in mg/kg (dry wt.)								
Total PCBs					0.699			
LPAHs in mg/kg (dry wt.)								
Acenaphthene					0.021			
Acenaphthylene					0.051			
Anthracene					0.236			
Fluorene					0.043			
Naphthalene					0.016 U			
Phenanthrene					0.353			
HPAHs in mg/kg (dry wt.)								
Benzo(a)anthracene					0.723			
Benzo(a)pyrene					1.07			
Benzo(b)fluoranthene					1.11			
Benzo(k)fluoranthene					1.1			
Benzo(g,h,i)perylene					0.611			
Chrysene					1.47			
Dibenz(a,h)anthracene					0.134			
Fluoranthene					1.01			
Indeno(1,2,3-cd)pyrene					0.718			
Pyrene					2.2			
Total HPAHs					10.15			

Table 3 - Analytical Results for Sediment Samples - Phase II

Sheet 1 of 30

Sample ID	CAO	13-S1	13-S3	13-S4	13-S5	13-S6	13-S7
Sampling Date	Screening	5/23/2000	5/23/2000	5/23/2000	5/23/2000	5/23/2000	5/23/2000
Depth in Feet	Criteria	3-6	8-10	10-12	12-14	14-16	16-18
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0029 U	0.0025 U	0.0024 U	0.0025 U	0.0023 UJ	0.0024 U
Monobutyltin		0.0029 U	0.0025 U	0.0024 U	0.0025 U	0.0023 U	0.0024 U
Tributyltin	5.75	0.0014 U	0.0012 U	0.0012 U	0.0013 U	0.0012 U	0.0012 U
Metals in mg/kg (dry wt.)							
Copper	810	48	7	6	2	1	2
Lead	231	69	5	4	4 U	3 U	4 U
Zinc	820	146	29	23	11	8	9
TPH in mg/kg (dry wt.)							
C06-C12		7 U	6 U	6 U	6 U	6 U	6 U
C10-C30		7 U	6 U	6 U	6 U	6 U	6 U
C28-C40		36 U	31 U	30 U	31 U	29 U	30 U
Total TPH	4300						
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.029 U	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Aroclor-1221		0.029 U	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Aroclor-1232		0.029 U	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Aroclor-1242		0.029 U	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Aroclor-1248		0.029 U	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Aroclor-1254		0.14	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Aroclor-1260		0.029 U	0.025 U	0.024 U	0.025 U	0.023 U	0.024 U
Total PCBs	0.95	0.14					
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.023 U	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Acenaphthylene		0.023 U	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Anthracene		0.023 U	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Fluorene		0.023 U	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Naphthalene		0.023 U	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Phenanthrene		0.027	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.033	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Benzo(a)pyrene		0.088	0.018 U	0.017 U	0.018 U	0.016 U	0.017 U
Benzo(b)fluoranthene		0.054	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Benzo(k)fluoranthene		0.049	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Benzo(g,h,i)perylene		0.075	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Chrysene		0.042	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Dibenz(a,h)anthracene		0.023 U	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Fluoranthene		0.094	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Indeno(1,2,3-cd)pyrene		0.054	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Pyrene		0.13	0.02 U	0.019 U	0.02 U	0.019 U	0.019 U
Total HPAHs	44	0.619					

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	13-S8	13-S9	13-S10	13-S11	13-S2	14-S1
Sampling Date	Screening	5/23/2000	5/23/2000	5/23/2000	5/23/2000	5/23/2000	5/22/2000
Depth in Feet	Criteria	18-20	20-22	22-24	24-26	6-8	0-1.75
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0024 U	0.0034 U
Monobutyltin		0.0022 U	0.0022 U	0.0022 U	0.0022 U	0.0024 U	0.0034 U
Tributyltin	5.75	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0012 U	0.0017 U
Metals in mg/kg (dry wt.)							
Copper	810	1	1	2	5	3	40
Lead	231	3 U	3 U	3 U	5	4	45
Zinc	820	4	5	12	21	11	114
TPH in mg/kg (dry wt.)							
C06-C12		5 U	6 U	6 U	6 U	6 U	8 U
C10-C30		5 U	6 U	6 U	6 U	6 U	8 U
C28-C40		27 U	28 U	28 U	28 U	30 U	44
Total TPH	4300						44
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Aroclor-1221		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Aroclor-1232		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Aroclor-1242		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Aroclor-1248		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Aroclor-1254		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Aroclor-1260		0.022 U	0.022 U	0.022 U	0.022 U	0.024 U	0.033 U
Total PCBs	0.95						
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.018 U	0.018 U	0.018 U	0.018 U	0.02 U	0.027 U
Acenaphthylene		0.018 U	0.018 U	0.018 U	0.018 U	0.02 U	0.064
Anthracene		0.018 U	0.018 U	0.018 U	0.018 U	0.023	0.043
Fluorene		0.018 U	0.018 U	0.018 U	0.018 U	0.02 U	0.027 U
Naphthalene		0.018 U	0.018 U	0.018 U	0.018 U	0.02 U	0.027 U
Phenanthrene		0.018 U	0.018 U	0.018 U	0.018 U	0.052	0.2
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.018 U	0.018 U	0.018 U	0.018 U	0.077	0.29
Benzo(a)pyrene		0.015 U	0.015 U	0.015 U	0.015 U	0.17	0.88
Benzo(b)fluoranthene		0.018 U	0.018 U	0.018 U	0.018 U	0.091	0.67
Benzo(k)fluoranthene		0.018 U	0.018 U	0.018 U	0.018 U	0.1	0.38
Benzo(g,h,i)perylene		0.018 U	0.018 U	0.018 U	0.018 U	0.12	0.34
Chrysene		0.018 U	0.018 U	0.018 U	0.018 U	0.084	0.35
Dibenz(a,h)anthracene		0.018 U	0.018 U	0.018 U	0.018 U	0.02 U	0.054
Fluoranthene		0.018 U	0.018 U	0.018 U	0.018 U	0.24	0.68
Indeno(1,2,3-cd)pyrene		0.018 U	0.018 U	0.018 U	0.018 U	0.087	0.27
Pyrene		0.018 U	0.018 U	0.018 U	0.018 U	0.29	1.1
Total HPAHs	44					1.259	5.014

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	14-S2	14-S3	14-S4	14-S5	14-S6	14-S7
Sampling Date	Screening	5/22/2000	5/22/2000	5/22/2000	5/22/2000	5/22/2000	5/22/2000
Depth in Feet	Criteria	1.75-3.5	3.5-5.5	5.5-7.5	7.5-9.5	9.5-11.5	11.5-13.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0033 U	0.003 U	0.0025 U	0.0026 U	0.0026 U	0.0022 U
Monobutyltin		0.0033 U	0.003 U	0.0025 U	0.0026 U	0.0026 U	0.0022 U
Tributyltin	5.75	0.0016 U	0.0015 U	0.0012 U	0.0013 U	0.0013 U	0.0011 U
Metals in mg/kg (dry wt.)							
Copper	810	36	51	3	2	1 U	1
Lead	231	41	59	4 U	4 U	4 U	3 U
Zinc	820	107	141	13	11	8	4
TPH in mg/kg (dry wt.)							
C06-C12		8 U	8 U	6 U	7 U	6 U	6 U
C10-C30		8 U	8 U	21	7 U	6 U	6 U
C28-C40		44	28	31 U	33 U	32 U	28 U
Total TPH	4300	44	28	21			
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Aroclor-1221		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Aroclor-1232		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Aroclor-1242		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Aroclor-1248		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Aroclor-1254		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Aroclor-1260		0.033 U	0.03 U	0.025 U	0.026 U	0.026 U	0.022 U
Total PCBs	0.95						
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.052 U	0.024 U	0.02 U	0.021 U	0.021 U	0.018 U
Acenaphthylene		0.063	0.024 U	0.02 U	0.021 U	0.021 U	0.018 U
Anthracene		0.052	0.032	0.02 U	0.021 U	0.021 U	0.018 U
Fluorene		0.052 U	0.024 U	0.02 U	0.021 U	0.021 U	0.018 U
Naphthalene		0.052 U	0.024 U	0.02 U	0.021 U	0.021 U	0.018 U
Phenanthrene		0.23	0.19	0.02 U	0.021 U	0.021 U	0.018 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.32	0.23	0.02 U	0.021 U	0.021 U	0.018 U
Benzo(a)pyrene		1	0.71	0.017 U	0.018 U	0.018 U	0.015 U
Benzo(b)fluoranthene		0.72	0.62	0.02 U	0.021 U	0.021 U	0.018 U
Benzo(k)fluoranthene		0.49	0.43	0.02 U	0.021 U	0.021 U	0.018 U
Benzo(g,h,i)perylene		0.53	0.29	0.02 U	0.021 U	0.021 U	0.018 U
Chrysene		0.44	0.28	0.02 U	0.021 U	0.021 U	0.018 U
Dibenz(a,h)anthracene		0.052 U	0.04	0.02 U	0.021 U	0.021 U	0.018 U
Fluoranthene		1.3	0.6	0.02 U	0.021 U	0.021 U	0.018 U
Indeno(1,2,3-cd)pyrene		0.43	0.23	0.02 U	0.021 U	0.021 U	0.018 U
Pyrene		1.6	1	0.02 U	0.021 U	0.021 U	0.018 U
Total HPAHs	44	6.83	4.43				

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	14-S8	14-S9	14-S10	14-S11	14-S12	14-S13
Sampling Date	Screening	5/22/2000	5/22/2000	5/22/2000	5/22/2000	5/22/2000	5/22/2000
Depth in Feet	Criteria	13.5-15.5	15.5-17.5	17.5-19	19-21	21-23	23-25
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 U	0.0025 U	0.0026 U	0.0025 U	0.0024 U	0.0025 U
Monobutyltin		0.0024 U	0.0025 U	0.0026 U	0.0025 U	0.0024 U	0.0025 U
Tributyltin	5.75	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U
Metals in mg/kg (dry wt.)							
Copper	810	2	2	1 U	2	2	11
Lead	231	4 U	4 U	4 U	4 U	4 U	11
Zinc	820	13	14	7	15	15	42
TPH in mg/kg (dry wt.)							
C06-C12		6 U	6 U	6 U	6 U	6 U	6 U
C10-C30		6 U	6 U	6 U	6 U	6 U	6 U
C28-C40		30 U	31 U	32 U	32 U	31 U	32 U
Total TPH	4300						
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Aroclor-1221		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Aroclor-1232		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Aroclor-1242		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Aroclor-1248		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Aroclor-1254		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Aroclor-1260		0.024 U	0.025 U	0.026 U	0.025 U	0.025 U	0.025 U
Total PCBs	0.95						
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acenaphthylene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Anthracene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Fluorene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Naphthalene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Phenanthrene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(a)pyrene		0.017 U	0.017 U	0.018 U	0.018 U	0.017 U	0.018 U
Benzo(b)fluoranthene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(k)fluoranthene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(g,h,i)perylene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chrysene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Dibenz(a,h)anthracene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Fluoranthene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Indeno(1,2,3-cd)pyrene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Pyrene		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Total HPAHs	44						

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	15-S1	15-S2	15-S3	15-S4	15-S5	15-S6
Sampling Date	Screening	5/20/2000	5/20/2000	5/20/2000	5/20/2000	5/20/2000	5/20/2000
Depth in Feet	Criteria	0-2	2-4	4-6	6-8	8-10	10-12
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0081 U	0.0036 U	0.0059 U	0.0024 U	0.0025 U	0.0023 U
Monobutyltin		0.0081 U	0.0036 U	0.0059 U	0.0024 U	0.0025 U	0.0023 U
Tributyltin	5.75	0.0233 J	0.0018 U	0.003 U	0.0012 U	0.0012 U	0.0011 U
Metals in mg/kg (dry wt.)							
Copper	810	298	64	17	1 U	2	3
Lead	231	123	49	13	4 U	4 U	5
Zinc	820	371	140	48	6	16	15
TPH in mg/kg (dry wt.)							
C06-C12		10 U	9 U	7 U	6 U	6 U	6 U
C10-C30		18	9 U	7 U	6 U	6 U	6 U
C28-C40		51 U	45 U	37 U	30 U	31 U	29 U
Total TPH	4300						
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.041 U	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Aroclor-1221		0.041 U	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Aroclor-1232		0.041 U	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Aroclor-1242		0.041 U	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Aroclor-1248		0.041 U	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Aroclor-1254		0.1	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Aroclor-1260		0.041 U	0.036 U	0.03 U	0.024 U	0.025 U	0.023 U
Total PCBs	0.95	0.1					
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.033 U	0.028 U	0.024 U	0.019 U	0.02 U	0.018 U
Acenaphthylene		0.033 U	0.028 U	0.024 U	0.019 U	0.02 U	0.018 U
Anthracene		0.071	0.028 U	0.024 U	0.019 U	0.02 U	0.018 U
Fluorene		0.033 U	0.028 U	0.024 U	0.019 U	0.02 U	0.018 U
Naphthalene		0.033 U	0.028 U	0.024 U	0.019 U	0.02 U	0.018 U
Phenanthrene		0.078	0.029	0.042	0.019 U	0.02 U	0.018 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.13	0.041	0.026	0.019 U	0.02 U	0.018 U
Benzo(a)pyrene		0.38	0.063	0.038	0.017 U	0.018 U	0.018 U
Benzo(b)fluoranthene		0.37 J	0.055 J	0.036 J	0.019 UJ	0.02 U	0.018 U
Benzo(k)fluoranthene		0.28	0.07	0.042	0.019 U	0.02 U	0.016 U
Benzo(g,h,i)perylene		0.11	0.028 U	0.026	0.019 U	0.02 U	0.018 U
Chrysene		0.18	0.041	0.033	0.019 U	0.02 U	0.018 U
Dibenz(a,h)anthracene		0.035	0.033	0.024 U	0.019 U	0.02 U	0.018 U
Fluoranthene		0.23	0.084	0.071	0.019 U	0.02 U	0.018 U
Indeno(1,2,3-cd)pyrene		0.12	0.039	0.024 U	0.019 U	0.02 U	0.018 U
Pyrene		0.31	0.12	0.094	0.019 U	0.02 U	0.018 U
Total HPAHs	44	2.145	0.546	0.366			

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	15-S7 5/20/2000 12-14	16-S1 5/25/2000 0-2	16-S2 5/25/2000 2-4	16-S3 5/25/2000 4-6	16-S4 5/25/2000 6-8	16-S5 5/25/2000 8-10
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0023 U	0.0047 U	0.0037 U	0.02 U	0.0027 U	0.0024 U
Monobutyltin		0.0023 U	0.0047 U	0.0037 U	0.02 U	0.0027 U	0.0024 U
Tributyltin	5.75	0.0011 U	0.0024 U	0.0018 U	0.01 U	0.0013 U	0.0012 U
Metals in mg/kg (dry wt.)							
Copper	810	5	533	122	341	276	11
Lead	231	7	159	57	204	171	4
Zinc	820	19	640	256	511	619	17
TPH in mg/kg (dry wt.)							
C06-C12		6 U	12 U	9 U	10 U	7 U	6 U
C10-C30		6 U	17	16	494	199	15
C28-C40		29 U	88	59	430	261	59
Total TPH	4300		105	75	924	460	74
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.023 U	0.048 U	0.036 U	0.04 U	0.027 U	0.024 U
Aroclor-1221		0.023 U	0.048 U	0.036 U	0.04 U	0.027 U	0.024 U
Aroclor-1232		0.023 U	0.048 U	0.036 U	0.04 U	0.027 U	0.024 U
Aroclor-1242		0.023 U	0.048 U	0.036 U	0.04 U	0.027 U	0.024 U
Aroclor-1248		0.023 U	0.048 U	0.036 U	0.04 U	0.027 U	0.024 U
Aroclor-1254		0.023 U	0.048 U	0.036 U	0.04 U	0.086	0.14
Aroclor-1260		0.023 U	0.048 U	0.036 U	0.56	0.027 U	0.024 U
Total PCBs	0.95				0.56	0.086	0.14
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.018 U	0.038 U	0.029 U	0.032 U	0.021 U	0.02 U
Acenaphthylene		0.018 U	0.038 U	0.029 U	0.058	0.021	0.02 U
Anthracene		0.018 U	0.042	0.029 U	0.069	0.042	0.02 U
Fluorene		0.018 U	0.038 U	0.029 U	0.032 U	0.021 U	0.02 U
Naphthalene		0.018 U	0.038 U	0.029 U	0.032 U	0.021 U	0.02 U
Phenanthrene		0.018 U	0.097	0.029 U	0.15	0.12	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.018 U	0.088	0.029 U	0.2	0.14	0.02 U
Benzo(a)pyrene		0.018 U	0.18	0.031	0.38	0.21	0.03
Benzo(b)fluoranthene		0.018 U	0.15	0.029 U	0.32	0.16	0.021
Benzo(k)fluoranthene		0.016 U	0.14	0.029 U	0.24	0.12	0.02 U
Benzo(g,h,i)perylene		0.018 U	0.072	0.029 U	0.11	0.059	0.02 U
Chrysene		0.018 U	0.13	0.029 U	0.24	0.16	0.02 U
Dibenz(a,h)anthracene		0.018 U	0.038 U	0.029 U	0.032 U	0.021 U	0.02 U
Fluoranthene		0.018 U	0.16	0.029 U	0.35	0.23	0.021
Indeno(1,2,3-cd)pyrene		0.018 U	0.056	0.029 U	0.095	0.05	0.02 U
Pyrene		0.018 U	0.19	0.029 U	0.54	0.34	0.02 U
Total HPAHs	44		1.166	0.031	2.475	1.469	0.072

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	16-S6	16-S7	16-S8	16-S9	17-S1	17-S2
Sampling Date	Screening	5/25/2000	5/25/2000	5/25/2000	5/25/2000	5/16/2000	5/16/2000
Depth in Feet	Criteria	10-12	12-14	14-16	16-18	0-2	2-4
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0025 U	0.0024 U	0.0024 U	0.0023 U	0.0039 UJ	0.0038 UJ
Monobutyltin		0.0025 U	0.0024 U	0.0024 U	0.0023 U	0.0039 UJ	0.0038 UJ
Tributyltin	5.75	0.0012 U	0.0012 U	0.0012 U	0.0011 U	0.0051 J	0.0046 J
Metals in mg/kg (dry wt.)							
Copper	810	1	2	3	5	178	211
Lead	231	4 U	4 U	3	6	81	141
Zinc	820	6	13	13	17	244	332
TPH in mg/kg (dry wt.)							
C06-C12		6 U	6 U	6 U	6 U	20 U	19 U
C10-C30		6 U	6 U	7	6 U	20 U	19 U
C28-C40		31 U	31 U	47	28 U	59	79
Total TPH	4300			54		59	79
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.025 U	0.024 U	0.024 U	0.023 U	0.039 U	0.038 U
Aroclor-1221		0.025 U	0.024 U	0.024 U	0.023 U	0.039 U	0.038 U
Aroclor-1232		0.025 U	0.024 U	0.024 U	0.023 U	0.039 U	0.038 U
Aroclor-1242		0.025 U	0.024 U	0.024 U	0.023 U	0.039 U	0.038 U
Aroclor-1248		0.025 U	0.024 U	0.024 U	0.023 U	0.081	0.142
Aroclor-1254		0.025 U	0.024 U	0.024 U	0.023 U	0.361	0.449
Aroclor-1260		0.025 U	0.024 U	0.024 U	0.023 U	0.039 U	0.038 U
Total PCBs	0.95					0.442	0.591
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.02 U	0.02 U	0.019 U	0.018 U	0.394 U	0.384 U
Acenaphthylene		0.02 U	0.02 U	0.019 U	0.018 U	0.394 U	0.384 U
Anthracene		0.02 U	0.02 U	0.019 U	0.018 U	0.394 U	0.384 U
Fluorene		0.02 U	0.02 U	0.019 U	0.018 U	0.394 U	0.384 U
Naphthalene		0.02 U	0.02 U	0.019 U	0.018 U	0.394 U	0.384 U
Phenanthrene		0.02 U	0.02 U	0.019 U	0.018 U	0.394 U	0.384 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.02 U	0.02 U	0.019 U	0.018 U	1.42	1.04
Benzo(a)pyrene		0.017 U	0.017 U	0.017 U	0.016 U	2.03	2.65
Benzo(b)fluoranthene		0.02 U	0.02 U	0.019 U	0.018 U	1.22	2.2
Benzo(k)fluoranthene		0.02 U	0.02 U	0.019 U	0.018 U	1.4	1.95
Benzo(g,h,i)perylene		0.02 U	0.02 U	0.019 U	0.018 U	1.46	1.72
Chrysene		0.02 U	0.02 U	0.019 U	0.018 U	1.57	1.68
Dibenz(a,h)anthracene		0.02 U	0.02 U	0.019 U	0.018 U	0.952	1.02
Fluoranthene		0.02 U	0.02 U	0.019 U	0.018 U	2.7	0.844
Indeno(1,2,3-cd)pyrene		0.02 U	0.02 U	0.019 U	0.018 U	1.68	2.03
Pyrene		0.02 U	0.02 U	0.019 U	0.018 U	5.31	1.94
Total HPAHs	44					19.742	17.074

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	17-S3	17-S4	17-S5	17-S6	17-S7	17-S8
Sampling Date	Screening	5/16/2000	5/16/2000	5/16/2000	5/16/2000	5/16/2000	5/16/2000
Depth in Feet	Criteria	4-6	6-8	8-10	10-12	12-14	14-16
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0036 UJ	0.0153 UJ	0.0026 UJ	0.0024 UJ		0.0025 UJ
Monobutyltin		0.0036 UJ	0.0153 UJ	0.0026 UJ	0.0024 UJ		0.0025 UJ
Tributyltin	5.75	0.0026 J	0.0077 UJ	0.0013 UJ	0.0012 UJ		0.0012 UJ
Metals in mg/kg (dry wt.)							
Copper	810	242	70	3	4	1	2
Lead	231	151	54	4 U	4 U	4 U	4 U
Zinc	820	338	107	7	12	8	14
TPH in mg/kg (dry wt.)							
C06-C12		18 U	15 U	13 U	12 U		12 U
C10-C30		18 U	15 U	13 U	12 U		12 U
C28-C40		263	422	13 U	12 U		12 U
Total TPH	4300	263	422				
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.365 U	0.031 U	0.026 U	0.024 U		0.025 U
Aroclor-1221		0.365 U	0.031 U	0.026 U	0.024 U		0.025 U
Aroclor-1232		0.365 U	0.031 U	0.026 U	0.024 U		0.025 U
Aroclor-1242		0.365 U	0.031 U	0.026 U	0.024 U		0.025 U
Aroclor-1248		1.02	0.031 U	0.026 U	0.024 U		0.025 U
Aroclor-1254		4.22	0.031 U	0.026 U	0.024 U		0.025 U
Aroclor-1260		0.365 U	0.031 U	0.026 U	0.024 U		0.025 U
Total PCBs	0.95	5.24					
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.365 U	0.307 U	0.026 U	0.024 U	0.024 U	0.025 U
Acenaphthylene		0.365 U	0.307 U	0.026 U	0.024 U	0.024 U	0.025 U
Anthracene		0.365 U	0.307 U	0.026 U	0.024 U	0.024 U	0.025 U
Fluorene		0.365 U	0.307 U	0.026 U	0.024 U	0.024 U	0.025 U
Naphthalene		0.365 U	0.307 U	0.026 U	0.024 U	0.024 U	0.025 U
Phenanthrene		0.365 U	0.307 U	0.026 U	0.024 U	0.024 U	0.025 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		1.32	1.95	0.036	0.024 U	0.024 U	0.025 U
Benzo(a)pyrene		2.79	3	0.114	0.075	0.024 U	0.025 U
Benzo(b)fluoranthene		2	1.48	0.066	0.033	0.024 U	0.025 U
Benzo(k)fluoranthene		2.01	1.53	0.076	0.045	0.024 U	0.025 U
Benzo(g,h,i)perylene		1.86	1.89	0.106	0.071	0.024 U	0.025 U
Chrysene		1.46	1.72	0.044	0.024 U	0.024 U	0.025 U
Dibenz(a,h)anthracene		0.981	0.797	0.057	0.051	0.024 U	0.025 U
Fluoranthene		1.21	2.2	0.048	0.024 U	0.024 U	0.025 U
Indeno(1,2,3-cd)pyrene		2.13	1.87	0.121	0.081	0.024 U	0.025 U
Pyrene		4.98	8.04	0.693	0.161	0.024 U	0.025 U
Total HPAHs	44	20.741	24.477	1.361	0.517		

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	17-S9	17-S10	18-S1	18-S2	18-S3	18-S4
Sampling Date	Screening	5/16/2000	5/16/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000
Depth in Feet	Criteria	16-18	18-20	0-2	2-4	4-6	6-8
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0025 UJ	0.0023 UJ	0.002 U	0.0036 U	0.0025 U	
Monobutyltin		0.0025 UJ	0.0023 UJ	0.002 U	0.0036 U	0.0025 U	
Tributyltin	5.75	0.0012 UJ	0.0012 UJ	0.0989 J	0.0048 J	0.0012 U	
Metals in mg/kg (dry wt.)							
Copper	810	1 U	4	130	209	2	2
Lead	231	4 U	4	79	74	4	4 U
Zinc	820	6	22	195	257	10	9
TPH in mg/kg (dry wt.)							
C06-C12		12 U	12 U	16 U	18 U	12 U	
C10-C30		12 U	12 U	16 U	18 U	12 U	
C28-C40		12 U	12 U	35	39	12 U	
Total TPH	4300			35	39		
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.023 U	0.156 U	0.036 U	0.024 U	
Aroclor-1221		0.024 U	0.023 U	0.156 U	0.036 U	0.024 U	
Aroclor-1232		0.024 U	0.023 U	0.156 U	0.036 U	0.024 U	
Aroclor-1242		0.024 U	0.023 U	0.156 U	0.036 U	0.024 U	
Aroclor-1248		0.024 U	0.023 U	0.156 U	0.036 U	0.024 U	
Aroclor-1254		0.024 U	0.023 U	2.48	0.38	0.024 U	
Aroclor-1260		0.024 U	0.023 U	1.56 U	0.036 U	0.024 U	
Total PCBs	0.95			2.48	0.38		
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.025 U	0.023 U	0.031 U	0.036 U	0.025 U	
Acenaphthylene		0.025 U	0.023 U	0.06	0.091	0.025 U	
Anthracene		0.025 U	0.023 U	0.073	0.118	0.025 U	
Fluorene		0.025 U	0.023 U	0.031 U	0.036 U	0.025 U	
Naphthalene		0.025 U	0.023 U	0.031 U	0.036 U	0.025 U	
Phenanthrene		0.025 U	0.023 U	0.031 U	0.036 U	0.025 U	
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.025 U	0.023 U	0.228	0.315	0.025 U	
Benzo(a)pyrene		0.025 U	0.023 U	0.682	0.832	0.025 U	
Benzo(b)fluoranthene		0.025 U	0.023 U	0.716	0.915	0.025 U	
Benzo(k)fluoranthene		0.025 U	0.023 U	0.49	0.656	0.025 U	
Benzo(g,h,i)perylene		0.025 U	0.023 U	0.368	0.458	0.025 U	
Chrysene		0.025 U	0.023 U	0.341	0.528	0.025 U	
Dibenz(a,h)anthracene		0.025 U	0.023 U	0.108	0.085	0.025 U	
Fluoranthene		0.025 U	0.023 U	0.243	0.382	0.025 U	
Indeno(1,2,3-cd)pyrene		0.025 U	0.023 U	0.39	0.563	0.025 U	
Pyrene		0.025 U	0.023 U	0.763	1.14	0.025 U	
Total HPAHs	44			4.329	5.874		

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	18-S5	18-S6	18-S7	18-S8	18-S9	18-S10
Sampling Date	Screening	5/15/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000
Depth in Feet	Criteria	8-10	10-12	12-14	14-16	16-18	18-20
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0026 UJ	0.0026 UJ	0.0024 UJ	0.0024 UJ	0.0024 UJ	0.0024 U
Monobutyltin		0.0026 UJ	0.0026 UJ	0.0024 UJ	0.0024 UJ	0.0024 UJ	0.0024 U
Tributyltin	5.75	0.0013 UJ	0.0013 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 U
Metals in mg/kg (dry wt.)							
Copper	810	2	2	2	2	2	1 U
Lead	231	4 U	4 U	4 U	4 U	4 U	4 U
Zinc	820	7	8	9	12	10	7
TPH in mg/kg (dry wt.)							
C06-C12		13 U	13 U	12 U	12 U	12 U	12 U
C10-C30		13 U	13 U	12 U	12 U	12 U	12 U
C28-C40		13 U	13 U	12 U	12 U	12 U	12 U
Total TPH	4300						
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Aroclor-1221		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Aroclor-1232		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Aroclor-1242		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Aroclor-1248		0.026 U	0.352	0.024 U	0.024 U	0.024 U	0.024 U
Aroclor-1254		0.026 U	0.304	0.024 U	0.024 U	0.024 U	0.024 U
Aroclor-1260		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Total PCBs	0.95		0.656				
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Acenaphthylene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Anthracene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Fluorene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Naphthalene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Phenanthrene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Benzo(a)pyrene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Benzo(b)fluoranthene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Benzo(k)fluoranthene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Benzo(g,h,i)perylene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Chrysene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Dibenz(a,h)anthracene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Fluoranthene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Indeno(1,2,3-cd)pyrene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Pyrene		0.026 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U
Total HPAHs	44						

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	18-S11	18-S12	19-S1	19-S2	19-S3	20-S1
Sampling Date	Screening	5/16/2000	5/16/2000	5/15/2000	NA	5/15/2000	5/13/2000
Depth in Feet	Criteria	20-22	22-24	3.5-5.5	5.5-7.5	7.5-9.5	0-2
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0025 UJ	0.0039 UJ	0.0026 U	0.0026 UJ	0.0024 UJ	0.0033 UJ
Monobutyltin		0.0025 UJ	0.0039 UJ	0.0026 U	0.0026 UJ	0.0024 UJ	0.0033 UJ
Tributyltin	5.75	0.0012 UJ	0.002 UJ	0.0041	0.0013 UJ	0.0012 UJ	0.009 J
Metals in mg/kg (dry wt.)							
Copper	810	2	4	8	4	5	81
Lead	231	3 U	4	7	4 U	5	145
Zinc	820	9	13	21	10	17	305
TPH in mg/kg (dry wt.)							
C06-C12		12 U	11 U	13 U		12 U	17 U
C10-C30		12 U	11 U	13 UJ		12 U	17 U
C28-C40		48	11 U	13 UJ		12 U	107
Total TPH	4300	48					107
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.025 U	0.023 U	0.026 U		0.024 U	0.033 U
Aroclor-1221		0.025 U	0.023 U	0.026 U		0.024 U	0.033 U
Aroclor-1232		0.025 U	0.023 U	0.026 U		0.024 U	0.033 U
Aroclor-1242		0.025 U	0.023 U	0.026 U		0.024 U	0.033 U
Aroclor-1248		0.025 U	0.023 U	0.026 U		0.024 U	0.242
Aroclor-1254		0.025 U	0.023 U	0.026 U		0.024 U	0.458
Aroclor-1260		0.025 U	0.023 U	0.026 U		0.024 U	0.033 U
Total PCBs	0.95						0.7
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.033 U
Acenaphthylene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.065
Anthracene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.087
Fluorene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.033 U
Naphthalene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.033 U
Phenanthrene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.189
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.347
Benzo(a)pyrene		0.025 U	0.023 U	0.026 UJ	0.026 UJ	0.024 U	0.977 J
Benzo(b)fluoranthene		0.025 U	0.023 U	0.033	0.026 UJ	0.024 U	1.09
Benzo(k)fluoranthene		0.025 U	0.023 U	0.026 UJ	0.026 UJ	0.024 U	0.584
Benzo(g,h,i)perylene		0.025 U	0.023 U	0.026 UJ	0.026 UJ	0.024 UJ	0.416 J
Chrysene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.024 U	0.609
Dibenz(a,h)anthracene		0.025 U	0.023 U	0.026 UJ	0.026 UJ	0.024 UJ	0.082 J
Fluoranthene		0.025 U	0.023 U	0.026 U	0.026 UJ	0.029	0.635
Indeno(1,2,3-cd)pyrene		0.025 U	0.023 U	0.026 UJ	0.026 UJ	0.024 UJ	0.458
Pyrene		0.025 U	0.023 U	0.04 J	0.026 UJ	0.038	2.45
Total HPAHs	44			0.073		0.067	7.648

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	20-S2	20-S3	20-S5	20-S6	20-S7	A6-S1
Sampling Date	Screening	5/13/2000	5/13/2000	5/13/2000	5/13/2000	5/13/2000	5/17/2000
Depth in Feet	Criteria	2-4	4-6	8-10	10-11	11-12	0-2
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0329 UJ	0.0031 UJ	0.0031 UJ	0.0166 UJ	0.0024 U	0.0039 U
Monobutyltin		0.0329 UJ	0.0031 UJ	0.0031 UJ	0.0166 UJ	0.0024 U	0.0039 U
Tributyltin	5.75	0.0165 UJ	0.0059 J	0.0015 UJ	0.0087 UJ	0.0012 U	0.0124 J
Metals in mg/kg (dry wt.)							
Copper	810	97	88	76	78	8	581
Lead	231	209	159	148	177	14	238
Zinc	820	237	220	180	191	27	589
TPH in mg/kg (dry wt.)							
C06-C12		16 U	16 U	15 U	17 U	12 U	20 U
C10-C30		16 U	16 U	15 U	17 U	12 U	20 U
C28-C40		199	164	393	383	12 U	57
Total TPH	4300	199	164	393	383		57
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.115 U	0.14 U	0.026 U	0.167 U	0.024 U	0.197 U
Aroclor-1221		0.115 U	0.14 U	0.026 U	0.167 U	0.024 U	0.197 U
Aroclor-1232		0.115 U	0.14 U	0.026 U	0.167 U	0.024 U	0.197 U
Aroclor-1242		0.115 U	0.14 U	0.026 U	0.167 U	0.024 U	0.197 U
Aroclor-1248		1.05	0.612	0.026 U	1.68	0.024 U	0.706
Aroclor-1254		0.694	0.593	0.35	1.32	0.024 U	0.677
Aroclor-1260		0.165 U	0.14 U	0.026 U	0.167 U	0.024 U	0.197 U
Total PCBs	0.95	1.744	1.205	0.35	3		1.383
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.033 U	0.031 U	0.155	0.667 U	0.024 U	0.039 U
Acenaphthylene		0.079	0.046	0.155	0.667 U	0.024 U	0.087
Anthracene		0.15	0.06	0.482	0.673	0.024 U	0.108
Fluorene		0.033 U	0.031 U	0.139	0.667 U	0.024 U	0.039 U
Naphthalene		0.033 U	0.031 U	0.031 U	0.667 U	0.024 U	0.039 U
Phenanthrene		0.163	0.118	0.361	0.749	0.024 U	0.082
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.433	0.299	0.83	1.33	0.032	0.301
Benzo(a)pyrene		0.837 J	0.558 J	1.21 J	1.51 J	0.037	0.758
Benzo(b)fluoranthene		0.82	0.687	0.77	1.14	0.046	0.907
Benzo(k)fluoranthene		0.469	0.383	0.533	0.879	0.024 U	0.576
Benzo(g,h,i)perylene		0.395 J	0.272 J	0.5 J	0.831 J	0.024 U	0.478
Chrysene		0.573	0.466	0.999	1.51	0.035	0.435
Dibenz(a,h)anthracene		0.065 J	0.039 J	0.079 J	0.667 UJ	0.024 U	0.107
Fluoranthene		0.71	0.452	1.37	2.43	0.053	0.496
Indeno(1,2,3-cd)pyrene		0.426	0.266	0.549	0.759	0.024	0.565
Pyrene		1.66	1.49	2.1	3.61	0.082	1.84
Total HPAHs	44	6.388	4.912	8.94	13.999	0.309	6.463

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	A6-S2 5/17/2000 2-4	A6-S3 5/17/2000 4-6	A6-S4 5/17/2000 9-12
Tributyltin in mg/kg (dry wt.)				
Dibutyltin		0.0037 U	0.0197 U	0.0197 U
Monobutyltin		0.0037 U	0.0197 U	0.0197 U
Tributyltin	5.75	0.0354	0.0099 U	0.0099 U
Metals in mg/kg (dry wt.)				
Copper	810	673	1060	777
Lead	231	378	368	266
Zinc	820	675	715	738
TPH in mg/kg (dry wt.)				
C06-C12		18 UJ	20 U	20 U
C10-C30		590 J	1200	1040
C28-C40		79 J	112	126
Total TPH	4300	669	1312	1166
PCBs in mg/kg (dry wt.)				
Aroclor-1016		0.37 U	0.394 U	0.393 U
Aroclor-1221		0.37 U	0.394 U	0.393 U
Aroclor-1232		0.37 U	0.394 U	0.393 U
Aroclor-1242		0.37 U	0.394 U	0.393 U
Aroclor-1248		5.38	4.42	2.89
Aroclor-1254		3.9	6.29	1.63
Aroclor-1260		0.37 U	0.394 U	0.393 U
Total PCBs	0.95	9.28	10.71	4.52
LPAHs in mg/kg (dry wt.)				
Acenaphthene		1.48 U	1.58 U	1.58 U
Acenaphthylene		1.48 U	1.58 U	1.58 U
Anthracene		6.41	6.06	8.5
Fluorene		1.48 U	1.58 U	1.58 U
Naphthalene		1.48 U	1.58 U	1.58 U
Phenanthrene		1.94	4.41	1.58 U
HPAHs in mg/kg (dry wt.)				
Benzo(a)anthracene		6.81	6.5	7.35
Benzo(a)pyrene		5.2	6.12	5.82
Benzo(b)fluoranthene		7.9	7.86	8.35
Benzo(k)fluoranthene		7.16	7.69	7.74
Benzo(g,h,i)perylene		2.17	2.75	2.01
Chrysene		9.6	9.71	11.4
Dibenz(a,h)anthracene		1.48 U	1.58 U	1.58 U
Fluoranthene		18.19	16	18.4
Indeno(1,2,3-cd)pyrene		2.25	2.83	2.12
Pyrene		11.63	11.7	11.3
Total HPAHs	44	70.91	71.16	74.49

U = Not detected at indicated detection limit.

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	A6-S5 5/17/2000 12-14	A6-S6 5/17/2000 14-16	A6-S7 5/17/2000 16-17	A6-S8 5/17/2000 17-18	A6-S9 5/17/2000 18-20	A7 - S1 5/12/2000 0-2
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0024 UJ	0.0036 U
Monobutyltin		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0024 UJ	0.0036 U
Tributyltin	5.75	0.0011 U	0.0012 U	0.0012 U	0.0012 U	0.0012 UJ	0.0321 J
Metals in mg/kg (dry wt.)							
Copper	810	5	5	8	8	6	166
Lead	231	4	4	29	8	6	156
Zinc	820	8	8	65	28	20	345
TPH in mg/kg (dry wt.)							
C06-C12		11 U	12 U	12 U	12 U	12 U	18 U
C10-C30		11 U	12 U	12 U	12 U	12 U	18 U
C28-C40		11 U	12 U	21	12 U	12 U	202
Total TPH	4300			21			202
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Aroclor-1221		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Aroclor-1232		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Aroclor-1242		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Aroclor-1248		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Aroclor-1254		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.517
Aroclor-1260		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Total PCBs	0.95						0.517
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Acenaphthylene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.117
Anthracene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.125
Fluorene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Naphthalene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.036 U
Phenanthrene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 U	0.328
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.023 U	0.024 U	0.045	0.024 U	0.024 U	0.426
Benzo(a)pyrene		0.023 U	0.024 U	0.126	0.024 U	0.024 U	1.12
Benzo(b)fluoranthene		0.023 U	0.024 U	0.099	0.024 U	0.024 U	1.04
Benzo(k)fluoranthene		0.023 U	0.024 U	0.067	0.024 U	0.024 U	0.933
Benzo(g,h,i)perylene		0.023 U	0.024 U	0.094	0.024 U	0.024 UJ	1.22 UJ
Chrysene		0.023 U	0.024 U	0.062	0.024 U	0.024 U	0.631
Dibenz(a,h)anthracene		0.023 U	0.024 U	0.024 U	0.024 U	0.024 UJ	0.182 UJ
Fluoranthene		0.037	0.024 U	0.125	0.024 U	0.024 U	0.624
Indeno(1,2,3-cd)pyrene		0.023 U	0.024 U	0.087	0.024 U	0.024 UJ	1.22 UJ
Pyrene		0.023 U	0.024 U	0.177	0.024 U	0.024 U	2.14
Total HPAHs	44	0.037		0.882			9.536

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	A7 - S2 5/12/2000 2-4	A7 - S3 5/12/2000 4-6	A7 - S4 5/12/2000 7.5-9	A7 - S5 5/12/2000 9-10.4	A7 - S6 5/12/2000 10.5-13.5	A7 - S7 5/12/2000 14-15.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0033 U	0.003 R	0.0029 R	0.0037 U	0.0026 U	0.0023 U
Monobutyltin		0.0033 U	0.003 R	0.0029 R	0.0037 U	0.0026 U	0.0023 U
Tributyltin	5.75	0.0672 J	0.0384 J	0.0015 R	0.0019 U	0.0013 U	0.0011 U
Metals in mg/kg (dry wt.)							
Copper	810	249	119	722	256	13	2
Lead	231	202	172	512	364	14	5
Zinc	820	434	276	1420	2030	244	14
TPH in mg/kg (dry wt.)							
C06-C12		17 U	15 U	73 U	19 U	13 U	11 U
C10-C30		17 U	15 U	896	19 U	13 U	11 U
C28-C40		182	279	420	362	52	11 U
Total TPH	4300	182	279	1316	362	52	
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.167 U	0.149 U	0.293 U	0.371 U	0.026 U	0.023 UJ
Aroclor-1221		0.167 U	0.149 U	0.293 U	0.371 U	0.026 U	0.023 UJ
Aroclor-1232		0.167 U	0.149 U	0.293 U	0.371 U	0.026 U	0.023 UJ
Aroclor-1242		0.167 U	0.149 U	0.293 U	0.371 U	0.026 U	0.023 UJ
Aroclor-1248		0.36	0.69	8.07	2.62	0.026 U	0.023 UJ
Aroclor-1254		0.51	0.86	5.86	2.37	0.145	0.023 UJ
Aroclor-1260		0.167 U	0.149 U	0.293 U	0.371 U	0.026 U	0.023 UJ
Total PCBs	0.95	0.87	1.55	13.93	4.99	0.145	
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.033 U	0.036	1.42	2.22	0.026 U	0.023 U
Acenaphthylene		0.094	0.03	1.36	0.954	0.026 U	0.023 U
Anthracene		0.071	0.28	5.34	5.59	0.026 U	0.023 U
Fluorene		0.033 U	0.078	2.76	2.21	0.026 U	0.023 U
Naphthalene		0.033 U	0.03 U	0.348	1.051	0.026 U	0.023 U
Phenanthrene		0.153	0.425	19.8	12.1	0.026 U	0.023 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.356	0.438	8.2	10.7	0.086	0.023 U
Benzo(a)pyrene		0.802	0.389	7.38	8.36	0.214	0.023 U
Benzo(b)fluoranthene		0.814	0.267	5.1	7.45	0.147	0.023 U
Benzo(k)fluoranthene		0.528	0.213	4.21	4.8	0.106	0.023 U
Benzo(g,h,i)perylene		0.85	0.324	3.11	2.92	0.187	0.023 UJ
Chrysene		0.483	0.55	7.74	10.3	0.09	0.023 U
Dibenz(a,h)anthracene		0.129	0.072	0.561	0.579	0.031	0.023 UJ
Fluoranthene		0.527	0.508	17.3	17.2	0.108	0.023 U
Indeno(1,2,3-cd)pyrene		0.848	0.33	3.41	3.25	0.172	0.023 UJ
Pyrene		2.01	1.39	20.8	20.8	0.51	0.023 U
Total HPAHs	44	7.347	4.481	77.811	86.359	1.651	

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	B6-S1	B6-S2	B6-S3	B6-S4	B6-S5	B6-S6
Sampling Date	Screening	5/19/2000	5/19/2000	5/19/2000	5/19/2000	5/19/2000	5/19/2000
Depth in Feet	Criteria	0-2.5	2.5-5.5	5.5-7.5	7.5-9.5	9.5-11.5	11.5-13.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0039 U	0.0032 U	0.003 U	0.0024 U	0.0025 U	0.0025 U
Monobutyltin		0.0039 U	0.0032 U	0.003 U	0.0024 U	0.0025 U	0.0025 U
Tributyltin	5.75	0.0067 J	0.0016 U	0.0015 U	0.0012 U	0.0012 U	0.0012 U
Metals in mg/kg (dry wt.)							
Copper	810	$\boxed{1920}$	289	18	5	2	1
Lead	231	$\boxed{400}$	205	23	4 U	4 U	11
Zinc	820	$\boxed{1720}$	$\boxed{1000}$	58	17	10	9
TPH in mg/kg (dry wt.)							
C06-C12		10 U	8 U	8 U	6 U	6 U	6 U
C10-C30		10 U	21	8 U	6 U	6 U	6 U
C28-C40		48 U	53	38 U	31 U	31 U	31 U
Total TPH	4300		74				
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.038 U	0.032 U	0.03 U	0.024 U	0.025 U	0.025 U
Aroclor-1221		0.038 U	0.032 U	0.03 U	0.024 U	0.025 U	0.025 U
Aroclor-1232		0.038 U	0.032 U	0.03 U	0.024 U	0.025 U	0.025 U
Aroclor-1242		0.038 U	0.032 U	0.03 U	0.024 U	0.025 U	0.025 U
Aroclor-1248		0.038 U	0.032 U	0.03 U	0.024 U	0.025 U	0.025 U
Aroclor-1254		0.07	0.21	0.03 U	0.024 U	0.025 U	0.025 U
Aroclor-1260		0.038 U	0.032 U	0.03 U	0.024 U	0.025 U	0.025 U
Total PCBs	0.95	0.07	0.21				
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.031 U	0.043	0.3	0.02 U	0.02 U	0.02 U
Acenaphthylene		0.031 U	0.048	0.027	0.02 U	0.02 U	0.02 U
Anthracene		0.031 U	0.055	0.069	0.02 U	0.02 U	0.02 U
Fluorene		0.031 U	0.026	0.024 U	0.02 U	0.02 U	0.02 U
Naphthalene		0.031 U	0.04	0.024 U	0.02 U	0.02 U	0.02 U
Phenanthrene		0.039	0.15	0.13	0.02 U	0.02 U	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.043	0.21	0.19	0.02 U	0.02 U	0.02 U
Benzo(a)pyrene		0.072	0.3	0.34	0.02	0.018 U	0.017 U
Benzo(b)fluoranthene		0.09	0.36	0.25	0.021	0.02 U	0.02 U
Benzo(k)fluoranthene		0.089	0.24	0.24	0.021	0.02 U	0.02 U
Benzo(g,h,i)perylene		0.037	0.15	0.12	0.02 U	0.02 U	0.02 U
Chrysene		0.067	0.026 U	0.21	0.02 U	0.02 U	0.02 U
Dibenz(a,h)anthracene		0.031 U	0.026 U	0.024 U	0.02 U	0.02 U	0.02 U
Fluoranthene		0.087	0.58	0.96	0.032	0.02 U	0.02 U
Indeno(1,2,3-cd)pyrene		0.037	0.14	0.11	0.02 U	0.02 U	0.02 U
Pyrene		0.1	0.88	0.84	0.04	0.02 U	0.02 U
Total HPAHs	44	0.622	2.86	3.26	0.134		

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	B6-S7	B6-S8	B7-S1	B7-S2	B7-S3	B7-S4
Sampling Date	Screening	5/19/2000	5/19/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000
Depth in Feet	Criteria	13.5-15.5	15.5-17.5	2-4	4-6	6-8	8-10
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0023 U	0.0025 U	0.0144 U	0.0122 U	0.0025 U	0.0026 U
Monobutyltin		0.0023 U	0.0025 U	0.0144 U	0.0122 U	0.0025 U	0.0026 U
Tributyltin	5.75	0.0023 J	0.0013 U	0.0267	0.0061 U	0.0013 U	0.0013 U
Metals in mg/kg (dry wt.)							
Copper	810	1 U	2	561	1140	26	6
Lead	231	3 U	4 U	649	3960	30	9
Zinc	820	4	8	1410	610	103	11
TPH in mg/kg (dry wt.)							
C06-C12		6 U	6 U	34	6 U	6 U	6 U
C10-C30		6 U	6 U	470	28	14	6 U
C28-C40		28 U	31 U	361	102	55	32 U
Total TPH	4300			865	130	69	
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.023 U	0.025 U	0.028 U	0.024 U	0.025 U	0.025 U
Aroclor-1221		0.023 U	0.025 U	0.028 U	0.024 U	0.025 U	0.025 U
Aroclor-1232		0.023 U	0.025 U	0.028 U	0.024 U	0.025 U	0.025 U
Aroclor-1242		0.023 U	0.025 U	0.028 U	0.024 U	0.025 U	0.025 U
Aroclor-1248		0.023 U	0.025 U	0.028 U	0.024 U	0.025 U	0.025 U
Aroclor-1254		0.023 U	0.025 U	0.49	0.13	0.025 U	0.025 U
Aroclor-1260		0.023 U	0.025 U	0.028 U	0.024 U	0.025 U	0.025 U
Total PCBs	0.95			0.49	0.13		
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.018 U	0.02 U	0.023 U	0.24	0.02 U	0.02 U
Acenaphthylene		0.018 U	0.02 U	0.023 U	0.027	0.041	0.02 U
Anthracene		0.018 U	0.02 U	0.049	0.48	0.051	0.02 U
Fluorene		0.018 U	0.02 U	0.023 U	0.21	0.02 U	0.02 U
Naphthalene		0.018 U	0.02 U	0.023 U	0.17	0.02 U	0.02 U
Phenanthrene		0.018 U	0.02 U	0.15	1.2	0.36	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.018 U	0.02 U	0.13	0.74	0.11	0.02 U
Benzo(a)pyrene		0.016 U	0.018 U	0.13	0.74 J	0.2 J	0.018 U
Benzo(b)fluoranthene		0.018 U	0.02 U	0.11	0.59 J	0.18 J	0.02 U
Benzo(k)fluoranthene		0.018 U	0.02 U	0.15	0.76 J	0.13 J	0.02 U
Benzo(g,h,i)perylene		0.018 U	0.02 U	0.027	0.24 J	0.085 J	0.02 U
Chrysene		0.018 U	0.02 U	0.15	0.68	0.14	0.02 U
Dibenz(a,h)anthracene		0.018 U	0.02 U	0.023 U	0.073 J	0.02 UJ	0.02 U
Fluoranthene		0.018 U	0.02 U	0.3	1.4	0.44	0.02 U
Indeno(1,2,3-cd)pyrene		0.018 U	0.02 U	0.027	0.22 J	0.072 J	0.02 U
Pyrene		0.018 U	0.02 U	0.38	1.3	0.57	0.02 U
Total HPAHs	44			1.404	6.743	1.927	

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	B7-S5 5/24/2000 10-11	B7-S6 5/24/2000 11-12	B7-S7 5/24/2000 12-14	B7-S8 5/24/2000 15.5-17.5	B7-S9 5/24/2000 17.5-19.5	B7-S10 5/24/2000 19.5-21.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0115 U	0.0023 U	0.0024 U	0.0048 U	0.0023 U	0.0023 U
Monobutyltin		0.0115 U	0.0023 U	0.0024 U	0.0048 U	0.0023 U	0.0023 U
Tributyltin	5.75	0.0057 U	0.0011 U	0.0012 U	0.0024 U	0.0012 U	0.0011 U
Metals in mg/kg (dry wt.)							
Copper	810	194	1	5	11	8	5
Lead	231	17	3 U	4	4	5	6
Zinc	820	39	6	19	59	26	18
TPH in mg/kg (dry wt.)							
C06-C12		6 U	6 U	6 U	6 U	6 U	6 U
C10-C30		21	6 U	6 U	6 U	6 U	6 U
C28-C40		25	28 U	30 U	30 U	29 U	28 U
Total TPH	4300	46					
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.023 U	0.022 U	0.024 U	0.024 U	0.023 U	0.023 U
Aroclor-1221		0.023 U	0.022 U	0.024 U	0.024 U	0.023 U	0.023 U
Aroclor-1232		0.023 U	0.022 U	0.024 U	0.024 U	0.023 U	0.023 U
Aroclor-1242		0.023 U	0.022 U	0.024 U	0.024 U	0.023 U	0.023 U
Aroclor-1248		0.023 U	0.022 U	0.024 U	0.024 U	0.023 U	0.023 U
Aroclor-1254		0.11	0.022 U	0.024 U	0.063 J	0.023 U	0.023 U
Aroclor-1260		0.023 U	0.022 U	0.024 U	0.024 U	0.023 U	0.023 U
Total PCBs	0.95	0.11			0.063		
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.018 U	0.018 U	0.019 U	0.019 U	0.019 U	0.018 U
Acenaphthylene		0.018 U	0.018 U	0.019 U	0.019 U	0.019 U	0.018 U
Anthracene		0.018 U	0.018 U	0.019 U	0.019 U	0.019 U	0.018 U
Fluorene		0.018 U	0.018 U	0.019 U	0.019 U	0.019 U	0.018 U
Naphthalene		0.018 U	0.018 U	0.019 U	0.019 U	0.019 U	0.018 U
Phenanthrene		0.018 U	0.018 U	0.019 U	0.019 U	0.019 U	0.018 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.018 U	0.018 U	0.04	0.019 U	0.019 U	0.018 U
Benzo(a)pyrene		0.016 U	0.016 U	0.03 J	0.018 J	0.016 U	0.016 U
Benzo(b)fluoranthene		0.018 U	0.018 U	0.029 J	0.021 J	0.019 U	0.018 U
Benzo(k)fluoranthene		0.018 U	0.018 U	0.02 J	0.019 U	0.019 U	0.018 U
Benzo(g,h,i)perylene		0.018 U	0.018 U	0.019 UJ	0.019 U	0.019 U	0.018 U
Chrysene		0.018 U	0.018 U	0.043	0.019 U	0.019 U	0.018 U
Dibenz(a,h)anthracene		0.018 U	0.018 U	0.019 UJ	0.019 U	0.019 U	0.018 U
Fluoranthene		0.021	0.018 U	0.081	0.021	0.019 U	0.018 U
Indeno(1,2,3-cd)pyrene		0.018 U	0.018 U	0.019 UJ	0.019 U	0.019 U	0.018 U
Pyrene		0.085	0.018 U	0.17	0.07	0.096	0.018 U
Total HPAHs	44	0.106		0.413	0.13	0.096	

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	B7X-S1	B7X-S2	B7X-S3	B7X-S4	B7X-S5	C6-S1
Sampling Date	Screening	5/25/2000	5/25/2000	5/25/2000	5/25/2000	5/25/2000	5/17/2000
Depth in Feet	Criteria	0-2	2-4	4-6	6-8	8-10	0-2
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0032 U	0.0025 U	0.0025 U	0.0024	0.0024 U	0.0095 U
Monobutyltin		0.0032 U	0.0025 U	0.0025 U	0.0024	0.0024 U	0.0095 U
Tributyltin	5.75	0.0151	0.0039 J	0.0012 U	0.0022	0.0012 U	0.0218
Metals in mg/kg (dry wt.)							
Copper	810	1000	319	88	29	3	376
Lead	231	164	111	21	19	4	160
Zinc	820	977	339	61	32	12	465
TPH in mg/kg (dry wt.)							
C06-C12		8 U	6 U	6 U	6 U	6 U	24 U
C10-C30		29	6	6 U	6 U	6 U	24 U
C28-C40		84	31 U	31 U	30 U	30 U	59
Total TPH	4300	113	6				59
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.032 U	0.13 U	0.025 U	0.024 U	0.024 U	0.237 U
Aroclor-1221		0.032 U	0.13 U	0.025 U	0.024 U	0.024 U	0.237 U
Aroclor-1232		0.032 U	0.13 U	0.025 U	0.024 U	0.024 U	0.237 U
Aroclor-1242		0.032 U	0.13 U	0.025 U	0.024 U	0.024 U	0.237 U
Aroclor-1248		0.032 U	0.13 U	0.025 U	0.024 U	0.024 U	0.237 U
Aroclor-1254		0.19	1.6	0.03	0.042	0.024 U	0.46
Aroclor-1260		0.032 U	0.13 U	0.025 U	0.024 U	0.024 U	0.237 U
Total PCBs	0.95	0.19	1.6	0.03	0.042		0.46
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.026 U	0.071	0.02 U	0.019 U	0.019 U	0.047 U
Acenaphthylene		0.098	0.037	0.02 U	0.019 U	0.019 U	0.047 U
Anthracene		0.12	0.17	0.02 U	0.019 U	0.019 U	0.101
Fluorene		0.026 U	0.1	0.02 U	0.019 U	0.019 U	0.047 U
Naphthalene		0.09	0.035	0.02 U	0.019 U	0.019 U	0.047 U
Phenanthrene		0.46	0.68	0.02 U	0.019 U	0.019 U	0.047 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.18	0.34	0.02 U	0.019 U	0.019 U	0.226
Benzo(a)pyrene		0.34	0.31 J	0.036	0.017 U	0.016 U	0.438
Benzo(b)fluoranthene		0.37	0.36 J	0.022	0.019 U	0.019 U	0.589
Benzo(k)fluoranthene		0.22	0.2 J	0.022	0.019 U	0.019 U	0.446
Benzo(g,h,i)perylene		0.098	0.084 J	0.03	0.019 U	0.019 U	0.205
Chrysene		0.25	0.35	0.02 U	0.019 U	0.019 U	0.372
Dibenz(a,h)anthracene		0.031	0.024 J	0.02 U	0.019 U	0.019 U	0.061
Fluoranthene		0.52	1.3	0.033	0.019 U	0.019 U	0.289
Indeno(1,2,3-cd)pyrene		0.078	0.065 J	0.023	0.019 U	0.019 U	0.253
Pyrene		0.55	0.73	0.059	0.027	0.019 U	0.983
Total HPAHs	44	2.637	3.763	0.225	0.027		3.862

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	C6-S2	C6-S3	C6-S4	C6-S5	C6-S6	C6-S7
Sampling Date	Screening	5/17/2000	5/17/2000	5/17/2000	5/17/2000	5/17/2000	5/17/2000
Depth in Feet	Criteria	2-4	4-6	6-8	8-10	10-12	12-14
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0091 U	0.0201 U	0.0221 U	0.0214 U	0.0156 U	0.0025 U
Monobutyltin		0.0091 U	0.0201 U	0.0221 U	0.0214 U	0.0156 U	0.0025 U
Tributyltin	5.75	0.0066	0.0101 U	0.0111 U	0.0107 U	0.0078 U	0.0013 U
Metals in mg/kg (dry wt.)							
Copper	810	274	358	504	246	141	15
Lead	231	192	292	252	147	122	14
Zinc	820	376	574	632	419	222	48
TPH in mg/kg (dry wt.)							
C06-C12		23 U	20 U	22 U	21 U	15 U	12 U
C10-C30		23 U	632	993	1110	813	12 U
C28-C40		50	109	144	100	121	45
Total TPH	4300	50	741	1137	1210	934	45
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.045 U	0.402 U	0.442 U	0.214 U	0.156 U	0.025 U
Aroclor-1221		0.045 U	0.402 U	0.442 U	0.214 U	0.156 U	0.025 U
Aroclor-1232		0.045 U	0.402 U	0.442 U	0.214 U	0.156 U	0.025 U
Aroclor-1242		0.045 U	0.402 U	0.442 U	0.214 U	0.156 U	0.025 U
Aroclor-1248		0.045 U	1.92	3.21	0.414	0.687	0.025 U
Aroclor-1254		0.752	3.32	2.76	0.938	0.699	0.025 U
Aroclor-1260		0.173	0.402 U	0.442 U	0.214 U	0.156 U	0.025 U
Total PCBs	0.95	0.925	5.24	5.97	1.352	1.386	
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.045 U	1.61 UJ	1.77 U	0.855 U	0.627	0.025 U
Acenaphthylene		0.049	1.61 U	1.77 U	0.855 U	0.623 U	0.028
Anthracene		0.059	8.25	3.09	1.37	1.36	0.041
Fluorene		0.045 U	1.61 U	1.77 U	0.855 U	0.623 U	0.025 U
Naphthalene		0.045 U	1.61 U	1.77 U	0.855 U	0.623 U	0.025 U
Phenanthrene		0.045 U	1.61 U	1.77 U	3.83	3.66	0.059
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.18	7.32	3.47	1.95	2.56	0.27
Benzo(a)pyrene		0.386	8.07	2.92	2.38	4.21	0.456
Benzo(b)fluoranthene		0.486	8.17	6.66	3.35	3.78	0.276
Benzo(k)fluoranthene		0.28	7.76	6.3	3.25	3.12	0.233
Benzo(g,h,i)perylene		0.254	1.87	1.77 U	2.05	4.23	0.249
Chrysene		0.278	10.6	4.6	2.27	3.06	0.292
Dibenz(a,h)anthracene		0.045 U	1.61 U	1.77 U	0.855 U	0.623 U	0.036
Fluoranthene		0.316	17.3 J	7.71	5.18	9.3	0.616
Indeno(1,2,3-cd)pyrene		0.262	1.7	1.77 U	1.57	3.05	0.251
Pyrene		0.91	10.7	5.68	6.2	10.9	1.11
Total HPAHs	44	3.352	73.49	37.34	28.2	44.21	3.789

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	C6-S8 5/17/2000 14-16	C7-S1 5/12/2000 0-2	C7-S2 5/12/2000 2-4	C7-S3 5/12/2000 4-6	C7-S4 5/12/2000 6-7	C7-S5 5/12/2000 7-8
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 U	0.0038 U	0.0037 U	0.0033 U	0.0031 U	0.0033 U
Monobutyltin		0.0024 U	0.0038 U	0.0037 U	0.0033 U	0.0031 U	0.0033 U
Tributyltin	5.75	0.0012 U	0.0201 J	0.0174 J	0.0426 J	0.0092 J	0.0113 J
Metals in mg/kg (dry wt.)							
Copper	810	6	157	170	166	151	97
Lead	231	5	159	164	205	271	250
Zinc	820	18	358	333	308	397	568
TPH in mg/kg (dry wt.)							
C06-C12		12 U	19 U	18 U	16 U	16 U	16 U
C10-C30		12 U	19 U	18 U	16 U	285	16 U
C28-C40		12 U	193	126	184	189	381
Total TPH	4300		193	126	184	474	381
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.038 U	0.185 U	0.164 U	0.323 U	0.161 U
Aroclor-1221		0.024 U	0.038 U	0.185 U	0.164 U	0.323 U	0.161 U
Aroclor-1232		0.024 U	0.038 U	0.185 U	0.164 U	0.323 U	0.161 U
Aroclor-1242		0.024 U	0.038 U	0.185 U	0.164 U	0.323 U	0.161 U
Aroclor-1248		0.024 U	0.038 U	0.185 U	0.164 U	1.94	1.34
Aroclor-1254		0.024 U	0.755	0.739	0.764	3.05	1.58
Aroclor-1260		0.024 U	0.038 U	0.185 U	0.164 U	0.323 U	0.161 U
Total PCBs	0.95		0.755	0.739	0.764	4.99	2.92
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.024 U	0.075	0.037 U	0.033 U	0.908	0.04
Acenaphthylene		0.024 U	0.357	0.059	0.057	0.585	0.068
Anthracene		0.024 U	0.385	0.057	0.076	1.8	0.199
Fluorene		0.024 U	0.085	0.037 U	0.033 U	0.7	0.04
Naphthalene		0.024 U	0.082	0.037 U	0.07	3.039	0.043
Phenanthrene		0.024 U	0.976	0.134	0.259	1.08	0.18
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.024 U	1.21	0.257	0.386	2.94	0.608
Benzo(a)pyrene		0.024 U	3.21	0.76	0.554	2.78	0.616
Benzo(b)fluoranthene		0.024 U	3.07	0.819	0.501	2.43	0.456
Benzo(k)fluoranthene		0.024 U	2.33	0.564	0.388	1.76	0.36
Benzo(g,h,i)perylene		0.024 U	2.51	0.705	0.573	0.977	0.474
Chrysene		0.024 U	2.04	0.31	0.508	3.22	0.659
Dibenz(a,h)anthracene		0.024 U	0.413	0.108	0.104	0.35	0.096
Fluoranthene		0.024 U	1.72	0.236	0.627	5.5	1.04
Indeno(1,2,3-cd)pyrene		0.024 U	2.82	0.843	0.601	1.12	0.494
Pyrene		0.024 U	6.58	1.79	1.49	7.06	1.42
Total HPAHs	44		25.903	6.392	5.732	28.137	6.223

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	C7-S6	C7-S7	C7-S8	C7-S9	D6-S1	D6-S2
Sampling Date	Screening	5/12/2000	5/12/2000	5/12/2000	5/12/2000	5/19/2000	5/19/2000
Depth in Feet	Criteria	8-10	10-11	11-12	12-13	0-2.5	2.5-4.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.003 U	0.0025 U	0.0023 U	0.0024 U	0.004 U	0.0025 U
Monobutyltin		0.003 U	0.0025 U	0.0023 U	0.0024 U	0.004 U	0.0025 U
Tributyltin	5.75	0.0275 J	0.0019 J	0.0011 U	0.0012 U	0.002 U	0.0013 U
Metals in mg/kg (dry wt.)							
Copper	810	102	5	4	5	62	8
Lead	231	206	4 U	4	5	45	5
Zinc	820	343	16	13	19	147	29
TPH in mg/kg (dry wt.)							
C06-C12		15 U	12 U	11 U	12 U	10 U	6 U
C10-C30		15 U	12 U	11 U	12 U	10	6 U
C28-C40		324	12 U	11 U	31	128	53
Total TPH	4300	324			31	138	53
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.151 U	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Aroclor-1221		0.151 U	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Aroclor-1232		0.151 U	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Aroclor-1242		0.151 U	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Aroclor-1248		1.35	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Aroclor-1254		2.31	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Aroclor-1260		0.151 U	0.025 U	0.023 U	0.024 UJ	0.04 U	0.025 U
Total PCBs	0.95	3.66					
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.035	0.025 U	0.023 U	0.024 U	0.032 U	0.02 U
Acenaphthylene		0.071	0.025 U	0.023 U	0.024 U	0.032 U	0.02 U
Anthracene		0.217	0.025 U	0.023 U	0.024 U	0.032 U	0.02 U
Fluorene		0.046	0.025 U	0.023 U	0.024 U	0.032 U	0.02 U
Naphthalene		0.03 U	0.025 U	0.023 U	0.024 U	0.032 U	0.02 U
Phenanthrene		0.178	0.025 U	0.023 U	0.024 U	0.068	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.773	0.025 U	0.023 U	0.024 U	0.032 U	0.02 U
Benzo(a)pyrene		0.912	0.025 U	0.023 U	0.024 U	0.12	0.019
Benzo(b)fluoranthene		0.715	0.025 U	0.023 U	0.024 U	0.12	0.02 U
Benzo(k)fluoranthene		0.636	0.025 U	0.023 U	0.024 U	0.12	0.02
Benzo(g,h,i)perylene		0.661	0.025 U	0.023 U	0.024 UJ	0.069	0.02 U
Chrysene		0.867	0.025 U	0.023 U	0.024 U	0.07	0.02 U
Dibenz(a,h)anthracene		0.27	0.025 U	0.023 U	0.024 UJ	0.032 U	0.02 U
Fluoranthene		1.14	0.025 U	0.023 U	0.024 U	0.15	0.024
Indeno(1,2,3-cd)pyrene		0.798	0.025 U	0.023 U	0.024 UJ	0.062	0.02 U
Pyrene		2.05	0.025 U	0.023 U	0.024 U	0.18	0.031
Total HPAHs	44	8.822				0.891	0.094

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID Sampling Date Depth in Feet	CAO Screening Criteria	D6-S3 5/19/2000 4.5-6.5	D6-S4 5/19/2000 6.5-8.5	D6-S6 5/19/2000 10.5-12.5	D6-S5 5/20/2000 8.5-10.5	D6-S7 5/20/2000 12.5-14.5	D6-S8 5/20/2000 14.5-16.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 U	0.0024 U	0.0021 U	0.0024 U	0.0025 U	0.0025 U
Monobutyltin		0.0024 U	0.0024 U	0.0021 U	0.0024 U	0.0025 U	0.0025 U
Tributyltin	5.75	0.0012 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0013 U
Metals in mg/kg (dry wt.)							
Copper	810	2	1	2	1	1	2
Lead	231	4 U	4 U	3 U	4 U	4 U	4 U
Zinc	820	8	6	5	9	9	13
TPH in mg/kg (dry wt.)							
C06-C12		6 U	6 U	5 U	6 U	6 U	6 U
C10-C30		6 U	6 U	5 U	6 U	6 U	6 U
C28-C40		30 U	30 U	27 U	30 U	31 U	32 U
Total TPH	4300						
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Aroclor-1221		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Aroclor-1232		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Aroclor-1242		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Aroclor-1248		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Aroclor-1254		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Aroclor-1260		0.024 U	0.024 U	0.021 U	0.024 U	0.025 U	0.025 U
Total PCBs	0.95						
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Acenaphthylene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Anthracene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Fluorene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Naphthalene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Phenanthrene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Benzo(a)pyrene		0.017 U	0.017 U		0.016 U	0.017 U	0.018 U
Benzo(b)fluoranthene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Benzo(k)fluoranthene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Benzo(g,h,i)perylene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Chrysene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Dibenz(a,h)anthracene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Fluoranthene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Indeno(1,2,3-cd)pyrene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Pyrene		0.019 U	0.019 U		0.019 U	0.02 U	0.02 U
Total HPAHs	44						

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	D6-S9	D7-1.5	D7-S1	D7-S2	D7-S3	D7-S4
Sampling Date	Screening	5/20/2000	6/4/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000
Depth in Feet	Criteria	16.5-18.5	0-0.3	0-3	3-6	6-8	8-10
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 U	0.0047 U	0.0042 U	0.0045 U	0.0041 U	0.0207 U
Monobutyltin		0.0024 U	0.0047 U	0.0042 U	0.0045 U	0.0041 U	0.0207 U
Tributyltin	5.75	0.0012 U	0.0274	0.0021 U	0.0097 J	0.002 U	0.0104 U
Metals in mg/kg (dry wt.)							
Copper	810	4	628	74	634	123	503
Lead	231	6	155	49	152	54	231
Zinc	820	21	626	161	767	199	567
TPH in mg/kg (dry wt.)							
C06-C12		6 U	23 U	10 U	11 U	10 U	10 U
C10-C30		6 U	23 U	10 U	25	28	393
C28-C40		31 U	23 U	52 U	79	93	286
Total TPH	4300				104	121	679
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.047 U	0.042 U	0.045 U	0.041 U	0.042 U
Aroclor-1221		0.024 U	0.047 U	0.042 U	0.045 U	0.041 U	0.042 U
Aroclor-1232		0.024 U	0.047 U	0.042 U	0.045 U	0.041 U	0.042 U
Aroclor-1242		0.024 U	0.047 U	0.042 U	0.045 U	0.041 U	0.042 U
Aroclor-1248		0.024 U	0.047 U	0.042 U	0.045 U	0.041 U	0.042 U
Aroclor-1254		0.024 U	0.103	0.042 U	0.045 U	0.041 U	0.37
Aroclor-1260		0.024 U	0.047 U	0.042 U	0.045 U	0.041 U	0.042 U
Total PCBs	0.95		0.103				0.37
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.02 U	0.047 U	0.033 U	0.036 U	0.033 U	0.033 U
Acenaphthylene		0.02 U	0.105	0.033 U	0.036 U	0.033 U	0.047
Anthracene		0.02 U	0.214	0.033 U	0.048	0.033 U	0.16
Fluorene		0.02 U	0.047 U	0.033 U	0.036 U	0.033 U	0.041
Naphthalene		0.02 U	0.047 U	0.033 U	0.036 U	0.033 U	0.033 U
Phenanthrene		0.02 U	0.627	0.033 U	0.1	0.038	0.16
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.02 U	0.705	0.033 U	0.13	0.062	0.31
Benzo(a)pyrene		0.017 U	2.54	0.03	0.26	0.098	0.3
Benzo(b)fluoranthene		0.02 U	2.9	0.033 U	0.27	0.087	0.31
Benzo(k)fluoranthene		0.02 U	1.76	0.033 U	0.28	0.076	0.28
Benzo(g,h,i)perylene		0.02 U	0.871	0.033 U	0.072	0.039	0.077
Chrysene		0.02 U	1.1	0.033 U	0.19	0.087	0.38
Dibenz(a,h)anthracene		0.02 U	0.279	0.033 U	0.036 U	0.033 U	0.033 U
Fluoranthene		0.02 U	1.13	0.033 U	0.22	0.094	0.65
Indeno(1,2,3-cd)pyrene		0.02 U	1.11	0.033 U	0.072	0.033 U	0.068
Pyrene		0.02 U	2.34	0.033 U	0.31	0.14	0.75
Total HPAHs	44		15.681	0.03	1.804	0.683	3.125

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	D7-S5	D7-S6	D7-S7	D7-S8	M1-S1	M1-S2
Sampling Date	Screening	5/24/2000	5/24/2000	5/24/2000	5/25/2000	5/17/2000	5/17/2000
Depth in Feet	Criteria	10-12	12-14	14-16	18-20	0-4	4-6.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0181 U	0.019 U	0.0036 U	0.0026 U	0.0041 U	0.0033 U
Monobutyltin		0.0181 U	0.019 U	0.0036 U	0.0026 U	0.0041 U	0.0033 U
Tributyltin	5.75	0.009 U	0.0095 U	0.0018 U	0.0013 U	0.0116 J	0.0016 J
Metals in mg/kg (dry wt.)							
Copper	810	418	506	422	14	401	111
Lead	231	180	168	170	11	207	58
Zinc	820	496	513	371	67	776	224
TPH in mg/kg (dry wt.)							
C06-C12		22	13	9 U	6 U	21 U	16 U
C10-C30		886	655	216	6 U	21 U	16 U
C28-C40		550	427	321	32 U	64	231
Total TPH	4300	1458	1095	537		64	231
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.036 U	0.038 U	0.036 U	0.026 U	0.207 U	0.164 U
Aroclor-1221		0.036 U	0.038 U	0.036 U	0.026 U	0.207 U	0.164 U
Aroclor-1232		0.036 U	0.038 U	0.036 U	0.026 U	0.207 U	0.164 U
Aroclor-1242		0.036 U	0.038 U	0.036 U	0.026 U	0.207 U	0.164 U
Aroclor-1248		0.036 U	0.038 U	0.036 U	0.026 U	1.04	0.201
Aroclor-1254		0.2	0.085	0.24	0.026 U	1.73	0.372
Aroclor-1260		0.036 U	0.038 U	0.036 U	0.026 U	0.207 U	0.164 U
Total PCBs	0.95	0.2	0.085	0.24		2.77	0.573
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.029 U	0.42	0.076	0.02 U	0.041 U	0.327 U
Acenaphthylene		0.029 U	0.54	0.089	0.02 U	0.069	0.327 U
Anthracene		0.13	1.4	0.16	0.02 U	0.089	0.327 U
Fluorene		0.029 U	0.8	0.1	0.02 U	0.041 U	0.327 U
Naphthalene		0.06	0.37	0.029 U	0.02 U	0.041 U	0.327 U
Phenanthrene		0.19	4.5	0.3	0.02 U	0.041 U	0.352
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.23	3.4	0.3	0.02 U	0.347	2.41
Benzo(a)pyrene		0.3 J	4.3 J	0.41 J	0.018 U	0.697	4.2
Benzo(b)fluoranthene		0.24 J	4.6 J	0.34 J	0.02 U	0.822	2.52
Benzo(k)fluoranthene		0.21 J	5.1 J	0.31 J	0.02 U	0.507	2.35
Benzo(g,h,i)perylene		0.11 J	1.4 J	0.15 J	0.02 U	0.321	3.49
Chrysene		0.3	5.1	0.38	0.02 U	0.456	2.23
Dibenz(a,h)anthracene		0.029 U	0.3 UJ	0.029 UJ	0.02 U	0.072	0.327 U
Fluoranthene		0.52	10	0.56	0.02 U	0.585	3.54
Indeno(1,2,3-cd)pyrene		0.077 J	1.2	0.12 J	0.02 U	0.393	2.53
Pyrene		0.64	12	0.8	0.02 U	1.32	9.38
Total HPAHs	44	2.627	47.1	3.37		5.52	32.65

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	M1-S3	M1-S4	M1-S5	M1-S6	M1-S7	M1-S8
Sampling Date	Screening	5/17/2000	5/17/2000	5/17/2000	5/17/2000	5/18/2000	5/18/2000
Depth in Feet	Criteria	6.5-8.5	8.5-10.5	10.5-12.5	12.5-14.5	14.5-16.5	16.5-18.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 U	0.0023 U	0.0023 UJ	0.0025 UJ	0.0025 UJ	0.0025 UJ
Monobutyltin		0.0024 U	0.0023 U	0.0023 UJ	0.0025 UJ	0.0025 UJ	0.0025 UJ
Tributyltin	5.75	0.0012 U	0.0011 U	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ
Metals in mg/kg (dry wt.)							
Copper	810	13	5	2	2	3	4
Lead	231	11	5	4	4 U	4 U	4 U
Zinc	820	33	14	8	14	15	17
TPH in mg/kg (dry wt.)							
C06-C12		12 U	11 U	12 U	12 U	6 U	6 U
C10-C30		12 U	11 U	12 U	12 U	6 U	6 U
C28-C40		46	11 U	12 U	12 U	31 U	31 U
Total TPH	4300	46					
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Aroclor-1221		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Aroclor-1232		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Aroclor-1242		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Aroclor-1248		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Aroclor-1254		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Aroclor-1260		0.024 U	0.023 U	0.023 U	0.025 U	0.025 U	0.025 U
Total PCBs	0.95						
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.024 U	0.023 U	0.023 U	0.044 J	0.02 U	0.02 U
Acenaphthylene		0.079	0.023 U	0.023 U	0.025 U	0.02 U	0.02 U
Anthracene		0.03	0.023 U	0.023 U	0.025 U	0.02 U	0.02 U
Fluorene		0.024 U	0.023 U	0.023 U	0.047 J	0.02 U	0.02 U
Naphthalene		0.038	0.023 U	0.023 U	0.025 U	0.02 U	0.02 U
Phenanthrene		0.031	0.023 U	0.023 UJ	0.292 J	0.02 U	0.02 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.415	0.032	0.023 U	0.025 U	0.02 U	0.02 U
Benzo(a)pyrene		1.17	0.05	0.023 U	0.025 U	0.017 U	0.017 U
Benzo(b)fluoranthene		0.608	0.035	0.023 U	0.025 U	0.02 U	0.02 U
Benzo(k)fluoranthene		0.626	0.028	0.023 U	0.025 U	0.02 U	0.02 U
Benzo(g,h,i)perylene		0.582	0.027	0.023 U	0.025 U	0.02 U	0.02 U
Chrysene		0.489	0.035	0.023 U	0.06 J	0.02 U	0.02 U
Dibenz(a,h)anthracene		0.074	0.023 U	0.023 U	0.025 U	0.02 U	0.02 U
Fluoranthene		0.65	0.059	0.023 UJ	0.274 J	0.02 U	0.02 U
Indeno(1,2,3-cd)pyrene		0.594	0.028	0.023 U	0.025 U	0.02 U	0.02 U
Pyrene		1.77	0.082	0.023 UJ	0.232 J	0.02 U	0.02 U
Total HPAHs	44	6.978	0.376		0.566		

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	M1-S9	M1-S10	M1-S11	M1-S12	M2-S1	M2-S2
Sampling Date	Screening	5/18/2000	5/18/2000	5/18/2000	5/18/2000	5/15/2000	5/15/2000
Depth in Feet	Criteria	18.5-20.5	20.5-22.5	22.5-23.5	23.5-24.5	0-2	2-4
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 UJ	0.0024 UJ	0.003 UJ	0.002 UJ	0.0037 U	0.0033 U
Monobutyltin		0.0024 UJ	0.0024 UJ	0.003 UJ	0.002 UJ	0.0037 U	0.0033 U
Tributyltin	5.75	0.0012 UJ	0.0012 UJ	0.001 UJ	0.001 UJ	0.0118	0.0055 J
Metals in mg/kg (dry wt.)							
Copper	810	2	2	2	5	150	115
Lead	231	4 U	4 U	4 U	4	147	215
Zinc	820	10	12	10	16	260	263
TPH in mg/kg (dry wt.)							
C06-C12		6 U	6 U	6 U	6 U	18 U	16 U
C10-C30		6 U	6 U	6 U	6 U	18 U	16 U
C28-C40		30 U	30 U	31 U	29 U	63	105
Total TPH	4300					63	105
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.024 U	0.025 U	0.023 U	0.037 U	0.163 U
Aroclor-1221		0.024 U	0.024 U	0.025 U	0.023 U	0.037 U	0.163 U
Aroclor-1232		0.024 U	0.024 U	0.025 U	0.023 U	0.037 U	0.163 U
Aroclor-1242		0.024 U	0.024 U	0.025 U	0.023 U	0.037 U	0.163 U
Aroclor-1248		0.024 U	0.024 U	0.025 U	0.023 U	0.228	0.388
Aroclor-1254		0.024 U	0.024 U	0.025 U	0.023 U	0.274	1.51
Aroclor-1260		0.024 U	0.024 U	0.025 U	0.023 U	0.037 U	0.163 U
Total PCBs	0.95					0.502	1.898
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 U	0.033 U
Acenaphthylene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 U	0.093
Anthracene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 U	0.148
Fluorene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 U	0.033 U
Naphthalene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 U	0.034
Phenanthrene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 U	0.189
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.019 U	0.019 U	0.02 U	0.018 U	0.293	0.421
Benzo(a)pyrene		0.017 U	0.017 U	0.017 U	0.016 U	0.764	1.43
Benzo(b)fluoranthene		0.019 U	0.019 U	0.02 U	0.018 U	0.836	1.21
Benzo(k)fluoranthene		0.019 U	0.019 U	0.02 U	0.018 U	0.621	1.07
Benzo(g,h,i)perylene		0.019 U	0.019 U	0.02 U	0.018 U	0.519 J	0.566 J
Chrysene		0.019 U	0.019 U	0.02 U	0.018 U	0.418	0.606
Dibenz(a,h)anthracene		0.019 U	0.019 U	0.02 U	0.018 U	0.184 UJ	0.297 J
Fluoranthene		0.019 U	0.019 U	0.02 U	0.018 U	0.375	0.455
Indeno(1,2,3-cd)pyrene		0.019 U	0.019 U	0.02 U	0.018 U	0.503 J	0.642 J
Pyrene		0.019 U	0.019 U	0.02 U	0.018 U	0.819	2.38
Total HPAHs	44					5.148	9.077

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	M2-S3	M2-S4	M2-S5	M3-S1	M3-S2	M3-S3
Sampling Date	Screening	5/15/2000	5/15/2000	5/15/2000	5/13/2000	5/13/2000	5/13/2000
Depth in Feet	Criteria	4-6	8-11	11-13.5	0-2.25	2.25-4.5	4.5-5.5
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0175 U	0.0143 U	0.0024 UJ	0.0069 UJ	0.0166 UJ	0.0316 UJ
Monobutyltin		0.0175 U	0.0143 U	0.0024 UJ	0.0069 UJ	0.0166 UJ	0.0316 UJ
Tributyltin	5.75	0.0055 J	0.0071 UJ	0.0012 UJ	0.0087 J	0.0083 UJ	0.0158 UJ
Metals in mg/kg (dry wt.)							
Copper	810	144	42	6	93	99	59
Lead	231	238	46	6	113	181	148
Zinc	820	393	105	23	275	277	175
TPH in mg/kg (dry wt.)							
C06-C12		17 U	14 U	12 U	17 U	17 U	16 U
C10-C30		17 U	14 U	12 U	17 U	17 U	16 U
C28-C40		391	170	12 U	130	422	229
Total TPH	4300	391	170		130	422	229
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.175 U	0.28 U	0.024 U	0.173 U	0.332 U	0.158 U
Aroclor-1221		0.175 U	0.28 U	0.024 U	0.173 U	0.332 U	0.158 U
Aroclor-1232		0.175 U	0.28 U	0.024 U	0.173 U	0.332 U	0.158 U
Aroclor-1242		0.175 U	0.28 U	0.024 U	0.173 U	0.332 U	0.158 U
Aroclor-1248		0.347	0.255	0.024 U	0.359	1.07	0.699
Aroclor-1254		1.27	0.325	0.024 U	0.818	1.44	1.2
Aroclor-1260		0.175 U	0.28 U	0.024 U	0.173 U	0.332 U	0.158 U
Total PCBs	0.95	1.617	0.58		1.177	2.51	1.899
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.698 U	0.285 U	0.024 U	0.693 U	0.312 U	0.032 U
Acenaphthylene		0.698 U	0.285 U	0.024 U	0.693 U	0.312 U	0.095
Anthracene		0.698 U	0.318	0.024 U	0.693 U	0.827	0.189
Fluorene		0.698 U	0.285 U	0.024 U	0.693 U	0.312 U	0.032 U
Naphthalene		0.698 U	0.285 U	0.024 U	0.693 U	0.312 U	0.037
Phenanthrene		0.698 U	0.448	0.024 U	4.18	0.312 U	0.202
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		1.59	0.791	0.024 U	1.14	2.1	0.641
Benzo(a)pyrene		1.69	0.998	0.024 U	1.43	2.65	1.06 J
Benzo(b)fluoranthene		1.4	0.675	0.024 U	2.01	2.16	0.829
Benzo(k)fluoranthene		1.29	0.648	0.024 U	1.26	1.44	0.661
Benzo(g,h,i)perylene		0.888 J	0.485 J	0.024 UJ	1.92	2.3	0.497 J
Chrysene		1.9	0.867	0.024 U	2.49	2.55	0.788
Dibenz(a,h)anthracene		0.698 UJ	0.285 UJ	0.024 UJ	1.39	1.48	0.091 J
Fluoranthene		2.24	1.1	0.024 U	8.26	4.42	1.41
Indeno(1,2,3-cd)pyrene		0.919 J	0.45 J	0.024 UJ	2.36	2.59	0.524
Pyrene		3.83	2.23	0.024 U	7.64	6.99	2.4
Total HPAHs	44	15.747	8.244		29.9	28.68	8.901

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO Screening Criteria	M3-S4	M3-S5	M4-S1	M4-S2	M4-S3	M4-S4
Sampling Date		5/13/2000	5/13/2000	5/13/2000	5/13/2000	5/13/2000	5/13/2000
Depth in Feet		5.5-6.5	6.5-7.5	0-3.5	3.5-6	6-7	7-8
Tributyltin in mg/kg (dry wt.)							
Dibutyltin		0.0024 UJ	0.0023 U	0.0031 U	0.0028 R	0.052 U	0.0023 U
Monobutyltin		0.0024 UJ	0.0023 U	0.0031 U	0.0028 R	0.052 U	0.0023 U
Tributyltin	5.75	0.0012 UJ	0.0011 U	0.0045 J	0.0185 J	1.28	0.0012 U
Metals in mg/kg (dry wt.)							
Copper	810	5	3	50	32	25	22
Lead	231	6	6	85	156	57	54
Zinc	820	19	10	250	103	99	72
TPH in mg/kg (dry wt.)							
C06-C12		12 U	11 U	16 U	14 U	13 U	12 U
C10-C30		12 U	11 U	16 U	14 U	13 U	12 U
C28-C40		12 U	11 U	136	86	75	12 U
Total TPH	4300			136	86	75	
PCBs in mg/kg (dry wt.)							
Aroclor-1016		0.024 U	0.023 U	0.031 U	0.14 U	0.026 U	0.023 U
Aroclor-1221		0.024 U	0.023 U	0.031 U	0.14 U	0.026 U	0.023 U
Aroclor-1232		0.024 U	0.023 U	0.031 U	0.14 U	0.026 U	0.023 U
Aroclor-1242		0.024 U	0.023 U	0.031 U	0.14 U	0.026 U	0.023 U
Aroclor-1248		0.024 U	0.023 U	0.031 U	0.14 U	0.026 U	0.023 U
Aroclor-1254		0.024 U	0.047	0.105	0.14 U	0.095	0.023 U
Aroclor-1260		0.024 U	0.023 U	0.031 U	0.14 U	0.026 U	0.023 U
Total PCBs	0.95		0.047	0.105		0.095	
LPAHs in mg/kg (dry wt.)							
Acenaphthene		0.024 U	0.023 U	0.031 U	0.047	0.082	0.023 U
Acenaphthylene		0.024 U	0.023 U	0.121	0.037	0.135	0.023 U
Anthracene		0.024 U	0.023 U	0.104	0.094	0.1	0.023 U
Fluorene		0.024 U	0.023 U	0.036	0.028 U	0.026 U	0.023 U
Naphthalene		0.024 U	0.023 U	0.037	0.028 U	0.026 U	0.023 U
Phenanthrene		0.024 U	0.023 U	0.468	0.495	0.216	0.023 U
HPAHs in mg/kg (dry wt.)							
Benzo(a)anthracene		0.024 U	0.023 U	0.485	0.423	0.488	0.023 U
Benzo(a)pyrene		0.024 UJ	0.023 U	0.819	0.388	0.526	0.023 U
Benzo(b)fluoranthene		0.024 U	0.023 U	0.624	0.333	0.386	0.023 U
Benzo(k)fluoranthene		0.024 U	0.023 U	0.388	0.269	0.263	0.023 U
Benzo(g,h,i)perylene		0.024 UJ	0.023 U	1.28	0.259	0.358	0.023 U
Chrysene		0.024 U	0.023 U	0.633	0.535	0.499	0.023 U
Dibenz(a,h)anthracene		0.024 UJ	0.023 U	0.091	0.05	0.063	0.023 U
Fluoranthene		0.024 U	0.023 U	1.02	1.09	0.941	0.023 U
Indeno(1,2,3-cd)pyrene		0.024 U	0.023 U	1.14	0.329	0.361	0.023 U
Pyrene		0.024	0.023 U	2.33	1.42	1.67	0.023 U
Total HPAHs	44	0.024		8.81	5.096	5.555	

Table 3 - Analytical Results for Sediment Samples - Phase II

Sample ID	CAO	Station 17-1.5	Station 18-1.5	Station 19-1.5
Sampling Date	Screening	6/4/2000	6/4/2000	6/4/2000
Depth in Feet	Criteria	0-0.3	0-0.3	0-0.3
Tributyltin in mg/kg (dry wt.)				
Dibutyltin		0.005 U	0.0036 U	0.0043 U
Monobutyltin		0.005 U	0.0105	0.0043 U
Tributyltin	5.75	0.0057	0.0036 U	0.0039
Metals in mg/kg (dry wt.)				
Copper	810	203	111	140
Lead	231	104	62	91
Zinc	820	300	174	270
TPH in mg/kg (dry wt.)				
C06-C12		25 U	11 U	21 U
C10-C30		25 U	11 U	21 U
C28-C40		25 U	11 U	21 U
Total TPH	4300			
PCBs in mg/kg (dry wt.)				
Aroclor-1016		0.05 U	0.035 U	0.043 U
Aroclor-1221		0.05 U	0.035 U	0.043 U
Aroclor-1232		0.05 U	0.035 U	0.043 U
Aroclor-1242		0.05 U	0.035 U	0.043 U
Aroclor-1248		0.05 U	0.035 U	0.043 U
Aroclor-1254		0.072	0.11	0.193
Aroclor-1260		0.05 U	0.035 U	0.043 U
Total PCBs	0.95	0.072	0.11	0.193
LPAHs in mg/kg (dry wt.)				
Acenaphthene		0.05 U	0.036 U	0.043 U
Acenaphthylene		0.072	0.061	0.076
Anthracene		0.159	0.065	0.085
Fluorene		0.05 U	0.036 U	0.043 U
Naphthalene		0.05 U	0.036 U	0.043 U
Phenanthrene		0.447	0.088	0.133
HPAHs in mg/kg (dry wt.)				
Benzo(a)anthracene		0.663	0.271	0.373
Benzo(a)pyrene		1.3	0.775	0.841
Benzo(b)fluoranthene		1.19	0.666	0.868
Benzo(k)fluoranthene		0.825	0.389	0.541
Benzo(g,h,i)perylene		0.723	0.408	0.385
Chrysene		1.1	0.476	0.671
Dibenz(a,h)anthracene		0.19	0.103	0.092
Fluoranthene		0.753	0.36	0.632
Indeno(1,2,3-cd)pyrene		0.74	0.422	0.412
Pyrene		1.72 J	0.733 J	1.42 J
Total HPAHs	44	9.882	4.817	6.235

U = Not detected at indicated detection limit.
J = Estimated value.
Boxed value indicates CAO exceedence

Figures

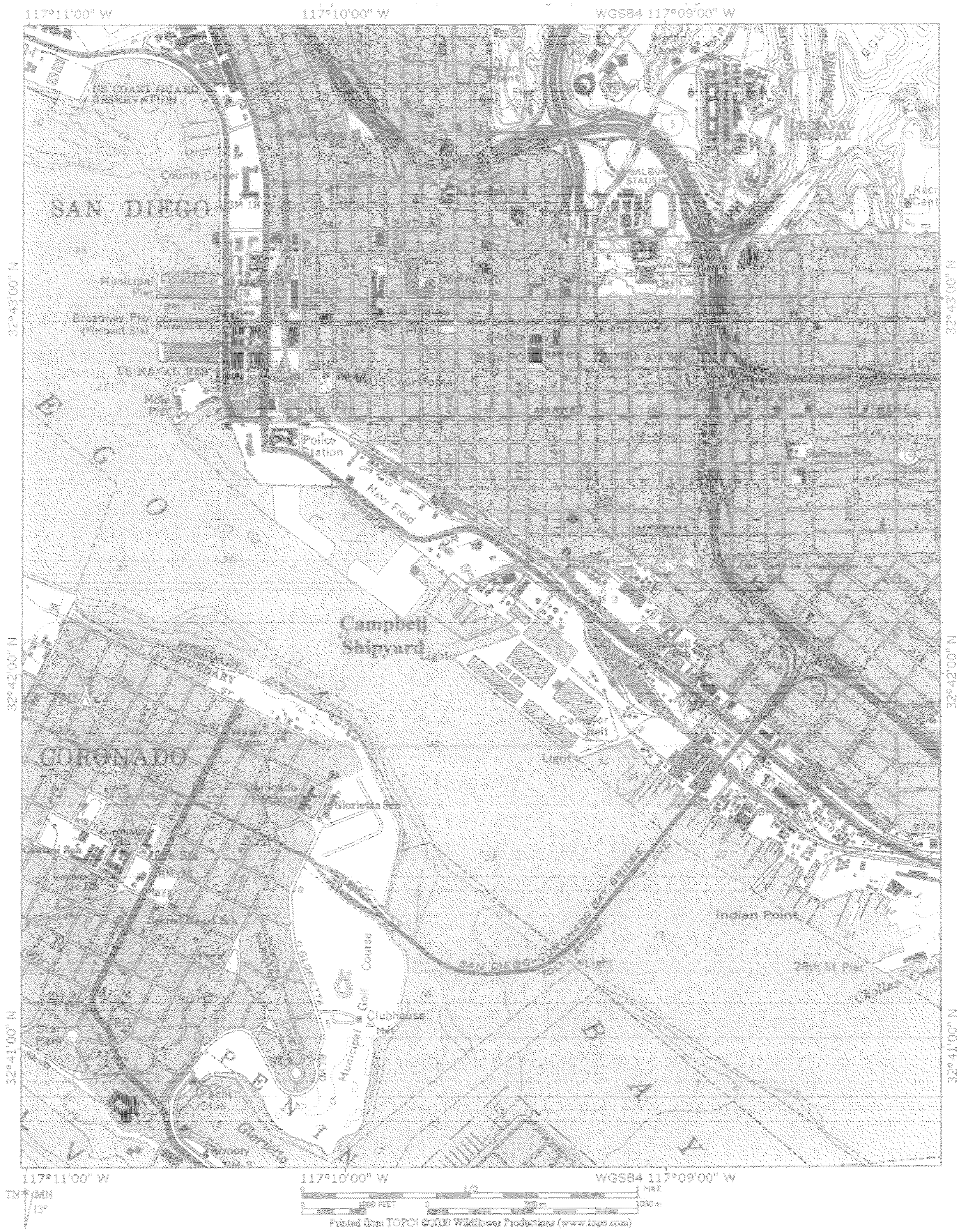

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Figure 1. Site Location Map

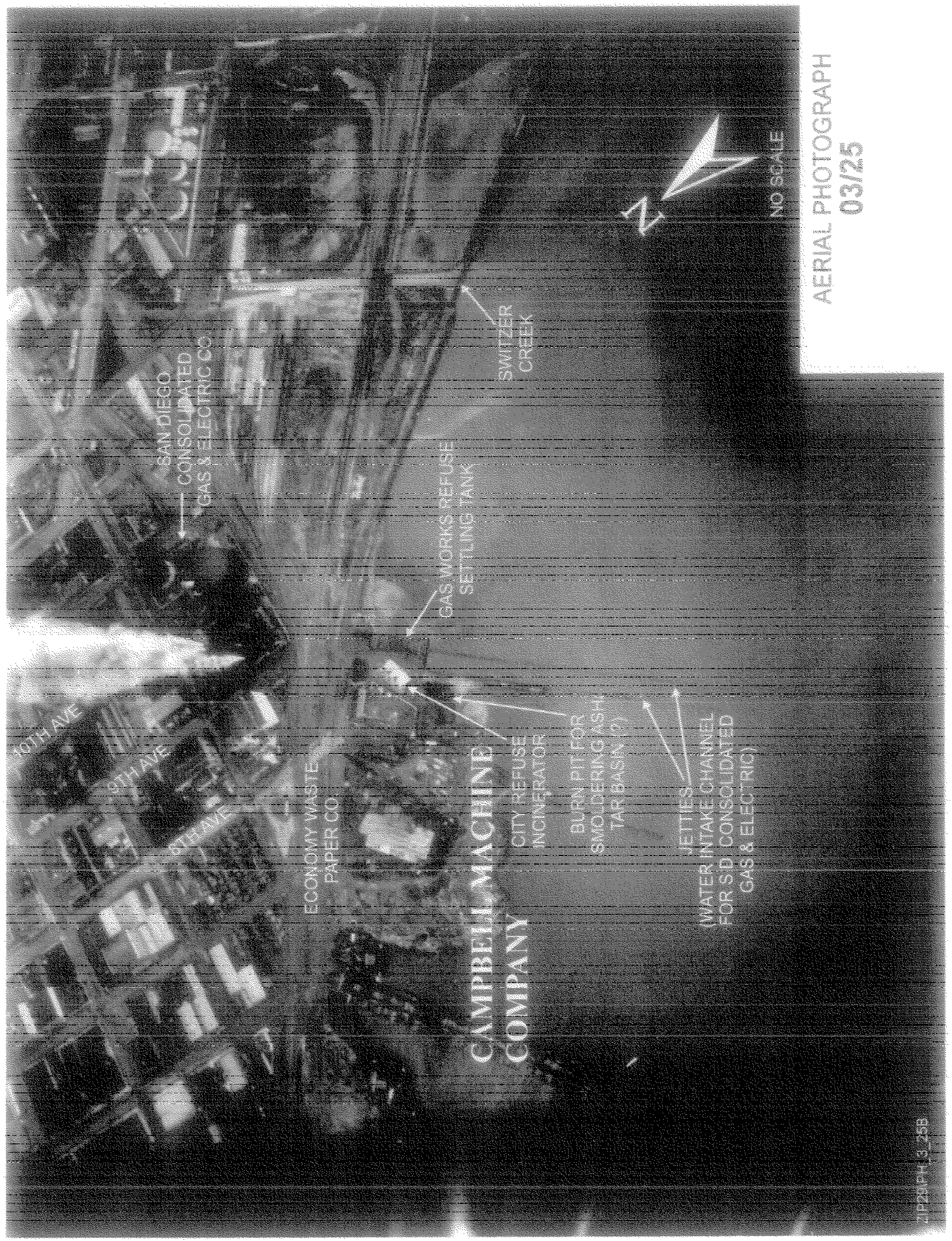

Figure 2. ***Portion of site prior to bulkhead emplacement c.1925. Note position of shoreline, SDCG&E Jetties, and Gasworks Refuse Settling Tank*** (after Ninyo and Moore, 1999)

Figure 3. ***c.1926 Aerial Photograph of new Bayshore Bulkhead extending southwest to vicinity of 8" SDCG&E cooling water pipeline.*** *(Courtesy Marco, Inc.)*

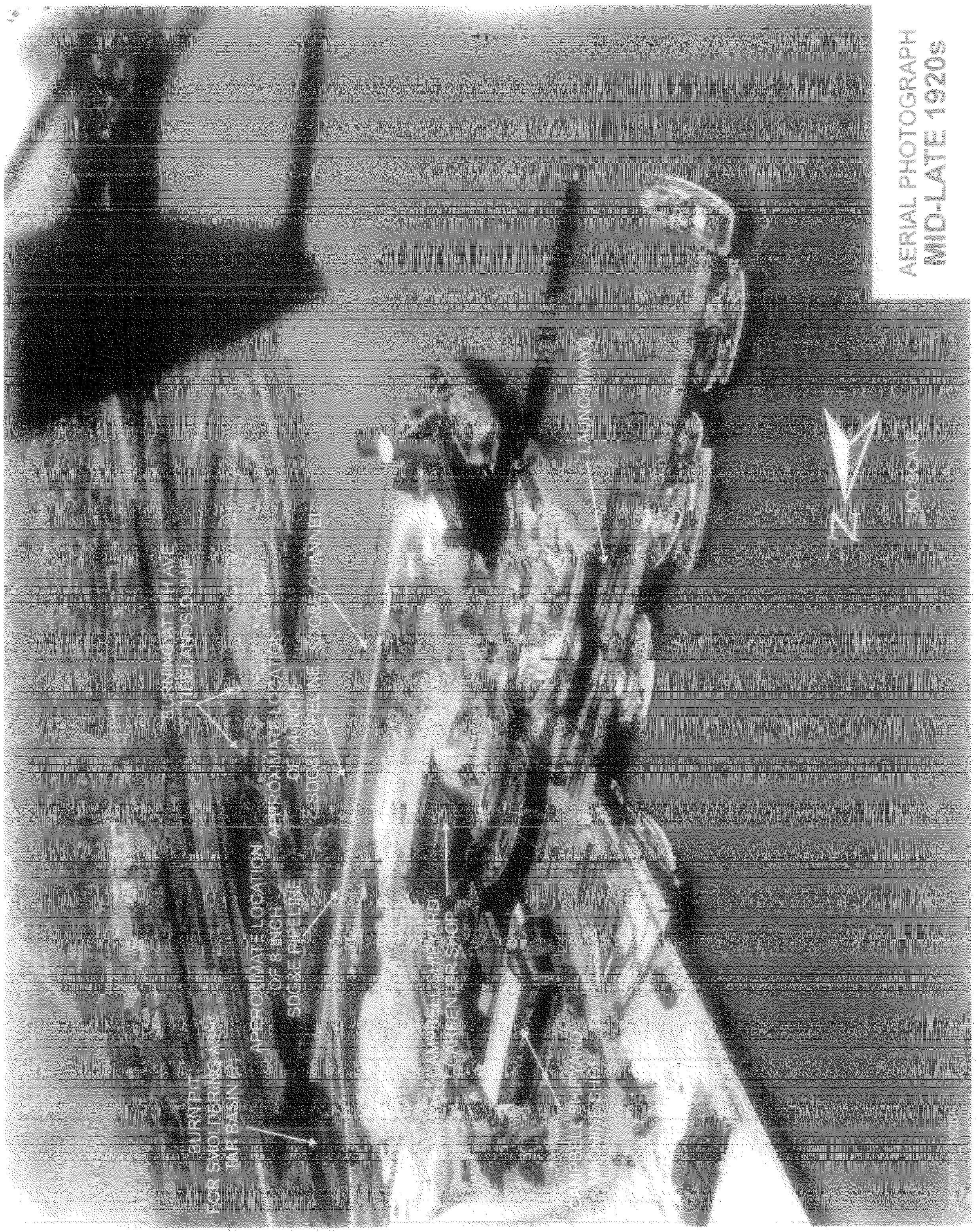

Figure 4. c.1920's. Campbell Shipyard relocated facilities. Site forms northern boundary of nascent channel. Note activities at 8th Avenue Tidelands Dump. (after Ninyo and Moore, 1999)

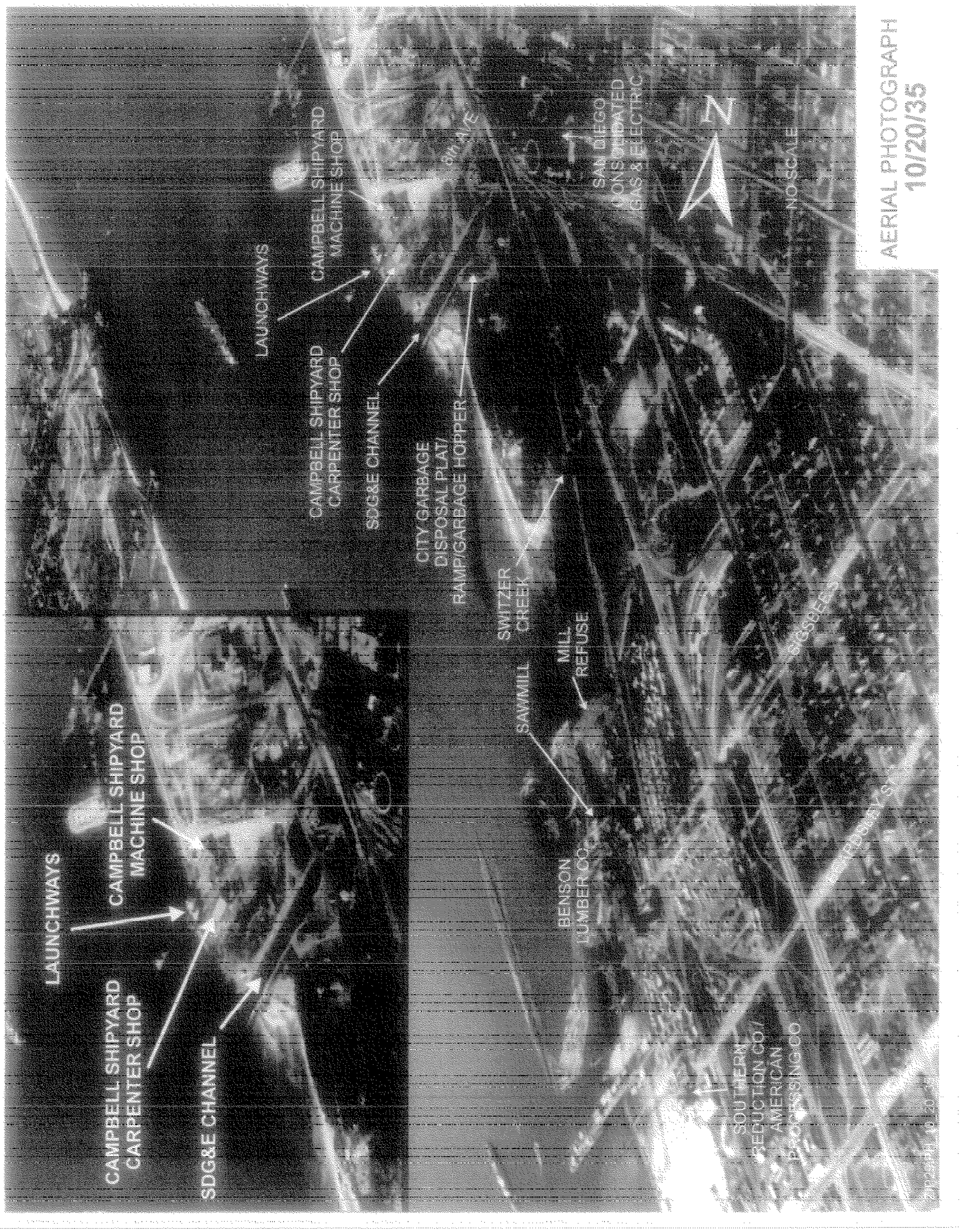

Figure 5. c.1935. SDCG&E channel. Note: Socony/Mobil Oil tank farm not present. (after Ninyo and Moore, 1999)

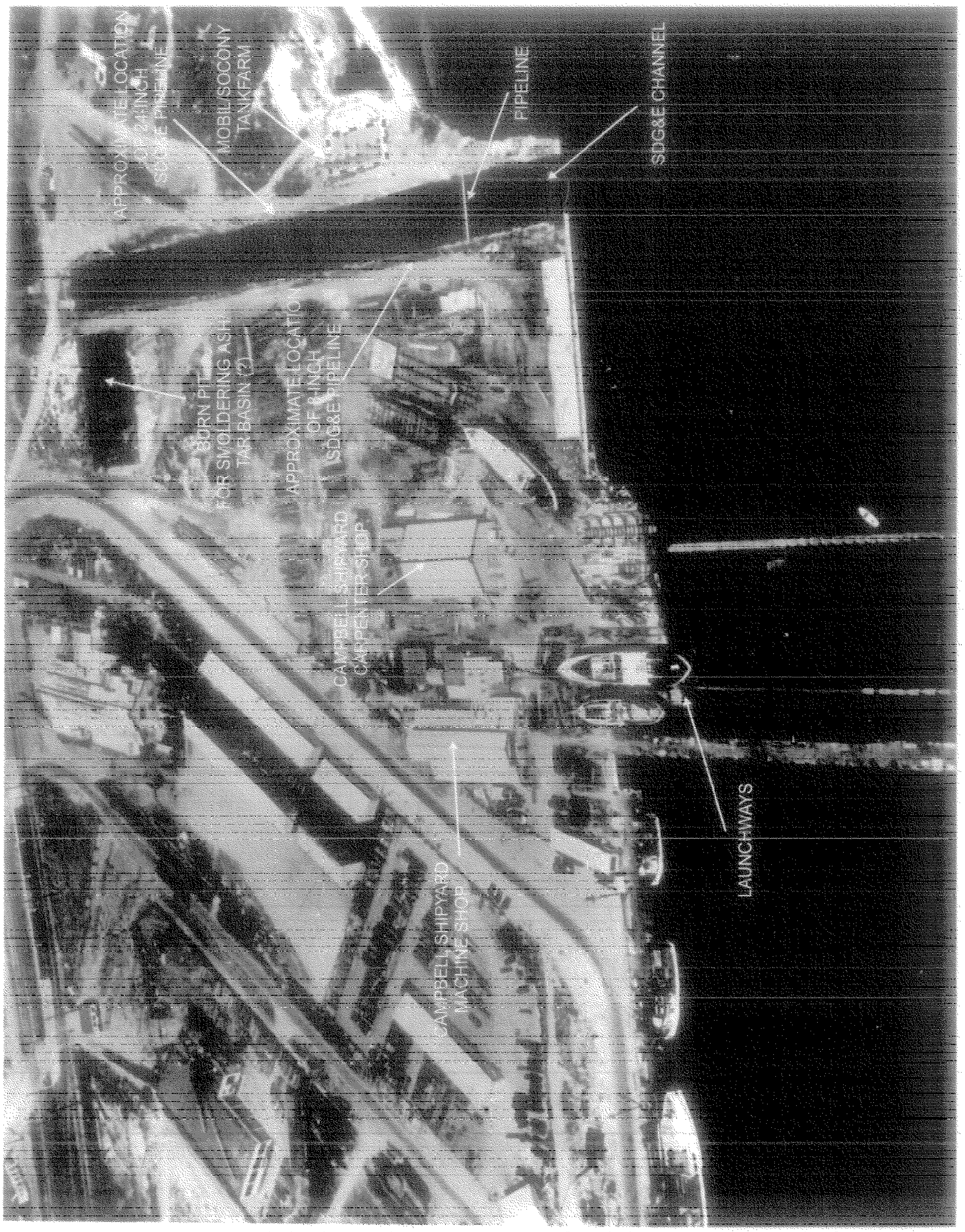

Figure 6. c.1937. Campbell Shipyard. Note presence of tank farm on south bank of SDCG&E channel. Also note pipeline and boom near channel entrance. (Courtesy Marco, Inc.)

Figure 7. c.1941. Closure of SDCG&E channel mouthoccurred prior to July, 1941. Note: extension of "spit" across channel entrance (7/41). Revetment construction commenced between 7/41 and 9/41.

(Ninyo and Moore, 1999)

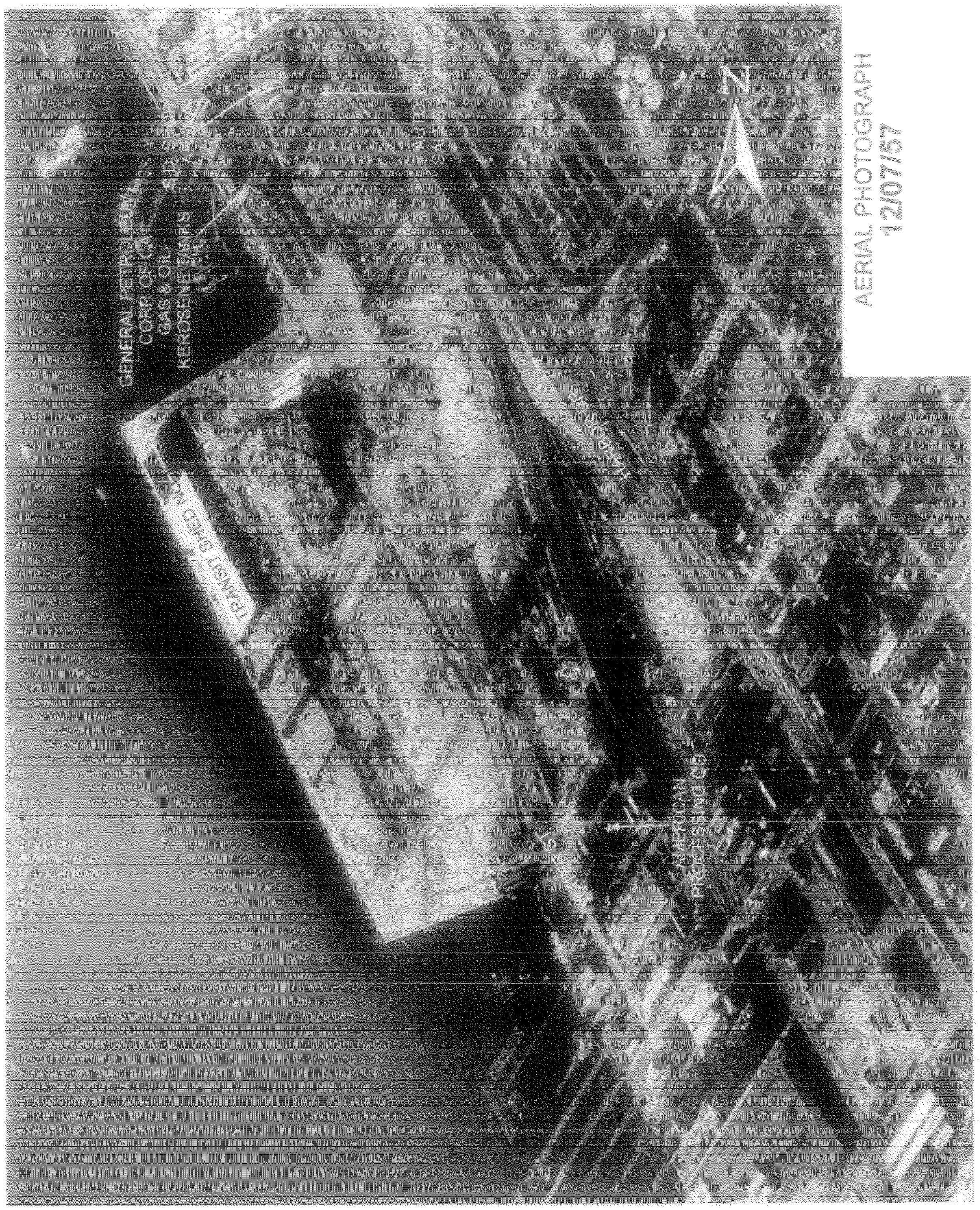

Figure 8. c.1957. 10th Avenue Marine Terminal with area filled and building foundations under construction. (Ninyo and Moore, 1999)

From: Alan Monji
To: Shipyard Staff
Date: 5/31/2001 4:21 PM
Subject: Fwd: Re: Ammonia
Attachments: Re: Ammonia

More ammonia data

Message Id: 3B16D1EE.A91 : 10 : 43292
Subject: Fwd: Re: Ammonia
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 5/31/2001 4:21 PM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: David Barker (barkd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	486	5/31/2001 4:21 PM

Options

Concealed Subject: No
Expiration Date: None
Priority: Standard
Reply requested by None
Security: Standard
To Be Delivered: Immediate

From: Bryn Phillips <bmphillips@ucdavis.edu>
To: "Alan Monji" <Monja@rb9.swrcb.ca.gov>
Date: 5/31/2001 4:13 PM
Subject: Re: Ammonia
Attachments: tolerances.xls; Part.002

Here is the info that I have. I've attached a spreadsheet for you to reference. It has all of the ammonia data that I know of with references.
Hope this helps,
Bryn

Message Id: 3B16D027.D30 : 23 : 44336
Subject: Re: Ammonia
Created By: "bmphillips@ucdavis.edu".mime.Internet
Scheduled Date:
Creation Date: 5/31/2001 10:27 AM
From: Bryn Phillips <bmphillips@ucdavis.edu>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

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Header	967	
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tolerances.xls	22016	

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Shipyard Staff
Date: 5/31/2001 4:21 PM
Subject: Fwd: Re: Ammonia
Attachments: Re: Ammonia

More ammonia data

Message Id: 3B16D1EE.A91 : 10 : 43292
Subject: Fwd: Re: Ammonia
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 5/31/2001 4:21 PM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: David Barker (barkd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	486	5/31/2001 4:21 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Bryn Phillips <bmphillips@ucdavis.edu>
To: "Alan Monji" <Monja@rb9.swrcb.ca.gov>
Date: 5/31/2001 4:13 PM
Subject: Re: Ammonia
Attachments: tolerances.xls; Part.002

Here is the info that I have. I've attached a spreadsheet for you to reference. It has all of the ammonia data that I know of with references.
Hope this helps,
Bryn

Message Id: 3B16D027.D30 : 23 : 44336
Subject: Re: Ammonia
Created By: "bmphillips@ucdavis.edu".mime.Internet
Scheduled Date:
Creation Date: 5/31/2001 10:27 AM
From: Bryn Phillips <bmphillips@ucdavis.edu>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

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Part.002	188	
tolerances.xls	22016	

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Cole, Keri
Date: 6/8/2001 3:21 PM
Subject: Fwd: pore water toxicity testing......
Attachments: pore water toxicity testing......

More pore water info from Joe Germano

AM

Message Id: 3B214FE9.A91 : 10 : 43292
Subject: Fwd: pore water toxicity testing
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 6/8/2001 3:21 PM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
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MESSAGE	668	6/8/2001 3:21 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Joe Germano <germano@ix.netcom.com>
To: <smitj@rb9.swrcb.ca.gov>, <dph@procopio.com>, <xiaoping.zhou@lvvwd.com>
Date: 6/8/2001 3:08 PM
Subject: pore water toxicity testing......
Attachments: Pellston.zip

Dear Jim, David, & Xiaoping,

For a little bit of background context for the attached zip file: there are 2 MS Word files contained. The first is the draft chapter on use of Porewater toxicity tests in sediment investigations/sediment quality triad studies with my comments inserted in red. This started a long series of back & forth revisions that ultimately resulted in a version that I still couldn't endorse. Scott Carr agreed with my suggestion of writing a "minority dissenting opinion" piece; however, after the other members of the workgroup reviewed it, they felt it was not appropriate for inclusion in the proceedings and that I should submit it as a separate article in a journal. I asked that my name be removed from the final published version of the Pellston proceedings since I could not endorse many of the ideas they were putting forth.

I still haven't made the time to revise the "dissenting opinion" file into the proper format for submission -- just sending you that file without the original draft chapter to put it in context would have been a little confusing (and with no citations), so unfortunately you'll have to plow through both. But, you'll at least see the main points on why I think it is EXTREMELY premature to be promoting these as valididated assessment tools. You should also take a look at:

Wang F. 1998. Porewater toxicity testing: does it make sense? SETAC News 5: 23-24.

Wang F, Chapman PM. 1999. Biological implications of sulfide in sediment B A review focusing on sediment toxicity. Environmental Toxicology and Chemistry 18: 2526-2532.

If you have any questions or need more information, please don't hesitate to contact me.

Sincerely,
Joe
--
****
Joseph D. Germano, Ph.D.
Germano & Associates, Inc.
12100 SE 46th Place
Bellevue, WA 98006

PHONE: (425) 653-2121
FAX: (425) 562-6671

Message Id: 3B214CC8.ED6 : 18 : 32470
Subject: pore water toxicity testing
Created By: "germano@ix.netcom.com".mime.Internet
Scheduled Date:
Creation Date: 6/8/2001 2:39 PM
From: Joe Germano <germano@ix.netcom.com>

Recipients

Recipient	Action	Date & Time	Comment
lvvwd.com To: (xiaoping.zhou@lvvwd.com)			
procopio.com To: (dph@procopio.com)			
RB9Post.Region9 To: James Smith (smitj@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
lvvwd.com		lvvwd.com
procopio.com		procopio.com
RB9Post.Region9		rb9.swrcb.ca.gov

Files

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Pellston.zip	221324	

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Cole, Ken; Smith, James
Date: 6/14/2001 10:01 AM
Subject: Fwd: Re: Floating percentile
Attachments: Re: Floating percentile

read on

Message Id: 3B28EDE9.A91 : 10 : 43292
Subject: Fwd: Re: Floating percentile
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 6/14/2001 10:01 AM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: James Smith (smitj.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
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Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Teresa Michelsen" <Teresa@avocetconsulting.com>
To: "Alan Monji" <Monja@rb9.swrcb.ca.gov>
Date: 6/14/2001 9:25 AM
Subject: Re: Floating percentile
Attachments: FP Demo Instructions.doc; FP Demo.xls; Floating Percentile Description.doc

Hi Alan,

Thanks for your message. I am sorry I've missed so many workshops lately - I've been ill for the past two or three months. I am recovering now, but have had to cancel most of my out-of-state travel this spring. Things are finally getting back to normal, but it's been a slow process :-).

I am aware of what is happening in San Diego Bay and would be very interested in exploring the use of this method there. Since the presentation Steve gave, I have applied this method to a region in New York at the request of DEC, and was able to calculate criteria with false positive and false negative rates that were both in the range of 5-15%, considerably better than the other available methods. These results have been added as an extra sheet at the end of the demo spreadsheet (unfortunately the project itself is still not in public domain so I can't release the actual data or site name). Typically, I can lower the error rates so that the false negatives are comparable to the TELs and the false positives to the AETs. This provides criteria that both sides are able to live with and a good compromise between these two approaches.

I have attached the demonstration spreadsheet he used at the workshop, and some text files that give instructions for the worksheet, along with some additional materials that explain the theory in more detail. Please feel free to give me a call at (425)485-4511 if you have any further questions.

Teresa Michelsen
Avocet Consulting
15907 76th PL NE
Kenmore WA 98028
home office (425)485-4511
cell phone (425)503-9014
fax (425)487-6277

Message Id: 3B28E573.0CA : 3 : 8394
Subject: Re: Floating percentile
Created By: "Teresa@avocetconsulting.com".mime.Internet
Scheduled Date:
Creation Date: 6/14/2001 9:26 AM
From: "Teresa Michelsen" <Teresa@avocetconsulting.com>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Floating Percentile Description.doc	53760	
FP Demo Instructions.doc	59904	
FP Demo.xls	551936	
Header	1014	
MESSAGE	1588	6/14/2001 9:26 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Bart Chadwick" <chadwick@spawar.navy.mil>
To: <alot@rb9.swrcb.ca.gov>, <steveb@sccwrp.org>, <emaher@portofsandiego.org>, Lucinda Jacobs <JacobsL@exponent.com>
Date: 6/21/2001 4:05 PM
Subject: Fwd: sediment TMDL
Attachments: WA 2001 (Bell Bay Sediment TMDL).pdf

>From: "Chip Johnson" <cjohnso@spawar.navy.mil>
>To: "Brian Gordon \(CNRSW\)" <gordon.brian.S@asw.cnrsw.navy.mil>,
>   "Chuck Katz" <ckatz@spawar.navy.mil>,
>   "Bart Chadwick" <chadwick@spawar.navy.mil>
>Subject: sediment TMDL
>Date: Thu, 21 Jun 2001 15:42:51 -0700
>X-Mailer: Microsoft Outlook IMO, Build 9.0.2416 (9.0.2911.0)
>Importance: Normal
>
>Attached is an interesting Washington State Marine Sediment TMDL (Inner
>Bellingham Bay) for comparison to the San Diego hotspot assessment. Of note
>is their derivation of marine sediment cleanup criteria, intergration of
>NPDES requirements by individual permitee, and contours of sediment
>contamination.
>
>-Chip

Dr. D. Bart Chadwick
Marine Environmental Quality Branch
SPAWAR System Center San Diego, Code D362
San Diego, CA 92152

Message Id: 3B327D66.ACC : 0 : 51916
Subject: Fwd: sediment TMDL
Created By: "chadwick@spawar.navy.mil".mime.Internet
Scheduled Date:
Creation Date: 6/21/2001 4:02 PM
From: "Bart Chadwick" <chadwick@spawar.navy.mil>

Recipients

Recipient	Action	Date & Time	Comment
exponent.com			
To: Lucinda Jacobs (JacobsL@exponent.com)			
portofsandiego.org			
To: (emaher@portofsandiego.org)			
RB9Post.Region9			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			
sccwrp.org			
To: (steveb@sccwrp.org)			

Post Offices

Post Office	Delivered	Route
exponent.com		exponent.com
portofsandiego.org		portofsandiego.org
RB9Post.Region9		rb9.swrcb.ca.gov
sccwrp.org		sccwrp.org

Files

File	Size	Date & Time
Header	1002	
MESSAGE	803	6/21/2001 4:02 PM
WA 2001 (Bell Bay Sediment TMDL).pdf	3756217	

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Smith, James
Date: 7/5/2001 3:05 PM
Subject: Fwd: Re: Paper request
Attachments: Re: Paper request

See Teresa response to floating percentile info.

AM

Message Id:	3B44E496.A91 : 10 : 43292
Subject:	Fwd: Re: Paper request
Created By:	Monja@rb9.swrcb.ca.gov
Scheduled Date:	
Creation Date:	7/5/2001 3:05 PM
From:	Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: James Smith (smitj.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	625	7/5/2001 3:05 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Teresa Michelsen" <Teresa@avocetconsulting.com>
To: "Alan Monji" <Monja@rb9.swrcb.ca.gov>
Date: 7/5/2001 2:44 PM
Subject: Re: Paper request

Hi Alan,

You can find the paper you requested on-line at http://www.nws.usace.army.mil/dmmo/9th_ARM/NEGCON97.htm - hope that is helpful.

I have had a chance to apply the Floating Percentile method to contamination of a lake in New England (unfortunately the data are not public yet). In that project I was able to achieve error rates of less than 10% for both false positives and false negatives, which was even lower than the Portland Harbor project and far lower than the other methods were able to achieve. In that project, they did side-by-side comparisons of the FP method with AETs, ERLs/ERMs, and TELs/PELs, and the FP method out-performed the others by a considerable margin. The resulting error rates are shown on the very last sheet of the demo spreadsheet I sent you.

I just received a contract to calculate freshwater sediment guidelines and develop associated guidance documents for the Washington Department of Ecology, and will be testing this method as part of that contract as well over the next year or so. Regards - Teresa

Message Id:	3B44DF9F.FD8 : 8 : 8152
Subject:	Re: Paper request
Created By:	"Teresa@avocetconsulting.com".mime.Internet
Scheduled Date:	
Creation Date:	7/5/2001 2:47 PM
From:	Teresa Michelsen <Teresa@avocetconsulting.com>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	971	
MESSAGE	1050	7/5/2001 2:47 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Cole, Ken; Smith, James
Date: 7/5/2001 8:08 AM
Subject: Fwd: Re: Sediment profiling
Attachments: Re: Sediment profiling

HEre some feedback from Joe Germano

AM

Message Id: 3B4482FF.A91 : 10 : 43292
Subject: Fwd: Re: Sediment profiling
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 7/5/2001 8:08 AM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: James Smith (smitj.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	570	7/5/2001 8:08 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Joe Germano <germano@ix.netcom.com>
To: Alan Monji <Monja@rb9.swrcb.ca.gov>
Date: 7/4/2001 8:34 AM
Subject: Re: Sediment profiling

Alan Monji wrote:

> Hello Joe
>
> I had a question on your presentation of sediment profiling. I was wondering what you feel is a reasonable number of sites to complete in a day and a ball park dollar estimate per site. A workplan I am reviewing is proposing using sediment profiling at 100+ stations with 3 replicates at each station. The work is in a shipyard facility located in a bay so most of the work will be between piers and docks.
>
> I have a good feel for the level of effort needed for vibracoring, chemistry work, and toxicity testing but no clue on sediment profiling. Your thoughts would be appreciated
>
> Thanks
>
> Alan
>
> Alan T. Monji
> Environmental Specialist III
> San Diego Regional Water Quality Control Board
> Phone: 858-637-7140
> FAX: 858-571-6972

***

Hi Alan,

Alan -- sorry for the delay in response, I've been going balls to the wall on a sediment profile camera job in LA for the LA COE until last night when I finished. Well, talk about a "conflict of interest" -- I'm doing the work that you're reviewing. The job in LA harbor that I just completed is on the SAME boat that I'll be using to do the work in San Diego. Anway, we worked a LONG day on Monday & did 37 stations (left the dock at 7 AM, got back to the dock at 5:30) -- so the 3 day estimate I gave for San Deigo for the 107 stations seems to be right on the money as far as time, and I factored in 1 day for contingency to re-do any stations where the images don't turn out.

I guess the one thing you can be assured of is that the guy who's doing the profile camera work is considered an expert in this particular application ......

take care,
Joe

--
****

Joseph D. Germano, Ph.D.
Germano & Associates, Inc.
12100 SE 46th Place
Bellevue, WA 98006

PHONE: (425) 653-2121
CELL: (425) 891-2121
FAX: (425) 562-6671

Message Id: 3B43376E.6DF : 15 : 1759
Subject: Re: Sediment profiling
Created By: "germano@ix.netcom.com".mime.Internet
Scheduled Date:
Creation Date: 7/4/2001 8:42 AM
From: Joe Germano <germano@ix.netcom.com>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	949	
MESSAGE	1833	7/4/2001 8:42 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Snyder, Barry, J." <barry.snyder@amec.com>
To: "'Tom Alo'" <alot@rb9.swrcb.ca.gov>
CC: "Stransky, Brian, C." <chris.stransky@amec.com>
Date: 7/9/2001 4:35 PM
Subject: RE: Porewater Toxicity Testing - SETAC 2001

Tom,

It can be found at

http://www.setac.org/files/PoreWaterSummary.pdf

but the quality of some of the tables is pretty bad. Maybe you can call scott carr (361-980-3216) for a clean copy.

Cheers,

Barry

> ----------
> From: Tom Alo[SMTP:alot@rb9.swrcb.ca.gov]
> Sent: Monday, July 09, 2001 12:06 PM
> To: Snyder, Barry, J.
> Subject: Porewater Toxicity Testing - SETAC 2001
>
> hey barry. i was wondering if you happened to have the following:
>
> SETAC. 2001. Porewater Toxicity Testing: Biological, Chemical, and
> Ecological Considerations with a Review of Methods and Applications, and
> Recommendations for Future areas of Research. SETAC Technical Workshop.
> Society for Environmental Toxicology and Chemistry, Pensacola, FL.
>
> if yes, can you please fax it over to me? thanks.
>
> --tom
>
> Tom C. Alo
> Water Resources Control Engineer
> CA Regional Water Quality Control Board
> 9771 Clairemont Mesa Blvd., Suite A
> San Diego, CA 92124-1324
> Main: (858) 467-2952
> Direct: (858) 636-3154
> Fax: (858) 571-6972
> <alot@rb9.swrcb.ca.gov>
>
> ***
> **
> "The energy challenge facing California is real. Every Californian needs
> to
> take immediate action to reduce energy consumption. For a list of simple
> ways you can reduce demand and cut your energy costs,
> see our Web-site at http://www.swrcb.ca.gov ."
>
> ***

> **
>

Message Id:	3B4A3FA3.A35 : 167 : 31285
Subject:	RE: Porewater Toxicity Testing - SETAC 2001
Created By:	"barry.snyder@amec.com".mime.Internet
Scheduled Date:	
Creation Date:	7/9/2001 4:40 PM
From:	"Snyder, Barry J." <barry.snyder@amec.com>

Recipients

Recipient	Action	Date & Time	Comment
amec.com			
CC: Stransky, Brian, C. (chris.stransky@amec.com)			
RB9Post.Region9			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
amec.com		amec.com
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	1191	
MESSAGE	1556	7/9/2001 4:40 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Cole, Keri; Smith, James
CC: Barker, David; Jayne, Deborah
Date: 7/9/2001 9:54 AM
Subject: Fwd: Re: Pore Water Collection

One of the problems with pore water is knowing how much sediment to collect to get enough pore water to do the analyses so maybe they want to do it onsite so they can collect as much sediment as needed with the worry of running out of mud for the other tests.

Alan

>>> Tom Alo 07/09/01 09:49AM >>>
fyi...

Message Id: 3B49E1DC.A91 : 10 : 43292
Subject: Fwd: Re: Pore Water Collection
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 7/9/2001 9:54 AM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
CC: David Barker (barkd@rb9.swrcb.ca.gov)			
CC: Deborah Jayne (jaynd@rb9.swrcb.ca.gov)			
To: James Smith (smitj@rb9.swrcb.ca.gov)			
To: Keri Cole (colek@rb9.swrcb.ca.gov)			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MESSAGE	1019	7/9/2001 9:54 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Cole, Keri; Smith, James
CC: Barker, David; Jayne, Deborah
Date: 7/9/2001 9:54 AM
Subject: Fwd: Re: Pore Water Collection

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Alan

>>> Tom Alo 07/09/01 09:49AM >>>
fyi...

Message Id:	3B49E1DC.A91 : 10 : 43292
Subject:	Fwd: Re: Pore Water Collection
Created By:	Monja@rb9.swrcb.ca.gov
Scheduled Date:	
Creation Date:	7/9/2001 9:54 AM
From:	Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
CC: David Barker (barkd@rb9.swrcb.ca.gov)			
CC: Deborah Jayne (jaynd@rb9.swrcb.ca.gov)			
To: James Smith (smitj@rb9.swrcb.ca.gov)			
To: Keri Cole (colek@rb9.swrcb.ca.gov)			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MESSAGE	1019	7/9/2001 9:54 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Snyder, Barry, J." <barry.snyder@amec.com>
To: "'Tom Alo'" <alot@rb9.swrcb.ca.gov>
Date: 7/11/2001 4:37 PM
Subject: RE: Porewater Toxicity Testing - SETAC 2001

Tom,

try (361) 825-3216

B.

> ----------
> From: Tom Alo[SMTP:alot@rb9.swrcb.ca.gov]
> Sent: Wednesday, July 11, 2001 3:38 PM
> To: Snyder, Barry, J.
> Subject: RE: Porewater Toxicity Testing - SETAC 2001
>
> barry, the number you gave me has been disconnected. do you have an
> alternate number?
>
> --tom
>
> >>> "Snyder, Barry, J." <barry.snyder@amec.com> 07/09/01 04:40PM >>>
> Tom,
>
> It can be found at
>
> http://www.setac.org/files/PoreWaterSummary.pdf
>
> but the quality of some of the tables is pretty bad. Maybe you can call
> scott carr (361-980-3216) for a clean copy.
>
> Cheers,
>
> Barry
>
>
> > ----------
> > From: Tom Alo[SMTP:alot@rb9.swrcb.ca.gov]
> > Sent: Monday, July 09, 2001 12:06 PM
> > To: Snyder, Barry, J.
> > Subject: Porewater Toxicity Testing - SETAC 2001
> >
> > hey barry. i was wondering if you happened to have the following:
> >
> > SETAC. 2001. Porewater Toxicity Testing: Biological, Chemical, and
> > Ecological Considerations with a Review of Methods and Applications, and
> > Recommendations for Future areas of Research. SETAC Technical Workshop.
> > Society for Environmental Toxicology and Chemistry, Pensacola, FL.
> >
> > if yes, can you please fax it over to me? thanks.
> >
> > --tom
> >
> > Tom C. Alo

> > Water Resources Control Engineer
> > CA Regional Water Quality Control Board
> > 9771 Clairemont Mesa Blvd., Suite A
> > San Diego, CA 92124-1324
> > Main: (858) 467-2952
> > Direct: (858) 636-3154
> > Fax: (858) 571-6972
> > <alot@rb9.swrcb.ca.gov>
> >
> >
> **
> > **
> > "The energy challenge facing California is real. Every Californian
> needs
> > to
> > take immediate action to reduce energy consumption. For a list of
> simple
> > ways you can reduce demand and cut your energy costs,
> > see our Web-site at http://www.swrcb.ca.gov ."
> >
> >
> **
> > **
> >
>

Message Id: 3B4CE30B.96E : 1 : 47470
Subject: RE: Porewater Toxicity Testing - SETAC 2001
Created By: "barry.snyder@amec.com".mime.Internet
Scheduled Date:
Creation Date: 7/11/2001 4:38 PM
From: "Snyder, Barry J." <barry.snyder@amec.com>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	1130	
MESSAGE	2108	7/11/2001 4:38 PM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "Scott Carr" <rcarr@falcon.tamucc.edu>
To: <alot@rb9.swrcb.ca.gov>
Date: 7/12/2001 7:43 AM
Subject: Porewater Workshop Summary Tables
Attachments: Part.001; Final revised Workshop Summary.doc

Tom,

Thanks for alerting us to the problem with the pdf document on the SETAC website. It looked fine when they first put it up but they took it down for a while and when they put it back they must have changed something. Here's the Word version of the document. Let me know if you're still having problems.

Regards,

Scott

****
R. Scott Carr, Ph.D.
USGS, BRD, CERC
Marine Ecotoxicology Research Station
TAMU-CC, Center for Coastal Studies
NRC Suite 3200, 6300 Ocean Drive
Corpus Christi, TX 78412 USA
(361) 825-3216; FAX (361) 825-3270
E-mail: rcarr@falcon.tamucc.edu <mailto:rcarr@falcon.tamucc.edu>
Homepage: http://www.sci.tamucc.edu/mers/

Message Id: 3B4DB76B.4C7 : 6 : 50875
Subject: Porewater Workshop Summary Tables
Created By: "rcarr@falcon.tamucc.edu"\mime.Internet
Scheduled Date:
Creation Date: 7/12/2001 7:50 AM
From: "Scott Carr" <rcarr@falcon.tamucc.edu>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Tom Alo (alot@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Final revised Workshop Summary.doc	523372	
Header	1013	
MESSAGE	695	7/12/2001 7:50 AM
Part.001	6284	

Options

Concealed Subject: No
Expiration Date: None
Priority: Standard
Reply requested by None
Security: Standard
To Be Delivered: Immediate

From: Alan Monji
To: Alo, Tom; Cole, Keri; Smith, James
CC: Barker, David
Date: 7/16/2001 8:01 AM
Subject: Fwd: RE: Hello
Attachments: RE: Hello

Some info on PCB congeners from a local expert. Jack Anderson at CAS

Alan

Message Id: 3B5301BC.A91 : 10 : 43292
Subject: Fwd: RE: Hello
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 7/16/2001 8:01 AM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
CC: David Barker (barkd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: James Smith (smitj.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	648	7/16/2001 8:01 AM

Options

Concealed Subject: No
Expiration Date: None
Priority: Standard
Reply requested by None
Security: Standard
To Be Delivered: Immediate

From: "janderson" <janderson@vista.caslab.com>
To: "'Alan Monji'" <Monja@rb9.swrcb.ca.gov>
Date: 7/13/2001 10:21 AM
Subject: RE: Hello

Alan: I'll fax the cover pages of the section of ASTM on biological tests, as I guess this is what you want. It is a long story on PCBs, but yes the Aroclor method is not good as it just integrates under a big envelope to produce a number. What we should be concerned with is the congeners (12) that have proven toxic effects. I will fax a table that list these, and we have shown that numbers 81 and 126 (2 of the 4 true coplanars) are much more potent in our human cells than the others. Our lab does about 40 congeners at 0.5 ppb each for about $265 per sample, and the high res GC/MS 1668 method does the 12 at about 0.005 ppb for $750 per sample. More later, and best wishes, Jack.

-----Original Message-----
From: Alan Monji [mailto:Monja@rb9.swrcb.ca.gov]
Sent: Tuesday, July 10, 2001 1:28 PM
To: janderson@vista.caslab.com
Subject: Hello

Hi Jack

Had a PCB question for you. What is the advantage of analyzing for PCB congenors over Arochlors? We are writing up a workplan and understand that total arochlors are cheaper but congeners preferred for decision making but don't know the logic. Any thoughts?

Also can you give me or fax the latest citation for ASTM. I would like to order a copy for the office.

Thanks

Alan

Alan T. Monji
Environmental Specialist III
San Diego Regional Water Quality Control Board
Phone: 858-637-7140
FAX: 858-571-6972

"The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at http://www.swrcb.ca.gov ."

Message Id: 3B4F2E1B.1B3 : 8 : 61875
Subject: RE: Hello
Created By: "janderson@vista.caslab.com".mime.Internet
Scheduled Date:
Creation Date: 7/13/2001 10:19 AM
From: "janderson" <janderson@vista.caslab.com>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	1090	
MESSAGE	1630	7/13/2001 10:19 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: Alan Monji
To: Alo, Tom; Cole, Keri; Smith, James
CC: Barker, David
Date: 7/16/2001 8:01 AM
Subject: Fwd: RE: Hello
Attachments: RE: Hello

Some info on PCB congeners from a local expert. Jack Anderson at CAS

Alan

Message Id: 3B5301BC.A91 : 10 : 43292
Subject: Fwd: RE: Hello
Created By: Monja@rb9.swrcb.ca.gov
Scheduled Date:
Creation Date: 7/16/2001 8:01 AM
From: Alan Monji

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
CC: David Barker (barkd.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: James Smith (smitj.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Keri Cole (colek.RB9Post.Region9@rb9.swrcb.ca.gov)			
To: Tom Alo (alot.RB9Post.Region9@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
MAIL		
MESSAGE	648	7/16/2001 8:01 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

From: "janderson" <janderson@vista.caslab.com>
To: "'Alan Monji'" <Monja@rb9.swrcb.ca.gov>
Date: 7/13/2001 10:21 AM
Subject: RE: Hello

Alan: I'll fax the cover pages of the section of ASTM on biological tests, as I guess this is what you want. It is a long story on PCBs, but yes the Aroclor method is not good as it just integrates under a big envelope to produce a number. What we should be concerned with is the congeners (12) that have proven toxic effects. I will fax a table that list these, and we have shown that numbers 81 and 126 (2 of the 4 true coplanars) are much more potent in our human cells than the others. Our lab does about 40 congeners at 0.5 ppb each for about $265 per sample, and the high res GC/MS 1668 method does the 12 at about 0.005 ppb for $750 per sample. More later, and best wishes, Jack.

-----Original Message-----
From: Alan Monji [mailto:Monja@rb9.swrcb.ca.gov]
Sent: Tuesday, July 10, 2001 1:28 PM
To: janderson@vista.caslab.com
Subject: Hello

Hi Jack

Had a PCB question for you. What is the advantage of analyzing for PCB congenors over Arochlors? We are writing up a workplan and understand that total arochlors are cheaper but congeners preferred for decision making but don't know the logic. Any thoughts?

Also can you give me or fax the latest citation for ASTM. I would like to order a copy for the office.

Thanks

Alan

Alan T. Monji
Environmental Specialist III
San Diego Regional Water Quality Control Board
Phone: 858-637-7140
FAX: 858-571-6972

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Message Id: 3B4F2E1B.1B3 : 6 : 61875
Subject: RE: Hello
Created By: "janderson@vista.caslab.com".mime.Internet
Scheduled Date:
Creation Date: 7/13/2001 10:19 AM
From: "janderson" <janderson@vista.caslab.com>

Recipients

Recipient	Action	Date & Time	Comment
RB9Post.Region9			
To: Alan Monji (Monja@rb9.swrcb.ca.gov)			

Post Offices

Post Office	Delivered	Route
RB9Post.Region9		rb9.swrcb.ca.gov

Files

File	Size	Date & Time
Header	1090	
MESSAGE	1630	7/13/2001 10:19 AM

Options

Concealed Subject:	No
Expiration Date:	None
Priority:	Standard
Reply requested by	None
Security:	Standard
To Be Delivered:	Immediate

San Diego Bay Council

A coalition of environmental organizations dedicated to protection and restoration of San Diego coastal waters

August 21, 2001

Chairman John Minan and Members of the Regional Board
Regional Water Quality Control Board
9771 Claremont Mesa Blvd., Suite A
San Diego, CA 92124

RE: COMMENTS ON WORK PLAN FOR THE NASSCO AND SOUTHWEST MARINE DETAILED SEDIMENT INVESTIGATION

Dear Chairman Minan and Regional Board Members:

We are writing to alert the Board that immediate action is required to prevent a dangerous precedent that will undermine the Board's ability to effectively clean up San Diego Bay over the next decade. We are profoundly concerned that the *Work Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation* is not scientifically defensible, will not deliver the preponderance of evidence the Board is seeking, and will not serve to protect beneficial uses of San Diego Bay. We wish to underscore that these explicit goals of the sediment remediation efforts cannot be met through the execution of the work plan as designed. Our concerns and recommendations are not merely a desire for more information (more data is always a good thing), but rather a demand for enough information to make the assessment valid at all. There are significant gaps in the data collection that threaten to render the entire assessment invalid.

As you know, this Work Plan was just presented at the public workshop on August 3. We secured the services of a consultant who has reviewed it and consulted with experts in the field. Her assessment of the work plan is attached. The Contractor for the shipyards apparently began implementing the work plan immediately after its presentation at the workshop, and has already completed well over half of the field sampling! Time is of the essence as this Phase 1 sampling forms the basis of the risk assessment and if not defensible, will render the entire investigation invalid. We requested an emergency meeting with your staff on Friday, August 10, as the full extent of the problems became evident to us. We met on Tuesday, August 12 with your staff and conveyed the urgent need for them to address these concerns.

You will read in the attached comments of several serious technical failings in the current design. We are also very concerned about the opportunities for obfuscation in the interpretation of the results that we believe should not be part of any approved work plan.

It is important not to lose sight of the inherent bias of the contractors for the shipyards. They have the option currently of starting cleanup tomorrow to background levels. We are convinced that they are choosing to undertake this extensive risk assessment strategy in efforts to weaken the cleanup standards and save money thereby. Their clear preference for AET, even in advance of the testing being completed, is revealing. The Apparent Effects Threshold or AET - appears to be greatly desired by the Shipyards, as is evident in their attorney's comments to the Board:

> *Should the RWQCB conclude that dredging to meet a background standard is required, the shipyards face a significant risk not only that operations may be curtailed or shutdown, but the continued operational viability of the shipyards could be placed in jeopardy as well. These are real and significant issues that must be addressed if the Regional Board is seriously considering any option other than the AET-based approach to the NASSCO and Southwest Marine facility sediment cleanups.*
>
> -- David L. Mulliken, Comment Number 7.08, RWQCB Response to Comments, February 16, 2001, p. 42.

It would appear that the Shipyards are confident that if the AET method is used, their cleanup requirement will be such that operations will not need to be curtailed i.e. less cleanup will occur. Their bias is clear.

Given the overarching goal of a clean and healthy San Diego Bay, the proposed Work Plan for cleaning up two large, and significantly contaminated, sites in the Bay, is highly problematic. Ideally these sites would be completely cleaned to out-of-bay, near pristine reference levels. Less ideal but second best, these sites would be cleaned up to match the cleanest (yet contaminated) in-bay sites, unless these levels were determined to not be protective enough. Third best, we would have an esteemed, objective group of scientists assess contamination at the sites and recommend the level of cleanup to protect environmental and other services of the Bay. Fourth best, levels would be set using a robust cost/benefit analysis and state-of-the-art measurements of benefits, including intangible benefits as measured by contingent valuation. Somewhere along a downward spiral from fourth best, is the unenviable situation we have before us: the companies performing the environmental impact assessment, deriving certain of the standards to meet, naming the chemicals of import, and with powerful financial incentives to show the least possible environmental and human health impact.

The proposed study design appears to be heavily biased to produce a desired outcome different from the goals stated by the Board. As such, it is ripe with opportunity for influencing results and diluting robust findings and action - from the number and placement of sampling stations, sample collection, and laboratory analyses which will determine the extent of the problem and its effects, to the sampling and selection of reference sites, to the selection of indicator chemicals, to data analysis, to the determination of cleanup levels, to the technical feasibility and cost benefit analyses which will in the end determine what is actually required.

To see what a contractor can do using a biased work plan, one needs only to look at the results of a similar impact study conducted by the same contractor, PTI, now using a new name - Exponent. "Safe" levels of PCBs and mercury determined for the Campbell shipyard and the Shelter Island boatyard site are between two and ten times higher than levels considered safe in Puget Sound. These higher allowable concentrations greatly reduce the size of the area requiring cleanup. Bioaccumulation was determined to be of no concern, despite fish contamination levels well above levels that trigger public health advisories in San Francisco. Rather than application of the precautionary principle, which would require erring on the side of public and ecological safety, the burden of proof here and in the Work Plan for NASSCO and Southwest Marine seems to be on the environment to prove itself worthy of protection.

The proposed cleanup should set a high standard for other cleanups around the Bay. We are profoundly concerned that if the Board allows this Work Plan to go forward as it now stands, the results will not be protective of beneficial uses and then the Board will be under extreme pressure to apply the same faulty methodology and cleanup levels to other sites in the Bay.

There are a number of key issues that we believe should and can be addressed immediately. These include:

- increase pore water and dilution series sampling to allow any analysis to be statistically defensible.
- requirement that on-site benthos and local fish and shellfish be tested.
- increased bioaccumulative sampling in areas known to have bioaccumulators
- removal of the opportunity for site specific tissue standards
- removal of the convoluted decision matrices by which many "hits" can and will be removed from consideration.
- changes in the manner that core sampling stations are located for Phase II
- Inclusion of ethnic and subsistence fishing standards as part of any health impact assessment
- remove species from species list for on-site species that are not found in the Bay and include those species that are key for the biota of the area.

Thank you for your attention to this important issue. If you wish to discuss this matter further, please feel free to contact me at 619-758-7743 or any of the signatories.

Sincerely,

Bruce Reznik
San Diego BayKeeper

On behalf of San Diego Bay Council Members

Laura Hunter
Environmental Health Coalition

Ed Kimura
Sierra Club, San Diego Chapter

Marco Gonzalez
Surfrider Foundation, San Diego Chapter

Allison Rolfe
San Diego Chapter Audubon Society

Cc: John Robertus
David Barker

August 21, 2001

Chairman John Minan and Boardmembers
California Regional Water Quality Control Board, San Diego Region
9771 Clairemont Mesa Boulevard, Suite A
San Diego, CA 92124

RE: COMMENTS ON WORK PLAN FOR THE NASSCO AND SOUTHWEST MARINE DETAILED SEDIMENT INVESTIGATION

Dear Chairman Minan and Boardmembers:

As has been requested by the Environmental Health Coalition and San Diego BayKeeper, I have performed a review of the *Work Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation* (and related documents) and have the following comments and recommendations:

Testing for Bioaccumulation. I am unaware of a rationale for eliminating bioaccumulation testing at most of the sampling stations. While all 30 stations include the triad of toxicity tests, only 9 stations will test for bioaccumulation. Only one bioaccumulation testing station at the NASSCO site is a high chemical concentration site. This would appear to present major problems for determining the extent of areas (within this 46 acre site) where bioaccumulation is occurring, and major problems for producing statistically-valid data sets. It is unclear why the Plan includes this testing at so few shipyard sites, while including this testing at all five reference stations.

RECOMMENDATION: Test for bioaccumulation at each of the 30 stations, and any known hotspots of PCBs, Mercury and other bioaccumulating chemicals that are not covered by these stations.

Sampling for Dilution Series, Pore Water, and Fish Tissue. I am unaware of how the Plan's proposed one sampling site per shipyard for the Dilution Series test will provide data for all of the chemicals of concern. Yet the Plan's methodology requires that the background cleanup values will be compared to toxicity benchmark values obtained from the Dilution Series test. The Pore Water Testing will occur at four stations per shipyard site or a total of eight. It is unclear to me whether 8 total samples will provide an accurate representation of pore water concentrations over the 63 total acres. Yet this testing is being used to balance the uncertainties and limitations of any one assessment method, such as the AET. If the bioaccumulation tests reveal that bioaccumulation is occurring above threshold values, then fishes will be collected at one station at each shipyard site. It is unclear to me how these collections will be representative of fishes that inhabit and traverse the 63 acres of water area at these sites.

RECOMMENDATION: Require an adequate number of sampling stations for each of these important tests. In addition, require that pore water be collected from depths greater than 0-2 centimeters (less than one inch).

Core Sampling. It is unclear to me why core sampling is not being conducted in Phase 1 based on the historical data used to determine sampling locations for the other tests. It appears that the locations for core sampling will be selected based on Phase 1 sampling of the top 2 centimeters of sediment. I am unaware of how one could confidently predict deep contamination based on contamination that appears in less than one inch of surface sediment.

RECOMMENDATION: Core sampling, essential to determine the depth of contamination and therefore depth of necessary cleanup, should be performed at each of the 30 sampling stations. Just as these 30 stations will be used to determined the horizontal extent of contamination, core samples at these same stations should be used to determine the vertical extent of contamination.

AET Method of Determining Cleanup Level. AET levels do not meet the Regional Board's basic mandate of protecting the Bay's most sensitive beneficial uses. If a calculation of AET values is to be derived as a tool for helping to select an appropriate clean-up level (which I do not believe is necessary), the Work Plan must at a minimum follow accepted practices for calculating AET values. To my knowledge the State of Washington is the authority on this assessment method, and I believe the State recommends that this approach be used for very large scale assessments where there are sufficient resources to sample hundreds of sites. Apparently the results of this method can be driven by individual, high values; therefore large data sets are necessary to achieve accurate (protective) results. It appears from a cursory examination of Board documents, that problems inherent in using too few sites have been illustrated at another site in San Diego Bay, where AET methodology produced 'acceptable' levels of mercury that are 10 times higher than those generally found safe. While the Board and its staff is to be commended for increasing the number of sites to 30 in this assessment, 50 is a more generally accepted minimum - and even at 50, I understand that extensive data refinement is required. The Plan indicates "An AET for benthic community effects may be calculated on a reduced subset of triad stations if physical disturbance is evident at some stations." This means that AET values for benthic community effects - in my view one of the Board's most important and reliable indicators of the health/toxicity of the shipyard sites - may be calculated on even less than 30 sites. Moreover, it is unlikely that all of the data will prove useable, causing even greater concern about the AET values that will be generated.

RECOMMENDATION: Use an alternative approach, one that will be scientifically defensible with 30 sampling stations. An alternative approach may also solve the apparently pervasive question of whether AET values are sufficiently protective.

Benthic Fauna. These tests are among the most important and reliable indicators of toxicity/health of the site. If physical disturbance is found at a sampling site, the Plan appears to allow the benthic fauna data from that site to be removed from the analyses. If the data indicates a toxic effect, the effect is assumed to be from physical disturbance.

RECOMMENDATION: Require the consideration of all benthic fauna data. Require replicate samples for this specific test at each sampling station.

On-site Fauna. An important focus of the study should be the tangible effects on the fauna that inhabit the site. Direct examination of clams, mussels, fishes and other fauna for tumors and other signs of contamination (including tissue analysis) is a particularly relevant indicator of toxicity/health of the site. Such analysis is not currently required by the Work Plan.

RECOMMENDATION: Require the collection and analysis of the fauna that actually inhabit the site, in addition to the testing performed in the laboratory using laboratory animals. Fauna should include both mobile and immobile species.

Most Sensitive Beneficial Uses. The Plan does not appear to require consideration of some of the most sensitive beneficial uses: The Bay is a nursery ground for many species; larval populations are well documented. Early life stage toxicity in fishes - which are very sensitive to waterborne exposure to metals, for example - has significant implications for the health of a fish population. Ethnic populations who fish in the Bay are more sensitive both because they consume a greater proportion of fish in their diets, and because a significant percentage of ethnic populations consume the entire fish.

RECOMMENDATION: Require consideration of toxic impacts on larval forms of marine life, and the consideration of health impacts on ethnic fishers.

Reference Sites. The Work Plan allows the pooling of reference site data. Moreover it allows the use of "other available and relevant" data sets to "more precisely characterize background conditions." A reference site should be selected based on at least the following characteristics: substantially free of pollutants, as similar as possible to the grain size of the contaminated sediments, and reflective of conditions at the site (Rubenstein, EPA Office of Research and Development).

RECOMMENDATION: Do not allow the pooling of reference site data. Do not allow the least-clean reference station or values to be used to compare with shipyard site data. Determine whether the Plan's use of other data sets (Navy, Bight, p. 6-1) will increase or decrease a background cleanup level based solely on this study's data. Require the Contractor to provide all raw data from the reference stations.

Protection of wildlife and human health. While not found in the Board's Guidelines, the Work Plan allows the Contractor to derive its own tissue residue standards - which will be "back-calculated" using an equation that would appear to allow a more contaminated site if there are few wildlife presently feeding at the site. These standards will override national standards, if the national standards are more restrictive.

A second apparent problem is that the wildlife - or receptors of concern - to be considered are limited to a few species, making it less likely to find much feeding going on, which in turn will make the standard less restrictive. For example, of the many terns and shorebirds around the

Bay, only the California least tern, an endangered species, will be considered a receptor of concern.

A third problem is that some of the species the Plan proposes to test would never occur in the Bay and some would not occur in this part of the Bay. Other species important to include are missing, and these may include more sensitive species.

RECOMMENDATION. Require the use of national standards exclusively. These should provide a balanced and defensible level of protection. Require the consideration of species that are most often, and regularly, found at these sites.

Other missing aspects of protecting beneficial uses. The impacts of metabolic products, molecular level stress, and cumulative and synergistic effects do not appear to be addressed in the Plan. Multiple, cumulative stressors on the biota, for example, are generally required to be addressed in order to provide adequate protection. For example, if the organisms on site are subject to stresses other than contaminant load in the sediments, a more stringent cleanup level may be necessary to protect them.

RECOMMENDATION: Consider the need to require assessment of these aspects of protecting beneficial uses.

Oversight. There is no independent expert oversight of this study.

RECOMMENDATION. The Board should hire independent expertise to sample a percentage of the sites, and have these samples independently analyzed.. Oversight promotes confidence in the data and reassures all parties.

Please feel free to contact me should you wish to discuss these findings.

Sincerely,

Elaine M. Carlin

Elaine M. Carlin

Research Scientist, Joint US/Norwegian Research Team
MPA Harvard University
MMA University of Washington

Cc: John Robertus
David Barker

San Diego Bay Council

A coalition of San Diego environmental organizations dedicated to protection and restoration of San Diego's coastal water resources

August 21, 2001

Chairman John Minan and Members of the Regional Board
Regional Water Quality Control Board
9771 Claremont Mesa Blvd., Suite A
San Diego, CA 92124

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Formal Positions expressed in letter are of signatory organizations only.

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Thank you for your attention to this important issue.

Sincerely,

Laura Hunter
Environmental Health Coalition

Bruce Reznik
San Diego Baykeeper

Marco Gonzalez
San Diego Chapter of the Surfrider Foundation

Allison Rolfe
San Diego Audubon Society

Ed Kimura
San Diego Chapter of the Sierra Club

Formal Positions expressed in letter are of signatory organizations only.

Standards & Criteria	Media	Weight (ppb)	aldrin	chlorbenside	alpha-chlordene	cis-chlordane	gamma-chlordene	trans-chlordane	cis-nonachlor	trans-nonachlor	oxychlordane
SMW EDL95 RCM	RCM	wet	0.0	0.5	0.0	3.2	0.0	2.2	1.2	1.2	0.3
SMW EDL95 TCM	TCM	wet	0.0	1.7	1.0	13.4	0.4	9.9	3.9	9.9	0.9
SMW EDL95 RBM	RBM	wet	0.3	5.8	1.1	17.9	1.2	17.2	4.5	16.5	0.9
SMW EDL95 TFC	TFC	wet	0.3	5.8	1.1	17.9	1.2	17.2	4.5	16.5	0.9
NAS (freshwater shellfish)	TFC	wet									
FDA Action Level (fish & shellfish)	TIS	wet	300.0			300.0		300.0			
EPA Screening (fish & shellfish)	TIS	wet				80.0		80.0			
NAS (fish)	FSH	wet	5.0			50.0		50.0			
NOAA effects range medium	SED	dry			6.0	6.0		6.0			
Calif Ocean Plan (MTRL)	TIS	wet	0.1		0.3	0.3		0.3			
Region 3 Basin Plan	H2O										
DHS Drinking water	H2O										
USEPA NTR	H2O										
USEPA CTR	H2O										
Calif Inland Waters	H2O										
Calif Enclosed Bays & Estuaries	H2O										
CAMP Attention Level (75%)			0.0	0.4	0.0	0.2	0.0	0.2	0.9	0.9	0.2
CAMP Attention Level(50%)			0.0	0.3	0.0	0.2	0.0	0.2	0.6	0.6	0.2

Comments

on the

Draft Environmental Impact Statement for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet, August, 1998

Prepared for
The Environmental Health Coalition
San Diego, CA

November 11, 1998

Katherine S. Squibb, PhD

Theodore J Henry
Theodore J. Henry, MS

Community Health Assessment
& Public Participation Center
Department of Pathology
University of Maryland, Baltimore
100 N. Greene Street, 4th Floor
Baltimore, MD 21201

total chlordane	chlorpyrifos	dacthal	o,p'-DDD	p,p'-DDD	o,p'-DDE	p,p'-DDE	p,p'-DDMS	p,p'-DDMU	o,p'-DDT	p,p'-DDT	total DDT	diazinon	dichlorobenzide	dicofol
7.6	0.0	0.4	2.0	7.5	12.3	105.1	2.4	8.9	1.2	3.4	128.9	0.0		0.0
35.9	1.5	6.4	12.7	67.4	10.5	170.1	6.2	10.4	8.6	32.6	311.5	0.0		0.0
56.2	1.0	21.2	23.6	83.3	15.6	321.8	5.3	11.3	23.1	96.7	496.9	0.0		
56.2	1.0	21.2	23.6	83.3	15.6	321.8	5.3	11.3	23.1	96.7	496.9	0.0		
											1000.0			
300.0											5000.0			
80.0	30000.0										300.0	900.0		10000.0
50.0											50.0			
6.0						27.0					46.1			
0.3											9.1			
0.2	0.0	0.3	1.5	5.6	7.9	20.3	1.8	6.7	0.9	2.6	6.8	0.0	0.0	0.0
0.2	0.0	0.2	1.0	3.8	5.3	13.5	1.2	4.5	0.6	1.7	4.6	0.0	0.0	0.0

is more than one thousand times smaller than the occupational dose limit. It is considered significant in EPA regulations, because large numbers of people may be exposed to contaminated water resources, producing consequences that have been deemed to be unacceptable. The Final EIS should contain a more careful discussion of this subject in a more appropriate tone.

5 Conclusions and recommendations

The Draft EIS lacks a comprehensive evaluation of radioactive emissions in normal operations and accidents. Crucial information necessary for a validation of the results is not provided. A proper analysis of the uncertainties associated with radiation exposures from routine operations is lacking. Potentially severe accidents on board the aircraft carriers are not considered in what has been published for the public. All information including risks to the public of any reactor accidents that may have been considered is classified. The impact of releases of radioactive materials in routine operation and accidents on workers is incompletely addressed. Relevant non-cancer risks from releases of tritiated water vapor have not been discussed.

A preliminary, illustrative check of some of the calculations using a standard EPA-approved dispersion model indicates that the Draft EIS may be seriously underestimating at least some of the doses. The Draft EIS does not provide an adequate evaluation of the risks associated with the development of home port facilities for three NIMITZ-Class aircraft carriers. It contains serious scientific deficiencies that at the very least should be fully corrected in the Final EIS. A better alternative, which we recommend, would be to provide a second Draft EIS for public comment with the appropriate data and more transparent calculations so that an independent check on the results can be performed.

Please feel free to contact us if you have any questions or comments.

Sincerely,

Bernd Franke

Arjun Makhijani, Ph.D.
President

dieldrin	endosulfan I	endosulfan II	endosulfan sulfate	total endosulfan	endrin	ethion	alpha HCH	beta HCH	delta HCH	gamma HCH	gamma HCH	heptachlor epoxide	hexachlorobenzene
2.5	1.3	0.0	0.0	1.3	0.0	0.0	1.7	1.2	0.0	0.3	0.0	0.0	0.0
18.2	23.5	15.4	26.8	46.5	1.4	0.0	1.1	0.0	0.0	0.7	0.0	0.5	0.1
22.2	125.9	74.3	72.6	231.8	4.1	0.0	0.5	0.3	0.0	0.4	0.6	0.5	0.2
22.2	125.9	74.3	72.6	231.8	4.1	0.0	0.5	0.3	0.0	0.4	0.6	0.5	0.2
300.0					300.0						300.0	300.0	
7.0	20000.0	20000.0	20000.0	20000.0	3000.0	5000.0						10.0	70.0
5.0	50.0	50.0	50.0	50.0	5.0						5.0	5.0	50.0
8.0					45.0								
0.2											8.1		2.0
0.2	1.0	0.0	0.0	1.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.0
0.1	0.7	0.0	0.0	0.7	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0

3 Radiation Doses to Workers

The Draft EIS does not address radiation exposures to workers less than 100 m of the point of the release. This is an arbitrary assumption, since it is possible that workers may be located closer than 100 m to the release point. The Draft EIS is thus incomplete because the impact of the operations on workers is not adequately addressed.

The Draft EIS provides some data on worker exposure in the NNPP. However, it appears that this is external exposure data only. Doses from internal burdens of radionuclides seem to have been excluded. If internal doses have been included, the Final EIS should so state, and discuss how the measurements were done and records maintained. If internal doses were not included, then the Final EIS should so state. It should discuss why these doses have been omitted and analyze the basis for its claims regarding compliance with dose limits.

4 Other comments

The discussion in the Draft EIS about the naval reactor program is misleading as to its overall environmental impact. While many aspects of the program do not directly impact homeporting, the Draft EIS makes mention of some of them selectively, while omitting others. Specifically, impacts related to uranium mining, processing, enrichment, reprocessing of irradiated reactor fuel (which creates highly radioactive liquid wastes, some of which are still stored in liquid form Idaho, "low-level" radioactive solid and liquid wastes, and gaseous radioactivity emissions), and reactor decommissioning wastes. These impacts are cumulatively considerable. The EIS should either state that it is not considering impacts associated with naval reactors that occur at locations other than the proposed homeports, or it should provide a more complete picture of the most important aspects of such impacts.

Another problem with the EIS is the discussion of the effects of exposure to low-level ionizing radiation in Section 9.0 of Appendix E. The tone of this section is propagandistic and misleading rather than scientific and analytical. The Draft EIS makes the assertion that the risks to exposures such as those experienced by workers at occupational levels are "extremely small." Occupational limits are currently 5 rem per year. A worker receiving a lifetime cumulative dose of 50 rem would have a 1 in 50 chance of getting a fatal cancer due to this exposure, using the EPA risk factor for radiogenic cancer. This is not an "extremely small" risk by any reasonable standard. Moreover, the uncertainties in this risk estimate are substantial. A 95 percent confidence bound would yield a considerably higher value for risk.

Section 9 was evidently written not to present the facts about what is known and not known, but rather to counter the effects of what the Navy considers to be an "article of faith that no one knows what the effects [of exposure to low levels of radiation] are." The Draft EIS does not cite any example of such an assertion. In many years of work in this field, we have not found this to be a common assertion. If the Navy believes fear-mongering assertions of complete ignorance about the effects of radiation are common, it should cite a few examples and point the public to the literature where others may be found.

It is highly inappropriate and misleading for the Draft EIS to set out to convince the public that risks of radiation are very small. The EIS should seek to inform and to discuss the facts and uncertainties in a scientific manner.

Moreover, the decision about what is "extremely small" is made by the government with public input in a regulatory context. Contrary to the implication in the Draft EIS, a dose of a few millirem is considered significant in the regulatory context. For instance, drinking water may not be polluted to a level greater than that which would produce a dose of 4 millirem per year. This

methoxychlor	ethylparathion	methylparathion	pentachlorophenol	tetrachlorophenol	phenol	ronel	tetradifon	toxaphene	chlordene	oxadiazon	PCB arochlor 1248	PCB arochlor 1254	PCB arochlor 1260	total of PCB arochlors	Polychlorinated Terphenyl	tributyltin	Total Group A
0.0	0.0	0.0	2.7	3.0	0.4		0.0	0.0	0.0	0.5	0.0	33.3	0.0	34.9	0.0		
0.0	0.0	0.0	34.0	5.4	0.9		0.0	83.3		2.3	28.3	374.3	0.0	426.1	0.0	2639.3	
0.0	0.0	0.0					0.0	238.7		1.9	14.0	192.7	0.0	192.7	0.0		
0.0	0.0	0.0					0.0	238.7		1.9	14.0	192.7	0.0	192.7	0.0		
														500.0			
								5000.0						2000.0			300
								100.0						10.0		300.0	
50.0								50.0						500.0			5
								2.8						0.6			
0.0	0.0	0.0	2.0	2.3	0.3	0.0	0.0	0.0	0.0	0.4	0.0	25.0	0.0	0.5	0.0	225.0	3.8
0.0	0.0	0.0	1.4	1.5	0.2	0.0	0.0	0.0	0.0	0.3	0.0	16.7	0.0	0.3	0.0	150.0	2.5

resources available for this review did not permit a careful verification of the items listed there. The Final EIS should provide a complete list of such accidents and explain which ones are being used as the basis for the calculations in the EIS, which ones are being omitted, and why. If the information provided at http://www.nitehawk.com/alleycat/nukes.html is incorrect, the Final EIS should set the record straight and provide the appropriate data and explanations (or if official reports already exist, references to these reports).

In contrast to the potential range of conceivable accident scenarios, the Draft EIS selectively limits the analysis to a relatively minor release of radionuclides in case of a fire or spill. The largest consequences were calculated for the fire scenario. Even this limited analysis is inadequate.

For the NANSI home port, the EDE doses for the fire scenario are reported as follows:

Worker:	0.6 rem
NPA:	0.9 rem
MOI:	0.2 rem

More than 95% of the calculated dose is due to cobalt-60 which deposits on the ground and results in external exposures due to gamma radiation. The Draft EIS claims that the meteorological data represents 95 percent condition which is defined as that condition that is not exceeded more than 5 percent of the time.

As is the case in the assessment of normal operations, the Draft EIS does not contain the essential data that is necessary to verify such a claim. The Draft EIS does not indicate the geographic location of the NPA and MOI as well as the meteorological analysis that was apparently performed.

In the case of a 1 Ci release of Co-60, the crucial parameters in determining dose are:

- the dispersion coefficient,
- the deposition velocity, and
- the length of exposure after initial deposition.

If an unfavorable dispersion situation occurs during a 1 Ci release, the dispersion coefficient χ/Q can be expected to be of $\sim 1*10^{-4}$ s/m^3. Another unfavorable situation would be a high deposition velocity due to rainfall at the time of the accident resulting in a deposition velocity of 0.1 m/s. Under such circumstances, the cumulative dose would be ~2 rem during the first year and ~16 rem over 20 years following the accident. Thus, even for the scenario selected in the Draft EIS, doses could be one or two orders of magnitude larger than the one calculated in the Draft EIS for the MOI. The discrepancy in the dose estimates indicates the need to conduct a through uncertainty assessment be performed for accidental releases as well. This evaluation should focus on

- the range of potential accidents on board of the aircraft carriers as well as in support facilities,
- the uncertainties in the magnitude of the radionuclide source term in case of accidents,
- uncertainties in the geographic location of the releases,
- uncertainties in meteorological models,
- uncertainties in pathway and dosimetric models, and
- uncertainties in the dose-risk relationship.

ID	STANUM	STANAME	CDATE	YEAR	REGION
20379.0	2.0	Crescent City/STP Outfall	3/22/83	83	1
20501.0	2.0	Crescent City/STP Outfall	9/20/83	84	1
21002.0	2.0	Crescent City/STP Outfall	2/19/85	85	1
23001.0	2.0	Crescent City/STP Outfall	2/26/87	87	1
26007.0	2.0	Crescent City/STP Outfall	2/23/90	90	1
28002.0	2.0	Crescent City/STP Outfall	3/12/92	92	1
23002.0	3.0	Crescent City/Control	2/26/87	87	1
20061.0	5.0	Redwoods/North	7/24/78	79	1
20003.0	10.0	Trinidad Head	7/7/77	78	1
20004.0	10.0	Trinidad Head	11/9/77	78	1
20063.0	10.0	Trinidad Head	7/24/78	79	1
20064.0	10.0	Trinidad Head	#######	79	1
20224.0	10.0	Trinidad Head	1/18/81	81	1
30730.0	10.0	Trinidad Head	#######	95	1
20382.0	100.0	Mad River Slough	#######	83	1
28006.0	100.0	Mad River Slough	2/25/92	92	1
20124.0	101.0	Samoa Bridge/West	5/8/80	80	1
20225.0	101.0	Samoa Bridge/West	11/4/80	81	1
20303.0	101.0	Samoa Bridge/West	1/21/82	82	1
23006.0	101.0	Samoa Bridge/West	1/30/87	87	1
20063.5	102.0	Samoa Bridge/East	3/26/79	79	1
20125.0	102.0	Samoa Bridge/East	5/8/80	80	1
20226.0	102.0	Samoa Bridge/East	11/4/80	81	1
25006.0	102.0	Samoa Bridge/East	2/17/89	89	1
28010.0	102.0	Samoa Bridge/East	2/25/92	92	1
20507.0	102.5	Woodley Island	2/15/84	84	1
20126.0	103.0	Eureka Channel	5/8/80	80	1
20227.0	103.0	Eureka Channel	11/4/80	81	1
25007.0	103.0	Eureka Channel	2/17/89	89	1
28011.0	103.0	Eureka Channel	2/25/92	92	1
27013.0	103.3	E Street	2/27/91	91	1
28012.0	103.3	E Street	2/25/92	92	1
23013.0	104.0	Eureka STP/Outfall	1/30/87	87	1
28015.0	104.0	Eureka STP/Outfall	2/25/92	92	1
25009.0	104.5	Eureka STP/Control	2/17/89	89	1
20005.0	105.0	Humboldt Bay/Entrance	7/8/77	78	1
20006.0	105.0	Humboldt Bay/Entrance	#######	78	1
20065.0	105.0	Humboldt Bay/Entrance	7/25/78	79	1
20066.0	105.0	Humboldt Bay/Entrance	#######	79	1
20007.0	130.0	Shelter Cove	7/9/77	78	1
20306.2	150.0	Glass Beach	2/4/82	82	1
20306.4	151.0	Shell Beach	2/4/82	82	1
20306.6	152.0	Pudding Creek	2/4/82	82	1
20009.0	153.0	Pygmy Forest	7/11/77	78	1
20010.0	153.0	Pygmy Forest	#######	78	1
20069.0	153.0	Pygmy Forest	7/27/78	79	1
20229.0	153.0	Pygmy Forest	2/18/81	81	1
29009.0	155.1	Lake Pillsbury 1	3/31/93	93	1
29010.0	155.3	Lake Pillsbury 2	3/31/93	93	1

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November 10, 1998

Ms. Laura Hunter
Director, Clean Bay Program
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1717 Kettner Blvd., Suite 100
San Diego, California 92101

Subject: *Review and Comments on the Draft Environmental Impact Statement for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet. Prepared by: Department of the Navy, August 1998.*

Dear Ms. Hunter:

As you requested, I have reviewed the health and safety sections of the Draft Environmental Impact Statement (DEIS) for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet. My comments on the hazardous constituent and radiation exposure analyses are presented below. In many ways, the health and safety analyses in the DEIS are similar to that presented in the Navy Report: Final Analysis of Airborne Hazardous and Radioactive Constituents from Normal Operations and Accident Scenarios for the Mixed Waste Storage Facility Proposed for Naval Air Station North Island, which I commented on in August 1998.

I have BS and MS degrees in atmospheric science and more than 15 years of regulatory and private-sector experience in air quality issues. I have prepared approximately 180 health risk assessments of major air toxics sources in California and have performed consequence analyses for numerous accidental air release situations. I have evaluated all the available accidental release dispersion models and provided selection criteria and recommendations to the California Office of Environmental Health Hazard Assessment in a report titled: "Modeling Exposures of Hazardous Materials Released During Transportation Incidents."

The hazardous constituent analyses should be prepared using levels of concern developed by the State of California.

The State of California has developed acute noncancer acceptable exposure levels for use in hazardous materials consequence analyses. The California values are much lower than the levels of concern used in the DEIS accidental release analyses, and would result in higher acute

28018.0	159.0	Russian River West Fork	3/6/92	92	1
29011.0	159.0	Russian River West Fork	3/30/93	93	1
26026.0	165.0	Russian River Below Ukiah	3/20/90	90	1
28019.0	165.0	Russian River Below Ukiah	3/6/92	92	1
29013.0	165.0	Russian River Below Ukiah	3/30/93	93	1
20011.0	170.0	Gerstle Cove	7/9/77	78	1
20012.0	170.0	Gerstle Cove	#######	78	1
20071.0	170.0	Gerstle Cove	8/28/78	79	1
20072.0	170.0	Gerstle Cove	12/3/78	79	1
29014.0	175.0	Big Sulfur Creek	3/30/93	93	1
29015.0	176.0	Lake Sonoma	3/30/93	93	1
20127.0	201.0	Bodega Bay	6/3/80	80	1
20230.0	201.0	Bodega Bay	#######	81	1
20013.0	202.0	Bodega Head	7/13/77	78	1
20014.0	202.0	Bodega Head	11/7/77	78	1
20073.0	202.0	Bodega Head	8/29/78	79	1
20074.0	202.0	Bodega Head	12/4/78	79	1
20231.0	202.0	Bodega Head	7/28/80	81	1
23016.0	202.0	Bodega Head	8/19/86	87	1
30731.0	202.0	Bodega Head	9/19/94	95	1
29005.0	204.0	Estero De San Antonio	2/26/93	93	1
25018.0	205.0	Bodega Harbor/Spud Point Marina	1/29/89	89	1
27025.0	205.0	Bodega Harbor/Spud Point Marina	1/29/91	91	1
28024.0	205.0	Bodega Harbor/Spud Point Marina	1/10/92	92	1
29017.0	205.0	Bodega Harbor/Spud Point Marina	3/2/93	93	1
29006.0	280.0	Russian River/S Goat Rock	2/25/93	93	1
29018.0	290.0	Russian River/near Moscow	3/30/93	93	1
28033.0	294.2	Windsor Creek/Mark West Station Rd	4/7/92	92	1
29019.0	294.5	Green Valley Creek 1	3/30/93	93	1
29020.0	294.6	Green Valley Creek 2	3/30/93	93	1
25011.0	295.1	Santa Rosa Fl Con Ch/Willowside Rd	12/5/88	89	1
26031.0	295.1	Santa Rosa Fl Con Ch/Willowside Rd	3/20/90	90	1
27028.0	295.1	Santa Rosa Fl Con Ch/Willowside Rd	1/30/91	91	1
25012.0	295.2	Laguna de Santa Rosa/Stony Point	12/5/88	89	1
26032.0	295.2	Laguna de Santa Rosa/Stony Point	3/20/90	90	1
27029.0	295.2	Laguna de Santa Rosa/Stony Point	1/30/91	91	1
25013.0	295.3	Mark West Creek/Wholer Road	12/5/88	89	1
26033.0	295.3	Mark West Creek/Wholer Road	3/20/90	90	1
28029.0	295.3	Mark West Creek/Wholer Road	4/7/92	92	1
25014.0	295.4	Russian River/Wholer Bridge	12/5/88	89	1
26034.0	295.4	Russian River/Wholer Bridge	3/20/90	90	1
27031.0	295.4	Russian River/Wholer Bridge	1/30/91	91	1
28030.0	295.4	Russian River/Wholer Bridge	4/7/92	92	1
25015.0	295.5	Russian River/Hacienda Bridge	12/5/88	89	1
26035.0	295.5	Russian River/Hacienda Bridge	3/20/90	90	1
28031.0	295.5	Russian River/Hacienda Bridge	4/7/92	92	1
20074.5	203.0	Tomales Bay	3/26/79	79	2
20130.0	203.0	Tomales Bay	10/9/79	80	2
20232.0	203.0	Tomales Bay	#######	81	2
28023.0	203.0	Tomales Bay	#######	92	2

those with 1+ rem. The authors focus excessively on tests of statistical significance based on arbitrary decisions about 95% confidence limits. Community members representing potential concerns for workers at a nuclear shipyard might suggest that protection of workers warrants alternative standards for statistical tests about what are acceptable levels of error in evaluating hazards."

20015.0	207.0	Point Reyes	7/13/77	78	2
20016.0	207.0	Point Reyes	#######	78	2
20075.0	207.0	Point Reyes	8/24/78	79	2
20076.0	207.0	Point Reyes	12/4/78	79	2
20131.0	208.0	Bolinas	6/4/80	80	2
20233.0	208.0	Bolinas	#######	81	2
24018.0	298.4	Concord Naval/Seal Island	12/8/87	88	2
21021.0	300.2	Mare Island	1/31/85	85	2
22020.0	300.2	Mare Island	#######	86	2
20386.0	301.0	Davis Point	12/7/82	83	2
20234.0	302.0	Point Pinole	1/27/81	81	2
25027.0	302.0	Point Pinole	1/27/81	89	2
20311.0	302.0	Point Pinole	2/2/82	82	2
30756.0	302.0	Point Pinole	2/2/82	95	2
20387.0	302.0	Point Pinole	12/7/82	83	2
20514.0	302.0	Point Pinole	#######	84	2
21023.0	302.0	Point Pinole	2/7/85	85	2
22022.0	302.0	Point Pinole	1/14/86	86	2
23023.0	302.0	Point Pinole	1/14/87	87	2
24026.0	302.0	Point Pinole	1/14/88	88	2
25026.0	302.0	Point Pinole	#######	89	2
26036.0	302.0	Point Pinole	2/9/90	90	2
27033.0	302.0	Point Pinole	1/16/91	91	2
28041.0	302.0	Point Pinole	#######	92	2
29021.0	302.0	Point Pinole	1/20/93	93	2
24027.0	302.4	Castro Cove Bridge	1/18/88	88	2
20135.0	303.0	Richmond/San Rafael Bridge	6/4/80	80	2
20235.0	303.0	Richmond/San Rafael Bridge	1/26/81	81	2
20312.0	303.0	Richmond/San Rafael Bridge	2/2/82	82	2
20389.0	303.0	Richmond/San Rafael Bridge	12/7/82	83	2
22023.0	303.1	Santa Fe Channel/Mouth	1/14/86	86	2
27034.2	303.1	Santa Fe Channel/Mouth	3/22/91	91	2
21024.0	303.2	Lauritzen Canal/Mouth	1/31/85	85	2
22024.0	303.2	Lauritzen Canal/Mouth	1/14/86	86	2
23025.0	303.2	Lauritzen Canal/Mouth	1/14/87	87	2
24029.0	303.2	Lauritzen Canal/Mouth	1/14/88	88	2
22024.5	303.3	Lauritzen Canal/End	3/31/86	86	2
23026.0	303.3	Lauritzen Canal/End	1/14/87	87	2
24030.0	303.3	Lauritzen Canal/End	1/14/88	88	2
27034.4	303.3	Lauritzen Canal/End	3/22/91	91	2
21025.0	303.4	Santa Fe Channel/End	1/31/85	85	2
22025.0	303.4	Santa Fe Channel/End	1/14/86	86	2
23027.0	303.4	Santa Fe Channel/End	1/14/87	87	2
27034.5	303.4	Santa Fe Channel/End	3/22/91	91	2
22026.0	303.6	Richmond Inner Harbor Basin	1/14/86	86	2
23028.0	303.6	Richmond Inner Harbor Basin	1/14/87	87	2
24031.0	303.6	Richmond Inner Harbor Basin	1/14/88	88	2
25030.0	303.6	Richmond Inner Harbor Basin	#######	89	2
27034.1	304.4	Serl Intake	3/22/91	91	2
20136.0	305.0	San Francisco Bay/Angel Island	6/4/80	80	2

The remaining literature cited in the review concerns studies of the effects of external exposure to ionizing radiation. The review of studies of atomic bomb survivors in Hiroshima and Nagasaki includes no references to the extended criticism of this study. In interpreting findings from a study of survivors of a nuclear bomb attack, it should be acknowledged that selective survival was likely. The most vulnerable did not survive the physical effects of the attack, the destruction of almost all medical services, and the lack of infrastructure following the war. The Lifespan study began in 1950, five years after the attack. Dr. Alice Stewart has written extensively about the consequences of selective survival, and communities should question the usefulness of such a study for evaluating the consequences of low level releases of radionuclides into their environment.(Stewart, A.M.; Kneale, G.W. A-bomb radiation and evidence of late effects other than cancer. Health Phys 58: 729-35; 1990. Stewart, A.M.; Kneale, G.W. A-bomb survivors: further evidence of late effects of early deaths. Health Phys 64: 467-72; 1993.)

The discussion of low level external exposure to ionizing radiation stresses the need for large numbers of persons in a study and makes the incorrect statement that "cancer induction is random in nature." What is not discussed are issues of bias, and the relatively high quality of exposure information (compared to the studies of atomic bomb survivors), and followup data for many occupational cohorts.

Studies of workers who have received long-term low level exposure to ionizing radiation may have more relevance to community exposures than studies of atomic bomb survivors. The DEIS provides no citations to occupational cohort studies that have reported evidence of positive associations between cancer mortality and low level radiation exposure. It should be stressed again that these are studies of cancer deaths among healthy adults (primarily males). Community concerns about radiation exposure go well beyond these restrictions, to concerns about non-fatal health effects, and potentially vulnerable sub-populations including pregnant women, the elderly, those with pre-existing diseases, and children.

Recent examples of evidence of increased cancer mortality rates among workers with low level radiation exposures include: studies of workers at Oak Ridge National Laboratory (Richardson, D.; Wing, S. Final Report: Time-related factors in radiation-cancer dose response. Cincinnati: National Institute for Occupational Safety and Health; RO3 OH03343; 1997. Wing, S.; Shy, C.M.; Wood, J.L.; Wolf, S.; Cragle, D.L.; Frome, E.L. Mortality among workers at Oak Ridge National Laboratory. Evidence of radiation effects in follow-up through 1984. JAMA 265: 1397-402; 1991); studies of workers at the Santa Susanna Laboratory (Morgenstern, H.; Froines, J.; Ritz, B.; Young, B. Final Report: Epidemiologic study to determine possible adverse effects to Rocketdyne/Atomics International workers from exposure to ionizing radiation. Berkeley, Ca.: Public Health Institute; Contract No. 324A-8701-S0163; 1997) ; and Stewart and Kneales study of several groups of US nuclear workers (Kneale, G.W.; Stewart, A.M. Factors affecting recognition of cancer risks of nuclear workers. Occup Environ Med 52: 515-23; 1995).

My interpretation of the study results from analyses of the Portsmouth Naval shipyard would be much more cautious than the author's conclusion that 'radiation was in all likelihood not the cause.' Interpretation of the findings should recognize the limitations in the available data, the limited period of follow-up, and the potential to obscure true relationships. After controlling for asbestos and welding exposures, these studies report excess lung cancer and leukemia among

20236.0	305.0	San Francisco Bay/Angel Island	1/26/81	81	2
20391.0	305.0	San Francisco Bay/Angel Island	12/7/82	83	2
20237.0	306.0	San Francisco Bay/Fort Baker	1/27/81	81	2
20393.0	306.0	San Francisco Bay/Fort Baker	12/7/82	83	2
27035.0	306.0	San Francisco Bay/Fort Baker	1/30/91	91	2
28042.0	306.0	San Francisco Bay/Fort Baker	#######	92	2
29022.0	306.0	San Francisco Bay/Fort Baker	1/20/93	93	2
25035.0	306.5	Alcatraz Island	1/5/89	89	2
20076.5	307.0	San Francisco Bay/Treasure Is	3/30/79	79	2
20137.0	307.0	San Francisco Bay/Treasure Is	6/4/80	80	2
20238.0	307.0	San Francisco Bay/Treasure Is	1/26/81	81	2
20315.0	307.0	San Francisco Bay/Treasure Is	2/2/82	82	2
20396.0	307.0	San Francisco Bay/Treasure Is	12/7/82	83	2
20515.0	307.0	San Francisco Bay/Treasure Is	#######	84	2
21027.0	307.0	San Francisco Bay/Treasure Is	2/7/85	85	2
23030.0	307.0	San Francisco Bay/Treasure Is	1/21/87	87	2
24033.0	307.0	San Francisco Bay/Treasure Is	1/14/88	88	2
25033.0	307.0	San Francisco Bay/Treasure Is	#######	89	2
26037.0	307.0	San Francisco Bay/Treasure Is	2/9/90	90	2
27036.0	307.0	San Francisco Bay/Treasure Is	1/16/91	91	2
28043.0	307.0	San Francisco Bay/Treasure Is	#######	92	2
29023.0	307.0	San Francisco Bay/Treasure Is	2/1/93	93	2
22028.0	307.2	Alameda Yacht Harbor	1/14/86	86	2
23031.0	307.2	Alameda Yacht Harbor	1/14/87	87	2
24034.0	307.2	Alameda Yacht Harbor	1/14/88	88	2
25034.0	307.2	Alameda Yacht Harbor	#######	89	2
22029.0	307.3	Oakland Inner Harbor/West	1/14/86	86	2
23032.0	307.3	Oakland Inner Harbor/West	1/21/87	87	2
21030.0	307.4	Oakland Inner Hbr/Embarcadero Cove	1/31/85	85	2
22030.0	307.4	Oakland Inner Hbr/Embarcadero Cove	1/14/86	86	2
23033.0	307.4	Oakland Inner Hbr/Embarcadero Cove	1/14/87	87	2
24035.0	307.4	Oakland Inner Hbr/Embarcadero Cove	1/14/88	88	2
25037.0	307.4	Oakland Inner Hbr/Embarcadero Cove	#######	89	2
27037.0	307.4	Oakland Inner Hbr/Embarcadero Cove	1/30/91	91	2
28044.0	307.4	Oakland Inner Hbr/Embarcadero Cove	#######	92	2
29024.0	307.4	Oakland Inner Hbr/Embarcadero Cove	1/20/93	93	2
28044.5	307.5	Lake Merritt	5/22/92	92	2
29025.0	307.5	Lake Merritt	3/16/93	93	2
21031.0	307.6	Oakland Back Harbor	1/31/85	85	2
22031.0	307.6	Oakland Back Harbor	1/14/86	86	2
23034.0	307.6	Oakland Back Harbor	1/14/87	87	2
24036.0	307.6	Oakland Back Harbor	1/14/88	88	2
25039.0	307.8	San Francisco Outfall	#######	89	2
23035.0	307.9	San Francisco/Islais Channel	1/21/87	87	2
24037.0	307.9	San Francisco/Islais Channel	1/15/88	88	2
20239.0	308.0	San Francisco Bay/Hunter's Point	1/26/81	81	2
20316.0	308.0	San Francisco Bay/Hunter's Point	1/18/82	82	2
20399.0	308.0	San Francisco Bay/Hunter's Point	12/7/82	83	2
24193.0	308.0	San Francisco Bay/Hunter's Point	1/15/88	95	2
27038.0	308.0	San Francisco Bay/Hunter's Point	1/16/91	91	2

Comments of Dr. David Richardson, Department of Epidemiology, School of Public Health, University of North Carolina, Chapel Hill, NC

"The information in the document (Appendix E of the EIS) has potentially little relevance to community concerns about construction of a nuclear port and maintenance facility.

The literature review is almost entirely about health effects of external exposure to penetrating ionizing radiation. Community concern about this facility, I assume, would primarily relate to concern about routine and accidental releases of radionuclides. All nuclear processes involve some routine exposures; and, the relatively short human experience with nuclear technologies includes numerous major and minor accidents that have led to environmental releases of radioactive material. The significance of radionuclide exposures occurs when they are ingested, inhaled, or enter the skin through cuts and abrasions. In a bay area, people may be additionally concerned about bio accumulation of these radionuclides, and in areas where drinking water would be contaminated people might be concerned that fluoridation and chlorination may increase biological uptake of these radionuclides.

The relevant literature on the human health effects of exposure to radionuclides is limited, particularly when one is interested on the effects of exposure to children, the elderly, pregnant women, the effects of bio accumulation and changes in radionuclide absorbtion with dietary changes, and when one is interested in effects other than cancer incidence.

Only two studies in the DEIS pertain to issues of potential community concern about environmental exposures to radionuclides. The first is the 1990 NCI study of cancer in populations near 62 nuclear facilities. There was no exposure assessment in this study (for example, people living upwind versus downwind of facilities were all considered exposed); there was no attempt to establish residential histories (duration of residence of the area was not established). The study had little ability to detect an effect, and consequently found no effect.

The second study related to community concern about environmental releases is Hatch et al.'s study of cancer in the population living within ten miles of Three Mile Island, following the accident. It is significant that the DEIS cites the Hatch study from 1990 which reported 'No associations...' but there is no citation to a more recent analysis of these data reported in the National Institute of Environmental Health Sciences journal, which concluded "Results support the hypothesis that radiation doses are related to increased cancer incidence around TMI." (Wing, S.; Richardson, D.;Armstrong, D.; Crawford-Brown, D. A Reevaluation of Cancer Incidence Near the Three Mile Island Nuclear Plant: The Collision of Evidence and Assumptions. Environ Health Per 105: 52 - 57; 1997.)

The report leaves out reference to other studies which may be particularly relevant to community concerns, and suggest potential adverse health effects from environmental exposure to radionuclides. These include the study of leukemia in the population living in areas believed to be most highly exposed from the Pilgrim nuclear plant (Morris, M.S.; Knorr, R.S.Adult leukemia and proximity-based surrogates for exposure to Pilgrim plant's nuclear emissions. Arch Env Hlth 51: 266-74; 1996.)

28045.0	308.0	San Francisco Bay/Hunter's Point	#######	92	2
29026.0	308.0	San Francisco Bay/Hunter's Point	2/1/93	93	2
24038.0	308.2	Hunter's Point/Shipyard	1/15/88	88	2
25040.0	308.2	Hunter's Point/Shipyard	#######	89	2
20240.0	309.0	San Mateo Bridge/8B	2/9/81	81	2
20317.0	309.0	San Mateo Bridge/8B	1/18/82	82	2
20403.0	309.0	San Mateo Bridge/8B	12/9/82	83	2
20516.0	309.0	San Mateo Bridge/8B	#######	84	2
30758.0	309.0	San Mateo Bridge/8B	2/12/85	95	2
27039.0	309.0	San Mateo Bridge/8B	1/16/91	91	2
28046.0	309.0	San Mateo Bridge/8B	#######	92	2
29027.0	309.0	San Mateo Bridge/8B	2/1/93	93	2
20318.0	310.0	San Mateo Bridge/8A	1/18/82	82	2
20241.0	313.0	San Francisco Bay/near Redwood Cr	1/26/81	81	2
20321.0	313.0	San Francisco Bay/near Redwood Cr	1/18/82	82	2
20407.0	313.0	San Francisco Bay/near Redwood Cr	12/9/82	83	2
20517.0	313.0	San Francisco Bay/near Redwood Cr	#######	84	2
30759.0	313.0	San Francisco Bay/near Redwood Cr	2/12/85	95	2
24194.0	313.0	San Francisco Bay/near Redwood Cr	1/15/88	95	2
27040.0	313.0	San Francisco Bay/near Redwood Cr	1/16/91	91	2
28047.0	313.0	San Francisco Bay/Near Redwood Cr	#######	92	2
29028.0	313.0	San Francisco Bay/near Redwood Cr	2/1/93	93	2
20140.0	316.0	Redwood Creek/Tradewinds	6/4/80	80	2
23037.0	318.4	Redwood Creek/Bair Island	1/22/87	87	2
20242.0	321.0	Dumbarton Bridge/Channel Marker 14	2/9/81	81	2
20325.0	321.0	Dumbarton Bridge/Channel Marker 14	1/18/82	82	2
25042.0	321.0	Dumbarton Bridge/Channel Marker 14	1/18/82	89	2
30757.0	321.0	Dumbarton Bridge/Channel Marker 14	1/18/82	95	2
20518.0	321.0	Dumbarton Bridge/Channel Marker 14	#######	84	2
30760.0	321.0	Dumbarton Bridge/Channel Marker 14	2/12/85	95	2
24195.0	321.0	Dumbarton Bridge/Channel Marker 14	1/15/88	95	2
25041.0	321.0	Dumbarton Bridge/Channel Marker 14	#######	89	2
27041.0	321.0	Dumbarton Bridge/Channel Marker 14	1/16/91	91	2
28048.0	321.0	Dumbarton Bridge/Channel Marker 14	#######	92	2
25043.0	323.3	Palo Alto Outfall	#######	89	2
26040.0	323.3	Palo Alto Outfall	2/9/90	90	2
27042.0	326.0	Palo Alto/Channel Marker 8	1/16/91	91	2
28049.0	326.0	Palo Alto/Channel Marker 8	#######	92	2
29030.0	326.0	Palo Alto/Channel Marker 8	2/1/93	93	2
20142.0	330.0	Duxbury Reef	#######	80	2
20242.3	330.0	Duxbury Reef	2/16/81	81	2
20017.0	333.0	Farallon Islands	7/15/77	78	2
20018.0	333.0	Farallon Islands	#######	78	2
20077.0	333.0	Farallon Islands	8/20/78	79	2
20078.0	333.0	Farallon Islands	#######	79	2
20019.0	336.0	J. Fitzgerald	7/16/77	78	2
20020.0	336.0	J. Fitzgerald	#######	78	2
20079.0	336.0	J. Fitzgerald	8/30/78	79	2
20080.0	336.0	J. Fitzgerald	#######	79	2
20242.6	336.0	J. Fitzgerald	2/16/81	81	2

no mention, however, of what conditions might cause them to conduct this work during the sensitive time periods.

Summary

The assessment of sediment quality in the areas of this proposed action and thus the impact of the dredging activities on marine life is a very weak area of this Environmental Impact Assessment. The 1996 report Chemistry, Toxicity and Benthic Community Conditions of Sediments of the San Diego Bay Region clear indicates that San Diego Bay is an area impacted by chemical contamination. The resuspension of sediments resulting from dredging activities not only increases suspended solids in an area, but also releases contaminants to the water column. A more empirical evaluation of the impacts of this specific activity is needed to adequately assess its impact. Additional analysis is also needed to determine whether the homeporting of the CVNs in this area will increase the frequency of dredging needed in the future to keep the navigational channel and the berth areas open.

The relocation of the disturbed eelgrass area to Bravo Pier is also questionable as a mitigation action. It is unclear whether this area will support an eelgrass bed long-term. Monitoring of the success of the eelgrass area established as part of the BRAC CVN action should be conducted to provide support for the selection of this site.

Overall, it is obvious that the selection of NASNI as the preferred site for the homeporting of the three CVNs was based on the objectives and requirements of the Navy and not on the degree to which the project would impact the environment. The assessment of all available data and the collection of project specific data are essential for evaluating environmental impacts. San Diego Bay is a valuable national resource that is already showing signs of environmental damage. To further destroy sensitive habitats and add substantially to existing cumulative impacts from ongoing activities would further endanger the delicate balance. The EIS needs to adequately assess how this project might upset this balance during intrusive activities and during regular operations and not just focus on whether NASNI meets strategic and operational needs.

27046.0	399.7	San Lorenzo River/Felton	2/16/91	91	3
20022.0	400.0	Ano Nuevo Island	#######	78	3
20081.0	400.0	Ano Nuevo Island	8/15/78	79	3
20082.0	400.0	Ano Nuevo Island	1/4/79	79	3
20424.0	400.0	Ano Nuevo Island	#######	83	3
26048.5	400.8	Aptos Creek	1/31/90	90	3
27047.0	400.8	Aptos Creek	#######	91	3
27185.0	400.8	Aptos Creek	#######	91	3
27186.0	400.8	Aptos Creek	#######	91	3
20149.0	401.0	Santa Cruz Harbor	5/29/80	80	3
20243.0	401.0	Santa Cruz Harbor	#######	81	3
20518.5	401.2	Watsonville Slough/Mouth	#######	84	3
22038.0	401.2	Watsonville Slough/Mouth	1/27/86	86	3
20519.0	401.3	Moss Landing/Yacht Harbor	#######	84	3
23041.0	401.3	Moss Landing/Yacht Harbor	1/29/87	87	3
25049.0	401.3	Moss Landing/Yacht Harbor	1/4/89	89	3
20519.5	401.4	Elkhorn Slough	#######	84	3
24045.0	401.5	Watsonville Slough/Bridge	2/2/88	88	3
29033.0	401.5	Watsonville Slough/Bridge	3/10/93	93	3
23043.0	401.6	Harkins Slough Bridge	#######	87	3
22044.0	401.8	San Andreas Road	12/6/85	86	3
23044.0	401.8	San Andreas Road	#######	87	3
24047.0	401.8	San Andreas Road	2/3/88	88	3
29034.0	401.9	Pajaro River Estuary	3/10/93	93	3
20330.3	402.0	Elkhorn Slough/Duck Club	2/24/82	82	3
29035.0	402.1	Azevedo Pond	2/25/93	93	3
20520.5	402.2	Parson's Slough	#######	84	3
21035.0	402.2	Parson's Slough	1/15/85	85	3
22045.0	402.2	Parson's Slough	1/16/86	86	3
23045.0	402.2	Parson's Slough	2/2/87	87	3
24048.0	402.2	Parson's Slough	3/2/88	88	3
25050.0	402.2	Parson's Slough	1/4/89	89	3
29037.0	402.2	Parson's Slough	2/25/93	93	3
20082.5	402.3	Elkhorn Slough/Pacific Mariculture	3/26/79	79	3
20243.5	402.3	Elkhorn Slough/Pacific Mariculture	2/13/81	81	3
20512.6	402.3	Elkhorn Slough/Pacific Mariculture	2/7/84	84	3
21036.0	402.3	Elkhorn Slough/Pacific Mariculture	3/20/85	85	3
25051.0	402.3	Elkhorn Slough/Pacific Mariculture	1/4/89	89	3
29037.5	402.5	Elkhorn Slough/Tidal Pond	2/25/93	93	3
20512.8	402.8	Elkhorn Slough/Skippers	2/2/84	84	3
20512.7	402.8	Elkhorn Slough/Skippers	2/2/84	84	3
20150.0	403.0	Elkhorn Slough/Highway 1 Bridge	5/29/80	80	3
20244.0	403.0	Elkhorn Slough/Highway 1 Bridge	#######	81	3
21037.0	403.0	Elkhorn Slough/Highway 1 Bridge	1/15/85	85	3
22046.0	403.0	Elkhorn Slough/Highway 1 Bridge	1/27/86	86	3
23046.0	403.0	Elkhorn Slough/Highway 1 Bridge	1/29/87	87	3
25052.0	403.0	Elkhorn Slough/Highway 1 Bridge	1/4/89	89	3
25054.0	403.2	Moro Cojo	1/4/89	89	3
24051.0	403.6	Moro Cojo Slough	2/2/88	88	3
20330.6	404.0	Sandholdt Bridge	2/24/82	82	3

There is mention of plans for pre and post-construction surveys to assess eelgrass impacts in the construction area as suggested by USFWS and Marine Fisheries Service. It is important that the Navy conduct such follow-up. It appears that this would be done to address coverage/shading issues by the new wharf, but there is little discussion regarding what these surveys would entail. Again, it is the Navy's responsibility not only to predict "no significant impacts," but to monitor and ensure that these predictions are correct.

The impacts from increased turbidity of the proposed dredging include reduced light penetration and dissolved oxygen and a possible reduction in survival, growth and biomass. The document notes, however, that these impacts would be localized and temporary. The problem is that the document provides no description of the size of the localized area or over what period of time the dredging would take place, which of course will directly influence the extent of the impacts. A discussion under Socioeconomic Considerations indicates that the dredging and disposal process would occur over 1 year. Certainly, resulting influences on the bay ecosystem may differ if the dredging takes 2 months vs 18 months. Additionally, the impact of this proposed action needs to be considered in conjunction with other dredging activities in the vicinity. The EIS should evaluate whether a series of individual impacts to the ecosystem could result in greater than expected or long-term adverse effects due to the repeated insults incurred.

Results in the Marine Biological Reconnaissance Field Survey Report provided in Section 3.5 of Volume 3 suggest that activities in San Diego Bay may already be having an effect on marine life. The 1997 field survey results from Pier Bravo, the navigation channel and the area near Pier J/K were similar to earlier studies, but "fewer resources were present in 1997." The authors suggest that "some of the reductions in eelgrass and less motile species are suggestive of some disturbance to the area over the last several years."

As indicated in the discussion of suspended solids on page 3.5-11, there is little discussion of actual sampling to verify the projected suspended solids concentrations, resurgence of affected organisms, etc. It is important for the Navy to verify predictions of "less than significant impacts." The BRAC CVN effort would appear to have provided the Navy with an opportunity to obtain such empirical data, yet there is little discussion of such information if it exists.

While it is expected that the suspended solid concentrations would be below levels that would significantly impact the various organisms discussed in this section, the EIS should still consider the benefits of timing the dredging activities for periods where impacts would be least likely. For a species that is either more sensitive than most or one that reproduces during a specific period of the year, it would seem possible to avoid dredging activities during that time, as suggested later for the California least tern. A few examples of reducing the impact on the Brown Pelican and the California least tern are discussed on 3.5-18-19. How were these impacts determined to be significant? Monitoring will be conducted during the dredging portion and efforts will be made not to conduct the dredging during breeding season "to the maximum extent possible." There is

20521.0	404.0	Sandholdt Bridge	#######	84	3
21041.0	404.0	Sandholdt Bridge	1/16/85	85	3
21038.0	404.0	Sandholdt Bridge	2/20/85	85	3
21040.0	404.0	Sandholdt Bridge	2/20/85	85	3
21039.0	404.0	Sandholdt Bridge	2/20/85	85	3
22052.0	404.0	Sandholdt Bridge	9/18/85	86	3
22049.0	404.0	Sandholdt Bridge	#######	86	3
22051.0	404.0	Sandholdt Bridge	1/16/86	86	3
22053.0	404.0	Sandholdt Bridge	1/16/86	86	3
22051.5	404.0	Sandholdt Bridge	3/28/86	86	3
23048.0	404.0	Sandholdt Bridge	#######	87	3
23051.0	404.0	Sandholdt Bridge	2/16/87	87	3
24056.0	404.0	Sandholdt Bridge	11/5/87	88	3
24053.0	404.0	Sandholdt Bridge	2/2/88	88	3
24054.0	404.0	Sandholdt Bridge	4/7/88	88	3
25058.0	404.0	Sandholdt Bridge	12/8/88	89	3
25055.0	404.0	Sandholdt Bridge	1/4/89	89	3
26049.0	404.0	Sandholdt Bridge	2/19/90	90	3
27048.0	404.0	Sandholdt Bridge	2/4/91	91	3
28062.0	404.0	Sandholdt Bridge	1/28/92	92	3
29041.0	404.0	Sandholdt Bridge	2/1/93	93	3
30105.0	404.0	Sandholdt Bridge	3/7/94	94	3
30754.0	404.0	Sandholdt Bridge	2/22/95	95	3
20512.2	405.0	Espinosa Slough	#######	84	3
29043.0	405.2	Old Salinas River 2	3/10/93	93	3
28053.0	405.3	Old Salinas River 1	3/16/92	92	3
29042.0	405.3	Old Salinas River 1	3/10/93	93	3
20512.3	405.4	Old Salinas River Channel 1	#######	84	3
29044.0	405.6	Salinas River Lag 1	3/10/93	93	3
28060.0	405.7	Salinas River Lag 2	3/16/92	92	3
20512.4	405.8	Salinas River Lagoon	#######	84	3
20512.5	406.0	Westley Station	9/9/83	84	3
29045.0	406.5	Tembladero Slough	3/10/93	93	3
21042.0	407.1	Moss Landing/Ag Drain/Old River	#######	85	3
21043.0	407.2	Moss Landing/Ag Drain/Espinosa	#######	85	3
23056.0	407.2	Moss Landing/Ag Drain/Espinosa	#######	87	3
23053.0	407.3	Moss Landing/Ag Drain/Davis Rd	#######	87	3
21045.0	407.4	Blanco Pump/West	#######	85	3
22065.0	407.4	Blanco Pump/West	12/5/85	86	3
29046.0	407.4	Blanco Pump/West	3/10/93	93	3
21046.0	407.5	Blanco Pump/East	#######	85	3
22062.0	407.5	Blanco Pump/East	12/6/85	86	3
23054.0	407.5	Blanco Pump/East	#######	87	3
21047.0	407.6	Moss Landing/Ag Drain/Blanco dstrm	#######	85	3
22068.0	407.8	Blanco/Hitchcock	12/5/85	86	3
23055.0	407.8	Blanco/Hitchcock	#######	87	3
22071.0	407.9	Salinas Sewage Treatment Plant	#######	86	3
22074.0	408.1	Canal Airport	#######	86	3
22077.0	408.2	Produce Wash/Downstream/West	#######	86	3
22080.0	408.3	Produce Wash/Downstream/East	#######	86	3

In the discussion of toxicity and bioaccumulation, the text states that Site 1 sediments from the approach channel did not exhibit any major toxicity to test bioassay organisms and that, except for lead in clams, no major bioaccumulation was observed. The text does not indicate where these samples were taken from and what tests were conducted. It should be noted that sediment tests associated with NASNI Bay Outfalls 3 through 8 did reveal toxicity and some bioaccumulation impacts, contrary to the conclusions reported in Section 3.2 for the Site IR study (see attached Comments and Recommendations regarding the Draft Remedial Investigation RCRA Facility Investigation Report. Site 1 Sediments). Two of these sites (Outfalls 3 and 8) are close to the areas being addressed under this project and these results must be considered.

Outfalls 9-15 are discussed within the Installation Restoration Program section of this report. It mentions that a time-critical removal action was conducted to construct a confined disposal facility for impacted sediments. The size of the area addressed and the contaminants that prompted the action are not mentioned. Furthermore, it is noted that the disposal facility is located in the area, but there is no discussion regarding its specific location, its design or the potential impacts this proposed project may have on this site containing contaminated sediments.

On a separate note, the EIS indicates that based on available data, sediments from the mitigation area would be suitable for ocean dumping. Clearly some data indicate that there may be areas in the mitigation site with contaminant levels that may not be suitable for ocean dumping. Given the limited core sampling that has been done, it is difficult to predict contaminant concentrations in the sediments that will eventually be excavated and it will be critical to conduct the proper analyses on the dredged material before a disposal approach is selected.

Marine Biology (Section 3.5)

Eelgrass is described as a valuable resource in the southern California bays and estuaries. While it is noted that eelgrass beds exist in the north and north-central bay at water depths of 0 to 24 feet, it is also noted that "over 90% of the 441 hectares of eelgrass [in San Diego Bay] occurs in the south and south-central bay. The tendency for eelgrass habitat to be in the southern portion of the bay is a critical issue since the proposed mitigation site is at Pier Bravo, which is in the north/north-central part of the bay. The limited amount of eelgrass in the northern half may indicate that this proposed mitigation site is not hospitable for the proposed eelgrass bed. The basis for selecting Pier Bravo, the usefulness of this location with regard to the type of organisms that use such beds and the monitoring and maintenance planned to ensure the site survives are critical areas that need to be clearly presented in this document. Several transects through the proposed mitigation site (at 0-6 feet) did not reveal any eelgrass, although 2,529 square feet were noted on the north side of the pier at depths between 11 and 18 feet MLLW. Is this an area of natural growth, or is this a part of the mitigation site constructed as part of the BRAC CVN project? Survival of the eelgrass in the proposed location is a primary concern.

22085.0	408.5	Associated Chemicals	12/5/85	86	3
22088.0	408.8	Salinas/Reclamation Canal 2	#######	86	3
22089.0	408.9	Salinas/Reclamation Canal 3	#######	86	3
23057.0	408.9	Salinas/Reclamation Canal 3	#######	87	3
24059.0	408.9	Salinas/Reclamation Canal 3	2/3/88	88	3
22090.0	409.0	Salinas/Reclamation Canal 4	#######	86	3
23058.0	409.0	Salinas/Reclamation Canal 4	#######	87	3
24060.0	409.0	Salinas/Reclamation Canal 4	2/3/88	88	3
20023.0	414.0	Pacific Grove	7/17/77	78	3
20024.0	414.0	Pacific Grove	#######	78	3
20083.0	414.0	Pacific Grove	8/19/78	79	3
20084.0	414.0	Pacific Grove	#######	79	3
20156.0	414.0	Pacific Grove	#######	80	3
20247.0	414.0	Pacific Grove	1/14/81	81	3
23060.0	414.0	Pacific Grove	1/28/87	87	3
30755.0	414.0	Pacific Grove	4/19/95	95	3
24062.0	421.7	Monterey Harbor/Marina	1/22/88	88	3
20025.0	423.0	Carmel Bay	7/18/77	78	3
20085.0	423.0	Carmel Bay	8/19/78	79	3
20086.0	423.0	Carmel Bay	#######	79	3
20526.1	423.2	Carmel STP/Control	#######	84	3
20526.2	423.4	Carmel STP/10m North	#######	84	3
20526.3	423.6	Carmel STP/10m South	#######	84	3
20027.0	424.0	Soberanes Point	7/20/77	78	3
20028.0	424.0	Soberanes Point	#######	78	3
20087.0	424.0	Soberanes Point	7/21/78	79	3
20088.0	424.0	Soberanes Point	#######	79	3
20029.0	425.0	J.P. Burns	7/22/77	78	3
20030.0	425.0	J.P. Burns	#######	78	3
20089.0	425.0	J.P. Burns	8/2/78	79	3
20090.0	425.0	J.P. Burns	#######	79	3
20157.5	425.0	J.P. Burns	11/4/79	80	3
20251.5	425.0	J.P. Burns	2/20/81	81	3
23070.0	425.4	Lake San Antonio/Buoy	#######	87	3
23071.0	425.6	Lake San Antonio	10/8/86	87	3
28061.5	425.6	Lake San Antonio	5/25/92	92	3
20031.0	426.0	Salmon Creek	7/22/77	78	3
20032.0	426.0	Salmon Creek	#######	78	3
20091.0	426.0	Salmon Creek	7/8/78	79	3
20092.0	426.0	Salmon Creek	#######	79	3
20158.0	427.0	Morro Bay/Upper	5/30/80	80	3
20252.0	427.0	Morro Bay/Upper	#######	81	3
20092.5	428.5	Morro Bay/Virg's	3/30/79	79	3
20159.0	428.5	Morro Bay/Virg's	5/30/80	80	3
20253.0	428.5	Morro Bay/Virg's	#######	81	3
20439.0	430.0	Montana De Oro	#######	83	3
20535.0	430.0	Montana De Oro	2/16/84	84	3
23079.0	430.0	Montana De Oro	9/30/86	87	3
27062.0	430.0	Montana De Oro	2/25/91	91	3
28082.0	430.0	Montana De Oro	2/25/92	92	3

burden on the stakeholder. The executive summary states that " the EIS must provide a full and fair analysis of the significant environmental impacts," and "sufficient evidence to support the environmental analysis."

In the discussion regarding dredging on page 3.3-6 and under Facility Improvements on page 3.3-8, the document explains that elutriate and bioassay tests conducted as part of the BRAC CVN homeporting (note reference DON 1995b appears to be incorrect) indicated that sediment resuspension would not result in significant contaminant releases or mortality of aquatic organisms. It is not clear that these tests would be applicable to the sediments dredged as part of this project. These tests need to be conducted prior to dredging, and all site specific contaminants must be analyzed.

One area under marine water quality that is not addressed at all is the potential for thermal pollution resulting from the cooling water from the nuclear reactors on these aircraft carriers. Have any calculations and/or measurements been made to determine the impact of the heat input into the Bay from the three the CVNs when they are all in port?

Sediment Quality (Section 3.4)

In Section 3.4, the EIS indicates that "no numerical sediment quality criteria presently exist." This statement is grossly misleading to the general public. In reality, there are multiple sources for sediment quality criteria available for evaluating current sediment contamination associated with this project. While this may be referring to the absence of enforceable standards similar to the maximum contaminant levels for drinking water, it should be noted that regardless of whether or not comparison criteria have made it through the legal arena, those responsible for conducting this EIS have the responsibility to use the best available scientific information to determine if and how this project will impact sediment quality.

The bulk chemistry section on page 3.4-2 discusses sediment samples collected from the northwest portion of the approach channel and indicates that some contaminants were found above their respective ER-L but below their ER-M values. It also mentioned that total petroleum hydrocarbons, volatile organics and organotins were less than or approaching their respective method detection limits. First, these data were collected for previous studies (i.e. the BRAC CVN Homeporting Project) and it is not clear that they adequately characterize the site in question. Second, discussing bulk chemistry results without providing all the pertinent information simply does not allow one to adequately evaluate the data that are available. The information provided in the report does not delineate where the sampling was conducted, the detection limits of the analyses conducted, what specific compounds were analyzed for, the concentration of each contaminant that was present or how these results relate to various comparison criteria (particularly in cases where ER-L/ER-M values do not exist for a given contaminant). The results from the Woodward-Clyde, 1998 sampling and analysis also should have been provided in this document in Volume 3.

20033.0	430.1	Montana De Oro/South	7/23/77	78	3
20093.0	430.1	Montana De Oro/South	8/1/78	79	3
20094.0	430.1	Montana De Oro/South	#######	79	3
28084.5	430.2	Montana De Oro 1	12/4/91	92	3
20449.0	433.0	Diablo Cove/North	#######	83	3
20452.0	434.0	Diablo Cove/South	#######	83	3
20546.0	434.0	Diablo Cove/South	10/5/83	84	3
20547.0	434.0	Diablo Cove/South	2/16/84	84	3
27069.0	434.0	Diablo Cove/South	2/26/91	91	3
28089.0	434.0	Diablo Cove/South	2/26/92	92	3
20455.0	435.0	Intake Cove	#######	83	3
20549.0	435.0	Intake Cove	10/5/83	84	3
20550.0	435.0	Intake Cove	2/16/84	84	3
23091.0	435.0	Intake Cove	10/1/86	87	3
23092.0	435.0	Intake Cove	4/3/87	87	3
25089.0	435.0	Intake Cove	9/26/88	89	3
25090.0	435.0	Intake Cove	3/1/89	89	3
27071.0	435.0	Intake Cove	2/26/91	91	3
28091.0	435.0	Intake Cove	2/26/92	92	3
20458.0	436.0	Pecho Rock	1/7/83	83	3
20552.0	436.0	Pecho Rock	10/5/83	84	3
20553.0	436.0	Pecho Rock	2/16/84	84	3
21101.0	436.0	Pecho Rock	8/17/84	85	3
21100.0	436.0	Pecho Rock	3/13/85	85	3
23093.0	436.0	Pecho Rock	10/1/86	87	3
23094.0	436.0	Pecho Rock	4/3/87	87	3
24092.0	436.0	Pecho Rock	10/5/87	88	3
25091.0	436.0	Pecho Rock	9/26/88	89	3
25092.0	436.0	Pecho Rock	3/1/89	89	3
26084.0	436.0	Pecho Rock	9/28/89	90	3
26083.0	436.0	Pecho Rock	3/6/90	90	3
20555.0	437.0	Point San Luis	10/5/83	84	3
20556.0	437.0	Point San Luis	2/16/84	84	3
21103.0	437.0	Point San Luis	8/16/84	85	3
21102.0	437.0	Point San Luis	3/12/85	85	3
23095.0	437.0	Point San Luis	9/30/86	87	3
23096.0	437.0	Point San Luis	4/3/87	87	3
26085.0	437.0	Point San Luis	3/5/90	90	3
27072.0	437.0	Point San Luis	9/3/90	91	3
27073.0	437.0	Point San Luis	2/25/91	91	3
28093.0	437.0	Point San Luis	2/26/92	92	3
20464.0	438.0	Avila	#######	83	3
21105.0	438.0	Avila	8/16/84	85	3
21104.0	438.0	Avila	3/12/85	85	3
22141.0	438.0	Avila	3/3/86	86	3
23097.0	438.0	Avila	9/30/86	87	3
20466.0	440.0	Lion Rock/Transplant	5/3/83	83	3
20467.0	441.0	Lion/Diablo/Transplant	5/3/83	83	3
20563.0	441.0	Lion/Diablo/Transplant	12/6/83	84	3
20565.0	441.0	Lion/Diablo/Transplant	4/23/84	84	3

In describing the water quality conditions, the document indicates that no site specific water quality data exist for either the homeporting site or the mitigation site. This is a serious concern considering the numerous sediment removal actions that have been performed in the past, the documented sediment contamination near NASNI outfalls and the industrial activities that still take place at this active base. It is noted that some metals, such as copper and silver, have been detected at elevated levels in surface water collected north of the site, and that the National Oceanic and Atmospheric Administration's Mussel Watch Program has detected bioaccumulation of DDT, chlordane, PCBs and PAHs. These data indicate that the impact of dredging contaminated sediments must be more carefully evaluated. Environmental data from sediment sampling collected near the adjacent outfalls by the IR program should be considered in this evaluation.

While assessing dredging impacts, the document explains that because the sediments are primarily sandy in nature, the sediments will generally contain "low concentrations of chemical contaminants and low potential for contaminant solubilization or adverse biological effects". However, it must be noted that in the NASNI evaluation of sediment contamination discovered in the characterization of Bay outfalls 3 - 8 (Draft Remedial Investigation RCRA Facility Investigation Report for Site 1- Shoreline Sediments), the distribution of contaminants did not consistently coincide with grain size. Given the many factors influencing contaminant distribution, some of which are discussed within this section, it is difficult to predict the level of sediment contamination and potential for contaminant release in the area proposed for dredging without collecting empirical data.

In the first paragraph of page 3.3-8, metals and PAH contamination known to be present in the sediments around Pier B is discussed. A 1994 report entitled Dredged Material Sediment Testing Results for Project M1-90 Maintenance Dredging at Pier Bravo, Naval Air Station, North Island is referenced. However, later sampling conducted as part of the Remedial Investigation RCRA Facility Investigation Report for Site 1 - Shoreline Sediments is not discussed. As part of this RI sampling, surface sampling and cores samples were collected at various distances. The PAH, pesticide and metal contamination detected during this investigation should be compiled with other available data, such as the referenced dredge material report, to accurately assess where excavation should and should not be conducted during the mitigation project. In addition, it is difficult to evaluate the quality of the authors' pledge not to excavate contaminated areas if the proposed areas of excavation based on the known contamination are not included within this report. Also, it is important to establish a definition of the term "contaminated."

It is critical that the EIS provide ample information regarding the evaluation of proposed intrusive activities, as well as adequate information on the work plans and best management practices for future activities associated with the CVNs. The specifics regarding the planned excavation and construction projects will have direct impacts during the intrusive work and certainly require more complete discussion and analysis than what is provided in the EIS. The many documents referencedin place of specific analysis is insufficient to evaluate the project within this report and places an undue

20468.0	443.0	Diablo Cove/South/Transplant	5/3/83	83	3
20568.0	443.0	Diablo Cove/South/Transplant	12/6/83	84	3
20570.0	443.0	Diablo Cove/South/Transplant	4/23/84	84	3
21122.0	443.0	Diablo Cove/South/Transplant	8/17/84	85	3
23111.0	443.0	Diablo Cove/South/Transplant	10/1/86	87	3
26100.0	443.0	Diablo Cove/South/Transplant	3/6/90	90	3
27089.0	443.0	Diablo Cove/South/Transplant	2/26/91	91	3
28109.0	443.0	Diablo Cove/South/Transplant	2/26/92	92	3
27091.0	443.1	Diablo Cove/S/Transplant/Shallow	2/26/91	91	3
20572.0	444.0	Intake Cove/Transplant	2/28/84	84	3
20573.0	444.0	Intake Cove/Transplant	4/23/84	84	3
21127.0	444.0	Intake Cove/Transplant	8/17/84	85	3
21130.0	444.0	Intake Cove/Transplant	3/13/85	85	3
22160.0	444.0	Intake Cove/Transplant	3/4/86	86	3
23117.0	444.0	Intake Cove/Transplant	4/3/87	87	3
26104.0	444.0	Intake Cove/Transplant	9/28/89	90	3
26105.0	444.0	Intake Cove/Transplant	3/6/90	90	3
27092.0	444.0	Intake Cove/Transplant	9/4/90	91	3
27094.0	444.0	Intake Cove/Transplant	2/26/91	91	3
20469.0	445.0	San Luis Harbor/Transplant	5/3/83	83	3
20573.5	445.0	San Luis Harbor/Transplant	12/6/83	84	3
20575.0	445.0	San Luis Harbor/Transplant	4/23/84	84	3
21135.0	445.0	San Luis Harbor/Transplant	3/12/85	85	3
22165.0	445.0	San Luis Harbor/Transplant	9/19/85	86	3
22163.0	445.0	San Luis Harbor/Transplant	3/3/86	86	3
23119.0	445.0	San Luis Harbor/Transplant	10/1/86	87	3
23121.0	445.0	San Luis Harbor/Transplant	4/2/87	87	3
24118.0	445.0	San Luis Harbor/Transplant	9/25/87	88	3
24119.0	445.0	San Luis Harbor/Transplant	3/15/88	88	3
25119.0	445.0	San Luis Harbor/Transplant	3/1/89	89	3
26108.0	445.0	San Luis Harbor/Transplant	9/28/89	90	3
26106.0	445.0	San Luis Harbor/Transplant	3/6/90	90	3
27097.0	445.0	San Luis Harbor/Transplant	2/25/91	91	3
28115.0	445.0	San Luis Harbor/Transplant	9/9/91	92	3
28117.0	445.0	San Luis Harbor/Transplant	2/25/92	92	3
27098.0	446.0	San Luis Obispo Creek 1	2/26/91	91	3
20035.0	449.0	Point Arguello	7/23/77	78	3
20036.0	449.0	Point Arguello	#######	78	3
20095.0	449.0	Point Arguello	8/3/78	79	3
20096.0	449.0	Point Arguello	#######	79	3
20037.0	450.0	Point Conception	7/25/77	78	3
20038.0	450.0	Point Conception	12/1/77	78	3
20098.0	450.0	Point Conception	#######	79	3
27101.0	450.0	Point Conception	1/4/91	91	3
25123.0	460.0	Goleta Slough 1	#######	89	3
25125.0	475.0	Carpinteria Marsh	#######	89	3
20039.0	500.0	San Miguel Island/West	8/1/77	78	3
20040.0	500.0	San Miguel Island/West	12/3/77	78	3
20099.0	500.0	San Miguel Island/West	8/15/78	79	3
20100.0	500.0	San Miguel Island/West	#######	79	3

probability does not include a fire resulting from an earthquake. How does the potential for earthquakes at NASNI increase the probability of a fire at this location?

Terrestrial Hydrology and Water Quality (Section 3.2)

This section discusses underground storage tanks, fuel pipelines and other RCRA/CERCLA sites that are being or have been addressed under the NASNI Installation Restoration Program. In doing so, this section points out that during the construction of the BRAC CVN Homeporting MILCONS, petroleum contamination was discovered, in addition to the previous contamination that was removed in 1997. Given NASNI's long history and known contamination, it is quite possible that additional contamination will be uncovered during the demolition and replacement of the pier and during dredging operations. It is important that this EIS specify what monitoring will be conducted to identify any uncovered contamination in a timely manner and identify what response actions will be possible under different potential scenarios. It is not sufficient to assume that "some" monitoring process to be implemented will be adequate, nor is it appropriate to assume that stakeholders will have a role in the process, which this EIS is suppose to provide. These issues must be delineated within this report.

In the Operations discussion on page 3.2-6, this document acknowledges that two additional CVNs would result in an increase in the quantity of chemicals handled, stored and disposed of at the home port location. As stated, "current regulations should minimize potential releases and there are various statutes and regulations pertaining to storm water retention and treatment and soil and groundwater contamination." The conclusion that these impacts are partially offset by the decommissioning of the two CVs by 2005 is questionable. First, it is our understanding that one CV has not been stationed at NASNI in four years. Second, there is no guarantee that the other CV will be replaced. Third, this conclusion assumes that the hazardous materials associated with the CVNs are equivalent in quantity, quality, handling procedures and toxicity. The EIS should evaluate what types and quantities of materials will be managed at this port as a result of this project. Additionally, it should consider the information and lessons learned from the previous CVN homeporting project to assess what specific impacts may be expected with the two additional CVNs. Calculations should be made to determine whether requirements established under existing permits can be met when the home port facilities are under full operation.

Marine Water Quality (Section 3.3)

The presentation of site specific information in this EIS is lacking, making it difficult to accurately assess impacts. Discussions regarding tidal circulations uses descriptors such as north, central and south Bay, and mention that central Bay is between Glorietta Bay and Silver Gate Power Plant. However, no maps identifying these delineations or showing the circulation theories are provided with the text. It is not clear how a concerned individual can evaluate the logic and information presented if important materials are not provided.

20041.0	501.0	San Miguel Island/East	7/23/77	78	3
20042.0	501.0	San Miguel Island/East	12/3/77	78	3
20101.0	501.0	San Miguel Island/East	8/15/78	79	3
20102.0	501.0	San Miguel Island/East	#######	79	3
20043.0	502.0	Santa Cruz Island	8/2/77	78	3
20044.0	502.0	Santa Cruz Island	12/4/77	78	3
20103.0	502.0	Santa Cruz Island	8/15/78	79	3
20104.0	502.0	Santa Cruz Island	#######	79	3
24126.0	485.0	Ventura Marina	1/25/88	88	4
20046.0	503.0	Anacapa Island	12/4/77	78	4
20105.0	503.0	Anacapa Island	8/14/78	79	4
20106.0	503.0	Anacapa Island	#######	79	4
20254.0	503.0	Anacapa Island	#######	81	4
20047.0	504.0	Santa Barbara Island	7/27/77	78	4
20048.0	504.0	Santa Barbara Island	12/6/77	78	4
20107.0	504.0	Santa Barbara Island	8/23/78	79	4
20108.0	504.0	Santa Barbara Island	#######	79	4
20255.0	505.0	Channel Island Harbor	#######	81	4
20336.6	505.0	Channel Island Harbor	2/8/82	82	4
23123.0	505.2	Channel Island Harbor/North	#######	87	4
20165.0	506.0	Port Hueneme	5/13/80	80	4
20256.0	506.0	Port Hueneme	#######	81	4
20336.3	506.0	Port Hueneme	2/8/82	82	4
22167.0	506.1	Port Hueneme/Wharf B	#######	86	4
23124.0	506.1	Port Hueneme/Wharf B	#######	87	4
24127.0	506.1	Port Hueneme/Wharf B	1/25/88	88	4
25127.0	506.1	Port Hueneme/Wharf B	#######	89	4
22168.0	506.2	Port Hueneme/Wharf 1	#######	86	4
23125.0	506.2	Port Hueneme/Wharf 1	#######	87	4
24128.0	506.2	Port Hueneme/Wharf 1	1/25/88	88	4
25128.0	506.2	Port Hueneme/Wharf 1	#######	89	4
24129.0	506.3	Port Hueneme/Entrance	1/25/88	88	4
20049.0	507.0	Point Mugu	7/24/77	78	4
20050.0	507.0	Point Mugu	12/2/77	78	4
20109.0	507.0	Point Mugu	8/4/78	79	4
20110.0	507.0	Point Mugu	#######	79	4
23126.0	507.1	Mugu Lagoon/L Street	#######	87	4
27113.0	507.1	Mugu Lagoon/L Street	#######	91	4
22170.0	507.2	Mugu Lagoon/Laguna Road	#######	86	4
23127.0	507.2	Mugu Lagoon/Laguna Road	#######	87	4
27115.0	507.2	Mugu Lagoon/Laguna Road	#######	91	4
22171.0	507.3	Mugu Lagoon/Calleguas Creek	#######	86	4
23128.0	507.3	Mugu Lagoon/Calleguas Creek	#######	87	4
25130.0	507.3	Mugu Lagoon/Calleguas Creek	#######	89	4
27116.0	507.3	Mugu Lagoon/Calleguas Creek	#######	91	4
30110.0	507.3	Mugu Lagoon/Calleguas Creek	2/8/94	94	4
23130.0	507.8	Revolon Slough	#######	87	4
24131.0	507.8	Revolon Slough	3/14/88	88	4
25132.0	507.8	Revolon Slough	1/29/89	89	4
25133.0	553.0	Marina Del Rey/Entrance	#######	89	4

offshore. It should be noted that approximately 15,000 cubic yards from this dredging activity may be used to fill in the 1.2 - 2.5 acre area behind the rebuilt Pier J/K area.

Comments

NEPA requires that an EIS provide a full and fair analysis of the significant environmental impacts of an action and sufficient evidence to support the environmental analysis. It is not clear that this document adequately satisfies these requirements. In assessing the impacts of placing two more nuclear-powered carriers (CVNs) at North Island Naval Air Station (NASNI), one must consider the risks to both human health and the environment from the site construction and development, as well as the ongoing impacts from the operation of the support facilities and the CVNs themselves over their lifetime residence in the San Diego Bay. There are a number of potential risks and impacts have not been adequately addressed.

Faulting and Seismicity (Section 3.1)

The proposed homeporting site at NASNI sits on the Rose Canyon fault zone. According to the EIS, an earthquake in this zone could result in "serious damage to dams, dikes and embankments." Given that a dike/embankment area will be constructed during this project, what engineering controls will be utilized to ensure that damage does not occur in such an event, since this area could contain nuclear and other hazardous material at the time of an earthquake? There is no discussion regarding the impacts of these geohazards on the constructed facilities. For instance, if a particular facility has a requirement for electrical power to properly store or control hazardous material, the project analysis should consider the impacts of an earthquake on the supply of power to these facilities and the potential hazards that would result from a power failure.

Additionally, it is stated that tsunamis and seiches are "very rare, unlikely to occur during the lifetime of the project" and are considered an "unavoidable, acceptable risk," indicating that impacts from such events would be considered insignificant. This logic is not necessarily sound, given that the impact of an event usually influences the significance of the risk. In other words, even a very rare event may be considered an unacceptable risk if the ramifications of such an event are massive. In turn, it would seem logical that the impacts from tsunamis and seiches should be evaluated based on the nature of the operations and facilities at the site. This document lacks discussion regarding what types of operations will take place.

Analysis of Normal Operations and Accident Conditions for Radiological Support Facilities (Appendix F)

An analysis of the health risk to the general population that would result from a fire accident at a radiological support facility is provided in this section. In Table F-8, the risk presented includes the probability of a fire occurring. Since the probability of a fire (1 in 200) used in this table is the same for all four locations, this implies that this

22172.0	554.0	Marina Del Rey/Harbor Patrol Docks	#######	86	4
24132.0	554.0	Marina Del Rey/Harbor Patrol Docks	1/25/88	88	4
25134.0	554.0	Marina Del Rey/Harbor Patrol Docks	#######	89	4
22173.0	555.0	Marina Del Rey/Basin G	#######	86	4
23132.0	555.0	Marina Del Rey/Basin G	#######	87	4
24133.0	555.0	Marina Del Rey/Basin G	1/25/88	88	4
25135.0	555.0	Marina Del Rey/Basin G	#######	89	4
24134.0	555.2	Marina Del Rey/Basin D	1/25/88	88	4
22174.0	556.0	Marina Del Rey/Basin E	#######	86	4
23133.0	556.0	Marina Del Rey/Basin E	#######	87	4
24135.0	556.0	Marina Del Rey/Basin E	1/25/88	88	4
25136.0	556.0	Marina Del Rey/Basin E	#######	89	4
22175.0	557.0	Marina Del Rey/Ballona Creek	#######	86	4
23134.0	557.0	Marina Del Rey/Ballona Creek	#######	87	4
24136.0	557.0	Marina Del Rey/Ballona Creek	1/25/88	88	4
24137.0	559.0	King Harbor	#######	88	4
20337.1	601.0	LA Harbor/National Steel	1/12/82	82	4
20576.0	601.0	LA Harbor/National Steel	#######	84	4
21137.0	601.0	LA Harbor/National Steel	1/2/85	85	4
22182.0	601.0	LA Harbor/National Steel	#######	86	4
23135.0	601.0	LA Harbor/National Steel	#######	87	4
24138.0	601.0	LA Harbor/National Steel	#######	88	4
25138.0	601.0	LA Harbor/National Steel	#######	89	4
26130.0	601.0	LA Harbor/National Steel	#######	90	4
27123.0	601.0	LA Harbor/National Steel	#######	91	4
28127.0	601.0	La Harbor/National Steel	#######	92	4
29052.0	601.0	LA Harbor/National Steel	1/6/93	93	4
30112.0	601.0	LA Harbor/National Steel	2/8/94	94	4
30734.0	601.0	LA Harbor/National Steel	1/31/95	95	4
20338.1	602.0	LA Harbor/West Basin	1/12/82	82	4
21138.0	602.0	LA Harbor/West Basin	1/2/85	85	4
22183.0	602.0	LA Harbor/West Basin	#######	86	4
23136.0	602.0	LA Harbor/West Basin	#######	87	4
24139.0	602.0	LA Harbor/West Basin	#######	88	4
30113.0	602.0	LA Harbor/West Basin	2/8/94	94	4
21140.0	602.5	LA Harbor/Todd Shipyards	1/2/85	85	4
22184.0	602.5	LA Harbor/Todd Shipyards	#######	86	4
24140.0	602.5	LA Harbor/Todd Shipyards	#######	88	4
25140.0	602.5	LA Harbor/Todd Shipyards	#######	89	4
26131.0	602.5	LA Harbor/Todd Shipyards	#######	90	4
27124.0	602.5	LA Harbor/Todd Shipyards	#######	91	4
24141.0	602.7	LA Harbor/Pacific Ave/Storm Drain	#######	88	4
23137.0	602.8	LA Harbor/Berth 49	#######	87	4
20339.1	603.0	LA Harbor/Berth 151	1/12/82	82	4
20578.0	603.0	LA Harbor/Berth 151	#######	84	4
21141.0	603.0	LA Harbor/Berth 151	1/2/85	85	4
22185.0	603.0	LA Harbor/Berth 151	#######	86	4
24143.0	603.0	LA Harbor/Berth 151	#######	88	4
25144.0	603.0	LA Harbor/Berth 151	#######	89	4
23139.0	603.6	LA Harbor/Slip 240	#######	87	4

Comments
on the
Draft Environmental Impact Statement for Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet, August, 1998.

The above referenced Environmental Impact Statement (EIS) was prepared in accordance with the National Environmental Policy Act (NEPA) to evaluate potential environmental impacts from the construction and operation of facilities needed to support the homeporting of three NIMITZ-class nuclear powered aircraft carriers (CVNs) at four locations within the U.S. Pacific Fleet: 1) Coronado, CA, 2) Bremerton, WA, 3) Everett, WA and 4) Pearl Harbor, Hawaii. These comments address the assessment for only one of these locations, the North Island Naval Air Station (NASNI) in Coronado, CA which is the preferred location (Alternative 2) for the homeporting of three CVNs, one which is already located at this site and two which will be added to the fleet by the year 2005. In addition to evaluating the placement of two more CVNs at NASNI, this EIS also evaluates the preservation of the existing CVN transient berth at NASNI.

It cannot be overstated that the selection of NASNI as the preferred location for the home porting facilities was not based on this environmental impact assessment, rather it is the site that best satisfies the four main CVN Home Port Objectives and Requirements. Two important advantages of homeporting these ships at NASNI are the presence of an airfield and the close proximity of NASNI to CVN training areas. The quality of life for the sailors was also an important consideration, as was the availability of needed facilities and maintenance/support factors.

This EIS, therefore, was conducted primarily to determine what impacts would occur from this construction/maintenance activity and what mitigations would be required to off-set these impacts. Briefly, the homeporting of two additional CVNs at NASNI and the associated dredging would result in the replacement of existing land uses, with the construction of a new pier to replace Pier J/K, the relocation of a flag/ferry landing, and electrical upgrades. An intertidal and shallow subtital habitat that supports eelgrass would be permanently replaced by a fill area. A proposal to replace the lost habitat is considered as part of this proposal. To provide clearance for the CVNs, the water depth adjacent to the pier will need to be increased from the current level of 42 feet mean lower low water (MLLW) to approximately 50-52 feet MLLW. It is expected that 490,000 cubic yards will be dredged during this effort. As for the pier, the current area is 63,000 square feet, which is short of the needed area of 117,000 square feet. In turn, the J/K Pier would be torn down and replaced. A dike area approximately 1.2-2.5 acre in size would be constructed in support of the new pier which would give rise to the loss of shallow water habitat. Mitigation of this loss would include the creation of new bay bottom and the establishment of eelgrass beds at another location. This site would be at Pier B, near outfall 3, where approximately 50,000 cubic yards of sediment would be replaced. The excavation depths would extend from 1 foot MLLW near shore to 5 feet MLLW

August 21, 2001

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9771 Clairemont Mesa Boulevard, Suite A
San Diego, CA 92124

RE: COMMENTS ON WORK PLAN FOR THE NASSCO AND SOUTHWEST MARINE

DETAILED SEDIMENT INVESTIGATION

Dear Chairman Minan and Boardmembers:

As has been requested by the Environmental Health Coalition and San Diego BayKeeper, I have performed a review of the Work Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation (and related documents) and have the following comments and recommendations:

Testing for Bioaccumulation. I am unaware of a rationale for eliminating bioaccumulation testing at most of the sampling stations. While all 30 stations include the triad of toxicity tests, only 9 stations will test for bioaccumulation. Only one bioaccumulation testing station at the NASSCO site is a high chemical concentration site. This would appear to present major problems for determining the extent of areas (within this 46 acre site) where bioaccumulation is occurring, and major problems for producing statistically-valid data sets. It is unclear why the Plan includes this testing at so few shipyard sites, while including this testing at all five reference stations.

RECOMMENDATION: Test for bioaccumulation at each of the 30 stations, and any known hotspots of PCBs, Mercury and other bioaccumulating chemicals that are not covered by these stations.

Sampling for Dilution Series, Pore Water, and Fish Tissue. I am unaware of how the Plan's proposed one sampling site per shipyard for the Dilution Series test will provide data for all of the chemicals of concern. Yet the Plan's methodology requires that the background cleanup values will be compared to toxicity benchmark values obtained from the Dilution Series test. The Pore Water Testing will occur at four stations per shipyard site or a total of eight. It is unclear to me whether 8 total samples will provide an accurate representation of pore water concentrations over the 63 total acres. Yet this testing is being used to balance the uncertainties and limitations of any one assessment method, such as the AET. If the bioaccumulation tests reveal that bioaccumulation is occurring above threshold values, then fishes will be collected at one station at each shipyard site. It is unclear to me how these collections will be representative of fishes that inhabit and traverse the 63 acres of water area at these sites.

RECOMMENDATION: Require an adequate number of sampling stations for each of these important tests. In addition, require that pore water be collected from depths greater than 0-2 centimeters (less than one inch).

Core Sampling. It is unclear to me why core sampling is not being conducted in Phase 1 based on the historical data used to determine sampling locations for the other tests. It appears that the locations for core sampling will be selected based on Phase 1 sampling of the top 2 centimeters of sediment. I am unaware of how one could confidently predict deep contamination based on contamination that appears in less than one inch of surface sediment.

RECOMMENDATION: Core sampling, essential to determine the depth of contamination and therefore depth of necessary cleanup, should be performed at each of the 30 sampling stations. Just as these 30 stations will be used to determined the horizontal extent of contamination, core samples at these same stations should be used to determine the vertical extent of contamination.

AET Method of Determining Cleanup Level. AET levels do not meet the Regional Board's basic mandate of protecting the Bay's most sensitive beneficial uses. If a calculation of AET values is to be derived as a tool for helping to select an appropriate clean-up level (which I do not believe is necessary), the Work Plan must at a minimum follow accepted practices for calculating AET values. To my knowledge the State of Washington is the authority on this assessment method, and I believe the State recommends that this approach be used for very large scale assessments where there are sufficient resources to sample hundreds of sites. Apparently the results of this method can be driven by individual, high values; therefore large data sets are necessary to achieve accurate (protective) results. It appears from a cursory examination of Board documents, that problems inherent in using too few sites have been illustrated at another site in San Diego Bay, where AET methodology produced 'acceptable' levels of mercury that are 10 times higher than those generally found safe. While the Board and its staff is to be commended for increasing the number of sites to 30 in this assessment, 50 is a more generally accepted minimum - and even at 50, I understand that extensive data refinement is required. The Plan indicates "An AET for benthic community effects may be calculated on a reduced subset of triad stations if physical disturbance is evident at some stations." This means that AET values for benthic community effects - in my view one of the Board's most important and reliable indicators of the health/toxicity of the shipyard sites - may be calculated on even less than 30 sites. Moreover, it is unlikely that all of the data will prove useable, causing even greater concern about the AET values that will be generated.

RECOMMENDATION: Use an alternative approach, one that will be scientifically defensible with 30 sampling stations. An alternative approach may also solve the apparently pervasive question of whether AET values are sufficiently protective.

Benthic Fauna. These tests are among the most important and reliable indicators of toxicity/health of the site. If physical disturbance is found at a sampling site, the Plan appears to allow the benthic fauna data from that site to be removed from the analyses. If the data indicates a toxic effect, the effect is assumed to be from physical disturbance.

RECOMMENDATION: Require the consideration of all benthic fauna data. Require replicate samples for this specific test at each sampling station.

On-site Fauna. An important focus of the study should be the tangible effects on the fauna that inhabit the site. Direct examination of clams, mussels, fishes and other fauna for tumors and other signs of contamination (including tissue analysis) is a particularly relevant indicator of toxicity/health of the site. Such analysis is not currently required by the Work Plan.

RECOMMENDATION: Require the collection and analysis of the fauna that actually inhabit the site, in addition to the testing performed in the laboratory using laboratory animals. Fauna should include both mobile and immobile species.

Most Sensitive Beneficial Uses. The Plan does not appear to require consideration of some of the most sensitive beneficial uses: The Bay is a nursery ground for many species; larval populations are well documented. Early life stage toxicity in fishes - which are very sensitive to waterborne exposure to metals, for example - has significant implications for the health of a fish population. Ethnic populations who fish in the Bay are more sensitive both because they consume a greater proportion of fish in their diets, and because a significant percentage of ethnic populations consume the entire fish.

RECOMMENDATION: Require consideration of toxic impacts on larval forms of marine life, and the consideration of health impacts on ethnic fishers.

Reference Sites. The Work Plan allows the pooling of reference site data. Moreover it allows the use of "other available and relevant" data sets to "more precisely characterize background conditions." A reference site should be selected based on at least the following characteristics: substantially free of pollutants, as similar as possible to the grain size of the contaminated sediments, and reflective of conditions at the site (Rubenstein, EPA Office of Research and Development).

RECCOMMENDATION: Do not allow the pooling of reference site data. Do not allow the least- clean reference station or values to be used to compare with shipyard site data. Determine whether the Plan's use of other data sets (Navy, Bight, p. 6-1) will increase or decrease a background cleanup level based solely on this study's data. Require the Contractor to provide all raw data from the reference stations.

Protection of wildlife and human health. While not found in the Board's Guidelines, the Work Plan allows the Contractor to derive its own tissue residue standards - which will be "back-calculated" using an equation that would appear to allow a more contaminated site if there are few wildlife presently feeding at the site. These standards will override national standards, if the national standards are more restrictive.

A second apparent problem is that the wildlife - or receptors of concern - to be considered are limited to a few species, making it less likely to find much feeding going on, which in turn will make the standard less restrictive. For example, of the many terns and shorebirds around the Bay, only the California least tern, an endangered species, will be considered a receptor of concern.

A third problem is that some of the species the Plan proposes to test would never occur in the Bay and some would not occur in this part of the Bay. Other species important to include are missing, and these may include more sensitive species.

RECOMMENDATION. Require the use of national standards exclusively. These should provide a balanced and defensible level of protection. Require the consideration of species that are most often, and regularly, found at these sites.

Other missing aspects of protecting beneficial uses. The impacts of metabolic products, molecular level stress, and cumulative and synergistic effects do not appear to be addressed in the Plan. Multiple, cumulative stressors on the biota, for example, are generally required to be addressed in order to provide adequate protection. For example, if the organisms on site are subject to stresses other than contaminant load in the sediments, a more stringent cleanup level may be necessary to protect them.

RECOMMENDATION: Consider the need to require assessment of these aspects of protecting beneficial uses.

Oversight. There is no independent expert oversight of this study.

RECOMMENDATION. The Board should hire independent expertise to sample a percentage of the sites, and have these samples independently analyzed.. Oversight promotes confidence in the data and reassures all parties.

Please feel free to contact me should you wish to discuss these findings.

Sincerely,

Elaine M. Carlin
Research Scientist, Joint US/Norwegian Research Team
MPA Harvard University
MMA University of Washington

Cc:

John Robertus

David Barker

San Diego Bay Council

A coalition of environmental organizations dedicated to protection and restoration of San Diego coastal waters

August 21, 2001

Chairman John Minan and Members of the Regional Board
Regional Water Quality Control Board
9771 Claremont Mesa Blvd., Suite A
San Diego, CA 92124

RE: COMMENTS ON WORK PLAN FOR THE NASSCO AND SOUTHWEST MARINE DETAILED SEDIMENT INVESTIGATION

Dear Chairman Minan and Regional Board Members:

We are writing to alert the Board that immediate action is required to prevent a dangerous precedent that will undermine the Board's ability to effectively clean up San Diego Bay over the next decade. We are profoundly concerned that the *Work Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation* is not scientifically defensible, will not deliver the preponderance of evidence the Board is seeking, and will not serve to protect beneficial uses of San Diego Bay. We wish to underscore that these explicit goals of the sediment remediation efforts cannot be met through the execution of the work plan as designed. Our concerns and recommendations are not merely a desire for more information (more data is always a good thing), but rather a demand for enough information to make the assessment valid at all. There are significant gaps in the data collection that threaten to render the entire assessment invalid.

As you know, this Work Plan was just presented at the public workshop on August 3. We secured the services of a consultant who has reviewed it and consulted with experts in the field. Her assessment of the work plan is attached. The Contractor for the shipyards apparently began implementing the work plan immediately after its presentation at the workshop, and has already completed well over half of the field sampling! Time is of the essence as this Phase 1 sampling forms the basis of the risk assessment and if not defensible, will render the entire investigation invalid. We requested an emergency meeting with your staff on Friday, August 10, as the full extent of the problems became evident to us. We met on Tuesday, August 12 with your staff and conveyed the urgent need for them to address these concerns.

You will read in the attached comments of several serious technical failings in the current design. We are also very concerned about the opportunities for obfuscation in the interpretation of the results that we believe should not be part of any approved work plan.

It is important not to lose sight of the inherent bias of the contractors for the shipyards. They have the option currently of starting cleanup tomorrow to background levels. We are convinced that they are choosing to undertake this extensive risk assessment strategy in efforts to weaken the cleanup standards and save money thereby. Their clear preference for AET, even in advance of the testing being completed, is revealing. The Apparent Effects Threshold or AET - appears to be greatly desired by the Shipyards, as is evident in their attorney's comments to the Board:

> *Should the RWQCB conclude that dredging to meet a background standard is required, the shipyards face a significant risk not only that operations may be curtailed or shutdown, but*

> *the continued operational viability of the shipyards could be placed in jeopardy as well. These are real and significant issues that must be addressed if the Regional Board is seriously considering any option other than the AET-based approach to the NASSCO and Southwest Marine facility sediment cleanups.*
>
> -- David L. Mulliken, Comment Number 7.08, RWQCB Response to Comments, February 16, 2001, p. 42.

It would appear that the Shipyards are confident that if the AET method is used, their cleanup requirement will be such that operations will not need to be curtailed i.e. less cleanup will occur. Their bias is clear.

Given the overarching goal of a clean and healthy San Diego Bay, the proposed Work Plan for cleaning up two large, and significantly contaminated, sites in the Bay, is highly problematic. Ideally these sites would be completely cleaned to out-of-bay, near pristine reference levels. Less ideal but second best, these sites would be cleaned up to match the cleanest (yet contaminated) in-bay sites, unless these levels were determined to not be protective enough. Third best, we would have an esteemed, objective group of scientists assess contamination at the sites and recommend the level of cleanup to protect environmental and other services of the Bay. Fourth best, levels would be set using a robust cost/benefit analysis and state-of-the-art measurements of benefits, including intangible benefits as measured by contingent valuation. Somewhere along a downward spiral from fourth best, is the unenviable situation we have before us: the companies performing the environmental impact assessment, deriving certain of the standards to meet, naming the chemicals of import, and with powerful financial incentives to show the least possible environmental and human health impact.

The proposed study design appears to be heavily biased to produce a desired outcome different from the goals stated by the Board. As such, it is ripe with opportunity for influencing results and diluting robust findings and action - from the number and placement of sampling stations, sample collection, and laboratory analyses which will determine the extent of the problem and its effects, to the sampling and selection of reference sites, to the selection of indicator chemicals, to data analysis, to the determination of cleanup levels, to the technical feasibility and cost benefit analyses which will in the end determine what is actually required.

To see what a contractor can do using a biased work plan, one needs only to look at the results of a similar impact study conducted by the same contractor, PTI, now using a new name - Exponent. "Safe" levels of PCBs and mercury determined for the Campbell shipyard and the Shelter Island boatyard site are between two and ten times higher than levels considered safe in Puget Sound. These higher allowable concentrations greatly reduce the size of the area requiring cleanup. Bioaccumulation was determined to be of no concern, despite fish contamination levels well above levels that trigger public health advisories in San Francisco. Rather than application of the precautionary principle, which would require erring on the side of public and ecological safety, the burden of proof here and in the Work Plan for NASSCO and Southwest Marine seems to be on the environment to prove itself worthy of protection.

The proposed cleanup should set a high standard for other cleanups around the Bay. We are profoundly concerned that if the Board allows this Work Plan to go forward as it now stands, the results will not be protective of beneficial uses and then the Board will be under extreme pressure to apply the same faulty methodology and cleanup levels to other sites in the Bay.

There are a number of key issues that we believe should and can be addressed immediately. These include:

- increase pore water and dilution series sampling to allow any analysis to be statistically defensible.
- requirement that on-site benthos and local fish and shellfish be tested.
- increased bioaccumulative sampling in areas known to have bioaccumulators
- removal of the opportunity for site specific tissue standards
- removal of the convoluted decision matrices by which many "hits" can and will be removed from consideration.
- changes in the manner that core sampling stations are located for Phase II
- Inclusion of ethnic and subsistence fishing standards as part of any health impact assessment
- remove species from species list for on-site species that are not found in the Bay and include those species that are key for the biota of the area.

Thank you for your attention to this important issue. If you wish to discuss this matter further, please feel free to contact me at 619-758-7743 or any of the signatories.

Sincerely,

Bruce Reznik
San Diego BayKeeper

On behalf of San Diego Bay Council Members

Laura Hunter
Environmental Health Coalition

Ed Kimura
Sierra Club, San Diego Chapter

Marco Gonzalez
Surfrider Foundation, San Diego Chapter

Allison Rolfe
San Diego Chapter Audubon Society

Cc: John Robertus
David Barker

California Regional Water Quality Control Board
San Diego Region

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Gray Davis
Governor

August 28, 2001

Mr. Bruce Reznik
San Diego Baykeeper
2924 Emerson Street, Suite 220
San Diego, CA 92106

RECD AUG 30 2001

Dear Mr. Resnik:

WORK PLAN FOR THE NASSCO AND SOUTHWEST MARINE DETAILED SEDIMENT INVESTIGATION

Staff forwarded your August 21, 2001 letter, on behalf of the San Diego Bay Council, concerning the NASSCO and Southwest Marine Sediment investigation, to me. I have read it carefully, and am aware of your concerns.

My purpose in writing is to acknowledge receipt of the letter and to indicate that it will become part of the record in these proceedings. I have also been assured that the other Board members will receive a copy of the letter.

I will discuss with Art Coe your request for "immediate action" by the Board based on your view that time is of the essence because of the importance of the Phase 2 sampling. I have asked Art to respond to your letter, particularly the "key issues" identified by you on page 2. As you may know, Art is the Board's Acting Executive Officer while John Robertus is on vacation.

Thank you for your continued interest in clean water issues.

Sincerely,

John H Minan LC
John H. Minan
Chair
San Diego Regional Water Quality Control Board

California Environmental Protection Agency

CC: Regional Board Members

Art Coe, RWQCB
David Barker, RWQCB

✓Laura Hunter
Environmental Health Coalition

Marco Gonzalez
Surfrider Foundation, San Diego Chapter

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Gray Davis
Governor

August 28, 2001

Mr. Bruce Reznik
San Diego Baykeeper
2924 Emerson Street, Suite 220
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John H Minan LC
John H. Minan
Chair
San Diego Regional Water Quality Control Board

California Environmental Protection Agency

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CC: Regional Board Members

Art Coe, RWQCB
David Barker, RWQCB

✓Laura Hunter
Environmental Health Coalition

Marco Gonzalez
Surfrider Foundation, San Diego Chapter

Ed Kimura
Sierra Club, San Diego Chapter

Allison Rolfe
San Diego Chapter Audubon Society

Final Draft
ACTION PLAN:

IMPLEMENTING POLLUTION PREVENTION AT SAN DIEGO SHIPYARDS

Environmental Health Coalition
San Diego, CA

September 2001

IMPLEMENTING POLLUTION PREVENTION AT SAN DIEGO SHIPYARDS

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Acknowledgments

This report was prepared by Environmental Health Coalition in collaboration with pollution prevention and environmental health experts. Nicole Capretz, Project Manager of the Campaign for Clean and Safe Shipyards, coordinated this effort at EHC with assistance from Joy Williams, Community Assistance Director; Melanie McCutchan, Air Toxic Policy Advocate, and Diane Takvorian, Executive Director.

Significant research and analysis was provided Dr. Bhaskar Kura, University of New Orleans, a pollution prevention expert for the shipbuilding and repair industry. Significant contributions were added by John Jaimez of Materials Productivity, Inc, a consulting firm specializing in pollution prevention.

This report is based on information from government and private research efforts. Information regarding the specific activities at the San Diego shipyards was provided in part by the following companies:

- National Steel and Shipbuilding Company (NASSCO)
- Southwest Marine (SWM)
- Continental Maritime

Financial support was provided by:

- Environmental Protection Agency's Environmental Justice Pollution Prevention Program. Although this report has been funded in part by the United Stated Environmental Protection Agency Grant Number PJ 989051 to Environmental Health Coalition, it has not been subjected to the Agency's required peer and policy review. Therefore it does not necessarily reflect the views of the Agency, and no official endorsement should be inferred.

Executive Summary

San Diego is home to three major commercial shipyards that primarily build and repair Navy ships: National Steel and Shipbuilding Company (NASSCO), Southwest Marine, and Continental Maritime. All three are owned by multinational corporations. NASSCO is owned by General Dynamics, Southwest Marine is owned by the Carlyle Group, and Newport News Shipbuilding owns Continental Maritime. Together, the shipyards employ over 5,000 workers and have multi-million dollar contracts.

Both ship repair and ship construction involve complex and highly-intensive industrial processes. These industrial processes use toxic materials, such as heavy metals and organic solvents, that are potential sources of pollution to the land, air, and water. Because these processes are done outdoors and at the water's edge, it is particularly easy for the pollution to reach San Diego Bay and the surrounding community.

The adjacent community, only a couple of blocks away, is predominately Latino and has one of the lowest median household incomes in the County. The emissions from the shipyards contribute to an inequitable pollution burden, as this neighborhood also has other polluting industries located right next door to schools, homes, and parks. Also at high risk are the workers, who are on the front lines of exposure every hour, every day.

The gravest threat to the community and workers comes from the hexavalent chromium emissions of welding operations. Welding occurs in all areas of the shipyards at all hours. Hexavalent chromium causes cancer and increases the excess cancer risk to the community from the shipyards' operations. Exposure to hexavalent chromium can also cause metal fume fever, occupational asthma, and lung damage.

The threat to San Diego Bay stems from the onslaught of toxic metals contained in the shipyards' storm water, in spills and leaks, and in dry weather runoff. These metals, such as copper, zinc, mercury, and lead, settle in the sediments at the bottom of the Bay. Further adding to the toxic soup are the air toxins from blasting and painting activities that fall into the water.

Environmental Health Coalition believes that the best way to reduce the potential harm from shipyard activities is to require maximum pollution prevention measures. Pollution prevention, or toxics use reduction, is a strategy for substantially reducing the use of toxic chemicals through the use of less toxic chemicals and process changes.

This report identifies and recommends pollution prevention opportunities for San Diego Bay shipyards. The recommended options are materials, techniques, or technologies that are being implemented in other shipyards or have proven effective in other comparable industries. They are intended as a starting point for discussions with the shipyards regarding what measures they can take to significantly reduce their pollution burden. Each option must be evaluated independently at each shipyard to ensure it is the best solution for its ~~facility, human health, and the environment. The recommendations summarized are in the~~ table below.

TABLE 1: POLLUTION PREVENTION RECOMMENDATIONS

TYPE OF PROCESS	OBJECTIVE	RECOMMENDATION
Welding	Minimize Heavy Metal Emissions (i.e., Hexavalent Chromium)	• Low Fume/Low Heavy Metal Welding Rods or Wires • Low Fume Welding Process (i.e, Gas Tungsten Arc Welding [GTAW]) • Good Operating Practices • Source Testing of Other Current Welding Processes • Additional Research on Welding Rods and Welding Processes
Surface Preparation	Minimize Use of Toxic Chemicals, Abrasives, and Thermal Energy	• Hydroblasting • Sponge Material/Fiber Media Blasting • Dry Ice Blasting • Plastic Media Blasting
Painting & Coating	Minimize Use of High-VOC and High-Toxic Paints	• Powder Coatings • Waterborne Coatings • Solvent-free Coatings • Low-VOC and Low-Toxic Paint • High Solids Coatings • Paint Heating Systems
	Reduce Paint Use and Paint Waste	• Electrostatic Application Systems • High-Volume Low-Pressure (HVLP) Systems • Air-Assisted Airless Spray Systems • Plural Component Systems
	Minimize Use of Toxic Antifouling Coatings	• Silicone-based or other Non-Toxic Antifouling Coatings

Section 1: Introduction

The shoreline landscape of San Diego Bay is spotted with highly polluting shipbuilding and ship repair facilities, with the largest operations concentrated adjacent to low-income communities of color. Environmental Health Coalition, the San Diego/Imperial Counties Labor Council, workers, and the residents of the impacted neighboring communities are concerned about the hazardous waste, air pollution, and discharges into the Bay generated by shipyard activities. These chemicals threaten public health and the environment, particularly for the shipyard workers and local residents of Barrio Logan, Sherman Heights, Logan Heights, and National City.

The major facilities of concern are: National Steel and Shipbuilding Company (NASSCO), Southwest Marine, and Continental Marine. These shipyards have been purchased in recent years by multi-national corporations. NASSCO is owned by General Dynamics; the Carlyle Group owns Southwest Marine; and Newport News Shipbuilding owns Continental Maritime. The shipyards build and repair primarily Navy ships, although the shipyards also have commercial contracts. The three shipyards employ an average of 5,000 workers and have contracts worth hundreds of millions of dollars.

Environmental Health Coalition believes the best strategy for reducing and eliminating the release of toxics into the environment is pollution prevention. EHC believes that pollution prevention, or toxics use reduction, is preferable to pollution control, as control measures can malfunction, may not be health protective due to limitations in scientific understanding of pollutant health effects, may not decrease hazardous waste generation, and are not always implemented adequately.

Environmental Health Coalition received a grant from the US Environmental Protection Agency Environmental Justice Pollution Prevention Program to:

- identify opportunities for pollution prevention at the San Diego shipyards;
- advocate for pollution prevention at the shipyards;
- establish a reliable way of measuring pollution reductions; and
- empower community residents to resolve toxic pollution problems in their neighborhoods.

In order to accomplish these goals, EHC embarked on the *Campaign for Clean and Safe Shipyards* in 1999. This campaign is a joint effort between Environmental Health Coalition, the San Diego/Imperial Counties Labor Council AFL-CIO, and the United Waterfront Council (a coalition of six unions at NASSCO). The goal is to make the shipyards good neighbors and safe employers, including giving the community some meaningful, permanent oversight authority over shipyard decisions that affect their lives. Many other labor, environmental, and community organizations have joined the campaign.

In order to reduce the significant environmental and public health risks associated with shipyard activities, this report seeks to identify pollution prevention opportunities for San Diego shipyards. This report focuses on identifying pollution prevention alternatives for those activities associated with the greatest risk to human health and the environment.

Due to the evolving nature of shipyard operations and practices, in addition to the fluctuations in the scope and type of work at each facility, the recommendations in this report are intended to be the starting point for more extensive and detailed discussions with each shipyard to ensure the most appropriate modifications and improvements are made.

Shipyard Pollution: What is the Problem?

The high volume of toxic chemicals used in the ship repair and construction process create a significant environmental and public health risk to the neighboring communities, the shipyard workers, and San Diego Bay. This risk is magnified because most of the industrial processes are conducted outdoors and at the water's edge, which makes it easy for the pollution to reach the surrounding community and the Bay.

The adjacent communities are predominately Latino and among the lowest income communities in the County. The 2000 census found that the neighborhoods living immediately adjacent to the Shipyards were 91% Latino and had a household income of $23,000[1]. The emissions from the shipyards contribute to an inequitable pollution burden, as these neighborhoods suffer from zoning which allows polluting industries to be located right next door to schools, homes, and parks. Also at high risk are the workers, who are on the front lines of exposure every hour, every day -- often for many years.

Threats to Human Health and the Environment

Air Pollution

Criteria Pollutants

Criteria air pollutants include nitrogen dioxide, sulfur dioxide, ozone, particulate matter of less than 10 micrometers in diameter, carbon monoxide, and lead. They were the first set of air pollutants to be regulated nationally and are the only air pollutants that have

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[1] Census data 2000, SANDAG, zip code 92113

federal standards for ambient air. They are produced in large amounts (except lead) and are ubiquitous in urban air. They are of concern both because of their harmfulness to health and because they lead to the formation of smog. Historically, the focus of concern for criteria pollutants is the entire air basin, rather than the people immediately downwind of emissions.

The shipyards contribute substantially to the region's burden of smog. According to California's Air Resources Board, NASSCO emits 202 tons per year of "reactive organic gases" (ROGs), a class of volatile organic compounds (VOCs). Southwest Marine emits 31 tons per year of these smog-forming air pollutants.[2]

Air Toxics

In addition to the tons of VOCs mentioned above, shipyards emit a long list of toxic air contaminants. Beyond simply adding to the total regional smog burden, these pollutants can affect the health of people downwind through their direct toxic effects on the body. The focus of concern for toxic air contaminants is their potential harmfulness to people close to the emission source - the "hot spot" effect. In general, they are emitted in smaller quantities than the criteria pollutants, but, because of their toxicity, they may be dangerous for people downwind. Although there are regulatory requirements for businesses that emit toxic air contaminants, as described below, there are no ambient air standards for toxic air pollutants. The shipyards' toxic air contaminant emissions are listed in Appendix C and include heavy metals, solvents, and other toxics.

Evidence accumulated throughout the 1990s leads to the conclusion that air toxic emissions are the most significant threat to the workers and communities surrounding the shipyards. As part of the California Air Toxics "Hot Spots" law (A.B. 2588), major polluters are required to assess their cancer risk and other chronic (long term) and acute (immediate) health risks to the surrounding community from their air emissions. Health risk studies completed by the shipyards and reported in 1991, 1996, and 1999 vary widely in their emissions estimates but consistently put the shipyards at or near the top of the facilities for both cancer and acute health risks. Cancer and chronic non-cancer health risks are driven primarily by hexavalent chromium emissions from welding operations. Specifically, hexavalent chromium accounts for 96% of the increased cancer risk and 80% of the

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[2] California Air Resources Board, 2001. California Emission Inventory Data, downloaded May 1, 2001, from the CARB website: http://www.arb.ca.gov.

increased long-term health risks.[3]

A recent national study revealed that lung cancer rates among workers exposed to hexavalent chromium were almost double what would have been expected for this group (even for workers who smoke). The study, published in the August 2000 issue of the *American Journal of Industrial Medicine*, was funded by the U.S. Environmental Protection Agency and conducted by the Johns Hopkins University School of Hygiene and Public Health. The study also found chromium exposure associated with increased rates of nasal irritation, skin irritation, and perforated eardrums. The Occupational Safety and Health Administration is in the process of developing new standards for reducing the permissible exposure limit for hexavalent chromium.

Other chemicals associated with welding are of concern. The American Conference of Governmental and Industrial Hygienists recently reduced their published threshold limit values for manganese and insoluble nickel compounds by a factor of five.

Another study links welding and Parkinson's disease. Scientists from the Washington University School of Medicine in St. Louis concluded in early 2001 that welders who are genetically predisposed to Parkinson's disease could show symptoms earlier because of their exposure to welding fumes with high levels of manganese.

Air particulates and metals

Additional sources of air pollution come from dust particles generated from the use, application, and removal of coatings. When a ship is prepared for painting it is usually blasted with abrasives first to remove any marine growth and/or paint on the hull, and/or to texturize the metal.[4] The abrasives used to blast typically contain heavy metals.[5] In addition, the paint blasted off the ship usually also contains heavy metals such as copper and zinc.[6] Together, the old paint and spent abrasives can generate a toxic dust that can cause respiratory irritation, dizziness, nausea, sneezing, and metal fume fever (a short-term painful ailment with symptoms of fever and chills) if inhaled by workers and/or residents. Paint and coating overspray may also emit particulates containing metals. Copper air emissions are the

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[3] Air Toxics Health Risk Assessment for NASSCO. (based on 1993 emissions). San Diego Air Pollution Control District, 1997.

[4] EPA Office of Compliance Sector Notebook Project: Profile of the Shipbuilding and Repair Industry, November 1997, page 24.

[5] *Ibid.*

[6] *Ibid.* page 29.

primary driver of acute health risks at NASSCO, accounting for 81% of the immediate health risks.[7]

In addition to heavy metals, the paint may contain solvents which emit volatile organic compounds (VOCs).[8] VOCs can cause eye, nose, and throat irritation and toxicity to the nervous system, in addition to contributing to the formation of smog.[9]

Recent monitoring results from a monitor stationed for a year at Memorial Academy in the Logan Heights community found elevated levels of particulate pollution and certain metals including manganese, iron, zinc, nickel, and chromium, but not hexavalent chromium. This result is hard to interpret without a better understanding of the fate and transport of hexavalent chromium as it is generated and released from welding and plating operations. It may mean that hexavalent chromium emissions affect residents more immediately downwind than the monitor indicates, or that the hexavalent form of the metal reacts with other substances to become trivalent chromium at some point after its release.

Concern about the toxicity of hexavalent chromium emissions are driving the California Air Resources Board to consider new control requirements for this metal. However, true pollution prevention of hexavalent chromium toxicity means that ultimately, it must be phased out of industrial operations altogether.

Hazardous Waste Storage and Generation

The shipyards are significant users of hazardous materials and generators of hazardous waste. The three commercial shipyards have on-site at any one time an estimated 3.7 million pounds of hazardous materials and generated over 25 million pounds of hazardous waste in 2000. The hazardous wastes include large amounts of oily bilge water, solvents, sludges, and paint wastes.[10]

Water Pollution and Sediment Contamination

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[7] Air Toxics Health Risk Assessment for NASSCO. (based on 1993 emissions). San Diego Air Pollution Control District, 1997.

[8] EPA Profile, page 34.

[9] EPA web site: http://www.epa.gov/iedweb00.voc.html.

[10] County of San Diego hazardous waste reporting for 2000. Note: sums in pounds are created by converting gallons and tons to pounds. Gallons are converted at the weight of water. Liquids such as some solvents are lighter than water and other, such as sludges, are heavier.

The primary threat to the health of San Diego Bay comes from air and water deposits. San Diego Bay was designated by the National Oceanic and Atmospheric Association (NOAA) as one of the most toxic bays in the nation in 1999 due to sediment toxicity. The shipyards were identified as a main area of concern. In fact, shipyard sediments are so highly contaminated with heavy metals such as copper and zinc that at least one area at Southwest Marine has been deemed a "dead zone" supporting little to no marine life.

Storm water run-off from all three shipyards is also highly toxic, posing a threat to marine life and the marine ecosystem. NASSCO was recently fined $135,000 from the Regional Water Quality Control Board for pouring toxic storm water into San Diego Bay. Southwest Marine and Continental Maritime were also fined at lower amounts for violations of toxic storm water discharges.

While we do not know the exact cause of the toxicity, data suggests copper and zinc are the main sources because of the high levels of these chemicals in the storm water. The most significant source of copper and zinc is likely from painting and blasting operations. Paint used on ships contain heavy metals such as copper and zinc as anti-fouling and anti-rusting agents. One of the most common blasting agents used in surface preparation at the San Diego shipyards is copper slag.

It is easy for copper and zinc to enter San Diego Bay via rainwater, air deposits during painting and blasting activity, dry weather runoff (runoff when it is not raining), and/or spills and leaks. Thus, this report includes recommendations that reduce the use of copper and zinc during the ship repair and ship building process.

As described above, and in the table below, the primary activities associated with the environmental and human health risks of greatest concern are welding, surface preparation, and painting/coating. Therefore, this report focuses on these three shipyard processes for the identification of pollution prevention opportunities.

TABLE 2: Potential Pollutants and Impacts from Shipyard Processes[11]

Process or Operation	Main Pollutants of Concern	Potential Health Impacts to Workers & Community Residents	Potential Impacts to Environment
Welding	• Hexavalent Chromium • Manganese • Nickel	• Carcinogen • Respiratory irritant • Metal Fume Fever • Occupational asthma • Reduced lung capacity • Lung damage • Possible effects on fertility • Early onset of Parkinson's Disease	• Contaminated sediments • Impaired water quality • Reduced air quality
Surface Preparation (Blasting)	• Metal particulates in blasting abrasives and paint chips (copper, zinc, and lead)	• Aggravate respiratory disease • Increase potential of premature mortality • Silicosis from glass or sand abrasive dusts	• Harm and kill marine life when discharged into Bay • Contaminated sediment (which can cause fin rot, tumors, and skin lesions on fish, as well as impact some aquatic species)
Painting/ Coating	• Metals (such as copper and zinc) in paint overspray and leaching from ship hulls	• Respiratory irritation	• Damage to marine life when discharged into Bay, and when copper passively leaches off hulls into Bay
Painting/ Coating	• Volatile organic compounds (VOCs) in solvents that evaporate as paint dries	• Eye, nose, throat irritation • Nervous system toxicity • Skin injury if paints, cleaning solvents, or acids touch skin	• Contribute to the formation of smog

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[11] References and descriptions of health effects in Table 2 in Appendix A

Section 2: Description of Three Shipyard Processes: Welding, Surface Preparation & Painting

The descriptions of shipyard processes presented below focus on commonly used materials and methods in the shipbuilding industry. It is important to note that changes in materials and processes can occur depending on the scope of work received by individual shipyards from the Navy and/or commercial contracts. Also, the types of wastes/ pollutants expected are discussed in broad terms. Because of the similarity of processes at these shipyards, most wastes/pollutants generated are of similar nature. Specific wastes/pollutants will vary when changes are made to the materials used for a specific job.

A. Welding

Welding is performed at nearly every location in a shipyard.[12] The process joins metals by heating them to high temperatures. The metals are joined together with a filler material. An electric arc or gas flame is used to heat the edges of the metals, allowing them to fuse with the fill metal in the form of an electrode, wire, or rod. The welding processes result in the emissions of toxic fumes, dusts, gases, and vapors from the metal, the rod or wire, and/or the heat source.[13]

Types of Welding Processes

The choice of a particular type of welding process is based upon customer specifications, production rates, and operating constraints. For commercial shipbuilding, welding processes are subject to review and approval by the regulatory bodies of the United States Coast Guard (USCG) and/or the classification societies of the American Bureau of Shipping (ABS). There are many different welding techniques used in the ship building industry. The two broad categories of welding processes are referred to as Gas Metal Arc Welding (GMAW) and Shielded Metal Arc Welding (SMAW). The GMAW category applies to welding processes that generally use a continuous uncovered wire, where the arc is shielded by a gas stream supplied by the weld gun. The GMAW process category includes

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[12] EPA Profile, page 19.

[13] Rom, William, 1992. Environmental and Occupational Disease, Second Edition. Boston: Little, Brown, and Company.

variations such as Flux Cored Arc Welding and Gas Tungsten Air Welding (GTAW).

The SMAW category is characterized by welding rods covered by a solid flux coating (a substance used to promote the fusion of metals) that melts and envelops the immediate area in an atmosphere of protective gas. Following is more discussion of each process:

1) Shielded Metal Arc Welding (SMAW)

Commonly known as "stick welding," SMAW uses short welding rods in conjunction with a portable welding unit.[14] Emissions rates from this process are usually in the middle range (300 to 800 mg per minute), and the emissions depend in large part on the composition of the rod. This process is one of the most popular of all arc welding processes because it is one of the most durable for structural and pipe applications. It is also allows for quick setup, works well in areas with limited access, and can be used with a wide range of consumables.[15]

1) Gas Metal Arc Welding (GMAW)

The GMAW process is a gas shielded welding processes commonly referred to as metal inert gas (MIG) welding. This process allows continuous welding without any interruption of changing electrodes by using an automatic wire feeder. At the point where the electrode meets the weld arc, argon or helium is used as the shielding gas. For welding steel, a combination of CO2 and an inert gas can be used. Often, a combination of the gases is used to optimize cost and weld quality. Fume generation rates are typically in the middle range, from 200 to 500 mg per minute.[16] This process is a primary method for fabricating ship structures, and is used extensively for piping and pressure vessel components. It is also preferred because of Navy requirements for shock resistance, static and fatigue strengths, and low temperature toughness.[17]

2) Gas Tungsten Arc Welding (GTAW)

This is another type of gas shielded welding process sometimes referred to as tungsten inert gas (TIG) welding. The arc is generated between the work piece and a

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[14] Environmental and Occupational Disease, p. 832.

[15] National Shipbuilding and Research Program, *The Shipyard State of the Art Report,* May 2000, p. 6.

[16] Environmental and Occupational Disease, Page 832.

[17] *NSRP State of the Art,* page 6.

tungsten electrode, which is not consumed. An inert gas (usually argon or helium) provides the shielding and also helps in providing a lower fume process. The arc simply melts the material and the wire; it does not transfer the filler metal, thus resulting in a cleaner weld. This process requires a highly skilled operator and has a low rate of production. It produces a superior weld quality and can be used to weld almost any metal.[18] It is used for small welds on thin plates, fine work, and difficult materials such as aluminum and magnesium. Fume generation rates are very low, typically 3 to 7 mg per minute.

3) Flux Cored Arc Welding (FCAW)

FCAW is a combination of SMAW and GMAW. In this process, the wire is fed continuously to the arc. The FCAW electrode is a tubular electrode wire with a flux core center that helps in localized shielding, although many FCAW processes used in a shipbuilding environment require the addition of gas shielding for the quality requirements of the industry (i.e., ABS and Navy standards). The process is well-suited to very high rates of production, and is liked because of its ability to weld through pre-construction paint primer.[19] However, it generates high fume generate rates, typically 900 to 3100 mg per minute.

4) Submerged Arc Welding (SAW)

Submerged arc welding (SAW) is a highly automated process mounted on a moving carriage or self-propelled platform on top of the work piece. In this process, a blanket of granulated flux is deposited on the work piece, followed by a wire electrode. The electrode serves as the filler material but in some cases metal granules are added to the flux. The arc, submerged in the blanket of flux, melts the flux to produce a protective insulated molten shield in the weld zone. After welding, the molten metal is protected by a layer of fused flux, which is subsequently removed and may be recovered. Very little welding fume is generated from this process, typically 3 to 6 mg per minute.[20] SAW is primarily used for joining plates to produce panels for hulls and bulkheads.[21]

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[18] *Ibid.*

[19] *Ibid.*

[20] Environmental and Occupational Disease, page 832

[21] *NSRP State of the Art, page* 6.

TABLE 3: Welding Processes Used at San Diego Shipyards

Each of the shipyards use different welding techniques. The type and frequency of the welding will vary with the type of work done. The following chart outlines which shipyard uses which of the processes described above:

	NASSCO	Southwest Marine	Continental
FCAW	√	√	√
SMAW	√	√	√
GMAW	√	√	
SAW	√		
GTAW			

Welding Pollutants and Wastes

Wastes

Welding operations typically produce solid wastes, hazardous wastes, wastewater, and air emissions. Specific waste streams depend on the methods and magnitude of welding employed. Welding rod stubs, wire stubs contaminated with flux, and welding wire spools are all solid wastes that come from welding. Diluted acids may be used for pre- and post-weld cleaning. The used acid waste is collected and managed as a hazardous waste. Also, a considerable amount of slag and wastewater is produced by these welding processes, except for GMAW, where only wastewater is produced. The wastewater must be treated, and the slag is disposed of as a solid waste.

Welding Fumes

Due to the significant health risk to workers and residents from the metals in welding fumes, this report focuses on those pollutants. The major sources of welding fumes are the welding consumables such as electrodes, filler wires and electrode coatings (commonly referred to collectively as "welding rods").[22] Significant contributions can come from the base metal, especially if the base metal is coated with zinc or cadmium, which have high vapor pressures.

The quantity of fumes released during welding depends largely on the type of welding process and its operating conditions. Specifically, the quantity of fumes depends upon factors such as:

- the heat source (gas or electric)
- the consumable or fill material
- the arc shielding and stability
- the welding voltage and current, and
- the type of base metal welded, in addition to any coatings on the surface of the base metal. Examples of base metal used includes mild and high strength steel, stainless steel, galvanized steel, and copper nickel

TABLE 4: **The type of processes generating the lowest fume generation potential to the highest**

Type of Welding	Emissions rate/mg per minute
GTAW	3-6 mg/minute
GMAW	200-500 mg/minute
SMAW	300-800 mg/minute
FCAW	900-3100 mg/minute

The high fume generation potential for FCAW can be attributed to the decomposition of flux and the use of carbon dioxide as a shielding gas. It is known that as oxidation potential of a shielding gas increases, the fume generation potential of the welding process also increases. Therefore, since carbon dioxide has an oxidation potential higher than any other inert shielding gas used, any welding process using carbon dioxide as a shielding gas has higher fume generating potential.

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[22] National Shipbuilding Research Program, *Impact of Recent and Anticipated Changes in Airborne Emission Exposure Limits on Shipyard Workers*, March 1996, p. 6.

For GTAW, the fume generated is negligible due to the nature of the process. Because the welding current is not directly passed through the electrode, this process results in low fume emissions. The quantity of fume generated varies in direct proportion to the welding current used. This process has lower operating current compared to other arc welding processes; therefore, it produces less fumes.

Just as important as knowing the quantity of fumes generated is knowing the composition of the fume. Having a high quantity of welding fume does not necessarily correlate with having higher hexavalent chromium, manganese, or nickel emissions. Thus, it is essential to know the concentration of metals in the fumes.[23]

For example, welding fumes contain hexavalent chromium when the base and/or filler metals contain chromium.[24] Typically, the filler metals are similar in composition to the base metals. So, if the base metal contains chromium, the filler metal will often contain chromium as well. This will likely lead to the generation of significant hexavalent chromium emissions. A specific illustration of the correlation between base and filler metals is when comparing hexavalent chrome emissions from FCAW performed on mild steel (low chrome content) to hexavalent chrome emissions from GMAW performed on stainless steel (high chrome content). Even though FCAW is known to have more emissions than GMAW, using the GMAW process on stainless steel emits a higher concentration of hexavalent chromium fumes due to high chromium content in both the base and filler material.[25]

In essence, then, the highest hexavalent chrome fume concentrations can be expected when using the welding processes of SMAW and FCAW with filler materials of stainless steel or high chromium, nickel-alloys.[26]

B. Surface Preparation

The majority of vessels constructed or repaired at medium to large size shipyards are made of metal. Because metal is subject to corrosion, it must be coated to prolong its useful life. To ensure proper adhesion of protective coatings, all metal surfaces must be prepared and/or cleaned prior to coating application (unless the steel is purchased pre-primed). Preparation entails removing all dirt and other surface contaminants that may interfere with

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[23] *Ibid.*

[24] *Ibid.*

[25] Conversation and email exchange with Dr. Bhaskar Kura in 2000.

[26] *NSRP Impact of Air Emissions*, page 16.

coating adhesion, as well as giving the metals a textured surface.[27]

There is primary and secondary surface preparation. Primary surface preparation refers to the initial blast cleaning of new sheets of metal prior to construction and assembly. After the metal is blasted clean and inscribed with a surface profile, it is then coated with a weld-through pre-construction primer to protect the metal from corrosion and preserve the surface profile. Sometimes primary surface preparation can be skipped because metal is purchased that is pre-primed.[28] Secondary surface preparation entails the re-preparation and re-painting of steel structures during ship repair and construction.

Various methods are available for preparing metal surfaces; the choice of method to be used is based on several factors, such as: (1) whether the surface is painted or covered with rust and scale, (2) which surface characteristics are required by the paint that is to be applied, (3) the size and shape of the surface to be prepared, and (4) the type of metal involved. Based on these factors, a suitable surface preparation method is employed.

Types of Surface Preparation

Surface preparation methods used by San Diego Bay shipyards are discussed in this section, as well as typical pollutants associated with these methods. Table 5 at the end charts the methods employed by each individual shipyard.

1) Abrasive Blasting

Abrasive blasting is a method of both removing contaminants from metal work pieces, and giving the metal a textured profile. The combination of a clean surface and textured profile enhances coating adhesion and provides corrosion-resistance. Abrasive blasting is performed by propelling hard materials at high speeds at the metal surface being prepared. This blasting action removes rust, paint, and any other contaminants from the surface.

The most common blasting abrasives are copper slag, coal slag, steel grit, and steel shot.[29] Slag and grit consist of small, angular particles, while steel shot is comprised of

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[27] EPA Office of Research and Development, *Pollution Prevention in the Paints and Coating Industry*, September 1996, p. 23-24.

[28] *NSRP State of the Art, page* 56-58.

[29] *EPA Profile*, page 24.

small, round balls. Copper slag can generally be used only once or twice before it becomes too small to be effective, while steel grit and shot and can be recycled between 50 to 200 times.[30] Despite greater recyclability, steel shot/grit is still much more expensive than slag even when costed out per use.

There are two different types of abrasive blasting – dry abrasive blasting and wet abrasive blasting. Dry abrasive blasting involves blasting with only a solid abrasive and air. Wet abrasive blasting involves blasting with a mixture of water, air and solid abrasives.

Two different techniques are used for dry abrasive blasting. One technique uses centrifugal blasting machines, where metallic shot or grit is propelled to the surface with a spinning wheel. These machines are large and not easily mobilized, so the technique is used for blasting flat surfaces, such as when preparing raw steel sheets for priming.[31] Centrifugal blasting allows for easy recovery of abrasive materials for reuse and recycling. The other technique is air nozzle blasting. Air nozzle blasting involves propelling abrasives to the target surface through an air nozzle. This technique allows flexibility and mobility, and is used manually by workers either within a building or in the open air. For air nozzle blasting, recycling is normally not feasible, and a disposable abrasive, e.g., copper slag, is usually used.

Because of its low cost, wide applicability, and effectiveness, abrasive blasting has long been the method of choice for the shipbuilding industry.

2) Water Blasting (Hydroblasting)

Water blasting allows the shipyard to clean coated and uncoated metal surfaces without the addition of solid abrasives (unless garnet is added to impart a profile on the surface of the metal).[32] Instead of propelling a solid material as in abrasive blasting, hydroblasting utilizes a high pressure water jet to remove rust, scales, and paints. These systems may use pressures as high as 50,000 pounds per inch (ultra high pressure washing). Furthermore, it can be used to remove scales and deposits from heat exchangers and can also be used to remove hard coatings and rubber lining.

Because hydroblasting does not typically use abrasives, this alternative reduces the

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[30] *Ibid.*, page 25

[31] *Ibid.*

[32] *State of the Art*, page 58.

generation and disposal of spent blasting media, thereby eliminating particulate air emissions. However, it can create significant amounts of wastewater. The way to avoid contaminated wastewater is to hydroblast in a closed-loop recycling process where the water is collected at the blast head, filtered, and reused. The trend has been to use magnetic crawlers to manipulate the waterjet systems about the hull. (NOTE: this same type of closed-cycle process can be used for abrasive blast machines). The obvious environmental benefits are augmented by the reduced downtime and improved schedules, since adjacent hull construction work does not have to be shut down when you use closed-loop hydroblasting or closed-loop abrasive blasting.

Hydroblasting without a closed-loop recycling system should be restricted to areas where the water can be easily managed, e.g., floating drydocks and graving docks. Hydroblasting done in a closed-loop recycling system, however, can be done in all areas of the yard.

The major production concern associated with this type of blasting is flash rusting which can be overcome by adding rust inhibitors to the water. Some commercially available rust inhibitors are found to contain compounds like oxalic acid and sodium nitrate.

According to EHC's conversations with NASSCO and Southwest Marine in the winter of 2001, they are doing limited hydroblasting with a concerted effort to increase the amount they do. For example, hydroblasting typically occurs when and where a customer specifies. However, Southwest Marine has been successful using hydroblasting even during times when a customer specified abrasive blasting because they know they can accomplish the same result. Southwest Marine has recently employed an enclosed hydroblasting process for underwater hull cleaning which recovers the spent water at the head of the machine, eliminating fugitive spray. The shipyards state that current limitations to using hydroblasting include that it only be used for new/raw steel if garnet is injected to impart a profile to the surface, and that it cannot be conducted on internal tanks and spaces aboard ship. NASSCO typically uses hydroblasting in repair operations, where there is a paint system that is needs to be removed, but the surface profile is still good. That surface can be hydroblasted so that the paint is removed, but the surface profile remains intact for the new coating.

3) Mechanical Stripping

Hand tools, such as grinders, wire brushes, sanders, chipping hammers, needle guns, and rotary peening tools are commonly used for small jobs, hard to reach areas, and areas where blasting material could be difficult to contain.[33] While very labor intensive, hand tools can be effective and economical when removing heavy paint formulations and heavy rust. Impact tools like chipping hammers and needle guns are best at removing heavy deposits of brittle substances; they are less effective at removing tight surface mill scale or tight surface rust due to the risk of damaging the metal surface.

These methods primarily generate paint waste and airborne particulate emissions. Paint waste in the form of paint chips can easily reach San Diego Bay through direct deposit, storm water, wind, and any water flow on the yard. These paint chips often contain heavy metals that are toxic to marine life. Particulate emissions can cause respiratory irritation to workers and the surrounding community. Mechanical stripping is performed at NASSCO.

TABLE 5: Surface Preparation Techniques Used at San Diego Shipyards

Surface Preparation Technique	**NASSCO**	**Southwest Marine**	**Continental**
Abrasive blasting:			
Copper slag	√	√	√
Steel grit/shot	√	√	√
Aluminum oxide	√	√	
Sand	√		
Garnet	√	√	√
Glass beads	√		√
Other Techniques:			
Hydroblasting	√	√	√

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[33] *EPA Profile*, page 25.

Mechanical stripping	√		

Surface Preparation Pollutants and Wastes

Surface preparation activities generate used abrasives, paint chips, wastewater, and particulate emissions. Specifically, pollutants from dry abrasive blasting include dusts and metals derived from three sources:

- the breakdown of the abrasive media;
- the breakdown of existing coating on the metal; and
- the breakdown of the metal being blasted

Used abrasives and paint chips can contain heavy metals. The heavy metals are usually copper and zinc, but may also include lead, nickel, chrome, and titanium. The copper is from the abrasive media and the antifouling paint, while the zinc is a component of the pre-construction primers.[34]

C. Painting and Coating

Due to the corrosion and deterioration potential of metal parts in the marine environment, proper surface coating is essential in ship construction and repair. Different coating performance is required at different points on a ship, so several types of paints are used. Paints range from water-based coatings to high performance epoxy coatings. Paint requirements vary, according to the environment to which the surface will be exposed. In general, there are six locations on a ship that have specific coating requirements.

- Underwater (hull bottom);
- Waterline;
- Topside superstructures;
- Internal spaces and tanks;
- Weather decks; and
- Loose equipment.[35]

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[34] *EPA Profile*, page 33-34.

[35] *EPA Profile*, page 29.

Other factors considered when choosing a particular paint include the environmental conditions, the severity of environmental exposure, drying and curing times, and the application equipment. Military specification (Milspecs) also determine the makeup of paint used on military vessels.

Paints

Paints are composed of three main ingredients: pigment, binder, and solvent/thinner. Pigments are small particles that primarily provide color.[36] Examples of pigments include: zinc oxide, carbon, mica, and aluminum. The binder holds the paint pigments together. Paints are often referred to by their binder type, e.g., epoxy, vinyl, and urethane. The binder also provides key performance characteristics, such as: flexibility, durability, and chemical resistance. Finally, a solvent vehicle of some kind is added to thin the paint so that it will flow during application and provide a relatively even coating. The solvent portion of the paint evaporates when it dries. Typical solvents include acetone, mineral spirits, xylene, and water.

The first coating applied to raw steel sheets is a pre-construction primer. This coat of primer helps maintain the condition of the part throughout the construction and assembly process, including through the cutting, welding and topcoating process (so the shipyards can apply the anti-corrosive paints and topcoats directly over these primers). Most pre-construction primers have high concentrations of zinc with organic or inorganic binders. Zinc coated on steel forms zinc oxide, which will not allow water or air to come into contact with the steel.[37] These primers also often contain chromate as a pigment, which has the potential to become an air carcinogen, and solvents.

Despite the fact that pre-construction primers can often withstand the entire assembly process, some customers require that the pre-construction primer be blasted off. It is possible to purchase steel sheets pre-primed, so they don't need the initial surface preparation of cleaning and priming.[38]

The most widely used paints on the hulls of ships are liquid coatings for antifouling and anti-corrosive properties. Antifouling paints are used to prevent the growth of marine organisms on the hulls of ships. Copper-based paints are widely used as antifouling paints.

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[36] *Ibid.*

[37] *EPA Profile, page* 29.

[38] *Pollution Prevention, page* 24.

These paints release toxins which reduce marine growth on the hull. These toxins may also end up in the marine environment in the form of overspray during application, and/or as paint chips during coating removal.

Two component epoxy paints are the predominant anti-corrosive coatings for shipyards. Other types include inorganic zinc, vinyl, lacquer, and urethane coatings.[39]

Types of Paint Application Equipment

The most common paint application method used in this industry is spray application. There are several spray application methods available. Of these, conventional air spraying and airless spraying are the most widely used in ship building and repair. Likewise, these are the most common methods employed at San Diego Bay shipyards. San Diego shipyards also utilize High Volume Low Pressure (HVLP) spray guns, and at least one shipyard (NASSCO) utilizes plural component systems.

1) Conventional Air Spray Systems

In conventional air systems, the material to be sprayed is supplied to the spray gun by gravity, siphon, or pump.[40] When the gun is triggered, the material exits the gun nozzle in a liquid stream. Upon exiting the gun, this stream comes into contact with a column of high pressure compressed air, emitted from the center of the gun nozzle. The air converts the liquid stream into small droplets and provides them with forward velocity.

Conventional spray systems have inherently low levels of transfer efficiency - the amount of paint solids that get on the object being painted (versus becoming a paint waste). Often, more material is wasted than is actually deposited on the part. The paint that blows past the object being painted is known as over spray.

2) Airless Application

The most widely used paint application method used in the ship building and repair industry is airless spraying.[41] Airless equipment uses an air-driven pump to push on the liquid through the hose using a spray gun tip at high pressure. The result is a finely

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[39] *NSRP State of the Art*, page 59.
[40] *Ibid.*
[41] *EPA Profile*, page 29.

atomized spray that has enough velocity to reach the object being coated. The major benefit of airless spraying is speed of application; this process can deliver twice the amount of material as conventional air systems. Other advantages include improved transfer efficiency and the ability to spray into recesses and cavities with a minimum of material bounce-back. Disadvantages of airless spraying include a lower quality finish and less ability to control spray patterns.[42] However, the ship building industry does not require a high quality finish on the products it paints.

3) High-Volume Low-Pressure (HVLP) Application

HVLP systems use extra-low pressures for applying paints. HVLP systems are generally classified into two categories, depending on whether the air is supplied by an air compressor or a turbine. Both systems are characterized by an air nozzle with a large-diameter opening for atomizing air. The low atomizing air pressure of HVLP systems minimizes the amount of bounce-back paint fog and reduces the amount of paint that blows past a part as overspray. Improved transfer efficiency helps reduce operating costs by reducing paint waste. However, high quality finishes are difficult to produce, since reduced atomizing air pressures decreases the fineness of atomization which reduces the finish smoothness. Also, paint flow to the gun is reduced which limits production speeds.[43]

Currently, San Diego shipyards employ a limited use of HVLP for painting application. The Air Pollution Control District (APCD), which regulates air quality in San Diego, requires the shipyards to use HVLP spray application for component parts which can be removed from the vessel and for all interior surfaces excluding tanks, machinery spaces above bilge line, crew habitability areas, and well deck and aircraft hanger areas. Shipyards must also use HVLP equipment for coating outside surfaces with any dimension equal to or less than 8 feet. This is to minimize the air pollution resulting from painting and coating activities.

4) Plural Component Systems

If two-part coatings are used, there is always a potential for creating waste from over-mixing. Once the components of a two-part coating are mixed, there is a limited time in which the coating must be applied before it begins to cure. Once curing begins, any excess coating must be disposed of.

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[42] US EPA, *Pollution Prevention in the Paintings and Coatings Industry*, September, 1996, pages. 79-80.
[43] *Ibid.*

In plural component systems, each coating component is pumped through a device that controls the mixing ratio and combines the two in a mixing chamber just prior to reaching the spray gun. This technology virtually eliminates waste caused by overmixing. Plural component systems are particularly useful when applying high viscosity, multi-component paints to hulls and tank interiors.[44] The only cleaning that is required is the mixing chamber, spray gun, and length of supply hose connecting them. Currently, NASSCO utilizes plural component systems.

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[44] *NSRP State of the Art*, page 60.

TABLE 5: Paints and Painting Applications Used at San Diego Shipyards

	NASSCO	SWM	Continental
Paints:			
Copper Antifoulants	√	√	√
Zinc Primer (solvent-based)	√	√	√
Solvent-based topcoats	√	√	√
High Solids Paints			√
Waterborne Paints			√
Paint Application:			
Conventional	√	√	√
Airless	√	√	√
High-Volume Low Pressure (limited)	√	√	√
Plural Component	√		

Equipment Cleaning

Paint spray guns, brushes, and equipment must be cleaned after use to render them reusable. Water and detergents are used for cleaning equipment used for water-based coatings, while equipment used with solvent-based paints are cleaned with suitable solvents. Although it may be possible to discharge a water-based coating rinsate to the sanitary sewer, the spent solvents require management as a hazardous waste.

Painting Pollutants and Wastes

Paint waste can account for more than half of the total hazardous waste generated at the shipyards.[45] This may include leftover paint, overspray, paint that is no longer usable, sludge produced during recycling of cleaning solvents, rags, and other materials contaminated with paint.

Air emissions from painting and coating operations are typically the largest source of Volatile Organic Compound emissions from shipyards.[46] This is due to the solvents used in coating and the paint equipment cleaning. VOCs can cause irritation of the skin, eyes, nose and throat, impaired lung function, and possible changes to the liver and kidneys, as well as effects such as headaches, dizziness, and confusion. (Volatile Organic Compounds are a large class of chemicals regulated by the Clean Air Act which contribute to the formation of smog when exposed to sunlight.)

Finally, wastewater is generated when water curtains are used during painting. Wastewater from water curtains often contains organic pollutants, such as solvents, and some metals. If water-based paints are used, wastewater may also be generated from equipment cleaning. If not contained properly, this wastewater can enter San Diego Bay.

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[45] *EPA Profile, page* 34.
[46] *EPA Profile, page* 65.

Section 3: Pollution Prevention

A. What is Pollution Prevention?

Pollution prevention (P2) can be defined as reduction or elimination of the hazards and environmental releases of pollutants at every stage: extraction, manufacturing / processing, incorporation into products, product use, and disposal. In 1992, the United States Environmental Protection Agency defined P2, also known as source reduction, as *"...Any practice which reduces the amount of any hazardous substance, pollutant, or contaminant entering any wastestream or otherwise released into the environment...prior to recycling, treatment, or disposal..."* By focusing on measures implemented at the source of generation, P2 is fundamentally different from "end of pipe" environmental protection methods, commonly referred to as pollution control or "waste management." The distinction between pollution control and pollution prevention is an important one. For many years, environmental protection meant figuring out how best to collect and dispose of wastes after the fact. However, pollution control has not adequately protected the environment. Pollution prevention will achieve this goal because the dangerous material will never be created or used. Consequently, interest in pollution prevention has been growing among businesses, government, environmentalists, and local communities.

The environmental management hierarchy depicts different environmental management methods from the most preferable to the least preferable.

1. **Pollution Prevention** - any technique, technology, or management practice which reduces or eliminates the use and/or generation of pollutants
2. **Reuse** - techniques and practices enabling a material to be used again for the originally intended purpose without physical or chemical treatment
3. **Recycling** - techniques and technologies enabling the reuse of materials after undergoing some physical or chemical processing
4. **Control, Treatment, and Disposal** - techniques and technologies that manage wastes after they have been created

While the lines may blur at times between these different approaches, P2 is the only approach that focuses on the beginning of a process and is aimed at identifying and eliminating the root cause of the pollutant in question. Although recycling and reuse are preferable to control, treatment or disposal, they can also become barriers to P2 by masking manufacturing problems and creating disincentives for process improvements, and creating a market for harmful chemicals.

B. Why Should Businesses Prevent Pollution?

In addition to the environmental and human health benefits of reduced waste generation, P2 also makes good business sense. Essentially, pollution is a symptom of poor materials utilization and process inefficiencies. Through detailed process analyses and cost accounting, businesses can uncover P2 alternatives that simultaneously yield manufacturing and environmental improvements. Typically, P2 alternatives take one, or more, of the following forms:

- Material substitutions;
- Product modifications;
- Process modifications (including equipment changes); and
- Procedural modifications (including housekeeping & maintenance).

Successful P2 efforts can yield:

- Reduced toxic burden on human health and the environment;
- Cost savings;
- Improved productivity;
- Improved process understanding and process control;
- Reduced costs in hazardous waste management; and
- Reduced future liabilities.

Section 4: POLLUTION PREVENTION OBJECTIVES AND RECOMMENDATIONS

A. Introduction to Recommended P2 Alternatives

The remainder of this report summarizes P2 techniques and technologies applicable in general to the ship building and repair industry. It is possible some of these P2 options may already be in place at one or more of these shipyards. It should also be noted that without detailed assessments of the individual shipyards, it is impossible to determine the economic and technical feasibility of a specific alternative at a particular shipyard. Nonetheless, the P2 techniques and technologies discussed below are those that are being implemented elsewhere in this industry or have proven effective in other industries that perform similar operations.

While applicability to a specific shipyard is difficult to evaluate at this point, most of the alternatives are known to reduce specific pollutants and their associated impacts. Based on this knowledge, the P2 techniques and technologies highlighted in this section are organized within a particular process area (e.g., welding) by the pollutant and impact they address. Organizing the alternatives in this manner provides a menu from which options can be selected, depending on the specific pollutant that are being targeted. In cases where an alternative addresses more than one pollutant, a judgment is made about where it fits best and a statement is made about the other pollutants that may be affected by this alternative. Also, research recommendations are made where more research is required.

The alternatives with the greatest pollution prevention potential are placed at the beginning of the section in which they appear. These alternatives are recommended due to the generic pollution prevention potential they present, based on the best information available to date. Moreover, in most instances, more than one recommended alternative could be pursued simultaneously. The alternative techniques and technologies discussed below are not necessarily mutually exclusive.

As an individual shipyard's work orders and requirements change over time, these P2 alternatives should also be reviewed to ensure that they still will achieve the desired objectives. It is important to note that this section lists only priority P2 options, based on the best available information of San Diego Bay shipyards' operations. If the suggested P2 options in this section are not suitable due to the specific context at a particular shipyard, other appropriate alternatives should be reviewed for potential applicability.

B. Process-Specific Pollution Prevention Objectives and Recommendations

1) Welding P2 Objective: Minimize Hexavalent Chromium Emissions

While metal fumes are not the only pollutants generated by welding operations, they are a priority concern due to their serious impact on human health. Therefore, the P2 options covered in this section are devoted to reducing the generation of welding fumes -- specifically welding fumes containing hexavalent chromium, manganese, and nickel. Welding emission rates depend on: process used, materials used, current, voltage, electrode angle, weld speed, arc length, deposition rate, and operator technique.[47] Consequently, the amount and content of fume emissions can be influenced by changing the type and content of consumables, the type of welding process, the type of base metal, and the power source used in the welding process. (*See also* earlier discussion of the welding process).

Recommendations:

a) Utilize Low Fume/Low Heavy Metal Welding Rods or Wires

The shipyards should utilize low fume/low heavy metal consumables (otherwise referred to as welding rods/wires/electrodes). Past studies indicate that air emission fumes from welding fumes are generally composed of the same components as the consumed materials.[48] Consumables are subject to constant changes in the industry and are fairly easy to change within the parameters and specifications of a particular welding task. For a given welding task, there are likely to be several choices for consumables, and in some cases, fume emission rates have already been characterized for some of the materials.

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[47] *NSRP Impact* at 14.

[48] NSRP *Impact*, page 16.

Therefore, it is possible to choose low fume consumables. In fact, some welding equipment suppliers advertise low fume as a benefit.

For instance, welding fumes can be reduced by using thinner filler wires. Changing the composition of shielding gas can also reduce the quantity of fumes emitted. Using argon or helium, instead of carbon dioxide, as shielding gas can reduce the quantity of fumes generated.

Choosing filler materials/welding rods with lower heavy metal content can also reduce metal fumes significantly. Edison Welding Institute (EWI) is currently working with two specific welding rods, E71T-1 and E70S-3, using a 95% Argon - 5% Carbon Dioxide (GMAW process), and has observed very low fume generation rates of 0.05 - 0.1 g/min and 0.25 - 0.3 g/min. Additional studies are being initiated in a collaborative effort among EWI, University of New Orleans, and several shipyards nationwide. This effort is being funded by MARITECH ASE and is set for completion by the end of 2002.

b) Use a Low Fume Welding Process

The shipyards should also employ the welding process which generates the lowest fume generation potential. As described earlier, the type of processes typically generating the lowest fume generation potential to the highest are listed below:

Gas tungsten arc welding (GTAW) – > LOWEST FUME RATE
Gas metal arc welding (GMAW)
Shielded metal arc welding (SMAW)
Flux cored arc welding (FCAW) – > HIGHEST FUME RATE

Fume reduction through low fume processes and low fume consumables should be priority variables, along with low chromium content in filler and base metals.

c) Use Good Operating Practices that Reduce Toxic Fume Emissions

Optimizing welding process parameters, such as weld speed, current, voltage, and shield gas pressures can also minimize emissions of particulates and metals. For example, using pulsed arc, instead of direct current, can bring down the quantity of fumes generated. Also, adjusting the current and voltage to get the right amount of heat required for welding can reduce excessive fume emissions. Operators should be trained on the optimal settings for welding tasks that are frequently encountered. This optimization should be done to match individual shipyard requirements (i.e. the specific combination of base metals, weld rods, ventilation conditions, etc.).

d) Pursue Areas of Additional Research

i. Low Fume/Low Metal Consumables and Welding Processes

San Diego shipyards, while participating actively in the aforementioned MARITECH ASE project, should also initiate research programs to evaluate various welding processes, welding rods, and process conditions with respect to fume generation potential, as well as heavy metal emission potential. Focusing on process changes will be necessary in order for the shipyards to comply with the anticipated new lower standards for hexavalent chromium. While it appears the MARITECH ASE project will look at some process changes in addition to engineering controls, more research and pilot programs are needed that evaluate potential process changes. These studies will stimulate the introduction and market development of less toxic processes. However, these studies must be not be used as an excuse to stall the implementation of newer, cleaner processes.

ii. Good Operating Practices

Efforts should be made to advance the understanding of fume minimization by altering the current, voltage, welding rod feed rate, type of welding process, shield gas pressure, and other parameters. The previously mentioned MARITECH ASE project should provide new information in this regard.

2) Surface Preparation P2 Objective: Minimize Use of Toxic Chemicals, Abrasives, and Thermal Energy in Surface Preparation

The primary pollutants generated from surface preparation is used blast media mixed with paint chips. As described earlier in the report, these materials create hazardous air pollution and impairs water quality and the marine ecosystem when discharged in San Diego Bay. Today, blasting media can be recovered and cleaned automatically. Air-powered cleaning equipment is often used to screen abrasive to separate it from large paint particles. These systems may also remove some of the dust that is generated. Off-site processing is also available for situations where on-site reclamation is not feasible or desirable. However, these systems are only controlling the pollution after it is generated, not preventing it. They reduce, but do not prevent, the impact. Thus, we do not qualify the cleaning equipment as pollution prevention.

The best pollution prevention alternatives for blasting operations are based on using technologies that do not need either toxic chemicals, abrasive media blasting, or thermal energy to clean parts and remove coatings.

Recommendations:

a) <u>Utilize Hydroblasting where possible</u>

As detailed earlier, hydroblasting utilizes a high pressure water jet to remove rust, scales, and paints. No toxic chemicals, abrasives, or thermal energy are used. This means that no particulate air emissions will result from blasting operations. However, hydroblasting can generate significant amounts of contaminated wastewater, and manual water blasting operations are known to have slower production rates than abrasive blasting.

One solution for wastewater concerns is to limit hydroblasting to contained areas such as dry docks and graving docks. The better, more comprehensive solution is to utilize an automated closed-loop hydroblasting unit, which captures all the process wastewater and separates the surface contaminants (such as paint chips).

The Puget Sound Naval Shipyard, among other shipyards in the U.S., is currently using closed-loop hydroblasting.[49] Puget Sound utilizes a robotically controlled magnetic crawler system for hydroblasting coatings from ship hulls. Puget Sound now performs all their exterior hull surface cleaning operations with this unit.

While surface preparation activities will, unfortunately, always result in some waste, closed-loop hydroblasting provides the best current solution to reducing pollution.

b) Use Sponge Material/Fiber Media Blasting

The Sponge-Jet and Fiber Media blasting systems are very similar. They both use reusable polyurethane sponge material, impregnated with abrasive grit such as steel or aluminum oxide which serves as the blasting medium.[50] Because of the open cell structure of the sponge material, the systems reportedly provide "micro-containment" of dust particles, thus containing more than 94 percent the particulate matter and leaving the surface cleaned. Because the sponge material can be reused six to eight times, this alternative can also reduce the use of abrasives, as well as reduce the generation and disposal of spent blasting media.

The Fiber Media system recently underwent a technology demonstration at the Portsmouth Naval Shipyard through the National Defense Center for Environmental Excellence (a non-profit organization specializing in transferring environmental tools and technologies into government and industrial facilities). The final report is not yet available, but evidence shows that the system was very effective in removing paints, corrosion such as rust, and other coatings. The cost-effectiveness of the rates were slightly higher than those resulting from sponge-jet blasting, but not as high as the closed-loop hydroblasting system (which was also tested at the Portsmouth Shipyard).

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[49] *NSRP State of the Art* at 58.

[50] National Shipbuilding Research Program, *Survey of Air and Water Quality Pollution Prevention and Control Technology Used in Shipyards and Similar Industries*, NSRP 0502, January 9, 1998, pp. 48-49.

While both the Sponge-jet and Fiber Media systems reduce particulate emissions and the generation and disposal of spent abrasives, the systems do add pollutants to the waste stream. Further, these systems do not currently have vacuum recovery systems to absorb the dust particles and spent abrasives. However, even without the vacuum recovery system, these processes are believed to generate less toxic dust than conventional dry abrasive blasting with heavy metals.[51] This system should be considered in those applications where closed-loop hydroblasting is not feasible or practical.

c) <u>Use of Dry Ice Blasting</u>

This is similar to abrasive blasting, except dry ice pellets (solid carbon dioxide) are substituted for other abrasives. Because dry ice immediately evaporates after use, only paint chips and removed rust have to be dealt with as wastes.[52] It has been reported that the Canadian Navy has used this blasting technique to remove coatings from the interior of submarines. The U. S. Navy has reportedly also used this technique for some stripping operations. In addition, the National Defense Center for Environmental Excellence, a non-profit research and demonstration facility with joint public/private funding, has completed a demonstration project for dry ice blasting and found the medium very effective at removing surface contaminants.

Major disadvantages appear to include storage and handling costs, lack of "bounce back" effect that aids in removing surface contaminants from the side and back of the object being blasted, and limited performance data. Another consideration is the energy costs for keeping the pellets frozen. More trials and research on this option should be pursued. This alternative, similar to the sponge jet/fiber media blasting alternatives, should be considered for those applications where closed-loop hydroblasting is not practical or feasible.

d) <u>Utilize Plastic Media Blasting where possible</u>

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[51] *Ibid.*

[52] *Ibid.*, page 32-33.

Because plastic media blasting is a completely dry process. As it uses no solvents, wastewater and VOC emissions are eliminated.[53] In most cases, the used plastic media are cleaned and reused. After repeated usage, the plastic media particles do degrade and have to be discarded. The plastic media blasting process uses low pressure air or rotating wheels to project the media. To be effective, the hardness of the plastic media should be greater than the hardness of the coating to be removed. There are two types of blasting systems that utilize plastic media: cabinet (enclosed) systems and open blast systems.

This process is especially effective at removing coatings from soft substrates, such as zinc, aluminum, and fiberglass. Because this process strips coatings layer by layer, it can be a lengthy process. Types and quantities of waste generation are similar to that of dry abrasive blasting, but the media can be reused. One potential disadvantage is that effectiveness is limited to softer coatings and substrates, but some ship parts use a soft substrate.

3) Painting and Coating P2 Objective One: Minimize Use of High-VOC and High-Toxic Paints

Painting and coating operations are often the largest source of volatile organic compound (VOC) releases from ship building and repair operations, and paint waste can comprise a significant amount of the hazardous waste generated at the shipyards. Paint is also a significant amount of the toxic material coming into the yards. Paint overspray and paint chips can easily enter the air and waterways. To reduce the wastes associated with painting and coating operations, changes can be made in the following areas: coatings, application equipment, and operator techniques and practices.

Changes in each of these areas -- coatings, application equipment, and operator techniques and practices -- can be made simultaneously. In fact, optimization of spray application equipment and operator techniques are dependent on the type of paint or coating being applied. Therefore, all these factors should be taken into consideration when making changes in this

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[53] *Ibid., page* 44-45.

process area. For example, one type of paint may yield the highest transfer efficiency when sprayed with airless guns, while another may attain its highest transfer efficiency when sprayed with electrostatic guns. And, some tasks may not lend themselves to the use of certain equipment, e.g., electrostatic, due to operational limitations.

As stated earlier in the report, paint selection is typically made by the vessel owners, leaving no choice for the shipyards. For vessels owned by the Navy, the Navy has military specifications that specify exactly what type of paint to use in what type of application. However, proper interaction and planning may help in getting approval for environmentally friendly paints from vessel owners, especially the Navy.

It is important to note that each type of paint offers certain advantages and disadvantages. If a certain type of paint has a limited life, though the initial pollution, in terms of VOCs emitted, can be minimal, it may actually result in more pollution over the lifetime of the vessel. If a paint has shorter service life, then a vessel with that paint will have to be blasted and repainted more frequently.

In a simplistic sense, there is a hierarchy for the best coating options based on reducing air, water, and/or waste production. They are as follows (from least polluting to most polluting):

1. powder coatings
2. water-borne coatings
3. solvent-borne coatings[54]

Recommendations:

a) <u>Use Powder Coatings</u>

Where possible, the shipyards should utilize powder coatings. Powder coatings contain no solvent and generate almost no VOC emissions. Unlike liquid coatings, they are supplied in dry powder form and each

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[54] *Pollution Prevention in the Paints and Coating Industry*, page 86.

powder particle contains the entire coating formulation, namely the resins, pigments, fillers, and modifiers.[55] The process entails applying the coating to the metal and then baking it in an oven. The most common application methods are: electrostatic spray, fluidized bed, and flame spraying.

Flame spraying is the most applicable method for shipyards. The resin powder is blown from the gun application through a high temperature flame, melting the powder before it reaches the substrate. This method is used widely for coating aluminum with epoxy powders.

Electrostatic application of powder is based on the same principle as electrostatic application of liquid coatings. (See the description of electrostatic spray later in this section.) Heat is applied to the substrate after it has been sprayed with powder, melting the powdered resin and coating the substrate. Overspray material can be readily reused, resulting in high material utilization and minimal waste.

Additional advantages of powder coating systems are:

- Thick coats can be applied in one pass, even over sharp edges;
- Little ventilation is needed in work areas or near curing ovens;
- Resins that are not soluble in organic solvents can also be used;
- Powder coatings come ready to use, requiring no mixing or thinning.[56]

Disadvantages includes less versatility. Powder coatings are often not suitable for parts with many inaccessible areas and deep recesses. Powder coatings are also not suitable for parts than need corrosion protection equivalent to high-performance liquid coatings. Finally, powder coatings are unsuitable for large parts that cannot enter a high temperature oven.[57]

However, because powder coatings are generally the least polluting of

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[55] *Ibid.*, page 86-89.

[56] *Ibid.*

[57] *Ibid.*

all coatings, they require serious consideration. In addition to reducing air, water, and/or waste pollution, powder coatings may also offer cost improvements and quality enhancements.

Several major U.S. shipyards have installed powder coating facilities, including the Norfolk Navy Shipyard and the Puget Sound Naval Shipyard.[58] These facilities perform either batch work on a few parts at one time or use automated equipment that can coat thousands of parts per week. Examples of parts that are routinely powder coated include pipe and electrical hangers, fixtures, small foundations for machinery, hatches, louvers, deck plates, gauge boards, furniture, and other miscellaneous structures.[59]

Shipyards have yet to use powder coatings for large parts of ships, but the potential exists to extend the powder coating process to more shipbuilding parts.[60] Technologies to help this process include infrared ovens, UV curing methods, and robotic application of powder. Maximizing the use of powder coating will both reduce coating costs and minimize environmental damage from coating operations.

b) Utilize Waterborne Coatings

If powder coatings are not feasible for a certain application, liquid coatings must be considered. The choice for liquid coatings is between waterborne and solvent-borne coatings.

Waterborne coatings is a term applied to coatings which use water as the principal solvent/diluent, although substantial quantities of organic solvents may also be present. Waterborne paints dry by evaporation of the water. The use of water has several advantages and disadvantages. The main advantages of waterborne coatings are:

- reduced levels of air pollution;

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[58] *NSRP State of the Art,* page 61.
[59] *Ibid.*
[60] *Ibid.*

- improved worker safety by reducing exposure to hazardous materials; and
- reduced hazardous waste generation.[61]

The main disadvantages of waterborne coatings are:

- lack of versatility in terms of the difficulty in matching many types of solvent-borne coatings;
- requires cleaner surfaces;
- wetting out problems;
- greater sensitivity to variations in humidity and temperature when applying; and
- limited use to areas of a vessel that are protected from extreme conditions.[62]

Continental-Maritime uses waterborne paints on exterior parts of ships, such as masts. In addition, the Navy is using a zero-VOC waterborne topcoat on military aircraft that must survive extreme marine conditions. Demonstration and tests have proven the paint sturdy and reliable. While a military specification for this paint has not yet been approved, Navy officials expect approval within two years.

c) <u>Utilize Solvent-free Coatings</u>

Solvent-free coatings consist of a low molecular weight resin system, which acts as the coating binder and carrier. Although there are no solvent emissions, VOC emissions can still occur during application of these coatings due to evaporation of low molecular weight resin species prior to curing/drying of the coating. Roller coating is currently the most widely used method of application, although spray application can be used.

d) <u>Employ use of Low-VOC and Low-Toxic Paint</u>

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[61] *Pollution Prevention*, pages 91 and 95-96.
[62] *Ibid.*

The Naval Warfare Center has developed a one coat priming system for industrial applications that is applied directly to metal without a primer. It replaces the traditional two coat primer and topcoat systems. Called UNICOAT, the system is a polyurethane that provides the adhesion and corrosion resistance of a primer and the chemical resistance, durability, and flexibility of the original topcoat.[63] It is lead-free, chromate-free, and a blend of non-toxic, organic and inorganic zinc compounds. The VOC concentrations are lower than traditional paints.

The main benefits are as follows:

- contains no toxic pigments (i.e, chromate, lead, etc.);
- reduces VOC emissions and hazardous waste generation by 50-70%; and
- paint and primer cost savings of approximately 65%. [64]

The UNICOAT may not be suitable for all coating applications, but should be given serious consideration. UNICOAT has been used successfully on both Navy and Air Force aircraft, and a federal specification has been developed for this technology[65].

The Navy's Joint Group of Acquisition Pollution Prevention (JG-APP) is also currently looking into non-chromate zinc primers. Currently, the zinc primers used by the shipyards contain chromate, which is a toxic air contaminant .

e) High Solids Coatings (Solvent-Borne)

If powder coatings and waterborne coatings are not feasible for a certain application, high solids coatings should be the next consideration. High solids coating is a term applied to a coating which

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[63] Department of Defense, *Joint Service Pollution Prevention Technical Library Data sheet: Section 4-6, UNICOAT Paint Technology.*

[64] *Ibid.*

[65] Department of Defense, *Joint Service Pollution Prevention Technical Library Data sheet: Section 4-6, UNICOAT Paint Technology.*

has a higher proportion of solid material than a traditionally formulated product for a particular application (typically 20% or more) and, hence, a correspondingly smaller amount of solvent. The following are benefits of using high solids coatings.

- Contain lower concentration of solvents than conventional coatings, thereby reducing environmental, odor, safety, and health problems
- Curing of high solids coatings requires less energy than conventional coatings
- High solids coatings produce films with greater thickness than conventional coatings, allowing increased line speeds and reduced number of coats
- Compatible with application equipment and techniques used in conventional coating systems
- Low capital investment required [66]

For example, the Navy is utilizing a new low-VOC high solids ballast tank coating system. The system will be applied with plural component spray equipment and have a much longer service life than current Navy ballast tank coating systems. Initial analysis suggests high cost savings by avoiding the cost (labor, materials, hazardous waste disposal, etc.) associated with the current 5-7 year cycle for ballast tank painting. This new system will enable the coating to last over 20 years[67]. Follow-up work will focus on identifying new, low-VOC coatings that can be used in fuel and waste storage tanks. In addition, Continental-Maritime is using high solid paints on uptakes and tanks, such as bilge, ballast, and fuel tanks.

f) Paint Heating Systems

The main purpose for adding a solvent to paint is to reduce the

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[66] *Pollution Prevention*, pages 89-105.

[67] *Coatings of the Future: New Ballast Tank Coasting System Offers Longer Service Life and less Pollution*, Naval Environmental News Currents, Winter 2000, http://navair.alc.daps.mil/communication/magazine/winter2000/ additional information can be obtained at www.jgpp.com.

viscosity. Viscosity occurs when the paint becomes sticky and does not flow smoothly on the surface. Paint heaters can replace, or be used along with, solvents to reduce paint viscosity.[68] Paint heaters reduce paint viscosity by heating the paint prior to application, using an in-line heating element just upstream of the spray gun. By reducing the use of solvents, paint heaters reduce VOC emissions from painting operations. By reducing viscosity, paint heaters reduces the number of re-paintings.

4) Painting and Coating P2 Objective Two: Reduce Paint Use and Paint Waste

When seeking methods to reduce waste from spraying operations, the type of application equipment used can result in significant differences. Each spray application method has its own production advantages and disadvantages, as well as a particular range of transfer efficiency. Descriptions of various application methods and other possible equipment changes are described below. Transfer efficiencies for various spray methods are listed in the following table. One spray application method may have the potential to regularly achieve higher transfer efficiencies than another method, but it is not accurate to assume this will always be the case in practice. The exact transfer efficiency achieved by a spray system is dependent upon the interaction of the following factors: coating being sprayed, application equipment, individual operator techniques and practices, and working conditions (e.g., windy or not windy).

Paint Spray System[69]	Transfer Efficiency Ranges
Conventional Air Atomized	25 - 50%
Airless	35 - 65%
HVLP	40 - 70%
Air-Assisted Airless	40 - 70%
Electrostatic	35 - 90%

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[68] *EPA Profile,* page 65.

[69] US EPA, *Control Technique Guidelines, New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants.*

In a typical shipyard spray painting operation, only 60 to 80% of the paint solids actually end up on the part being sprayed. This means that anywhere from 20 to 40 % of the paint does not adhere to the structures being painted and becomes over spray. This over spray can end up in the environment and/or be inhaled by workers. This over spray also represents a lot of wasted paint purchases that, if reduced, could result in significant cost savings. Therefore, it is always desirable to reduce over spray as much as possible.

The alternatives in this section can significantly reduce paint use through minimizing paint waste; most of them achieve this reduction through improved transfer efficiency. Moreover, most of these alternatives also have the potential to significantly reduce VOC emissions in cases where VOC-containing paints are in use. Improving transfer efficiency allows the operator to use less paint for the same task, resulting in reduced VOC emissions overall. For that matter, any technique or technology that results in reduced usage of VOC-containing paints will also reduce VOC emissions.

Recommendations:

a) Utilize Electrostatic Systems

In electrostatic systems, the fluid is first atomized, using conventional, airless, or air-assisted airless methods.[70] Next, the atomized particles pass through a cloud of electrons (negative charges). Each negatively charged particle seeks the closest grounded object (positively charged). If the object to be coated is sufficiently grounded, particles that normally would have blown by it will now be drawn back to it. This phenomenon is commonly known as the "wrap effect". The main advantage of electrostatic spraying is the material savings. In good conditions, transfer efficiencies can go as high as 95%.[71]

Routine system maintenance is critical for achieving and maintaining high transfer efficiency. Conveyors, hangers, and other supports must be kept clean to assure conductivity to ground. Finally, paint coverage in corners and recesses may be poor due to the fact that paint particles

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[70] *Pollution Prevention,* page 81.
[71] *EPA Profile,* page 66.

being attracted to the closest grounded object, preventing the paint from reaching deeply recessed areas. Where this occurs, manual touch up is needed.

b) High-Volume Low-Pressure (HVLP) Systems

HVLP systems use high volumes of air that are supplied at low pressure.[72] HVLP systems are generally classified into two categories, depending on whether the air is supplied by an air compressor or a turbine. Both systems are characterized by an air nozzle with a large-diameter opening for atomizing air. The low atomizing air pressure of HVLP systems minimizes the amount of bounce-back paint fog and reduces the amount of paint that becomes overspray. Improved transfer efficiency helps reduce operating costs by reducing paint waste. However, high quality finishes are difficult to produce, since reduced atomizing air pressures decreases the fineness of atomization which reduces the finish smoothness. Fortunately, high quality finishes are not typically necessary for shipyard parts. Also, paint flow to the gun can be reduced which limits production speeds.

While we know that the San Diego shipyards employ a limited use of HVLP, the next evaluation must determine if increased uses of HVLP are suitable.

c) Air-Assisted Airless Spray Systems

Air-assisted airless spray systems combine conventional air and airless spray technologies.[73] Fluid material is first partially atomized hydrostatically, using a special nozzle tip similar to an airless tip. Then, the atomization is completed with small amounts of compressed air emitted from the face of the nozzle. The result is a finely atomized spray similar to one produced by a conventional gun. Air-assisted airless provides about 30% better transfer efficiency than conventional sprayers, while still providing high quality finishes. Some operators feel air-assisted airless is slow compared to airless systems, and the

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[72] *Pollution Prevention*, page 79-80.
[73] *Ibid.*, page 80.

finish produced is not as good as application by conventional methods. There are more controls to learn on this system, and poorly trained operators tend to use excessive fluid and air pressures.

d) Plural Component Systems

As described earlier, plural component systems eliminate the potential paint waste generated when mixing two paint-part coatings. Each coating component is pumped through a device that controls the mixing ratio and combines the two in a mixing chamber just prior to reaching the spray gun. The only cleaning that is required is the mixing chamber, spray gun, and length of supply hose connecting them.

While NASSCO uses this system now, NASSCO may be able to utilize it more often and in different applications. The other shipyards should consider implementing this technique as a way to reduce paint use.

5) Painting and Coating P2 Objective Three: Minimize Use of Toxic Antifouling-Hull Coatings

Copper acts as a pesticide in antifouling coatings used on ship and Navy vessel hulls to prevent marine growth. It also affects species in the water column and sediments, so hull coatings are needed that do not impact non-target species. In San Diego Bay, total dissolved copper levels exceed state water quality criteria[74]. Navy researchers estimate copper leachate from Navy hulls contributes 22% (7200 kg/yr) of the total copper load to San Diego Bay [75]. This level may increase with the addition of two NIMITZ-class nuclear aircraft carriers at Naval Air Station North Island. The magnitude of the impact to marine species from excess copper in the Bay is not completely defined, but at chronically elevated copper levels, marine species susceptible to copper pollution are replaced by copper-tolerant communities. Further, elevated levels of copper is considered a primary source for the acute toxicity exhibited by storm water leaving the shipyards' facilities.

Recommendations:

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[74] Regional Water Quality Control Board, 303(d) list for San Diego Bay.
[75] Johnson et al. 1998

a) Facilitate the development, testing, and early use of Silicone-Based and Other Non-Toxic Antifouling Coatings

Unlike conventional copper- or tin-based antifouling coatings, silicone coatings do not kill organisms with chemicals. Instead, organisms cannot strongly adhere to the physical coating surface. At certain vessel speeds, the force of water removes the organisms. Advantages over copper coatings include:

- Growth that does attach is easily removed at a fraction of the effort required to clean hulls with copper-based coatings;
- Silicones also reduce drag by creating a very slick surface profile, which in turn may increase vessel speed and fuel efficiency;
- Significant cost savings can be realized because no coating-related material needs to be disposed of as hazardous waste; and
- No pesticides are leached into surface waters.

Non-toxic silicone-based coatings have been used on smaller Navy and Coast Guard vessels, largely in demonstration projects, that do not require NAVSEA approval. The following vessels have the Intersleek biocide-free elastomeric foul release coating system: USS Scott (guided missile cruiser), various vessels such as MCM's (Minesweeper), PHM's (Hydrofoil), and Coast Guard Patrol Boats[76]. Currently, no non-toxic coatings meet NAVSEA specifications.

In order for non-toxic coatings to meet new military specification criteria, they must undergo 5-7 years of trials, including two years of patch tests and at least one year of full ship tests on Navy vessels. These tests present opportunities for shipyards to become familiar with handling, application, maintenance and removal techniques for the coatings.

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[76] Personal communication with Richard Xavier, International Paint, Inc. by email, October 11, 2000

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Winston H. Hickox
Secretary for Environmental Protection

Gray Davis
Governor

List of Attendees
November 7, 2001 Meeting
Cal/EPA Headquarters Building
Conference 1630

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2. Alan Monji
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3. Deborah Jayne
   California Regional Water Quality Control Board – San Diego Region

4. David Barker
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5. Brennan Ott
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6. Michael Martin
   Department of Fish and Game

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8. Michael Anderson
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AUGUST 21, 2001 LETTER

1. Testing for Bioaccumulation

Comment from San Diego Bay Council:
I am unaware of a rationale for eliminating bioaccumulation testing at most of the sampling stations. While all 30 stations include the triad of toxicity tests, only 9 stations will test for bioaccumulation. Only one bioaccumulation testing station at the NASSCO site is a high chemical concentration site. This would appear to present major problems for determining the extent of areas (within this 46 acre site) where bioaccumulation is occurring, and major problems for producing statistically-valid data sets. It is unclear why the Plan includes this testing at so few shipyard sites, while including this testing at all five reference stations.

Recommendation from San Diego Bay Council:
Test for bioaccumulation at each of the 30 stations, and any known hotspots of PCBs, Mercury and other bioaccumulating chemicals that are not covered by these stations.

Regional Board Response:
We do not agree with San Diego Bay Council's recommendation that Phase 1 bioaccumulation sampling is needed at all 30 triad stations. Bioaccumulation testing at all 30 triad stations during Phase 1 is not necessary because Phase 1 is considered an initial screening evaluation to determine if bioaccumulative chemicals exist at concentrations that may pose a risk to human health and wildlife. If it is evident that there is a bioaccumulation potential based on the Phase 1 screening results, a more intensive bioaccumulation study will be conducted to define the areal extent of bioaccumulative contaminants within the NASSCO and Southwest Marine leaseholds (i.e., Phase 2). Phase 2 is a baseline risk assessment that consists of the direct measurement and evaluation of tissue concentrations in resident biota (fish and/or shellfish). In Phase 2, a broad scan of bioaccumulative contaminants may be measured in resident biota tissues rather than just those contaminants that exceed the screening criteria established in Phase 1 (RWQCB 2001b). The target contaminants, as recommended by the EPA Fish Contaminant Workgroup (USEPA 2000b), consist of metals, organochlorine pesticides, organophosphate pesticides, chlorophenoxy herbicides, PAHs, PCBs, and dioxins/furans. Additionally, because of the potential of polychlorinated terphenyls (PCTs), a chemical contaminant associated with shipbuilding and repair activities, to accumulate in aquatic tissues PCTs will also be measured in the Phase 2 bioaccumulation study (RWQCB 2001c).

A "small-scale" study that requires the sampling of onsite fauna (similar to the Phase 2 bioaccumulation study but less intensive) will also be conducted at NASSCO and Southwest Marine if one of the following are concluded (RWQCB 2001c):

- There is some uncertainty in the Phase 1 bioaccumulation results (e.g., conflicting results). Sampling the onsite fauna will be conducted for clarification purposes.

- The Phase 1 bioaccumulation results indicate that all of the bioaccumulation stations at both shipyard sites do not pose a risk to aquatic-dependent wildlife. Sampling the onsite fauna will be conducted for verification purposes.

NASSCO and Southwest Marine shipyards are being treated as a single site for the purposes of sampling, data analysis, and development of cleanup levels based on similarities relating to sources, transport, exposure, and effects (Exponent 2001a). If the Phase 1 screening evaluation indicates that there is bioaccumulation potential from just one shipyard site, a Phase 2 bioaccumulation study will be conducted at both shipyard sites. The nine *Macoma* tissue-sampling stations have been strategically placed in areas where bioaccumulative chemicals exist to adequately ascertain the potential for contaminant uptake of these chemicals. Sediment quality data from previous investigations were used to position the stations along a chemical gradient to determine the threshold at which bioavailable contaminants become potentially harmful to human health and wildlife. A sufficient number of bioaccumulation stations are positioned in high concentration areas. Stations are also positioned in low and medium concentration areas because it is also important to assess the potential for contaminant uptake at these lower concentration levels.

At the October 12, 2001 meeting held at the Regional Board office, staff reported that each bioaccumulation station will be assessed using a weight-of-evidence approach (RWQCB 2001b); similar to the weight-of-evidence approach used by EPA for the St. Louis River Area of Concern (USEPA 2000a). Staff noted that there are situations, based on EPA's approach, where it is "possible" that aquatic-dependent wildlife beneficial uses may be impaired even if the Phase 1 bioaccumulation results suggest that harmful levels of bioaccumulative contaminants are not present in *Macoma* tissue. Consequently, Regional Board staff indicated at the meeting that a Phase 2 bioaccumulation study could be triggered regardless of the outcome of the Phase 1 bioaccumulation results. Based on recent discussions with one of the co-authors of the EPA document for the St. Louis River Area of Concern, Regional Board staff was interpreting the "possible" scenario incorrectly (MacDonald 2001). The "possible" scenario is not related to bioaccumulation, rather, it is related to benthic community degradation attributed to either chemical contamination or physical disturbance. Because the benthic community is degraded it is suspected that benthos-eating birds and/or fish can "possibly" be affected if organisms are not abundantly available for consumption. Therefore, for clarification purposes a comprehensive Phase 2 bioaccumulation study will only be triggered whenever the Phase 1 bioaccumulation data suggests that harmful levels of bioaccumulative contaminants are present in Macoma tissue.

2. Sampling for Dilution Series, Pore Water, and Fish Tissue

Comment from San Diego Bay Council:
I am unaware of how the Plan's proposed one sampling site per shipyard for the Dilution Series test will provide data for all of the chemicals of concern. Yet the Plan's methodology requires

that the background cleanup values will be compared to toxicity benchmark values obtained from the Dilution Series test. The Pore Water Testing will occur at four stations per shipyard site or a total of eight. It is unclear to me whether 8 total samples will provide an accurate representation of pore water concentrations over the 63 total acres. Yet this testing is being used to balance the uncertainties and limitations of any one assessment method, such as the AET. If the bioaccumulation tests reveal that bioaccumulation is occurring above threshold values, then fishes will be collected at one station at each shipyard site. It is unclear to me how these collections will be representative of fishes that inhabit and traverse the 63 acres of water area at these sites.

Recommendation from San Diego Bay Council:
Require an adequate number of sampling stations for each of these important tests. In addition, require that pore water be collected from depths greater than 0-2 centimeters (less than one inch).

Regional Board Response:
This comment has four concerns: (a) Sediment serial dilution toxicity testing at the two proposed sampling stations will not include all the chemicals of concern, (b) Pore water chemistry testing at the eight proposed sampling stations will not provide an accurate representation of pore water concentrations at the two sites, (c) Collection of pore water samples from depths greater than 2-cm, and (d) Collection of fish at two sampling stations will not be representative of fish throughout the two sites.

(a) Sediment serial dilution toxicity testing at two stations. The dilution series test is an ancillary validation procedure to supplement the proposed suite of tests used in developing the Apparent Effects Threshold (AET) and Equilibrium Partitioning (EqP) numbers. Its sole purpose is to provide a quality assurance check to validate some of the AET and EqP numbers developed once the contaminants of concern (COC) are identified. The sediment serial dilution toxicity test is not used by itself as a basis for establishing cleanup levels. The test can provide evidence to substantiate that proposed sediment cleanup levels determined through the AET and EQP approaches are below levels where toxicity can no longer be measured in laboratory evaluations. The sediment serial dilution testing will provide useful data for comparisons with reference sediment toxicity tests as "benchmarks," as well as comparisons with other toxicity endpoints measured in co-located samples.

It is not realistic to expect that all COCs will be found at the two serial dilution sampling stations (Stations SW04 and NA17). Because of the different exposure pathways and toxicity characteristics of the COCs on the test animals, only historical data for copper and zinc were considered in determining where the stations should be placed. These two metals tend to be more acutely toxic to marine organisms and should show a better dose-response relationship in a short-term test. Contaminants like PCBs and PAHs may not show obvious toxic effects in a 10-day amphipod test, but will more likely show sublethal effects or bioaccumulation potential in longer duration tests like the 28-day *Macoma* test. The presence or absence of the COCs cannot be confirmed until Phase 1 of this study is complete and the COCs can be compared with the dilution series sediment chemistry. If conflicting information is presented between the AET, EqP, and the dilution series tests, additional validation data such as dilution series tests, sediment chemistry, and/or other toxicity tests can be requested in Phase 2.

Station location for the dilution series test was based solely on historical sediment chemistry data from both shipyards and best professional judgement. No concurrent toxicity or benthic community data was available for the site selection. The selected stations for the dilution series tests are located near piers within the shipyard's leaseholds and close to shore. These locations are expected to show relatively high chemical concentrations of metals, mainly copper and zinc, that are known to exhibit toxicity to amphipods. It was mentioned at the October 12, 2001 meeting that, in retrospect, it might have been more appropriate to conduct the dilution series tests in Phase 2 because the Phase 1 chemistry and toxicity data would be available for a more accurate site selection (RWQCB 2001b). However, historical data indicates that the location of the two dilution series stations (SW04 and NA17) will provide a good initial verification of the AET and EqP numbers for the site. Accordingly, it is appropriate to proceed with analysis of the dilution series test data collected at Stations SW04 and NA17. The preliminary Phase 1 chemistry data submitted by Exponent to the Regional Board indicates that the estimated copper and zinc sediment concentrations are above published Effects Range Median (ERM) sediment values at both the selected dilution series stations (SW04 and NA17) (Exponent 2001c). SW04 is also above the published marine sediment amphipod 1994 AET concentrations for both copper and zinc (WDOE 1996).

(b) Pore water chemistry testing at eight stations. The Regional Board considers the eight proposed sampling stations for pore water described in the shipyard workplan as a preliminary estimate of the number of pore water sampling stations. The final number and positions of pore water stations will be determined by the Regional Board based on the results of the Phase 1 sampling. As a point of clarification, pore water sampling for chemical analysis in Phase 2 of the investigation is not intended to define the extent of contamination in the pore water within the shipyard leaseholds. Rather, the objective of collecting pore water samples is to derive sediment cleanup levels based on the EqP approach (RWQCB 2001a). In the EqP approach, water quality criteria developed for the protection of marine organisms (i.e., the California Toxics Rule (CTR)) are used as the basis for developing sediment quality criteria. As such, the water quality criteria formulated for the protection of water column species are assumed to be applicable to benthic organisms. The calculation procedure for establishing sediment quality criteria using the EqP approach consists of multiplying the partition coefficient, Kp, with the water quality criteria for the chemical of interest. Collecting synoptic pore water chemistry and sediment chemistry data at an appropriate number of sites in Phase 2 of the investigation will provide a basis to develop a wide range of site-specific Kp values.

(c) Collection of pore water samples at depths greater than 2-cm. We do not agree with San Diego Bay Council's recommendation that pore water samples (for both toxicity and chemical analyses) be collected at depths greater than 2-cm. The sediment depth to be sampled for pore water should match the depth of interest for each particular survey (SETAC 2001). The depth of interest for the shipyard investigation consists of the top 2-cm of the surface sediment. The top 2-cm is located within the "biologically active zone," which provides an assessment of areas that are impacting beneficial uses. Benthic organisms live in the biologically active zone and are potentially exposed to the contaminated sediments throughout most or all of their life cycles and thus they have the greatest risk of being affected. Because benthic organisms represent important components of the food web, the effects of contaminated sediments can be transferred to higher trophic levels (e.g., benthic organisms to fish, fish to wildlife or humans).

Furthermore, it's important to sample the top 2-cm for pore water to be consistent with several regional monitoring programs. The regional monitoring programs include the Southern California Bight 1994 Pilot Project (Bight '94), Southern California Bight 1998 Regional Monitoring Program (Bight '98), and the Bay Protection and Toxic Cleanup Program (BPTCP). All of these programs sampled pore water in the top 2-cm because it reflects the biologically active zone, is generally above the anoxic zone, reflects recent deposition, and was easily sampled.

(d) Collection of fish at two stations. We do not agree with San Diego Bay Council's comment that fish will be collected at just two sampling locations at NASSCO and Southwest Marine. If the Phase 2 bioaccumulation study is triggered, the Regional Board will require that fish be collected at an appropriate number of stations to provide an accurate representation of fish tissue concentrations within the shipyard leaseholds. Target species will include those listed in the EPA document titled "Guidance for Assessing Chemical Contaminant Data For Use in Fish Advisories" (USEPA 2000b) and those that are recommended by Fish & Game, Fish & Wildlife, and OEHHA.

3. Core Sampling

Comment from San Diego Bay Council:
It is unclear to me why core sampling is not being conducted in Phase 1 based on the historical data used to determine sampling locations for the other tests. It appears that the locations for core sampling will be selected based on Phase 1 sampling of the top 2-cm of sediment. I am unaware of how one could confidently predict deep contamination based on contamination that appears in less than one inch of surface sediment.

Recommendation from San Diego Bay Council:
Core sampling, essential to determine the depth of contamination and therefore depth of necessary cleanup, should be performed at each of the 30 sampling stations. Just as these 30 stations will be used to determine the horizontal extent of contamination, core samples at these same stations should be used to determine the vertical extent of contamination.

Regional Board Response:
We do not agree with San Diego Bay Council's recommendation that core sampling is necessary at all 30 triad stations. The objectives of collecting the sediment cores are to: (1) determine the vertical extent of contamination in areas where there are impacts to aquatic life, aquatic-dependent wildlife, and human health beneficial uses, and (2) identify the depth at which cleanup will occur from these areas. The Regional Board has determined that the highest priority for evaluating exposure pathways to humans and the environment is the surficial sediments, thus, we have recommended focused analyses and evaluation to develop potential remedial action(s). Further evaluation of core and potential exposure of sub-surficial sediments will be conducted following the initial evaluation.

Sediment cores will be focused in areas where the surface sediments are impacting beneficial uses; similar to the approach outlined in the State of Washington's sediment cleanup process (WDOE 1995). The impacted areas will be identified by assessing the "biologically active zone." This zone is defined as the upper layer of sediment that is subject to significant penetration and reworking by benthic organisms. Because benthic organisms live in this zone and are potentially exposed to the contaminated sediments throughout most or all of their life cycles, they have the greatest risk of being affected. Thus, benthic organisms occupy an important position on the food chain that may eventually lead up to higher trophic receptors such as fish, wildlife, and humans. Sampling of the top 2-cm was selected for the Phase 1 shipyard investigation to evaluate the effects on these benthic organisms and to also maintain consistency with several regional monitoring programs. The regional monitoring programs include Bight '94, Bight '98, and the BPTCP.

The USEPA has also reported that contaminated sediments separated from the overlying water by a surface layer of relatively clean sediments may not represent an ongoing risk to humans, aquatic organisms, or wildlife (USEPA 1994). Thus, it may not be necessary to require core sampling or require remedial action in areas where the "surface" sediments are not impacting beneficial uses. In fact, according to the USEPA, the best remedial alternative may be no action; allowing additional deposition and accumulation of cleaner sediments to further isolate the contaminated sediments. If surface sediments in a depositional environment are sufficiently contaminated to require evaluation of remedial alternatives, it will then be necessary to sample the subsurface sediments. This sampling will provide information that will be used to define the vertical extent of sediments that may need to be dredged, to investigate remedial alternatives for those sediments, and to characterize the sediment that will be left in place and expose once the overlying contaminated sediments are removed (USEPA 1994).

Dredging will likely be selected as the cleanup alternative to remediate contaminated sediments from areas that are impacting beneficial uses. Because dredging will expose a new surface to the aquatic environment, the vertical extent of contamination from these impacted areas will need to be defined to determine the depth at which beneficial uses are impaired and the depth at which sediment quality is protective of beneficial uses. Following the removal of contaminated sediments at these depths, a post sampling program will be implemented by NASSCO and Southwest Marine to ensure that the new surface does not exceed sediment cleanup levels.

4. AET Method of Determining Cleanup Level

Comment from San Diego Bay Council:
AET levels do not meet the Regional Board's basic mandate of protecting the Bay's most sensitive beneficial uses. If a calculation of AET values is to be derived as a tool for helping to select an appropriate clean-up level (which I do not believe is necessary), the Work Plan must at a minimum follow accepted practices for calculating AET values. To my knowledge the State of Washington is the authority on this assessment method, and I believe the State recommends that this approach be used for very large scale assessments where there are sufficient resources to sample hundreds of sites. Apparently the results of this method can be driven by individual, high values; therefore large data sets are necessary to achieve accurate (protective) results. It appears from a cursory examination of Board documents, that problems inherent in using too few sites have been illustrated at another site in San Diego Bay, where AET methodology produced 'acceptable' levels of mercury that are 10 times higher than those generally found safe. While the Board and its staff is to be commended for increasing the number of sites to 30 in this assessment, 50 is a more generally accepted minimum - and even at 50, I understand that extensive data refinement is required. The Plan indicates "An AET for benthic community effects may be calculated on a reduced subset of triad stations if physical disturbance is evident at some stations." This means that AET values for benthic community effects - in my view one of the Board's most important and reliable indicators of the health/toxicity of the shipyard sites - may be calculated on even less than 30 sites. Moreover, it is unlikely that all of the data will prove useable, causing even greater concern about the AET values that will be generated.

Recommendation from San Diego Bay Council:
Use an alternative approach, one that will be scientifically defensible with 30 sampling stations. An alternative approach may also solve the apparently pervasive question of whether AET values are sufficiently protective.

Regional Board Response:
This comment has three concerns: (a) AET approach will not protect the bay's most sensitive beneficial uses, (b) A minimum of 50 stations is required to calculate AET values, and (c) AET values for benthic community effects may be calculated on even less than 30 sites if physical disturbance is evident.

(a) AET approach will not protect the bay's most sensitive beneficial uses. We agree with San Diego Bay Council that the AET approach will not protect all of the bay's most sensitive beneficial uses, however, the AET approach may provide protection to one of three sensitive beneficial uses. Of the 12 beneficial uses identified for San Diego Bay, the Regional Board is making the assumption that the following represent the most sensitive beneficial uses needing protection from contaminated sediment at NASSCO and Southwest Marine (RWQCB 2001a):

- Benthic community (covered under the marine habit [MAR] beneficial)
- Aquatic-dependent wildlife consumption of fish and other aquatic organisms
- Human consumption of fish and shellfish (covered under the Commercial and Sport Fishing and Shellfish Harvesting beneficial use)

The AET approach is intended to derive sediment cleanup levels that protect the benthic community. The other two sensitive beneficial uses (aquatic-dependent wildlife and human health) will be protected by developing cleanup levels for bioaccumulative chemicals using a tiered methodolgy (RWQCB 2001a).

In order to provide confidence that the benthic community is protected by AET cleanup levels, the "lowest" AET values (LAET) for each indicator pollutant will be used. By definition, the LAET cleanup level is expected to be protective of a wide range of adverse biological effects. Furthermore, a safety factor will be applied to the LAET values to account for any uncertainties and limitations provided by the AET approach.

It should also be noted that the USEPA has evaluated the AET approach extensively. In 1989, the USEPA Sediment Criteria Subcommitte recognized the AET approach as a technically defensible tool for managing contaminated sediments (USEPA 1989). The method was considered by the Subcommittee to contain sufficient scientific merit that, with appropriate validation could be used to estimate sediment quality at specific sites. The AET is included in the USEPA's Sediment Classification Compendium (USEPA 1992) as one of several state of the art scientific methods that can be used to assess whether, and to what extent, sediments are "contaminated" or have the potential for posing a threat to the environment. In that publication EPA notes that the AET method can be used as follows in managing contaminated sediments:

- Provide a preponderance of evidence for narrowing a list of problem chemical measured at a site;
- Provide a predictive tool for cases in which site-specific biological testing results are not available;
- Enable designation of problem areas within the site by determining the spatial extent and relative priority of areas of contaminated sediment;
- Provide a consistent basis on which to evaluate sediment contamination and to separate acceptable from unacceptable conditions;
- Provide an environmental basis for triggering sediment remedial action; and
- Provide a reference point for establishing a cleanup goal.

This is not to say, however, that the Regional Board advocates setting cleanup levels to protect the benthic community based solely on the results of the AET approach. As recommended by the USEPA Subcommittee, multiple approaches should be used to estimate sediment quality, determine criteria, and guide regulatory actions since the AET approach alone provides insufficient certainty for broad-scale decision making (USEPA 1989). As such, other methodologies such as the Equilibrium Partitioning approach will also be used to develop sediment cleanup levels for NASSCO and Southwest Marine. The use of various methodologies provides multiple lines of evidence and allows for the integration of empircal data and theoretical information. The combination of these methodologies balances the uncertainties and limitations of any one method by incorporating the strengths of the other methods. Strong agreement in the results of each method will provide an independent validation of each method and a sound scientific basis to support the decision-making process and final selected cleanup levels. Disagreement in the results of the methods will increase scientific uncertainty and indicate a need for caution in interpreting the data during the cleanup level decision-making process.

(b) A minimum of 50 stations is required to calculate AET values. We disagree with San Diego Bay Council that a minumum of 50 sampling stations is necessary to calculate AET values for NASSCO and Southwest Marine. A minimum of 50 stations with matched chemical and biological-effects data is preferred for establising "watershed-wide" or "region-wide" cleanup levels when using the AET approach (Gries 2000, pers. comm.). The NASSCO and Southwest Marine investigation is considered a site-specific study and it's appropriate and scientifically defensible to base AET cleanup levels on the data from 30 stations. A biased sampling plan (i.e., not randomly positioning stations) should always be used when developing AET values, especially when using a small data set. The 30 sampling stations at NASSCO and Southwest Marine were strategically placed throughout each leasehold to ensure that a wide range of contaminant concentrations is represented rather than a completely random sampling of the sediment. Furthermore, Exponent has reported that historical data was used to "place triad stations so they closely and broadly bracket the expected toxicity thresholds" and that "AETs derived from this study are therefore expected to have a very high predictive reliability" (Exponent 2001b). For confirmational purposes, the Regional Board will require NASSCO and Southwest Marine to provide supporting evidence using the Phase 1 sampling data that the 30 triad stations are appropriate for calculating AET values (i.e., representative of a wide range of concentrations and biological effects).

(c) AET values for benthic community effects may be calculated on even less than 30 sites if physical disturbance is evident. The Regional Board is aware that benthic community AET values may be calculated using less than 30 stations if physical disturbance is identified at any one station, however, a reduced subset of stations is not as important as data sets that have large concentration gaps between stations. AET values generated using data sets that have these gaps will increase the risks of being under-protective (not restrictive enough) or over-protective (too restrictive) of beneficial uses. If these significantly large data gaps are present in the current data sets and reliable AET values cannot be derived based on the existing information, then the Regional Board has the discretion to require NASSCO and Southwest Marine to collect the necessary information to fill the data gaps. Efforts have been made, however, by Exponent to avoid positioning stations in physically disturbed areas and to prevent significant concentration gaps. Prior to conducting the field investigation at the 30 stations a Sediment Profiling Imaging (SPI) camera was deployed to determine the extent of physical disturbances (Exponent 2001a). The photographic images of the surface sediment from the SPI camera were used to refine the positions of the 30 sampling stations. Additionally, in order to prevent large concentration gaps in the data set Exponent utilized the results from previous sediment investigations to position the 30 stations so they closely and broadly bracket the expected toxicity thresholds (Exponent 2001b).

5. Benthic Fauna

Comment from San Diego Bay Council:
These tests are among the most important and reliable indicators of toxicity/health of the site. If physical disturbance is found at a sampling site, the Plan appears to allow the benthic fauna data from that site to be removed from the analyses. If the data indicates a toxic effect, the effect is assumed to be from physical disturbance.

Recommendation from San Diego Bay Council:
Require the consideration of all benthic fauna data. Require replicate samples for this specific test at each sampling station.

Regional Board Response:
We disagree with San Diego Bay Council that all benthic fauna data be considered in determining cleanup levels even though the weight of evidence for a particular station may indicate that benthic community degradation was due to physical disturbances. The purpose of this workplan is to determine whether pollutants in the sediment at NASSCO and Southwest Marine are causing adverse effects to the beneficial uses of San Diego Bay. Potential causes of benthic community degradation include sediment contamination, pore water contamination, sediment-water interface contamination, and/or physical disturbances caused by normal activities like ship movement and vessel propeller wash. Benthic community degradation data caused by physical disturbances or other reasons not related to pollutants in the sediment should not be included in the data set used for determining cleanup levels.

Both NASSCO and Southwest Marine are active shipyards and the possibility that benthic community degradation at the site could be caused by physical disturbances cannot be discounted. However, physical disturbance will not be designated as the source of degradation until toxicity tests, which includes whole sediment and porewater toxicity testing, and sediment chemistry are determined to not be the significant causative factors of the degradation. Signs of physical disturbance will be determined by examining images of the vertical stratification provided by the sediment profile imaging. If there are no signs of physical disturbance other than degraded benthic communities, then the cause of degradation could be sediment contamination or natural succession of a benthic community.

The benthic community data will be assessed according to Figure 4-3 in Exponent's work plan and used in the overall site assessment decision matrix provided in Table 4-1 (Exponent 2001a). Figure 4-3 outlines the procedure for assessing benthic community data. Key decision points in Figure 4-3 are: assessing data quality objectives, comparisons to the Bight 98 index, and the influence of noncontamination factors, which includes physical factors like propeller wash. Once a sample has been analyzed for the various criteria, it will be ranked as impacted (+) or not impacted (-). The benthic community score will be used as part of the sediment quality decision matrix (Table 4-1) which also includes toxicity data and sediment chemistry as the three lines of evidence. This triad or weight of evidence approach will be used to determine whether it is highly unlikely, unlikely, possible, likely, or very likely that beneficial uses are impacted at each station (Exponent 2001a).

We also disagree with San Diego Bay Council statement that if a "toxic effect" is observed in the benthic communities, it will be attributed to physical disturbances. See staff response above in this section.

Collection of replicate samples for benthic community analysis is already part of the NASSCO and Southwest Marine workplan and should be helpful in accurately assessing the health of the benthic community at each station.

6. **On-site Fauna**

Comment from San Diego Bay Council:
An important focus of the study should be the tangible effects on the fauna that inhabit the site. Direct examination of clams, mussels, fishes and other fauna for tumors and other signs of contamination (including tissue analysis) is a particularly relevant indicator of toxicity/health of the site. Such analysis is not currently required by the Work Plan.

Recommendation from San Diego Bay Council:
Require the collection and analysis of the fauna that actually inhabit the site, in addition to the testing performed in the laboratory using laboratory animals. Fauna should include both mobile and immobile species.

Regional Board Response:
The Regional Board will require a “small-scale” study that consists of sampling the onsite fauna (similar to the Phase 2 bioaccumulation study but less intensive) if one of the following are concluded (RWQCB 2001c):

- There is some uncertainty in the Phase 1 bioaccumulation tissue chemistry results (e.g., conflicting results). Sampling the onsite fauna will be conducted for clarification purposes. The collection of resident biota in Phase 2 will help in assessing the validity of the 28-day

Macoma bioaccumulation testing from Phase 1. Direct comparisons between the laboratory focused data (28-day bioaccumulation) and the field collected data (resident biota) can be made for data confirmation.

- The Phase 1 bioaccumulation results indicate that all of the bioaccumulation stations at both shipyard sites do not pose a risk to aquatic-dependent wildlife. Sampling the onsite fauna will be conducted to verify this finding.

Furthermore, if it is evident that there is a bioaccumulation potential based on the Phase 1 screening results a more intensive bioaccumulation study will be conducted to define the areal extent of bioaccumulative contaminants within the NASSCO and Southwest Marine leaseholds (i.e., Phase 2). Phase 2 consists of the direct measurement of tissue concentrations in resident biota (fish and/or shellfish) and may also include the examination of fish for biological effects (e.g., biochemical, physiological, and histopathological measurements).

7. Most Sensitive Beneficial Uses

Comment from San Diego Bay Council:
The Plan does not appear to require consideration of some of the most sensitive beneficial uses: The Bay is a nursery ground for many species; larval populations are well documented. Early life stage toxicity in fishes - which are very sensitive to waterborne exposure to metals, for example - has significant implications for the health of a fish population. Ethnic populations who fish in the Bay are more sensitive both because they consume a greater proportion of fish in their diets, and because a significant percentage of ethnic populations consume the entire fish.

Recommendation from San Diego Bay Council:
Require consideration of toxic impacts on larval forms of marine life, and the consideration of health impacts on ethnic fishers.

Regional Board Response:
This issue was discussed in detail at the October 12, 2001 meeting (RWQCB 2001b). Consensus was reached by those attending the meeting that the toxicity test species and methods selected for bioassay testing described in the shipyards' workplan are appropriate. The echinoderm (or sea urchin) fertilization test and the sediment-water interface bivalve (or blue mussel) bivalve larval development test are considered short-term chronic bioassays that examine the critical and most sensitive life stage (fertilization and embryo development, respectively) of the marine organism. These critical life stage tests will be much more sensitive toxicity tests than tests using 7-10 day old larval fish like the topsmelt (*Atherinops affinis*). Therefore, adverse effects to aquatic life beneficial uses are much more likely to be detected by the recommended toxicity test species described in the shipyard workplan.

In the event that a Phase 2 human health risk assessment is conducted, Exponent will address ethnic populations in human health risk assessment and this should include looking at whole fish rather than fillets. Site-specific consumption habits and exposure, will also be considered in ethnic populations. Human health risk assessment will be compared to the San Diego Bay Health Risk Study conducted in 1990 by the San Diego County Department of Health (SDCDH, 1990).

8. Reference Sites

Comment from San Diego Bay Council:
The Work Plan allows the pooling of reference site data. Moreover it allows the use of "other available and relevant" data sets to "more precisely characterize background conditions." A reference site should be selected based on at least the following characteristics: substantially free of pollutants, as similar as possible to the grain size of the contaminated sediments, and reflective of conditions at the site (Rubenstein, EPA Office of Research and Development).

Recommendation from San Diego Bay Council:
Do not allow the pooling of reference site data. Do not allow the least- clean reference station or values to be used to compare with shipyard site data. Determine whether the Plan's use of other data sets (Navy, Bight, p. 6-1) will increase or decrease a background cleanup level based solely on this study's data. Require the Contractor to provide all raw data from the reference stations.

Regional Board Response:
The five reference stations were selected to represent a wide range of grain sizes and total organic carbon (similar to the sediment characteristics at NASSCO and Southwest Marine), while maintaining relatively low chemical contaminant concentrations, lack of acute toxicity, and a diverse benthic community. The five reference stations are the same reference stations that are being used for the TMDL sediment investigations at the mouth of Chollas Creek and at 7th Street Channel (Bay and Chadwick 2001). The five reference stations are in conformance with desirable characteristics of reference stations defined by EPA and cited by the San Diego Bay Council.

Pooling reference site data, when appropriate, is acceptable because it provides the basis for a more robust statistical analysis when determining whether the site stations are significantly different from background conditions. For clarification purposes, the Regional Board interprets pooling as combining sediment quality data from a subset of reference sites for which the grain sizes and TOC are similar to the site station that is being compared. Pooling does not suggest that the reference site data from all five reference stations will automatically be combined and thus be compared to each site station. It should be noted however that a one-to-one comparison (single reference station to site station) is also considered to be acceptable when it is determined that pooling is not a viable option. Selecting the pooling approach or the one-to-one comparison will be determined on a case-by-case evaluation of the sediment characteristics at each site station.

The raw data for the reference stations will be provided to the Regional Board and will be available for review by San Diego Bay Council.

9. Protection of Wildlife and Human Health

Comment from San Diego Bay Council:
While not found in the Board's Guidelines, the Work Plan allows the Contractor to derive its own tissue residue standards - which will be "back-calculated" using an equation that would appear to allow a more contaminated site if there are few wildlife presently feeding at the site. These standards will override national standards, if the national standards are more restrictive.

A second apparent problem is that the wildlife - or receptors of concern - to be considered are limited to a few species, making it less likely to find much feeding going on, which in turn will make the standard less restrictive. For example, of the many terns and shorebirds around the Bay, only the California least tern, an endangered species, will be considered a receptor of concern.

A third problem is that some of the species the Plan proposes to test would never occur in the Bay and some would not occur in this part of the Bay. Other species important to include are missing, and these may include more sensitive species.

Recommendation from San Diego Bay Council:
Require the use of national standards exclusively. These should provide a balanced and defensible level of protection. Require the consideration of species that are most often, and regularly, found at these sites.

Regional Board Response:
Regional Board staff has met with and will continue consulting with state and federal resource agencies to discuss the overall approach to assess aquatic-dependent wildlife and human health risks at the shipyards. The resource agencies include Fish & Game, Fish & Wildlife, DTSC, OEHHA, and NOAA. Consultation with these agencies will ensure the adequate protection of wildlife and human health beneficial uses and will, most importantly, allow for agreement amongst the state and federal agencies on the shipyards' overall approach to assess human health and ecological risks.

On November 7, 2001, Regional Board staff met with representatives from the resource agencies in Sacramento, California. The purpose of the meeting was to discuss the overall approach to assess aquatic-dependent wildlife and human health risks at NASSCO and Southwest Marine. The topics of discussion, however, were focused primarily on ecological risks to natural resources due to the representatives that were present at the meeting: Mr. Michael Martin of Fish & Game, Mr. Scott Sobiech of Fish & Wildlife, and Mr. Michael Anderson of DTSC. Additionally, we have had subsequent discussions with Fish and Game regarding issues on the assessment of adverse effects of chemical contaminants on fish populations. Based on the comments and recommendations received from Fish & Game, Fish & Wildlife, and DTSC, the Executive Officer issued a 13267 letter to NASSCO and Southwest Marine on December 24, 2001 directing them to address the following:

- The conceptual site model that is provided in the NASSCO and Southwest Marine workplan titled *"Workplan for the NASSCO and Southwest Marine Detailed Sediment Investigation"* (July 2001) is incomplete. The model is missing other key potential ecological receptors that need to be evaluated: aquatic plants, aquatic reptiles, and fish. The conceptual site model shall be revised in accordance with DTSC's guidance document titled *"Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities"* (July 4, 1996). A copy of DTSC's guidance document is available on the DTSC website at:

  www.dtsc.ca.gov/ScienceTechnology/eco.html#Part%20A

- Because available tissue residue guidelines (TRGs) are developed for other states and countries for the protection of wildlife, these values may not be appropriate for use at NASSCO and Southwest Marine. It is likely that these TRGs were developed for receptors of concern other than those that are representative in San Diego Bay and may be over- or under-protective. As such, it is more appropriate to use site-specific information to evaluate tissue concentrations from the Phase 1 and 2 bioaccumulation investigations at the shipyard sites. Comparison of TRGs to tissue concentrations shall therefore be removed from the aquatic-dependent wildlife assessment at NASSCO and Southwest Marine.

- For the site-specific tissue screening level (TSL) equation, DTSC's *Ecological Risk Assessment Note 4* (December 8, 2000) shall be used for the toxicity reference values and an area-use-factor of "1" shall be used for the Phase 1 bioaccumulation study. All values/parameters proposed by the shipyards for the TSL equation shall be reviewed by the resource agencies and will be subject to the approval of the Regional Board. A copy of DTSC's Note 4 is available on the DTSC website at:

  www.dtsc.ca.gov/ScienceTechnology/eco.html#EcoNOTE4

- The wildlife receptors proposed in Technical Memorandum 2 (October 31, 2001) are considered appropriate. However, to ensure that other sensitive receptor species are not being disregarded, the following documents shall be reviewed: *"San Diego Bay Integrated Natural Resources Management Plan"* (September 2000) and *"South San Diego Bay Enhancement Plan"* (March 1990).

- Because the California Least Tern occupies San Diego Bay 5-months out of the year (or less), the Western Grebe shall be included as a receptor of concern. The Western Grebe is known to spend most of its time in the bay.

- The proposed tissue screening level equation for aquatic-dependent wildlife has two parameters that appear to be redundant: DF = dietary fraction from the shipyard site (proportion), and AUF = area use factor, or the fraction of time receptor j spends feeding at the shipyard site (proportion). Supporting information is needed to justify the use of these two parameters in the equation.

- A "small-scale" study that requires the sampling of onsite fauna (similar to the Phase 2 bioaccumulation study but less intensive) shall be conducted if one of the following are concluded:

  (1) There is some uncertainty in the Phase 1 bioaccumulation results (e.g., conflicting results). Sampling the onsite fauna will be conducted for clarification purposes.

  (2) The Phase 1 bioaccumulation results indicate that all of the bioaccumulation stations at both shipyard sites do not pose a risk to aquatic-dependent wildlife. Sampling the onsite fauna will be conducted for verification purposes.

  NASSCO and Southwest Marine shall propose the methodology to collect and analyze the onsite fauna.

- As recommended in the August 24, 2001 memorandum from DTSC (DTSC 2001), the assessment of adverse effects of chemical contaminants on fish populations shall be included in the Phase 2 bioaccumulation study. We have discussed the issues with Fish and Game and reviewed the references provided in the memorandum. Additionally, we have had preliminary discussions with Mr. Dreas Nielsen of Exponent regarding the assessment approach (December 21, 2001 teleconference call). Following further consultation with Fish and Game and DTSC, we will send NASSCO and Southwest Marine a separate letter with specific guidelines.

On another matter, the resource agencies also confirmed at the meeting that the 28-day bioaccumulation test is appropriate because it is an ASTM standard (E 1688 – 00a). Additionally, using just *Macoma* as the test species for the Phase 1 bioaccumulation study is considered acceptable.

10. Other Missing Aspects of Protecting Beneficial Uses

Comment from San Diego Bay Council:
Impacts of metabolic products, molecular level stress, and cumulative and synergistic effects do not appear to be addressed in the Plan. Multiple, cumulative stressors on the biota, for example, are generally required to be addressed in order to provide adequate protection. For example, if the organisms on site are subject to stresses other than contaminant load in the sediments, a more stringent cleanup level may be necessary to protect them.

Recommendation from San Diego Bay Council:
Consider the need to require assessment of these aspects of protecting beneficial uses.

Regional Board Response:
The Regional Board disagrees that the shipyards' workplan is deficient with respect to assessment of cumulative and synergistic effects on beneficial uses. Toxicity tests are being conducted on pore water, whole sediment, and at the intact sediment water interface. As discussed in our October 12, 2001 meeting, the nature of these three different media (sediment, pore water, and sediment-water interface) would address cumulative, additive, and synergistic pollutant effects on beneficial uses because the samples have multiple pollutants found in the sediment matrix and interstitial porewater. The amphipod, sediment water interface, and the 28-day bioaccumulation test all use whole sediment. The only change to the sediment sample for the amphipod and bioaccumulation tests is that the site sample is composited and homogenized before testing in accordance with standard testing procedures (ASTM 2001a). Porewater will be tested using a dilution series of concentrations with the highest concentration 100 percent (undiluted) sample.

As recommended in the August 24, 2001 memorandum from DTSC (DTSC 2001), the assessment of adverse effects of chemical contaminants on fish populations may be included in the Phase 2 bioaccumulation study. The assessment may include biochemical (e.g., DNA damage), physiological (e.g., viruses and parasites in the blood), and/or histopathological (e.g., liver tumor) measurements of the resident fish populations. Following further consultation with Fish and Game and DTSC, the Regional Board will provide NASSCO and Southwest Marine specific guidelines on the assessment approach.

11. Oversight

Comment from San Diego Bay Council:
There is no independent expert oversight of this study.

Recommendation from San Diego Bay Council:
The Board should hire independent expertise to sample a percentage of the sites, and have these samples independently analyzed. Oversight promotes confidence in the data and reassures all parties.

Regional Board Response:
The Regional Board does not agree that independent experts should be hired to collect and analyze samples from the NASSCO and Southwest Marine sites. Resolution 92-49 (the State policy that establishes policies and procedures for investigation and cleanup and abatement under Water Code Section 13304) addresses this comment directly. Resolution 92-49 provides that the Regional Board's role is to provide regulatory oversight of investigations to determine (1) the nature and horizontal and vertical extent of discharges, and (2) appropriate cleanup and abatement measures. The Regional Board makes decisions regarding cleanup and abatement goals and objectives for the protection of water quality and the beneficial uses. Dischargers fund and carry out investigations to define the nature and extent of waste discharges and to develop appropriate cleanup and abatement measures. The investigations must be conducted in accordance with Regional Board requirements and must be performed by qualified professionals, licensed where applicable, and competent and proficient in the fields pertinent to the issue. This approach will provide the Regional Board with the necessary information it needs to determine the final sediment cleanup levels at NASSCO and Southwest Marine.

Furthermore, an effective quality assurance/quality control program has already been implemented and shall continue until all field tasks are completed. To date the Regional Board has collected split sediment samples from a total of 14 stations during the Phase 1 investigation. Six of 14 stations were analyzed by the Regional Board's contracted laboratory for chemical constituents similar to the chemicals of concern analyzed by the shipyards (metals, butyltin species, polychlorinated biphenyls/polychlorinated triphenyls, polynuclear aromatic hydrocarbons, and total petroleum hydrocarbons). Additionally, the Regional Board has conducted several site visits and observed sample collection and handling techniques performed by the field crew.

The analytical chemistry laboratory and the toxicity testing laboratories selected by Exponent and authorized by the Regional Board for this study are approved by the State of Washington, Washington Department of Ecology and/or the State of California, Department of Health Services Environmental Laboratory Accreditation Program (ELAP) (Exponent 2001a).

OCTOBER 10, 2001 LIST OF QUESTIONS

1. Bioaccumulation and Site Specific Guidelines

(A) Have you used ARC VIEW, SED QUAL, or other tools to produce a chemical contamination footprint? This footprint would assist in determining how much bioaccumulation testing is enough. With a visual, probable distribution of bioaccumulators, we could agree on where sampling must occur.

Regional Board Response

Exponent used ArcView to generate the figures provided in Appendix F of the shipyard workplan (Exponent 2001a). Figures F-1 through F-7 contain historical surface sediment concentrations for copper and zinc at NASSCO and copper, lead, mercury, zinc, and PCBs at Southwest Marine. Although chemical footprints (i.e., areas impacted by sediment contaminants) were not produced in these figures, the spatial distribution of chemicals as determined from the plotted historical data were used to strategically position the triad stations, dilution series stations, and bioaccumulation stations. The rationale used to position each of these stations is summarized in Table 3-3 of the workplan.

(B) Has the Board staff produced the footprint? The state of WA has provided staff with the Sed Qual tool. Board staff needs to independently use this tool and the historical data to produce their own footprint.

Regional Board Response

Regional Board staff has not independently produced the chemical footprint for NASSCO and Southwest Marine. Regional Board staff will contact Washington State Department of Ecology to discuss the potential use of SEDQUAL Release 4.

(C) There are many approaches to measure bioaccumulation - direct measure of animals on-site, caged mussels, testing in lab - why did you choose just one and why the lab approach? Is it a matter of cost or difficulty? Lab bioassay has its own set of uncertainties so why not determine empirically?

Regional Board Response

The 28-day bioaccumulation study is a frequently used and accepted test method for bioaccumulation site assessments and dredge material programs. The Regional Board mentioned at the October 12, 2001 meeting with San Diego Bay Council and the Shipyard representatives that in-situ testing was considered an option when the guidelines were being finalized. However, due to the temperature requirements of *Macoma,* this option was eliminated because the San Diego Bay water temperature would have been outside the animal's acceptable range during Phase 1. Commercial sources of *Macoma* are located in northern California and Washington State where the water tends to be much cooler than in southern California's bays and estuaries.

The protocol for bioaccumulation provided by Exponent describes the test temperature as 15°C ± 2.0 or 60°F ± 2.0 (Exponent 2001a). In-situ test animals could also suffer additional stress from disease, predation, and/or physical disturbances caused by ship movement. Any one of these factors could invalidate the results and require re-testing. All these uncertainties are effectively managed by laboratory testing where the environmental conditions and water quality are under strict controls.

Collection of onsite fauna may occur as a part of Phase 2 to confirm the finding in the Phase 1 bioaccumulation testing. This will allow comparisons to be made between the 28-day bioaccumulation laboratory results and field results generated from the assessment of the resident animals that live in the sediment at NASSCO and Southwest Marine Shipyards.

Also, see Regional Board response on Comment #6 – On-Site Fauna (August 21, 2001 Letter).

(D) Why are you not using two organisms to test as best science dictates? Two animals are required because *Macoma sp.* has been found to be insensitive - will not bioaccumulate some contaminants. (WA State)

Regional Board Response

The EPA "Greenbook" (Evaluation of Dredged Material Proposed for Ocean Disposal, EPA 503/8-91/001) recommends the use of two species for dredge material programs. The Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates, ASTM E 1688, states "*In general, a single species should be adequate for a general area survey or for assessing a small discharge or volume of dredge material*" (ASTM 2001a). As mentioned previously, Phase 1 is viewed as a quantitative site assessment.

As part of the Regional Board's November 7, 2001 meeting with the resource agencies the test species selection and duration for the 28-day bioaccumulation test with *Macoma* as outlined in the workplan was discussed in detail. It was agreed that the bioaccumulation approach outlined in Phase 1 was acceptable and meets the goal of the study. The use of *Macoma* alone for bioaccumulation studies is also consistent with previous San Diego Bay site assessments conducted at Naval Air Station North Island (NASNI) and the Naval Training Center Boat Channel. It is also consistent with the recent work done by SCCWRP and the Navy in the Chollas Creek and Paleta Creek Channel. No changes are needed to the test duration or species selection proposed in the Phase 1 bioaccumulation testing program.