///

DOCUMENT REQUESTS

1. All DOCUMENTS RELATING TO any work YOU performed regarding the human health risk assessment utilized in connection with the proposed cleanup levels and remediation of the SITE.

2. All DOCUMENTS RELATING TO any work YOU performed regarding the ecological risk assessment utilized in connection with the proposed cleanup levels and remediation of the SITE.

3. All DOCUMENTS RELATING TO any work YOU performed regarding the economic feasibility analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

4. All DOCUMENTS RELATING TO any work YOU performed regarding the technological feasibility analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

5. All DOCUMENTS RELATING TO any work YOU performed regarding the cost analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

6. All DOCUMENTS RELATING TO any work YOU performed regarding the remedy selection alternatives analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

7. All DOCUMENTS RELATING TO any work YOU performed regarding the aquatic life impairment analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

8. All DOCUMENTS RELATING TO any work YOU performed regarding the aquatic-dependent wildlife impairment analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

9. All DOCUMENTS RELATING TO any work YOU performed regarding the bioavailability analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

10. All DOCUMENTS RELATING TO any work YOU performed regarding any alternative sediment cleanup levels analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

11. All DOCUMENTS RELATING TO any work YOU performed regarding any remedial monitoring analysis utilized in connection with the proposed cleanup levels and remediation of the SITE.

12. All DOCUMENTS RELATING TO any work YOU performed regarding the analysis of the contribution of stormwater to sediment contamination in the San Diego Bay, utilized in connection with the proposed cleanup levels and remediation of the SITE.

13. All DOCUMENTS RELATING TO any COMMUNICATIONS between YOU and ENVIRONMENTAL GROUPS RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

14. All DOCUMENTS RELATING TO any COMMUNICATIONS between YOU and any local, state or federal agency RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

15. All DOCUMENTS RELATING TO any COMMUNICATIONS between YOU and the ADVISORY TEAM RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

16. All DOCUMENTS RELATING TO any COMMUNICATIONS between YOU and any PERSON, other than a member of the CLEANUP TEAM, RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

Dated: January 24, 2011

LATHAM & WATKINS LLP

By _____
Jeffrey P. Carlin
Attorneys for Designated Party
National Steel and Shipbuilding Company

PROOF OF SERVICE

I am a resident of the State of California, over the age of eighteen years, and not a party to the within action. My business address is Latham & Watkins, 600 West Broadway, Suite 1800, San Diego, California 92101. On January 24, 2011, I served the within document(s):

NASSCO'S SECOND AMENDED NOTICE OF VIDEOTAPED DEPOSITION OF CRAIG CARLISLE

☒ **BY E-MAIL:** I caused the above-referenced documents to be converted in digital format (.pdf) and served by electronic mail to the addresses listed below.

Mike Tracy
Matthew Dart
DLA Piper LLP US
401 B Street, Suite 1700
San Diego, California 92101-4297
mike.tracy@dlapiper.com
matthew.dart@dlapiper.com
Telephone: (619) 699-3620
Fax: (619) 764-6620

Raymond Parra
Senior Counsel
BAE Systems Ship Repair Inc.
PO Box 13308
San Diego, CA 92170-3308
raymond.parra@baesystems.com
Telephone: (619) 238-1000+2030
Fax: (619) 239-1751

Michael McDonough
Counsel
Bingham McCutchen LLP
355 South Grand Avenue, Suite 4400
Los Angeles, CA 90071-3106
michael.mcdonough@bingham.com
Telephone: (213) 680-6600
Fax: (213) 680-6499

Christopher McNevin
Attorney at Law
Pillsbury Winthrop Shaw Pittman LLP
725 South Figueroa Street, Suite 2800
Los Angeles, CA 90017-5406
chrismcnevin@pillsburylaw.com
Telephone: (213) 488-7507
Fax: (213) 629-1033

Brian Ledger
Kristin Reyna
Attorney at Law
Gordon & Rees LLP
101 West Broadway, Suite 1600
San Diego, CA 92101
bledger@gordonrees.com
kreyna@gordonrees.com
Telephone: (619) 230-7729
Fax: (619) 696-7124

Christian Carrigan
Senior Staff Counsel
Office of Enforcement,
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100
ccarrigan@waterboards.ca.gov
Telephone: (916) 322-3626
Fax: (916) 341-5896

1000.6

Marco Gonzalez
Attorney at Law
Coast Law Group LLP
1140 South Coast Highway 101
Encinitas, CA 92024
marco@coastlawgroup.com
Telephone: (760) 942-8505
Fax: (760) 942-8515

James Handmacher
Attorney at Law
Morton McGoldrick, P.S.
PO Box 1533
Tacoma, WA 98401
jvhandmacher@bvmm.com
Telephone: (253) 627-8131
Fax: (253) 272-4338

Jill Tracy
Senior Environmental Counsel
Sempra Energy
101 Ash Street
San Diego, CA 92101
jtracy@sempra.com
Telephone: (619) 699-5112
Fax: (619) 699-5189

Sharon Cloward
Executive Director
San Diego Port Tenants Association
2390 Shelter Island Drive, Suite 210
San Diego, CA 92106
sharon@sdpta.com
Telephone: (619) 226-6546
Fax: (619) 226-6557

Leslie FitzGerald
Deputy Port Attorney
San Diego Unified Port District
PO Box 120488
San Diego, CA 92112
lfitzger@portofsandiego.org
Telephone: (619) 686-7224
Fax: (619) 686-6444

William D. Brown
Brown & Winters
120 Birmingham Drive, #110
Cardiff By The Sea, CA 92007
bbrown@brownandwinters.com
Telephone: (760) 633-4485
Fax: (760) 633-4427

Nate Cushman
Associate Counsel
U.S. Navy
SW Div, Naval Facilities Engineering Command
1220 Pacific Hwy
San Diego, CA 92132-5189
nate.cushman@navy.mil
Telephone: (619) 532-2511
Fax: (619) 532-1663

Roslyn Tobe
Senior Environmental Litigation Attorney
U.S. Navy
720 Kennon Street, #36, Room 233
Washington Navy Yard, DC 20374-5013
roslyn.tobe@navy.mil
Telephone: (202) 685-7026
Fax: (202) 685-7036

Melanie Andrews
Special Assistant U.S. Attorney
U.S. Department of Justice
880 Front Street, Room 6293
San Diego, CA 92101-8893
melanie.andrews@usdoj.gov
Telephone: (619) 557-7460
Fax: (619) 557-5004

Sandi Nichols
Allen Matkins
Three Embarcadero Center, 12th Floor
San Francisco, CA 94111
snichols@allenmatkins.com
Telephone: (415) 837-1515
Fax: (415) 837-1516

1000.7

Laura Hunter
Environmental Health Coalition
401 Mile of Cars Way, Suite 310
National City, CA 91950
laurah@environmentalhealth.org
Telephone: (619) 474-0220
Fax: (619) 474-1210

Gabe Solmer
Jill Witkowski
San Diego Coastkeeper
2825 Dewey Road, Suite 200
San Diego, CA 92106
gabe@sdcoastkeeper.org
jill@sdcoastkeeper.org
Telephone: (619) 758-7743
Fax: (619) 223-3676

C. Scott Spear
U.S. Department of Justice,
Environmental Defense Section
P.O. Box 23986
Washington, D.C. 20026-3986
scott.spear@usdoj.gov
Telephone: (202) 305-1593
Fax: (202) 514-8865

Sarah R. Brite Evans
Schwartz Semerdjian Haile Ballard & Cauley
101 West Broadway, Suite 810
San Diego, CA 92101
Telephone (619) 236-8821
Fax: (619) 236-8827
sarah@ssbclaw.com

I declare under penalty of perjury according to the laws of the State of California that the above is true and correct. Executed on January 24, 2011, at San Diego, California.

Shelley R. Campbell

1000-8

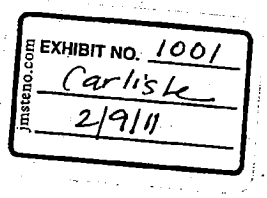
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

In the matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 (Shipyard Sediment Cleanup)	San Diego Water Board Cleanup Team's Amended Witness Designations

TO ALL PARTIES AND TO THEIR ATTORNEYS OF RECORD HEREIN;

PLEASE TAKE NOTICE that, pursuant to the Presiding Officer's February 18, 2010 Order Issuing Final Discovery Plan Etc., and all applicable Orders in the above-referenced proceeding, Designated Party the California Regional Water Quality Control Board, San Diego Region Cleanup Team ("Cleanup Team") hereby designates the following witness who may testify in the above-referenced proceeding.

- David Gibson – Executive Officer, Former Branch Chief of the Water Quality Restoration Standards Branch and an Environmental Program Manager 1.
- David Barker – Branch Chief of the Surface Waters Basins Branch and a Supervising Water Resource Control Engineer.
- Julie Chan – Branch Chief of the Ground Water Basins Branch and a Supervising Engineering Geologist.
- Craig Carlisle – Senior Engineering Geologist.
- Tom Alo – Water Resource Control Engineer.



- Vicente Rodriguez – Water Resource Control Engineer.
- All persons designated as witnesses by any other Designated Party under the Presiding Officer's February 18, 2010 Order Issuing Final Discovery Plan, Etc. and all applicable Orders.

PLEASE TAKE FURTHER NOTICE that Alan Monji, Cynthia Gorham-Test, Benjamin Tobler and Peter Peuron, all of whom were previously designated as potential witnesses by the Cleanup Team will not testify.

Each of the specifically-identified above-referenced witnesses may testify regarding some or all aspects of Cleanup and Abatement Order No. R9-2011-0001 and/or the contents of the accompanying Draft Technical Report, has agreed to testify in this proceeding, and is sufficiently familiar with this proceeding to submit to an oral deposition concerning his or her specific testimony, but none will be paid a fee for his or her testimony.

Each of the specifically-identified above-referenced witnesses may testify as a percipient witness, and/or, with the exception of Vicente Rodriguez, may offer an expert opinion within the scope of his or her expertise as an employee of the San Diego Water Board.

1001.2

The address for all of the specifically-identified witness above is 9174 Sky Park Court, Suite 100, San Diego, CA 92123-4353.

Dated: January 18, 2011

Respectfully submitted,

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION CLEANUP TEAM

By: _____

Christian Carrigan

1001.3

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

In the matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 (Formerly R9-2010-0002) Shipyard Sediment Cleanup	Regional Board Cleanup Team's Responses & Objections to Designated Party San Diego Unified Port District's First Set of Requests for Admissions

Propounding Party: San Diego Unified Port District (the "Port")

Responding Party: California Regional Water Quality Control Board, San Diego Region Cleanup Team

Set Number: One (1)

Pursuant to the Presiding Officer's February 18, 2010 Order Issuing Final Discovery Plan for Tentative Cleanup and Abatement Order No. R9-2010-0002 and Associated Draft Technical Report, the Presiding Officer's October 27, 2010 Order Reopening Discovery Period, Establishing Discovery Schedule, and Identifying Star and Crescent Boat Company as a Designated Party for Purposes of Tentative Cleanup and Abatement Order R9-2011-0001 (the "10.27.10 Order"), the Parties' August 9, 2010 Stipulation Regarding Discovery Extension and all applicable law, Designated Party the San Diego Water Board Cleanup Team ("Cleanup Team"), hereby responds and objects to the Port's First Set of Requests for Admissions (the "Requests") as follows:

GENERAL STATEMENT OF OBJECTIONS

The Cleanup Team makes the following general objections, whether or not separately set forth in response to each Request, to each and every Request by the Port, all as set forth herein and incorporated specifically into each of the responses below:

1. Privilege Objection. The Cleanup Team objects to each Request to the extent it requests information protected by the attorney-client privilege, joint prosecution privilege, common interest privilege, mediation privilege, official information privilege and/or deliberative process privilege, and to the extent it requests information subject to the work-product exemption, collectively referred to herein as the "privilege" or "privileged." The Cleanup Team contends that all communications exchanged between it and its counsel are privileged. The Cleanup Team objects to identifying or producing any and all products of investigations or inquiry conducted by, or pursuant to the direction of counsel, including, but not limited to, all products of investigation or inquiry prepared by the Cleanup Team in anticipation of this proceeding, based on the attorney-client privilege and/or the work-product doctrine. The Cleanup Team further objects to providing information subject to or protected by any other privilege, including, but not limited to, settlement communications, the joint prosecution privilege, the common interest privilege, the mediation privilege, the official information privilege and/or the deliberative

process privilege. Inadvertent provision of privileged information shall not constitute a waiver of said privileges.

2. Scope of Discovery Objection. The Cleanup Team objects to each Request to the extent it purports to impose any requirement or discovery obligation other than as set forth in Title 23 of the California Code of Regulations, sections 648 et seq., the California Government Code, sections 11400 et seq. and/or applicable stipulations, agreements and/or orders governing this proceeding, including, but not limited to, the limitations on the proper subject matter for the Port's discovery to the Cleanup Team, as specifically set forth in the 10.27.10 Order; to wit: "[T]he scope of additional discovery allowed by this Order is limited to revisions to the TCAO/DTR released on September 15, 2010 as compared to the December 2009 versions of these documents." The Cleanup Team further objects to instructions set forth in the Port's "DEFINITIONS" that are inconsistent with, and/or to the extent they purport to impose obligations on the Cleanup Team not specifically set forth in, Title 23 of the California Code of Regulations, sections 648 et seq., the California Government Code, sections 11400 et seq. and/or applicable stipulations, agreements and/or orders governing this proceeding.
3. Irrelevant Information Objection. The Cleanup Team objects to the Requests to the extent they are overbroad and/or seek information that is not relevant to the claims or defenses asserted in this proceeding and is not reasonably calculated to lead to the discovery of admissible evidence.
4. Burdensome and Oppressive Objection. The Cleanup Team objects to each Request to the extent that it seeks information that has

already been provided, or that otherwise is equally available to the Port, or is already in the Port's possession, which renders the Request unduly burdensome and oppressive. The Cleanup Team has already provided the Port with a copy of the electronic, text searchable administrative record and supplemental administrative record for this matter. Therefore, the burden of providing information that is equally accessible to the Port is no greater on the Port than it would be on the Cleanup Team, and the Cleanup Team will not provide again the information it has already provided and which is contained in the electronic, text searchable administrative record, or that is otherwise already in the Port's possession, custody or control.

5. Overbroad Objection. The Cleanup Team objects that certain Requests are overbroad, and are framed in a manner that prevents any reasonable ability to provide responsive information. Such Requests create an unreasonable risk of inadvertent noncompliance as framed.

6. Cleanup and Abatement Order Proceeding is Ongoing. The instant Cleanup and Abatement Order proceeding is ongoing, and the Cleanup Team expects that additional evidence will be provided by the Designated Parties hereto in accordance with governing statutes, regulations and applicable hearing procedures. While the Cleanup Team's response to each of these Requests is based on a reasonable investigation and the state of its knowledge as of this date, additional information may be made available to or otherwise obtained by the Cleanup Team subsequent to the date of this response. These responses are provided without prejudice to the Cleanup Team's right to supplement these responses, or to use in

this proceeding any testimonial, documentary, or other form of evidence or facts yet to be discovered, unintentionally omitted, or within the scope of the objections set forth herein.

OBJECTIONS TO DEFINITIONS

1. The Cleanup Team objects to the defined term "DOCUMENT" on the ground and to the extent that it seeks information protected by settlement confidentiality rules, the attorney-client privilege, the joint prosecution privilege, the work product doctrine, the mediation privilege, the common interest privilege, the official information privilege, the deliberative process privilege, and/or any other privilege or confidentiality protection.
2. The Cleanup Team objects to the defined term "COMMUNICATIONS" on the ground and to the extent that it seeks information protected by settlement confidentiality rules, the attorney-client privilege, the joint prosecution privilege, the work product doctrine, the mediation privilege, the common interest privilege, the official information privilege, the deliberative process privilege, and/or any other privilege or confidentiality protection.
3. The Cleanup Team objects to the defined term "IDENTIFY" on the ground and to the extent it purports to impose requirements and/or obligations on the Cleanup Team in preparing these Responses not otherwise required by Title 23 of the California Code of Regulations, sections 648 et seq., the California Government Code, sections 11400 et seq. and/or applicable stipulations, agreements and/or orders governing this proceeding.

4. The Cleanup Team objects to the defined term "MS4 SYSTEM" as hopelessly overbroad, unduly burdensome, not reasonably calculated to lead to the discovery of admissible evidence and beyond the scope of permissible discovery. The Cleanup Team will respond herein as if the term "MS4 SYSTEM" was defined to include those components of the Municipal Separate Storm Sewer Systems under Order No. 2007-001, NPDES No. CAS0108758 that RELATE TO the Cleanup Team's bases for naming the Port as a DISCHARGER in the CURRENT TCAO and CURRENT DTR.

RESPONSES TO REQUESTS FOR ADMISSIONS

REQUEST FOR ADMISSION NO. 1:

Admit that the Port District itself never contributed directly to the DISCHARGE of waste to the SITE.

RESPONSE TO REQUEST NO. 1:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request on the ground that it is vague and ambiguous with respect to the terms "Port District itself" and "contributed directly."

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

The Port contributed to the DISCHARGE of waste to the SITE as a co-permittee under its currently applicable MS4 permit, and the preceding permits. The Port has filed Reports of Waste Discharge with the Regional Board. The Port also contributed to the DISCHARGE of waste to the SITE because it has the ability and legal responsibility to

control the activities and DISCHARGES of its tenants. The Port's tenants' DISCHARGES could not have occurred without the Port allowing the discharging tenants to operate and conduct the activity on the land. The source of the DISCHARGE is the land controlled by the Port, which land held and managed as trust property on behalf of the People of the State of California. Further facts supporting the Cleanup Team's denial to this Request are set forth in Finding 11 of the TCAO and Chapter 11 of the DTR and will not be repeated here.

REQUEST FOR ADMISSION NO. 2:

Admit that the Port District itself never DISCHARGED storm water that contained waste into the City of San Diego MS4 SYSTEM onto the SITE.

RESPONSE TO REQUEST NO. 2:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request on the ground that it is vague and ambiguous with respect to the terms "Port District itself," "contributed directly" and "City of San Diego MS4 SYSTEM."

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

The Port is responsible for DISCHARGED storm water that contained waste to the SITE as a co-permittee under its currently applicable MS4 permit, and the preceding permits. The Port has filed Reports of Waste Discharge with the Regional Board. Further facts supporting the Cleanup Team's denial to this Request are set forth in Finding 11 of the TCAO and Chapter 11 of the DTR and will not be repeated here.

REQUEST FOR ADMISSION NO. 3:

Admit that the Port District itself never contributed directly to the DISCHARGE of storm water containing waste to the SITE through the City of San Diego MS4 SYSTEM.

RESPONSE TO REQUEST NO. 3:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request on the ground that it is vague and ambiguous with respect to the terms "Port District itself," "contributed directly" and "City of San Diego MS4 SYSTEM."

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

The Port contributed to the DISCHARGE of storm water containing waste to the SITE as a co-permittee under its currently applicable MS4 permit, and the preceding permits. The Port has filed Reports of Waste Discharge with the Regional Board. Further facts supporting the Cleanup Team's denial to this Request are set forth in Finding 11 of the TCAO and Chapter 11 of the DTR and will not be repeated here.

REQUEST FOR ADMISSION NO. 4:

Admit that the City of San Diego owns and operates the MS4 SYSTEM Storm Drain Outfalls identified as SW4 and SW9 in the CURRENT TCAO and CURRENT DTR that are alleged to have DISCHARGED storm water containing waste onto the SITE.

RESPONSE TO REQUEST NO. 4:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground that it is vague and ambiguous with respect to the term "Storm Drain Outfalls... DISCHARGED." The Cleanup Team further objects to the Request on the ground that NPDES Permit No. CAS0108758 speaks for itself and is the best evidence of its contents with regard to ownership and operation of the various components of the MS4

SYSTEM.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: The Cleanup Team admits that the City of San Diego owns the Storm Drain Outfalls identified as SW4 and SW9 in the CURRENT TCAO and CURRENT DTR which are the point sources from which it is alleged storm water containing wastes were DISCHARGED onto the SITE. The Cleanup Team also admits that the City of San Diego is one of the operators of the MS4 SYSTEM identified in NPDES Permit No. CAS0108758, which MS4 SYSTEM includes Storm Drain Outfalls SW4 and SW9. Except as specifically admitted, the remainder of the Request is denied.

REQUEST FOR ADMISSION NO. 5:

Admit that the Port District does not own or operate the MS4 SYSTEM Storm Drain Outfalls identified as SW4 and SW9 in the CURRENT TCAO and CURRENT DTR that are alleged to have DISCHARGED urban storm water containing waste onto the SITE.

RESPONSE TO REQUEST NO. 5:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground that it is vague and ambiguous with respect to the term "Storm Drain Outfalls... DISCHARGED." The Cleanup Team further objects to the Request on the ground that NPDES Permit No. CAS0108758 speaks for itself and is the best evidence of its contents with regard to ownership and operation of the various components of the MS4 SYSTEM.

Subject to and without waiving the preceding objections, the Cleanup Team

responds as follows: The Cleanup Team admits that the Port does not own the Storm Drain Outfalls identified as SW4 and SW9 in the CURRENT TCAO and CURRENT DTR. Except as expressly admitted, the Request is denied.

REQUEST FOR ADMISSION NO. 6:

Admit that PERSONS located upgradient from the Port District tidelands have DISCHARGED urban storm water containing waste into the MS4 SYSTEM FACILITIES which was conveyed through the Storm Drain Outfalls identified as SW4 and SW9 in the CURRENT TCAO and CURRENT DTR onto the SITE.

RESPONSE TO REQUEST NO. 6:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to the Request on the ground that NPDES Permit No. CAS0108758 speaks for itself and is the best evidence of its contents with regard to PERSONS who DISCHARGE to the MS4 SYSTEM. The Cleanup Team further objects to this Request as vague and ambiguous with respect to the term "Port District tidelands." The Cleanup Team further objects to this Request as hopelessly overbroad with respect to "PERSONS located upgradient from the Port District tidelands." The Cleanup Team further objects to this Request as beyond the scope of permissible discovery under the 10.27.10 Order.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Admit.

REQUEST FOR ADMISSION NO. 7:

Admit that for the tidelands and submerged lands in or adjacent to the SITE that the State of California has ultimate authority over the Port District to specify the permitted uses of the SITE, how title to the SITE may be held, and to whom title to the

SITE may revert or be transferred.

RESPONSE TO REQUEST NO. 7.

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request as vague, ambiguous and grammatically unintelligible. The Cleanup Team further objects to this Request on the ground that the term "ultimate authority" is vague and ambiguous. The Cleanup Team further objects to this Request on the ground that the San Diego Unified Port District Act speaks for itself and is the best evidence of its contents.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: The Cleanup Team lacks information sufficient to form a belief as to: (1) whether the State of California has ultimate authority over the Port District to specify the permitted uses of the SITE; (2) how title to the SITE may be held; (3) to whom title to the SITE may revert; and (4) to whom title to the SITE may be transferred, and based thereon denies this Request.

REQUEST FOR ADMISSION NO. 8:

Admit that the State of California is in effect the equitable and beneficial property owner of the tidelands in or adjacent to the SITE.

RESPONSE TO REQUEST NO. 8:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground that the term "is in effect the equitable and beneficial property owner" is vague and

ambiguous. The Cleanup Team further objects to this Request on the ground that the San Diego Unified Port District Act speaks for itself and is the best evidence of its contents.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: The Cleanup Team lacks information sufficient to form a belief as to: (1) whether the State of Califomia is in effect the equitable owner of the tidelands in the SITE; (2) whether the State of California is in effect the equitable owner of the tidelands adjacent to the SITE; (3) whether the State of California is in effect the beneficial owner of the tidelands in the SITE; and (4) whether the State of California is in effect the equitable owner of the tidelands adjacent to the SITE, and based thereon denies this Request.

REQUEST FOR ADMISSION NO. 9:

Admit that there were no new facts discovered by YOU between December 2009 and September 2010 to support YOUR revision of the PRIOR TCAO and PRIOR DTR to name the Port District as a DISCHARGER in the CURRENT TCAO and CURRENT DTR.

RESPONSE TO REQUEST NO. 9:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

With respect to naming the Port as a discharger based on its status as an MS4 co-permittee, the Cleanup Team determined after December 2009 that its recommendation to the San Diego Water Board in the PRIOR TCAO and PRIOR DTR

that the Port not be named as a Discharger was inconsistent with previous State Water Resources Control Board and SDRWQCB orders concerning the naming of co-permittees in cleanup and abatement orders. With respect to naming the Port as a discharger based on its status as a trustee/landowner, the Cleanup Team determined to change its recommendation to the SDRWQCB from the PRIOR TCAO based on the following facts: (1) In December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to clean up the Site by contributing money towards the cost of cleanup, including potential insurance proceeds from its responsible, yet absentee and/or non-participating tenants whose policies name the Port as an additional insured, whereas by the time the CURRENT TCAO was issued, the Port's representatives made it clear it does not intend to do so; (2) Prior to the release of the PRIOR TCAO in December 2009, the Port cooperated with the San Diego Water Board's efforts to clean up the Site by providing expertise to the Cleanup Team regarding scientific and technical issues, whereas by the time the CURRENT TCAO was issued, such cooperation was withdrawn by the Port's representatives; (3) Prior to December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to clean up the Site by identifying and making available (at fair market lease rates) potential sediment staging and dewatering locations, whereas by the time the CURRENT TCAO was issued, the Port's representatives made it clear it will not voluntarily do so; (4) Prior to December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to clean up the Site by designating percipient and expert witnesses to testify in support of the proposed cleanup, whereas on July 19, 2010, the Port's representatives advised the San Diego Water Board that the Port was not designating a single witness to testify in support of the cleanup; (5) Prior to December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to cleanup up the Site by assisting both financially and technically with California Environmental Quality Act compliance, whereas by the time the CURRENT TCAO was issued, in spite of repeated

requests to the Port's representatives by the Cleanup Team for CEQA assistance, the Port's representatives have refused.

REQUEST FOR ADMISSION NO. 10:

Admit that no changed circumstances or conditions occurred from December 2009 to September 2010 to support YOUR revision of the PRIOR TCAO and PRIOR DTR to name the Port District as a DISCHARGER in the CURRENT TCAO and CURRENT DTR.

RESPONSE TO REQUEST NO. 10:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

With respect to naming the Port as a discharger based on its status as an MS4 co-permittee, the Cleanup Team determined after December 2009 that its recommendation to the San Diego Water Board in the PRIOR TCAO and PRIOR DTR that the Port not be named as a Discharger was inconsistent with previous State Water Resources Control Board and SDRWQCB orders concerning the naming of co-permittees in cleanup and abatement orders. With respect to naming the Port as a discharger based on its status as a trustee/landowner, the Cleanup Team determined to change its recommendation to the SDRWQCB from the PRIOR TCAO based on the following changed circumstances: (1) In December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to clean up the Site by contributing money towards the cost of cleanup, including potential insurance proceeds from its responsible, yet absentee and/or non-participating tenants whose policies name the Port as an additional insured, whereas by the time the CURRENT

TCAO was issued, the Port's representatives made it clear it does not intend to do so; (2) Prior to the release of the PRIOR TCAO in December 2009, the Port cooperated with the San Diego Water Board's efforts to clean up the Site by providing expertise to the Cleanup Team regarding scientific and technical issues, whereas by the time the CURRENT TCAO was issued, such cooperation was withdrawn by the Port's representatives; (3) Prior to December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to clean up the Site by identifying and making available (at fair market lease rates) potential sediment staging and dewatering locations, whereas by the time the CURRENT TCAO was issued, the Port's representatives made it clear it will not voluntarily do so; (4) Prior to December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to clean up the Site by designating percipient and expert witnesses to testify in support of the proposed cleanup, whereas on July 19, 2010, the Port's representatives advised the San Diego Water Board that the Port was not designating a single witness to testify in support of the cleanup; (5) Prior to December 2009, the Cleanup Team believed the Port would cooperate with the San Diego Water Board's efforts to cleanup up the Site by assisting both financially and technically with California Environmental Quality Act compliance, whereas by the time the CURRENT TCAO was issued, in spite of repeated requests to the Port's representatives by the Cleanup Team for CEQA assistance, the Port's representatives have refused.

REQUEST FOR ADMISSION NO. 11:

Admit that in connection with California State Water Resources Control Board Order No. WQ 90-3, *In the Matter of the Petition of San Diego Unified Port District*, YOU advised the State Water Board that the SDRWQCB would take enforcement action against the Port District only as a last resort after the Port had ample opportunity to compel the Port District's tenants to comply with SDRWQCB orders.

RESPONSE TO REQUEST NO. 11:

The Cleanup Team objects to this Request on the ground that it is not full and

complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground that the terms "in connection with," "as a last resort" and "ample opportunity" are vague and ambiguous. The Cleanup Team further objects to this Request on the ground that it is irrelevant what the Cleanup Team may have stated to the State Water Resources Control Board regarding its Order No. WQ 90-3 because Order No. WQ 90-3 speaks for itself and is the best evidence of its contents; therefore, the Request is not reasonably calculated to lead to the discovery of admissible evidence.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied. The Cleanup Team never commented to the State Board on the cited Order.

REQUEST FOR ADMISSION NO. 12:

Admit that YOUR determination not to name the Port District as a Discharger in the PRIOR TCAO and PRIOR DTR was consistent with previous California State Water Resources Control Board and SDRWQCB orders concerning the naming of non-operating public agencies in cleanup and abatement orders.

RESPONSE TO REQUEST NO. 12:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: The Cleanup Team admits that its recommendation to the San Diego Water Board in the PRIOR TCAO and PRIOR DTR that it not name the Port as a

discharger was consistent with previous California State Water Resources Control Board and SDRWQCB orders concerning the naming of non-operating public agency landowners in cleanup and abatement orders based on the facts known to the Cleanup Team as of December 22, 2009. Except as expressly admitted, the Request is denied. The Cleanup Team's recommendation to the San Diego Water Board in the PRIOR TCAO and PRIOR DTR that the Port not be named as a Discharger was inconsistent with previous State Water Resources Control Board and SDRWQCB order concerning the naming of co-permittees in cleanup and abatement orders.

REQUEST FOR ADMISSION NO. 13:

Admit that YOUR determination to name Port District as a Discharger in the CURRENT TCAO and CURRENT DTR is inconsistent with previous California State Water Resources Control Board and SDRWQCB orders concerning the naming of non-operating public agencies in cleanup and abatement orders.

RESPONSE TO REQUEST NO. 13:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

New facts and circumstances developed between December 22, 2009, and September 15, 2010 that made the Cleanup Team's previous recommendation inconsistent with previous California State Water Resources Control Board and SDRWQCB orders concerning the naming of non-operating public agency landowners in cleanup and abatement orders. The facts and circumstances are detailed in the Cleanup Team's responses to Request Nos. 9 and 10. Additionally, naming the Port as

a Discharger based on its status as a co-permittee under NPDES Permit No. CAS0108758 is consistent with previous State Water Resources Control Board and SDRWQCB orders.

REQUEST FOR ADMISSION NO. 14:

Admit that YOU do not allege in the CURRENT TCAO and CURRENT DTR that any of Port District's TENANTS at the SITE DISCHARGED waste into the SITE in violation of any of the TENANTS' applicable waste discharge permit requirements that were issued by YOU since February 1963.

RESPONSE TO REQUEST NO. 14:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

It is a violation of each and all of the applicable permits of the Port's TENANTS, as well as the Port's MS4 permit, to cause or permit, or threaten to cause or permit waste to be discharged or deposited where it is, or probably will be, discharged into waters of the state and creates, or threatens to create, a condition of pollution or nuisance.

REQUEST FOR ADMISSION NO. 15:

Admit that Campbell Industries, Inc., is the corporate successor of former SITE TENANT San Diego Marine Construction Corporation, formerly known as MCCSD.

REPONSE TO REQUEST NO. 15:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060,

subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground the term "corporate successor" is vague and ambiguous.

Subject to and without waiving the preceding objection, the Cleanup Team responds as follows: The Cleanup Team admits that Campbell Industries is legally responsible for the acts and omissions of former SITE TENANT San Diego Marine Construction Corporation, also known as MCCSD, from June 23, 1972 through 1979, when it operated a shipyard at what is now known as the BAE leasehold.

REQUEST FOR ADMISSION NO. 16:

Admit that San Diego Marine Construction Corporation, a wholly owned subsidiary of Campbell Industries, Inc., is the corporate successor of San Diego Marine Construction Company's marine division's shipyard operations.

RESPONSE TO REQUEST NO. 16:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground the terms "corporate successor" and "marine division's shipyard operations" are vague and ambiguous.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Admit that San Diego Marine Construction Corporation was a wholly owned subsidiary of Campbell Industries. Except as expressly admitted, the Request is denied.

San Diego Marine Construction Corporation purchased the assets of what appears to be known as the "marine division" of the San Diego Marine Construction

Company.

REQUEST FOR ADMISSION NO. 17:

Admit that the Port District's TENANT Star & Crescent Boat Company, is the corporate successor of the operations of San Diego Marine Construction Company's boat division known as Star and Crescent Boat Company.

RESPONSE TO REQUEST NO. 17:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground the term "corporate successor of the operations" is vague and ambiguous.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Admit.

REQUEST FOR ADMISSION NO. 18:

Admit that YOU are responsible for issuing permits regulating the discharge of storm water and other discharge point sources onto the SITE.

RESPONSE TO REQUEST NO. 18:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground that the term "other discharge point sources" is vague and ambiguous.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: While the Cleanup Team is not responsible for issuing permits, it admits that the SDRWQCB is responsible for issuing permits regulating the discharge of

storm water and other pollutants from point sources to waters of the state, including those waters at the SITE.

REQUEST FOR ADMISSION NO. 19:

Admit that YOU issued permits to the Port District's TENANTS, who are currently leasing the tidelands in or adjacent to the SITE, including San Diego Gas & Electric Company, National Steel and Shipbuilding Company, and BAE Systems San Diego Ship Repair, Inc., regulating the TENANTS' storm and waste water DISCHARGES onto the SITE.

RESPONSE TO REQUEST NO. 19:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f). The Cleanup Team further objects to this Request on the ground that the term "regulating the TENANTS' storm and waste water DISCHARGES onto the SITE" is vague and ambiguous and that the referenced permits speak for themselves and are the best evidence of their contents.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: While the Cleanup Team did not issue permits, it admits that the SDRWQCB issued permits to the referenced TENANTS, which permits speak for themselves and are the best evidence of their contents.

REQUEST FOR ADMISSION NO. 20:

Admit that YOU issued storm and waste water DISCHARGE permits to the Port District's TENANTS, who are currently leasing the tidelands in or adjacent to the SITE, including San Diego Gas & Electric Company, National Steel and Shipbuilding Company, and BAE Systems San Diego Ship Repair, Inc., that contained water quality based effluent limitations which permitted the TENANTS to DISCHARGE waste onto

the SITE that contained certain levels of contaminants of concern that are identified in the CURRENT TCAO and CURRENT DTR, including, but not limited to, chromium, copper, nickel, and zinc.

RESPONSE TO REQUEST NO. 20:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: While the Cleanup Team did not issue permits, it admits that the SDRWQCB issued some permits to some of the TENANTS referenced in the Request that contain water quality based effluent limitations for chromium copper, nickel and zinc, while other issued permits to the TENANTS referenced in the Request are BMP based.

REQUEST FOR ADMISSION NO. 21:

Admit that the storm and waste water DISCHARGES that YOU permitted the Port District's TENANTS, who are currently leasing the tidelands in or adjacent to the SITE, including San Diego Gas & Electric Company, National Steel and Shipbuilding Company, and BAE Systems San Diego Ship Repair, Inc., to DISCHARGE onto the SITE contained waste that contributed to the alleged contamination of the sediment at the SITE.

RESPONSE TO REQUEST NO. 21:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060,

subdivision (f). The Cleanup Team further objects to the Request on the ground that it is vague, ambiguous and grammatically unintelligible.

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

The Cleanup Team does not permit DISCHARGES. While the SDRWQCB issues permits that allow certain DISCHARGES, it is a violation of each and all of the applicable permits of the Port's TENANTS, as well as the Port's MS4 permit, to cause or permit, or threaten to cause or permit waste to be discharged or deposited where it is, or probably will be, discharged into waters of the state and creates, or threatens to create, a condition of pollution or nuisance.

REQUEST FOR ADMISSION NO. 22:

Admit that the Port District does not have authority to impose more stringent requirements on its TENANTS' storm water discharges than those imposed by YOU.

RESPONSE TO REQUEST NO. 22:

The Cleanup Team objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objection, the Cleanup Team responds as follows: Denied.

The Cleanup Team does not impose requirements on storm water discharges. The Cleanup Team lacks information sufficient to form a belief about the scope of the Port's authority as a special government agency that holds and manages land in trust for the People of the State, or as a lessor engaged in a commercial transaction with its lessees, to impose requirements on its TENANTS storm water discharges, and based thereon denies this Request.

REQUEST FOR ADMISSION NO. 23:

Admit that the Port District has never been cited by YOU for violating the terms of the current or prior MS4 SYSTEM permits YOU issued to the Port District and the other

MS4 SYSTEM co-permitees RELATING TO DISCHARGES onto the SITE.

RESPONSE TO REQUEST NO. 23:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Admit.

REQUEST FOR ADMISSION NO. 24:

Admit that the Port District did not have knowledge of all of the waste DISCHARGES into the SITE, since February 1963, for which YOU seek to hold it primarily liable.

RESPONSE TO REQUEST NO. 24:

The Cleanup Team objects to this Request on the ground that it is not full and complete in and of itself, in violation of Code of Civil Procedure section 2033.060, subdivision (d). The Cleanup Team further objects to this Request as compound, conjunctive, and/or disjunctive in violation of Code of Civil Procedure section 2033.060, subdivision (f).

Subject to and without waiving the preceding objections, the Cleanup Team responds as follows: Denied.

The Port has sufficient knowledge of the activities of its TENANTS, which are controlled by the terms of its leases with those TENANTS, and the mechanics and operations of the MS4 SYSTEM of which it is a co-permittee, to name it as a Discharger.

Dated: January 5, 2010

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION, CLEANUP TEAM

By: _____

Christian Carrigan

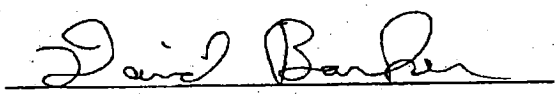
SAN DIEGO UNIFIED PORT DISTRICT WRITTEN DISCOVERY RESPONSE VERIFICATION

I, David Barker, declare:

I am the Branch Chief of the Surface Waters Basins Branch and a Supervising Water Resource Control Engineer at the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board). I am the designated manager of the Cleanup Team for the San Diego Water Board's proceedings to consider the development and issuance of a cleanup and abatement order for discharges of metals and other pollutant wastes to San Diego Bay marine sediments and waters at a Site referred to as the Shipyard Sediment Site. I am authorized to make this verification on behalf of the San Diego Water Board's Cleanup Team.

I have read the foregoing Regional Board Cleanup Team's Responses & Objections to Designated Party San Diego Unified Port District's First Set of Requests for Admissions, Regional Board Cleanup Team's Responses & Objections to Designated Party San Diego Unified Port District's First Set of Requests for Production of Documents and Regional Board Cleanup Team's Responses & Objections to Designated Party San Diego Unified Port District's First Set of Special Interrogatories, and know their contents. I am informed and believe that the matters stated therein are true and on that ground certify or declare under penalty of perjury under the laws of the State of California that the same are true and correct.

Dated: January 5, 2011



David Barker

OFFICE OF THE GENERAL COUNSEL
JILL A. TRACY (State Bar No. 182136)
101 Ash Street, 12th Floor
San Diego, CA 92101
Telephone: (619) 699-5112
Facsimile: (619) 696-4488
jtracy@semprautilities.com

WARD L. BENSHOOF (State Bar No. 054987)
PETER A. NYQUIST (State Bar No. 180953)
CATHERINE M. WIEMAN (State Bar No. 222384)
ALSTON & BIRD LLP
333 South Hope Street, Sixteenth Floor
Los Angeles, California 90071
Telephone: (213) 576-1000
Facsimile: (213) 576-1100
ward.benshoof@alston.com

Attorneys for Designated Party
SAN DIEGO GAS & ELECTRIC COMPANY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

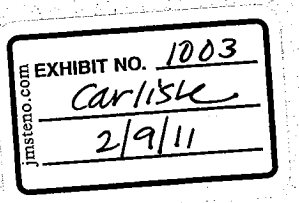
SAN DIEGO REGION

IN THE MATTER OF:

TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

SAN DIEGO GAS & ELECTRIC COMPANY'S NOTICE OF JOINDER IN NASSCO'S SECOND AMENDED NOTICE OF VIDEOTAPED DEPOSITION OF CRAIG CARLISLE

Date: February 9-10, 2011
Time: 9:00 a.m.
Place: Latham & Watkins LLP
600 West Broadway, Suite 1800
San Diego, CA 92101



TO ALL PARTIES AND THEIR COUNSEL OF RECORD:

PLEASE TAKE NOTICE that San Diego Gas & Electric Company ("SDG&E") hereby joins the Second Amended Notice of Videotaped Deposition of Craig Carlisle ("Amended Notice"), served by National Steel and Shipbuilding Company ("NASSCO") on January 24, 2011, scheduled to take place on February 9 and 10, 2011, at 9:00 a.m., at the law offices of Latham & Watkins LLP, 600 West Broadway, Suite 1800, San Diego, California, 92101, upon oral examination before a Certified Shorthand Reporter duly authorized to administer oaths, and continuing from day to day, weekends and holidays excluded, until completed.

SDG&E incorporates the provisions of NASSCO's Amended Notice as though fully set forth herein, including, without limitation, each of the definitions and document requests described in the Amended Notice. SDG&E reserves the right to examine the witness on all matters relevant to this proceeding, until completion, and to use any videotaped portion of the deposition testimony at any subsequent hearing in this matter.

Dated: January 26, 2011

OFFICE OF THE GENERAL COUNSEL

By: _____ for

Jill A. Tracy
Attorneys for Designated Party
SAN DIEGO GAS & ELECTRIC COMPANY

1003.2

Exponent®

NASSCO and Southwest Marine Detailed Sediment Investigation

Volume I

Prepared for

NASSCO and Southwest Marine
San Diego, California

Exponent

NASSCO and Southwest Marine Detailed Sediment Investigation

Volume I

Prepared for

NASSCO and Southwest Marine
San Diego, CA 92113

Prepared by

Exponent
15375 SE 30th Place, Suite 250
Bellevue, WA 98007

October 2003

Doc. no. 8601718.002 1201 0903 DN05

Contents

VOLUME I

Page

Part 2: Feasibility Study

VOLUME II

VOLUME III

List of Figures

Figures appear at the end of the main text.

List of Tables

Tables appear at the end of the main text.

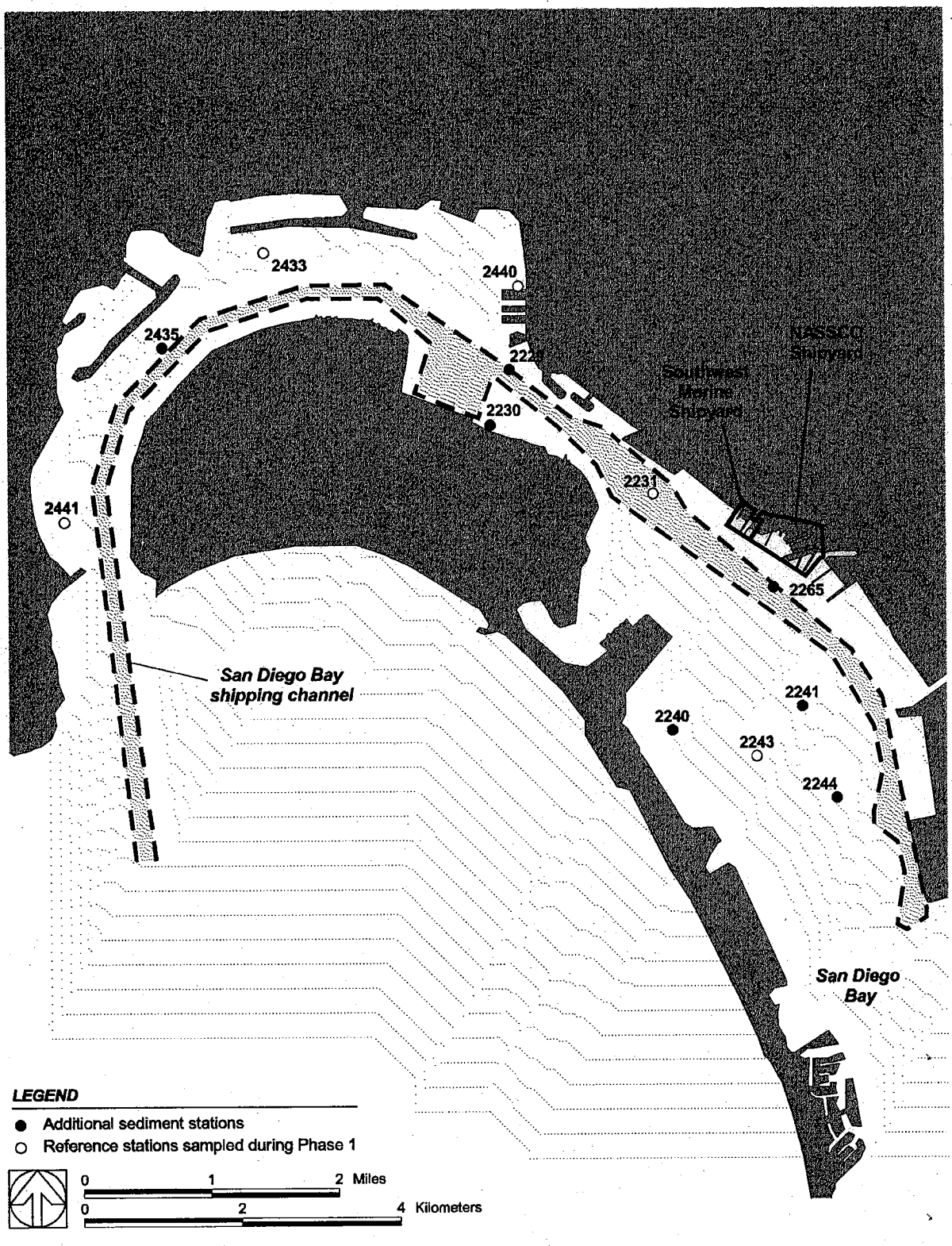


Figure 2-3. Additional sediment sampling locations in San Diego Bay

Exponent®

8601718/8601731.002 1201 | Sep 03, 2003 add SDB sample view | Fig 2-3 additional samples layout | g:\swm nassco\projects\shipyards rpt.apr

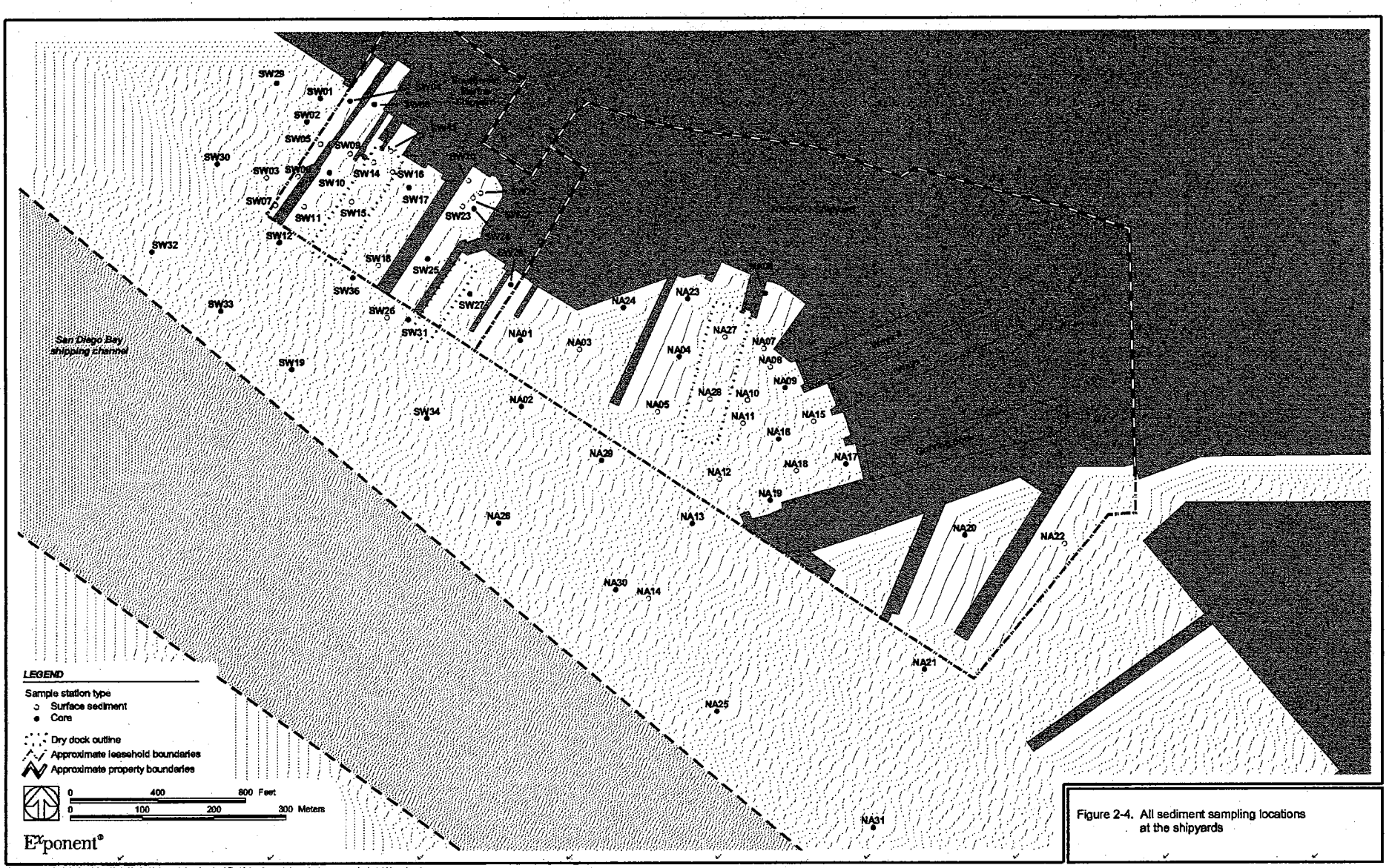


Figure 2-4. All sediment sampling locations at the shipyards

6501715/6501731.002 1201 | Sep 22, 2003 | fig 02-4 sample location view | Fig 02-4 sed sample layout | g:/swm_nassco/projects/shipyards_rpt.apr

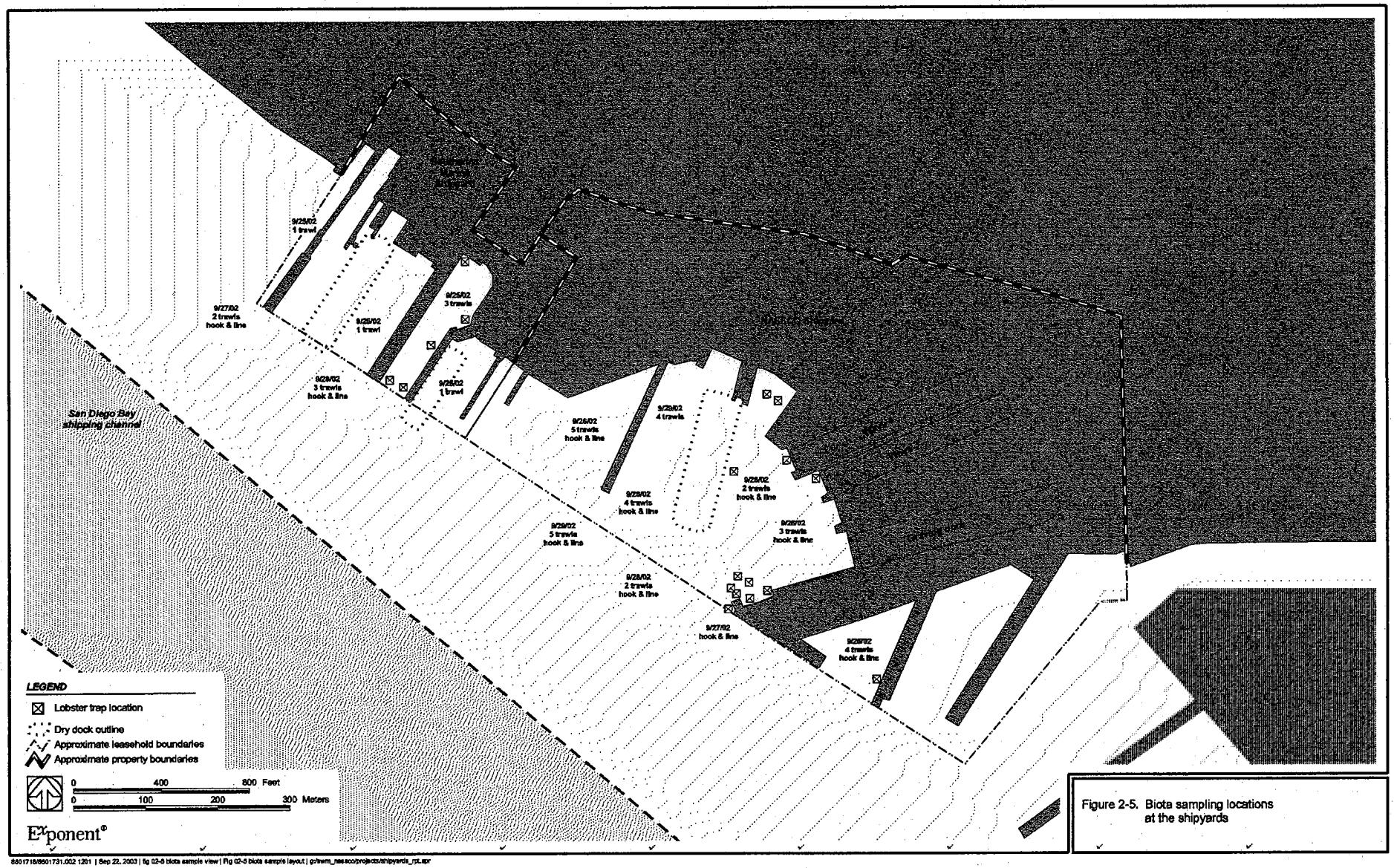


Figure 2-5. Biota sampling locations at the shipyards

8501718/8501731.002 1201 | Sep 22, 2003 | fig 02-5 biota sample view | Fig 02-5 biota sample layout | g:\twm_nassco\projects\shipyards_rpt.apr

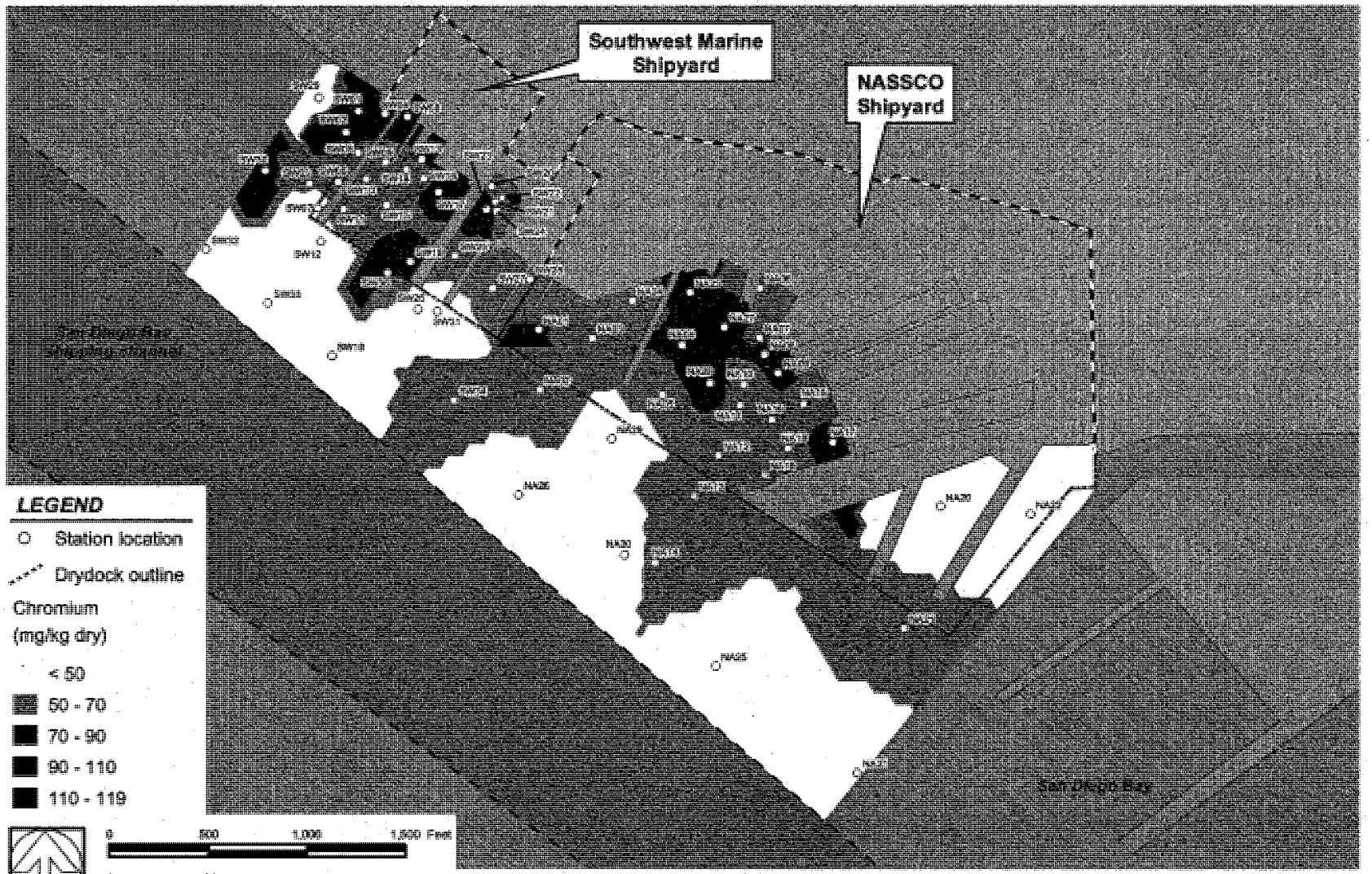


Figure 4-5. Surface sediment concentrations of chromium

Exponent®

8601718/8601731.002 1201 | August 21, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Cr.mxd

SAR105797

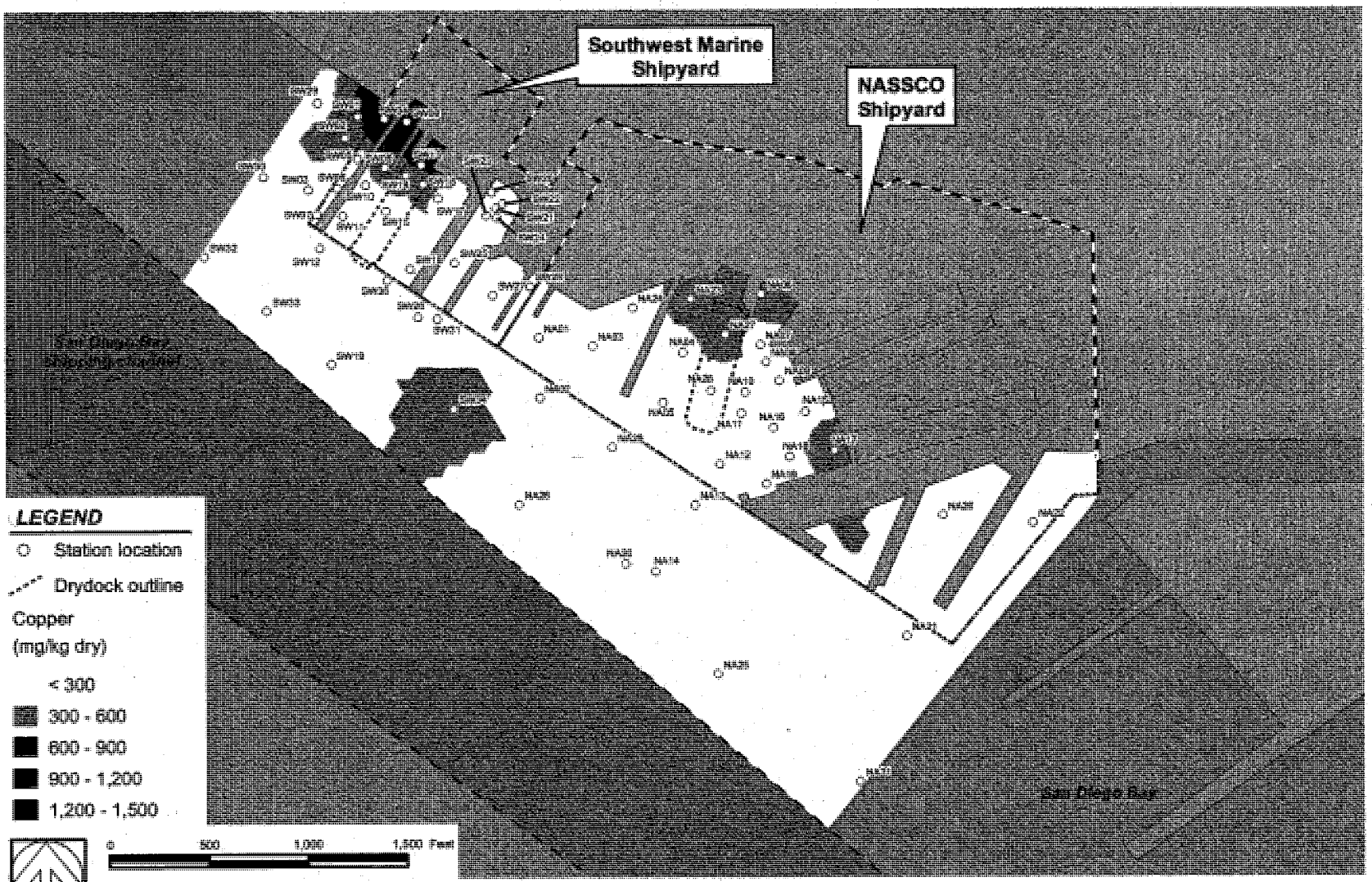


Figure 4-6. Surface sediment concentrations of copper

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Cu.mxd

SAR105798

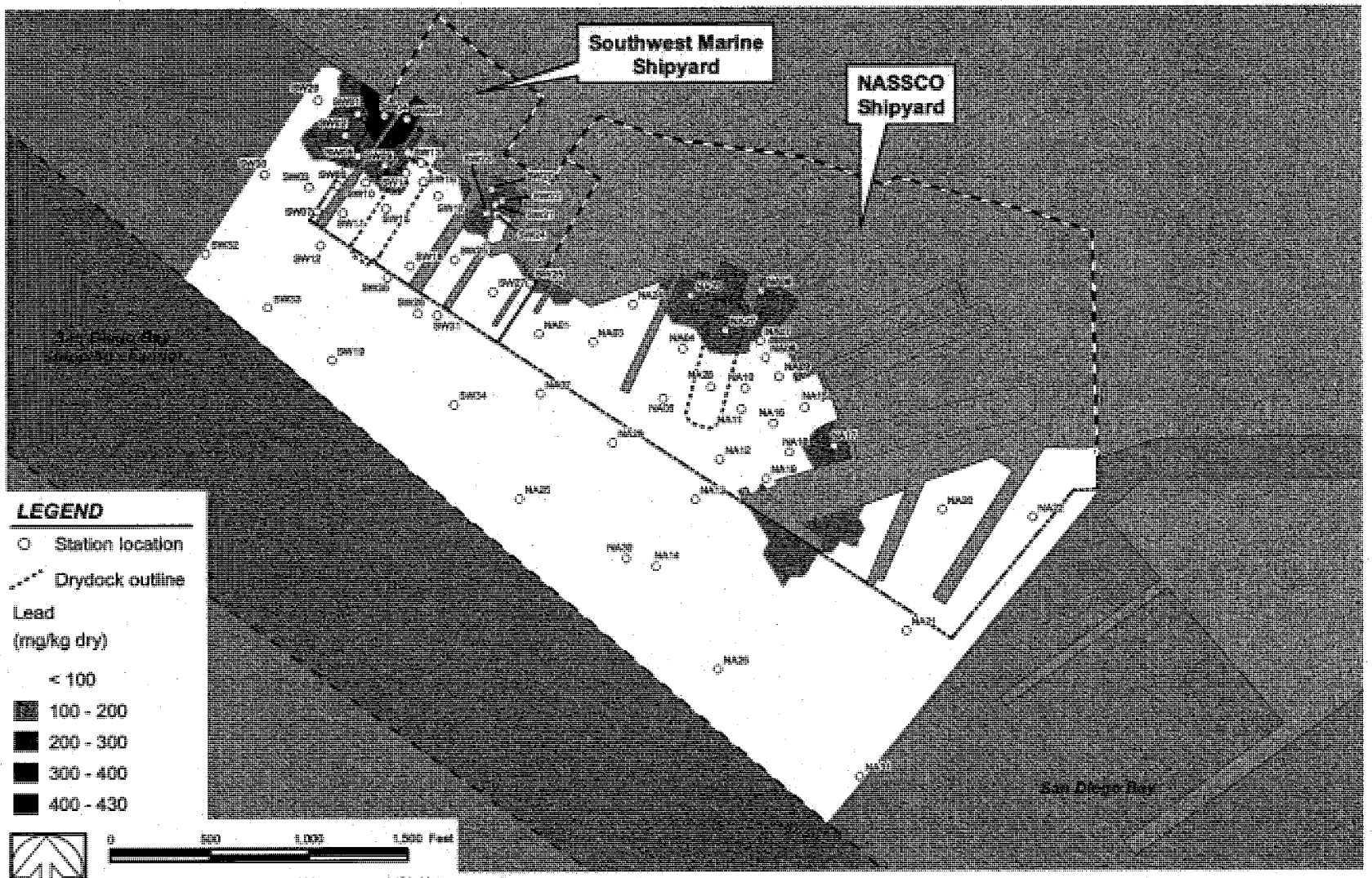


Figure 4-7. Surface sediment concentrations of lead

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Pb.mxd

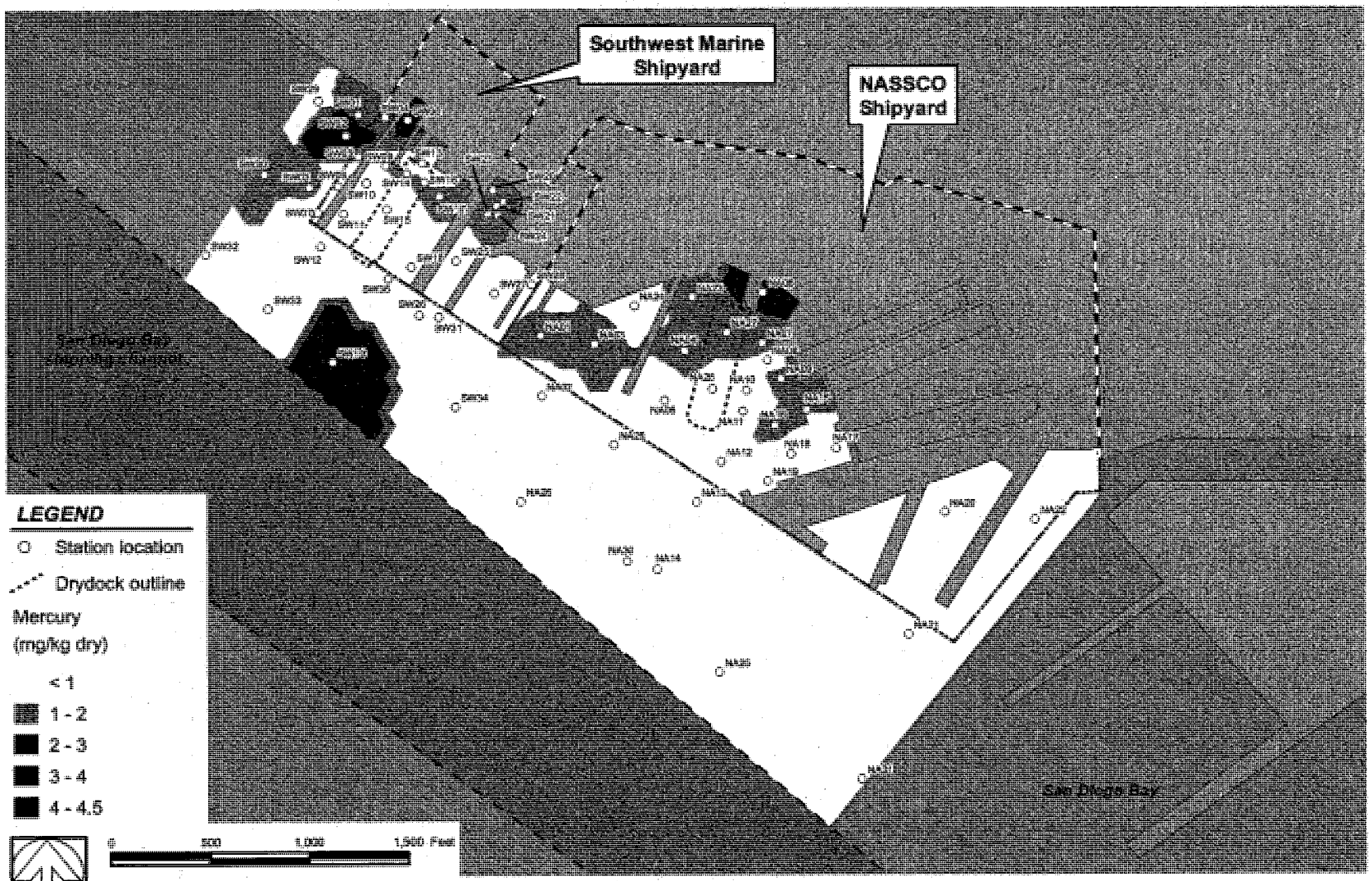


Figure 4-8. Surface sediment concentrations of mercury

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Hg.mxd

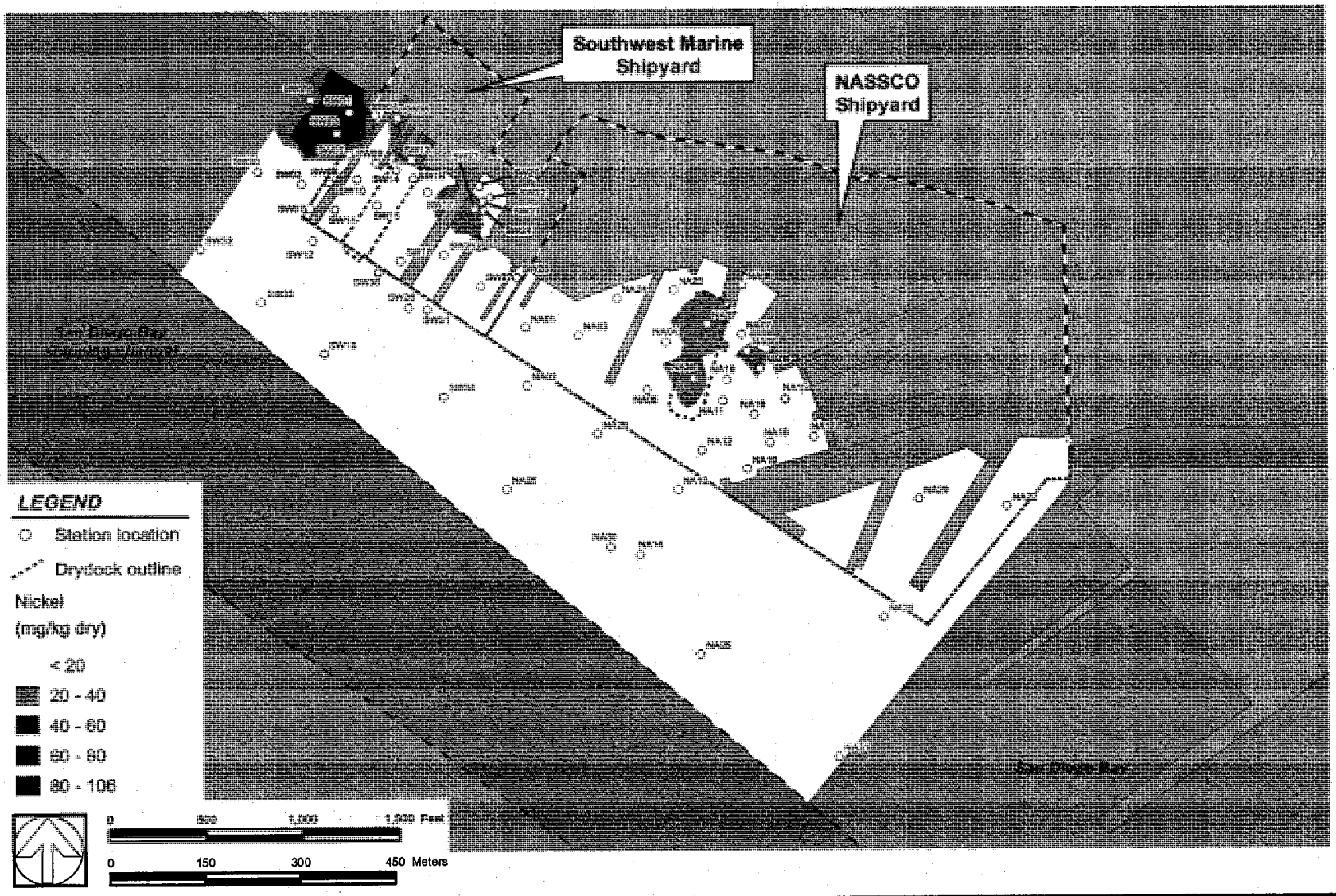


Figure 4-9. Surface sediment concentrations of nickel

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Ni.mxd

SAR105801

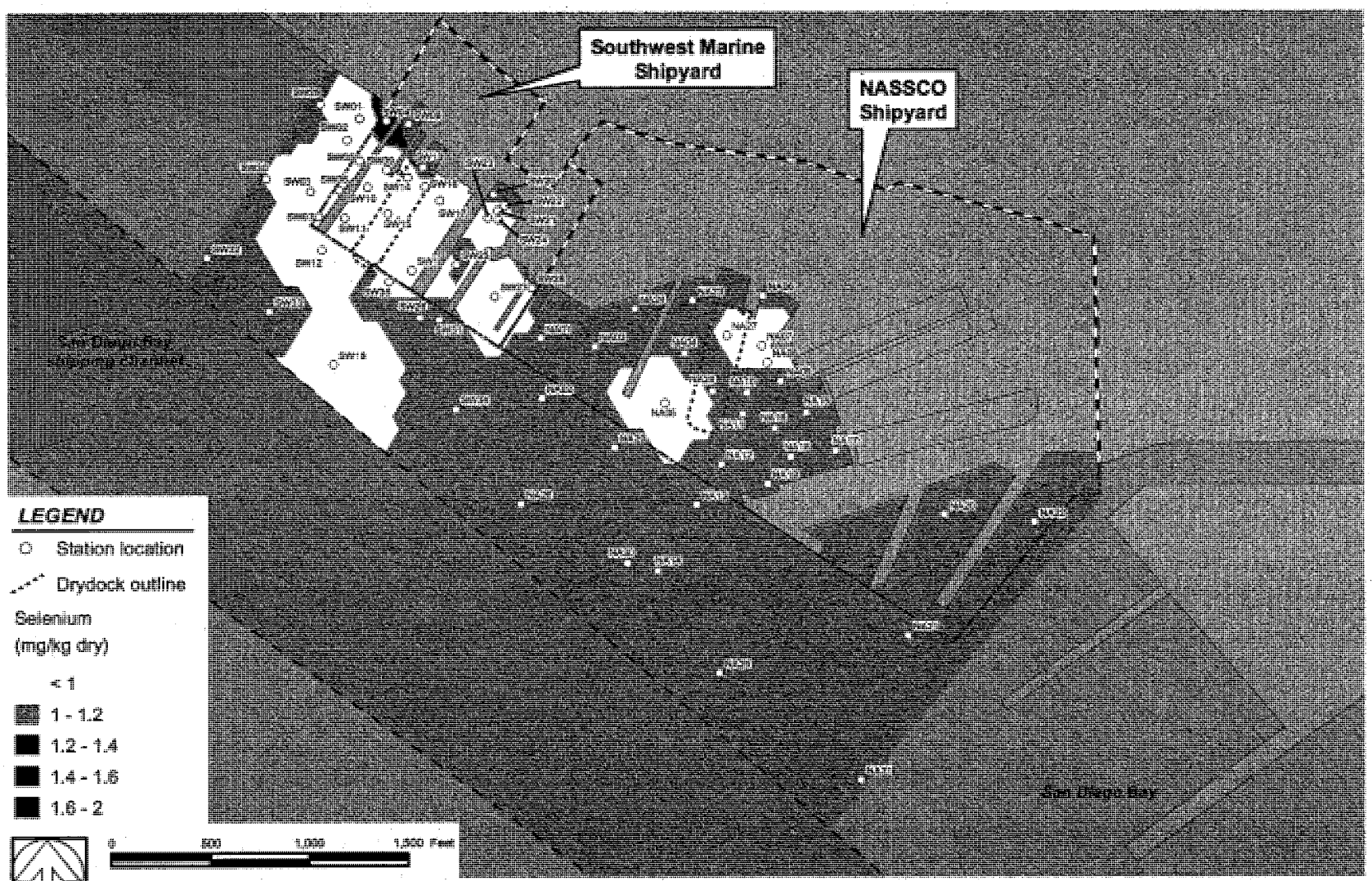


Figure 4-10. Surface sediment concentrations of selenium

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Se.mxd

SAR105802

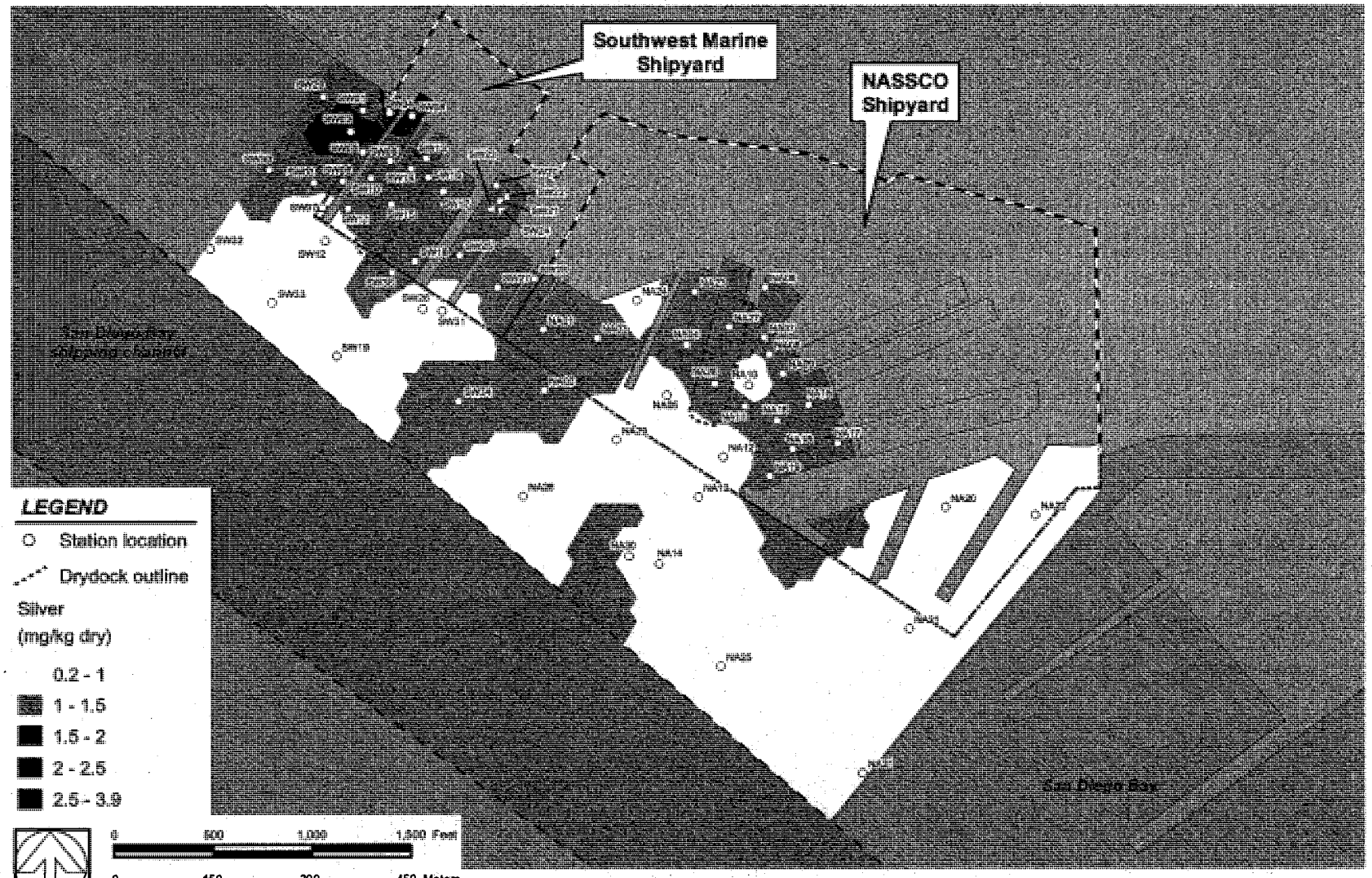


Figure 4-11. Surface sediment concentrations of silver

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_deta_cntrs_Ag.mxd

SAR105803

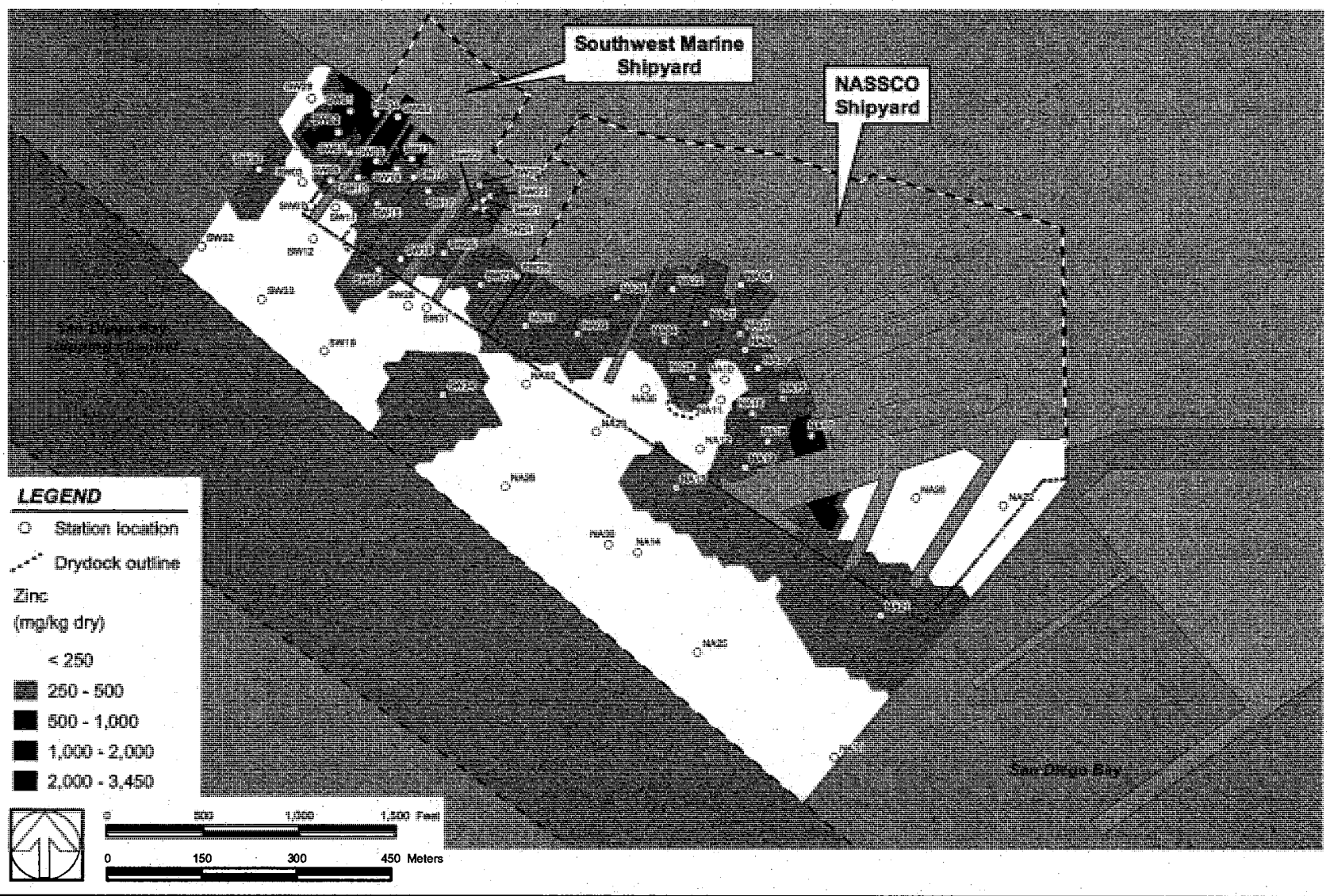


Figure 4-12. Surface sediment concentrations of zinc

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_Se.mxd

SAR105804

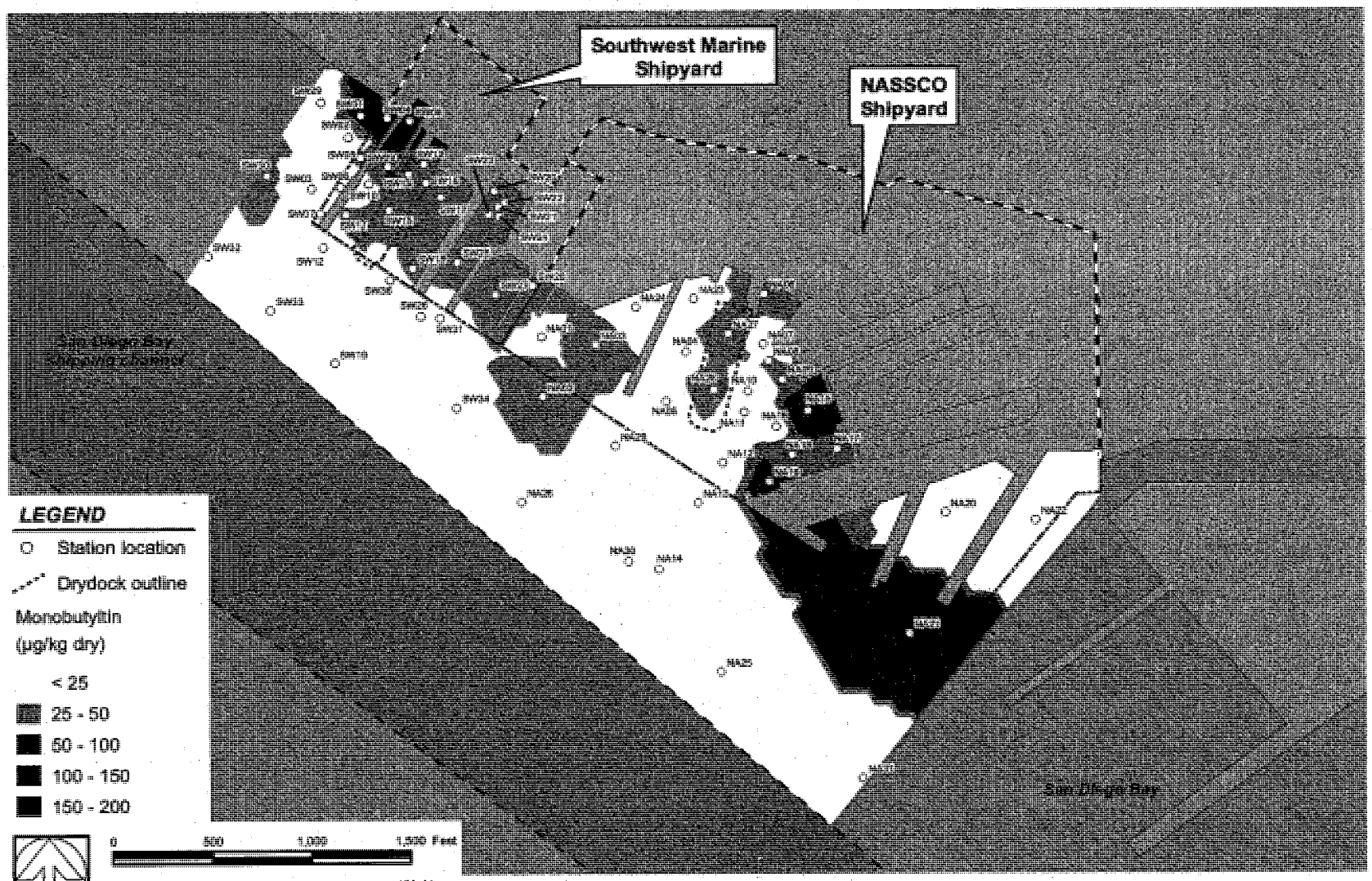


Figure 4-13. Surface sediment concentrations of monobutyltin

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_monobutyltin.mxd

SAR105805

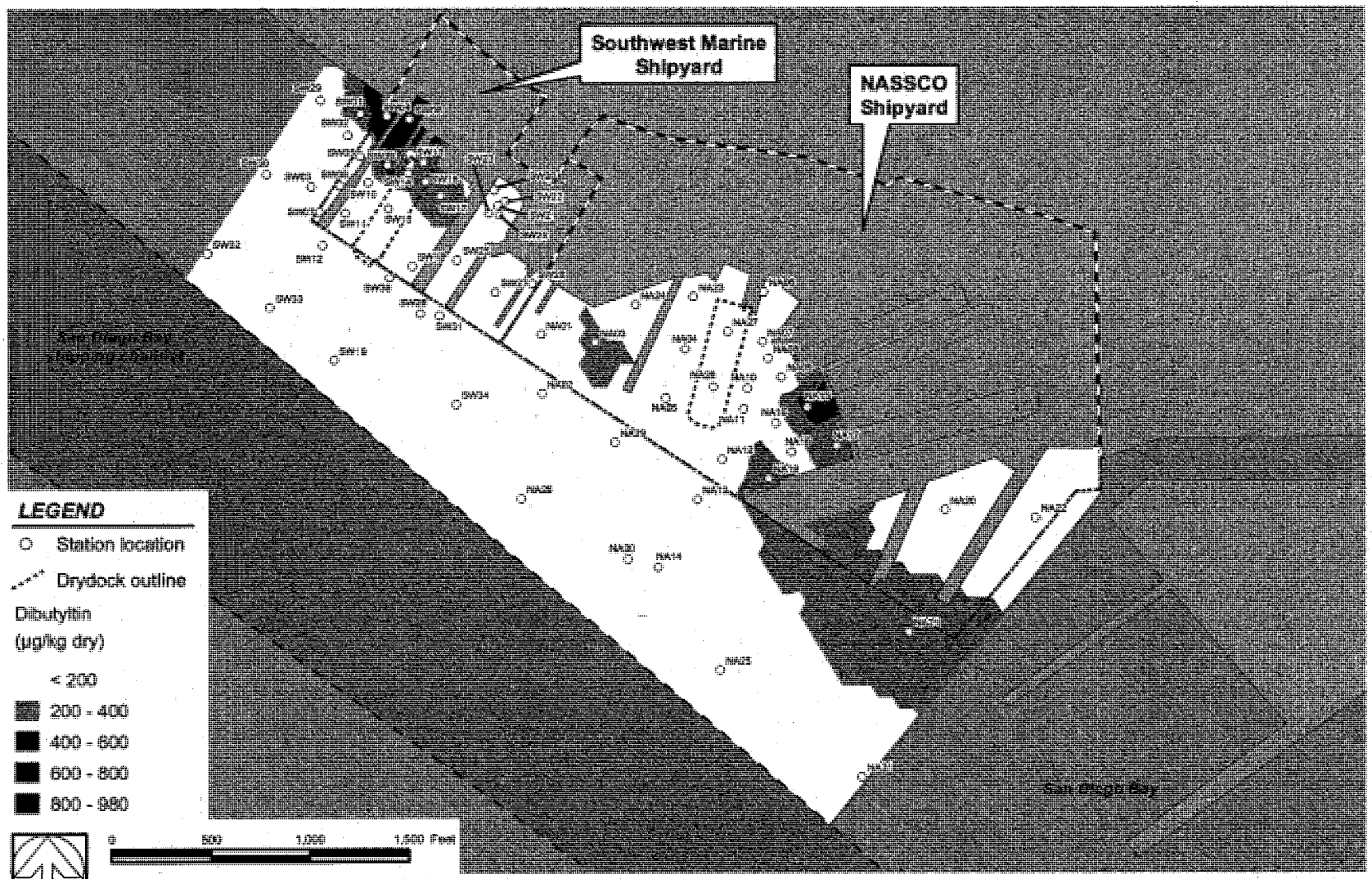


Figure 4-14. Surface sediment concentrations of dibutyltin

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_dibutyltin.mxd

SAR105806

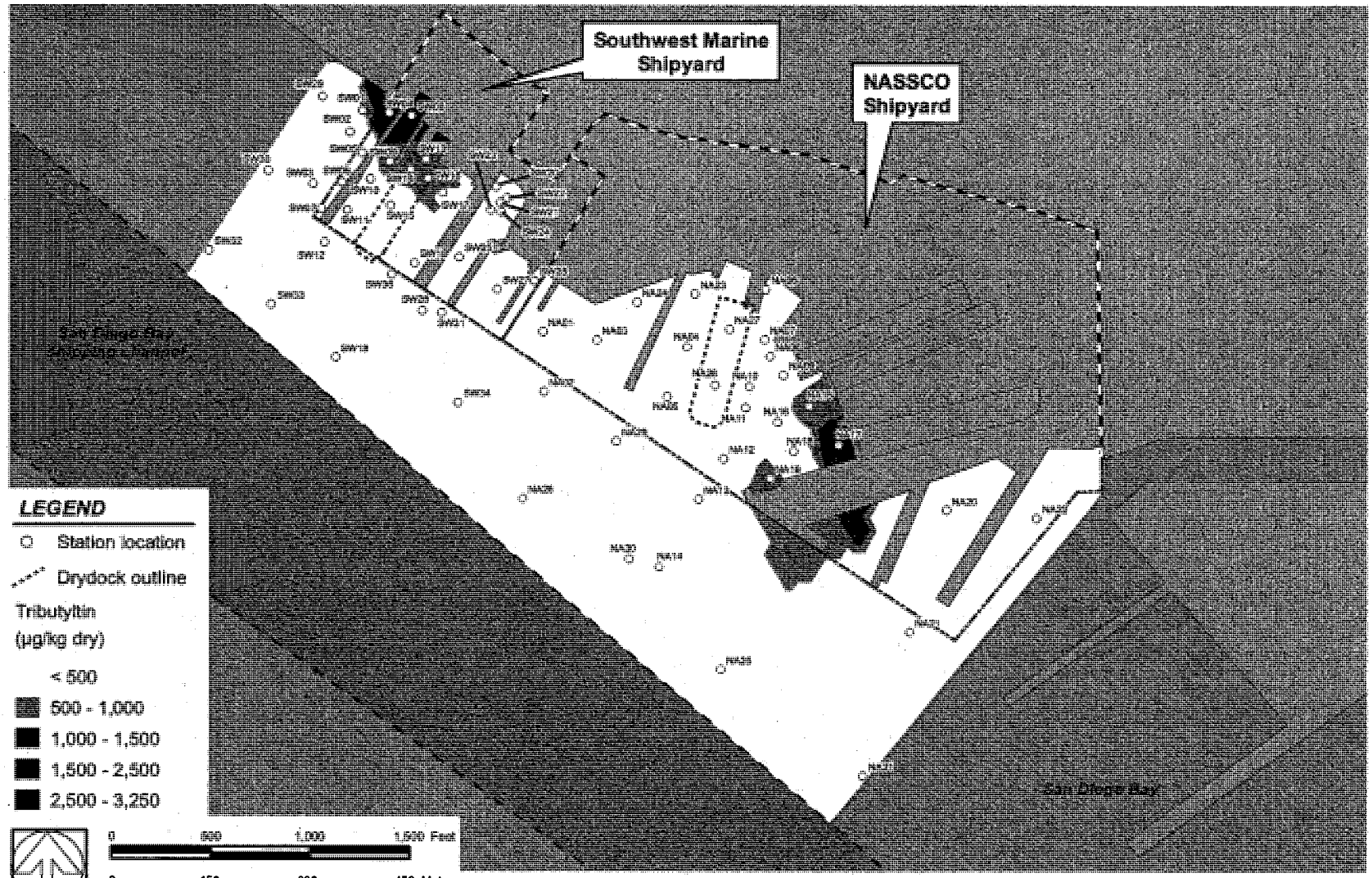


Figure 4-15. Surface sediment concentrations of tributyltin

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_tbt.mxd

SAR105807

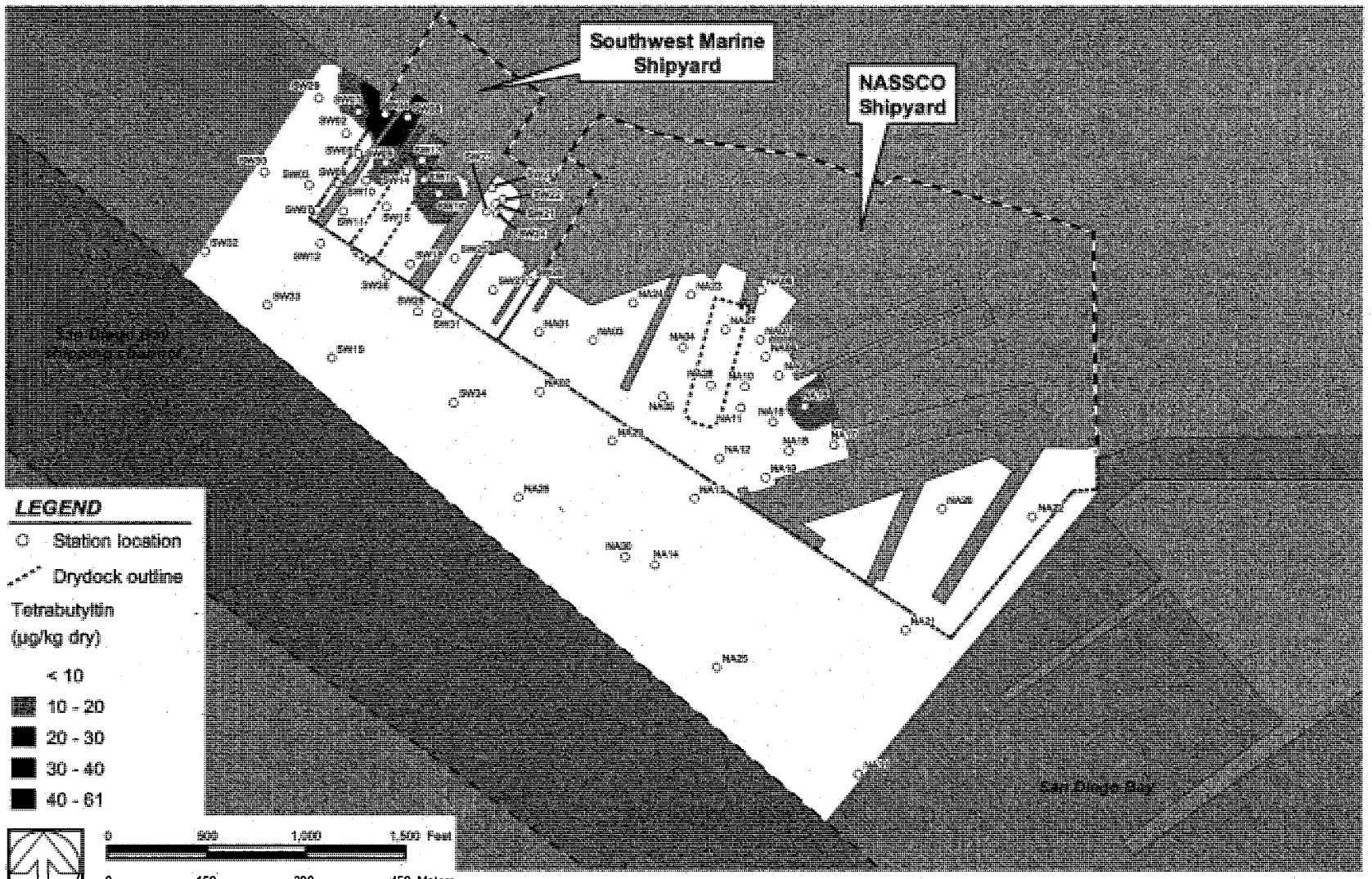


Figure 4-16. Surface sediment concentrations of tetrabutyltin

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_tetrabutyltin.mxd

SAR105808

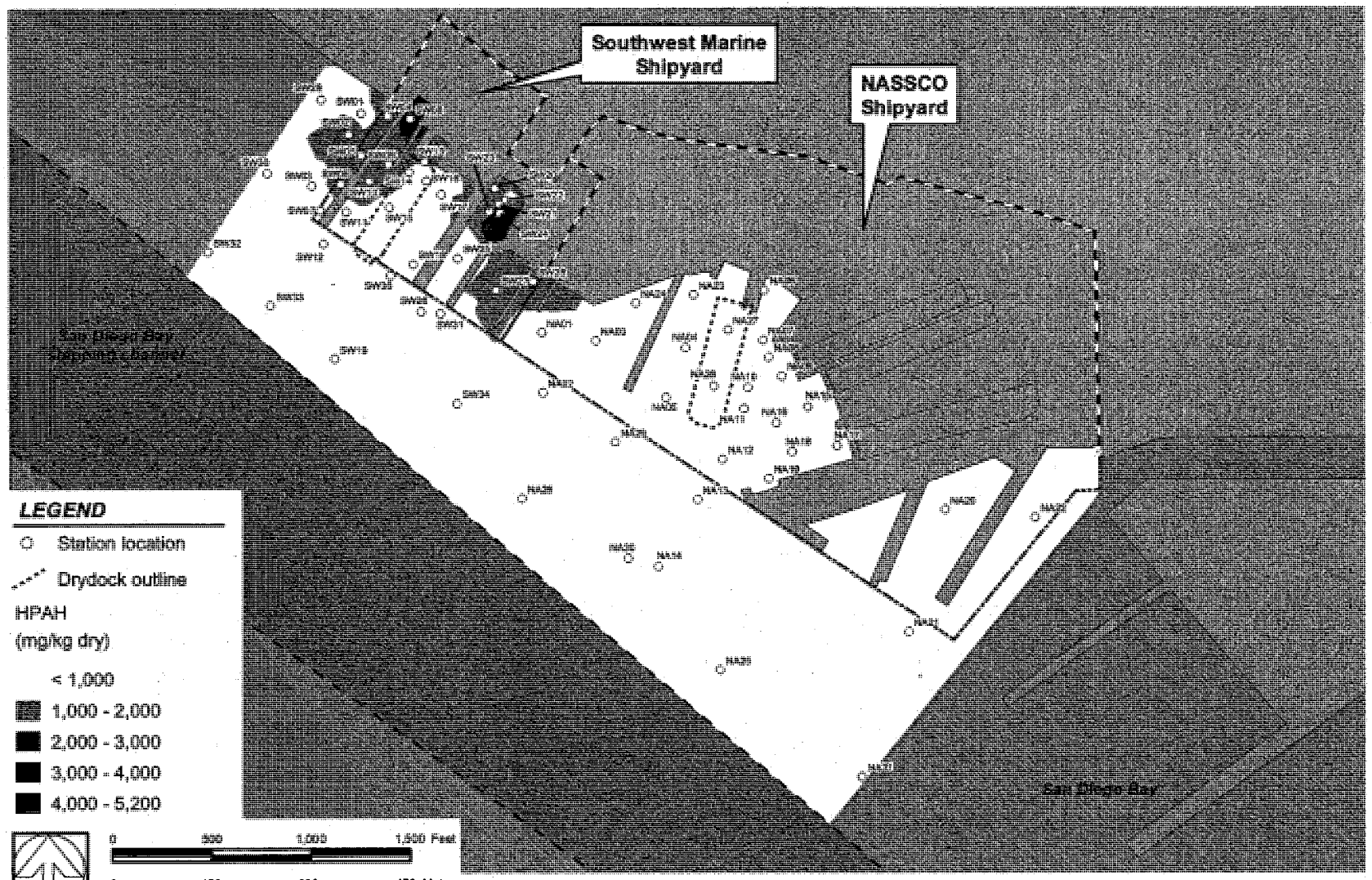


Figure 4-17. Surface sediment concentrations of high molecular weight polycyclic aromatic hydrocarbon (HPAH)

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_HPAH.mxd

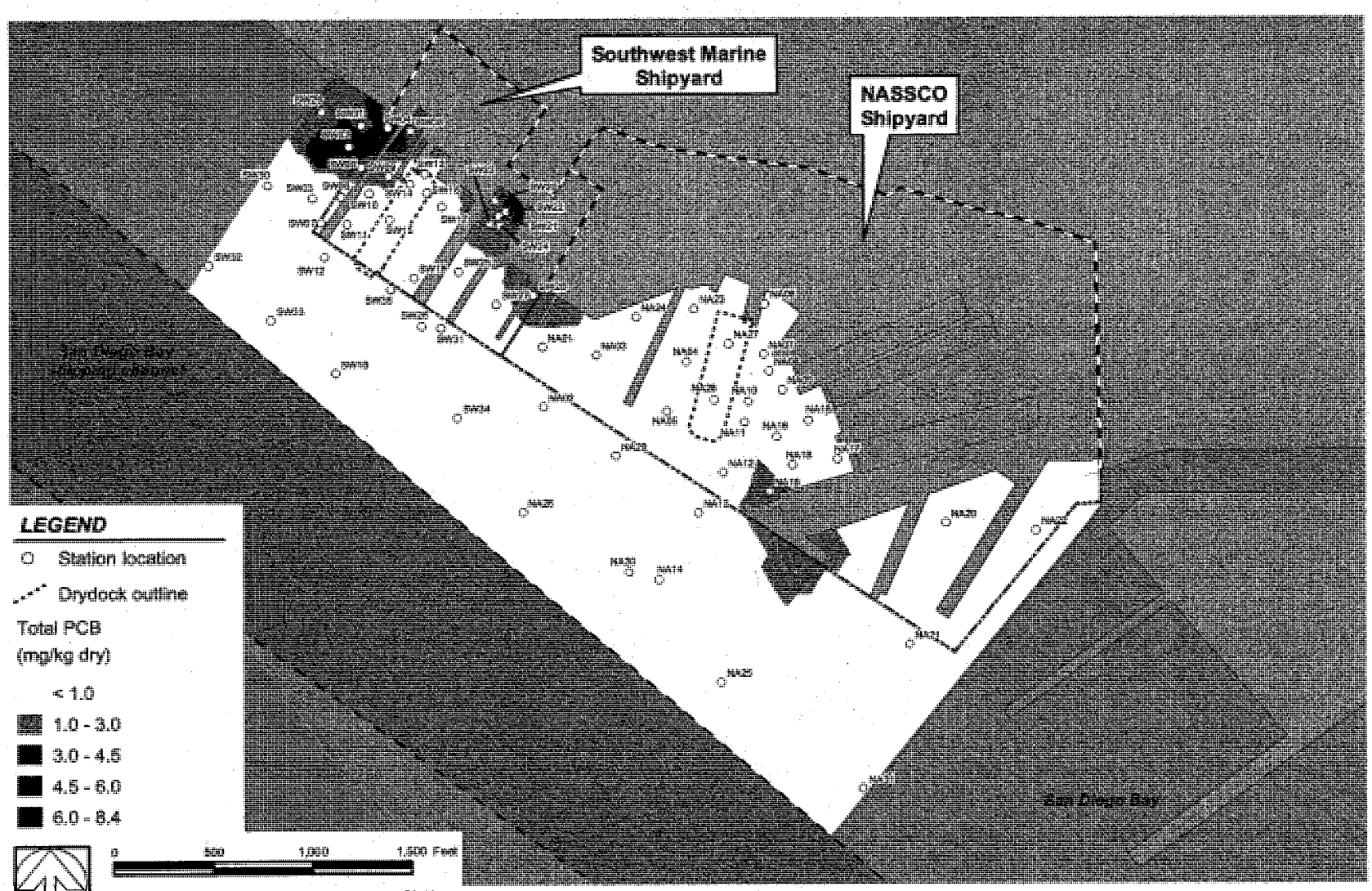


Figure 4-18. Surface sediment concentrations of total PCB homologs

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_PCB.mxd

SAR105810

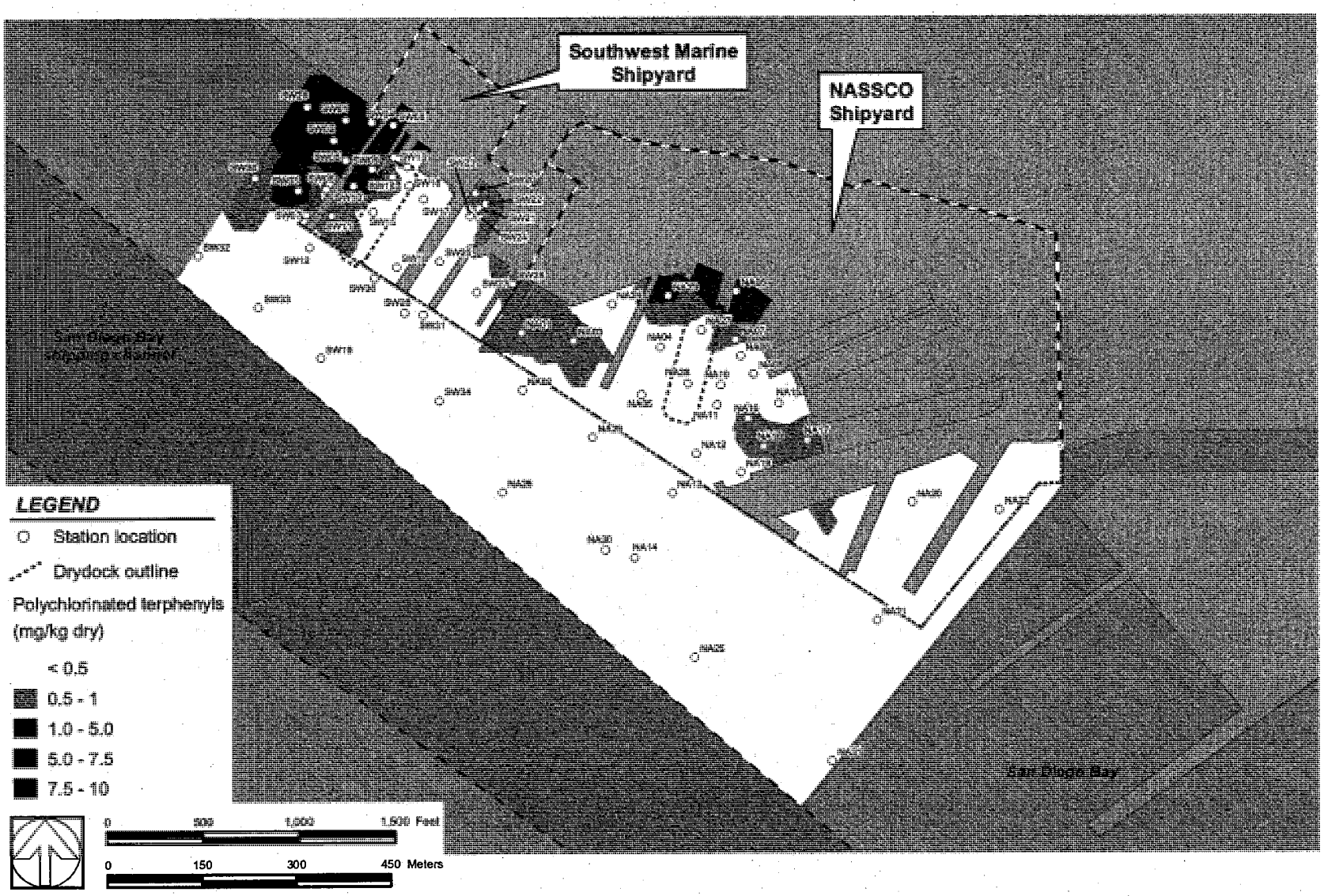


Figure 4-19. Surface sediment concentrations of polychlorinated terphenyls

Exponent®

8601718/8601731.002 1201 | August 22, 2003 | G:\swm_nassco\projects\surface_data_cntrs_PCT.mxd

SAR105811

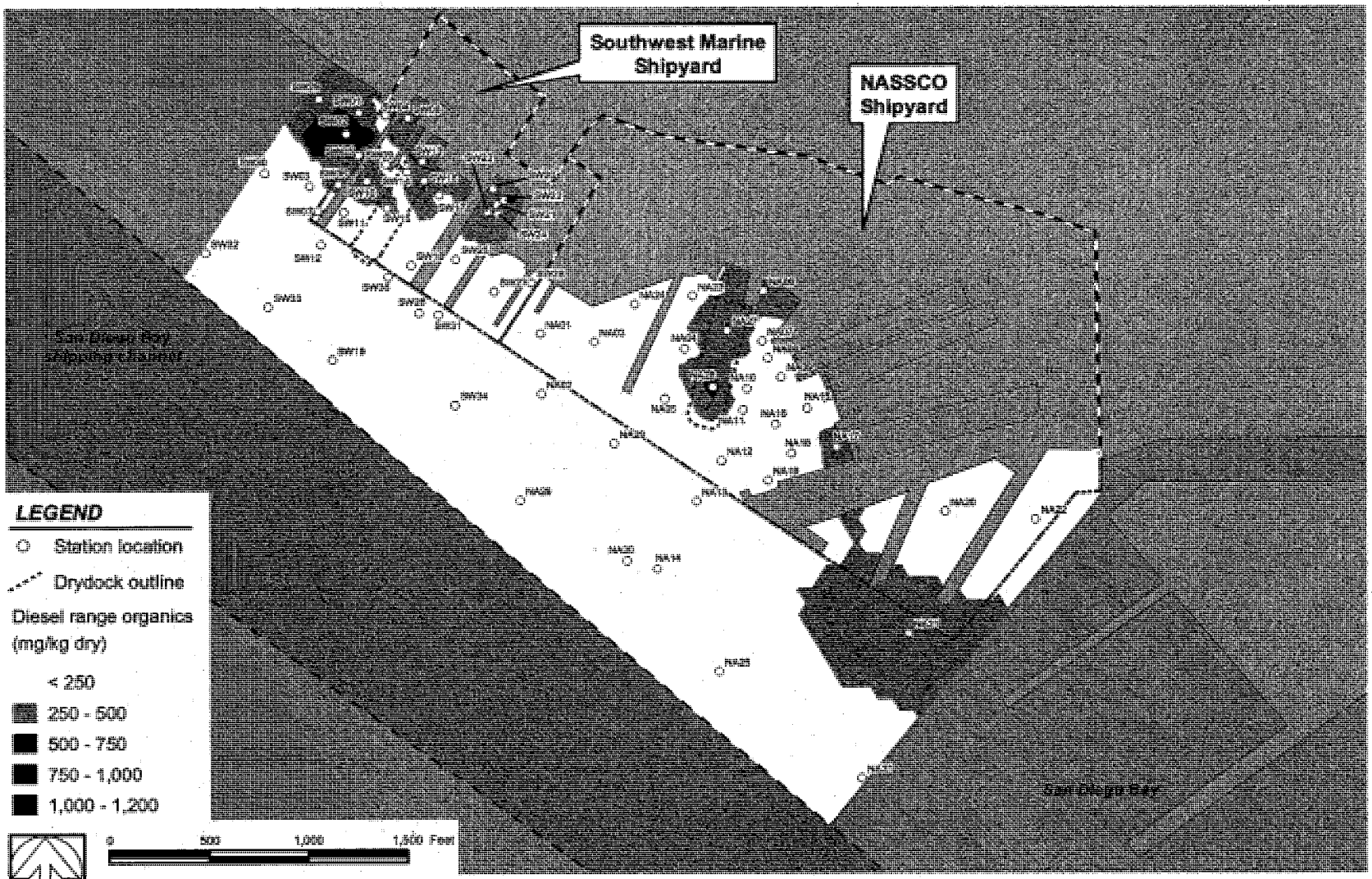


Figure 4-20. Surface sediment concentrations of diesel range organics

Exponent®

8601718/8601731.002 1201 | August 21, 2003 | G:\swm_nassco\projects\surface_data_cntrs_DRO.mxd

SAR105812

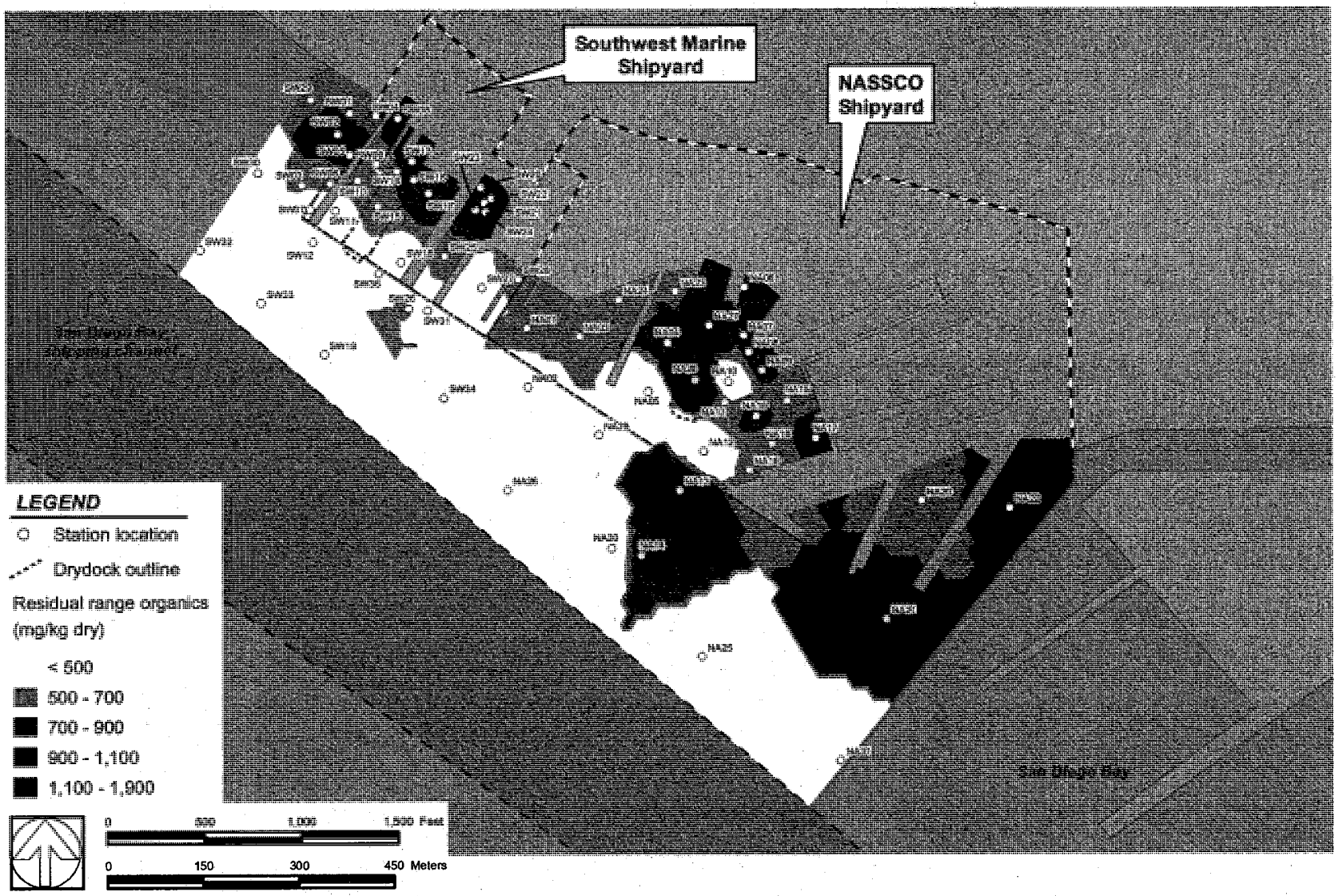


Figure 4-21. Surface sediment concentrations of residual range organics

Exponent®

8601718/8601731.002 1201 | August 21, 2003 | G:\swm_nassco\projects\surface_data_cntrs_RRO.mxd

SAR105813

Exponent®

NASSCO and Southwest Marine Detailed Sediment Investigation

Volume II
Appendices A–E

Prepared for

NASSCO and Southwest Marine
San Diego, California

Volume II

Appendix A	Sediment Profile Images and Data Summary
Appendix B	Surface and Subsurface Sediment Chemistry Data
Appendix C	Sediment Core Logs
Appendix D	Pore Water Chemistry Data
Appendix E	Tissue Chemistry Data

Table B1-7. PCB and PCT results for surface sediment samples

Station	Sample Number	Date	Field Split	PCB Aroclors® 1016	1221	1232	1242	1248	1254	1260	Total[a]	PCT Aroclors® 5432	5442	5460	Total[a]
Reference															
2229	SD0103	09/09/2002		15 *U*	30 *U*	15 *U*	15 *U*	15 *U*	32	32	64	15 *U*	15 *U*	75 *U*	75 *U*
2230	SD0104	09/09/2002		15 *U*	30 *U*	15 *U*	15 *U*	15 *U*	17	19	36	15 *U*	15 *U*	75 *U*	75 *U*
2231	SD0013	08/08/2001		10 *U*	20 *U*	10 *U*	10 *U*	10 *U*	240	140	380	48 *U*	48 *U*	240 *U*	240 *U*
2231	SD0134	09/14/2002		26 *U*	52 *U*	26 *U*	26 *U*	26 *U*	66	87	150	26 *U*	26 *U*	150	150
2240	SD0125	09/12/2002		25 *U*	50 *U*	25 *U*	25 *U*	25 *U*	59	69	130	25 *U*	25 *U*	140	140
2241	SD0128	09/12/2002		14 *U*	27 *U*	14 *U*	14 *U*	14 *U*	14 *U*	18	18	14 *U*	14 *U*	68 *U*	68 *U*
2243	SD0049	08/14/2001		16 *U*	31 *U*	16 *U*	16 *U*	16 *U*	23	16 *U*	23	31 *U*	31 *U*	160 *U*	160 *U*
2243	SD0124	09/12/2002		16 *U*	32 *U*	16 *U*	16 *U*	16 *U*	27	29	56	16 *U*	16 *U*	85	85
2244	SD0126	09/12/2002	1	8.1 *U*	17 *U*	8.1 *U*	8.1 *U*	8.1 *U*	23	30	53	17 *U*	17 *U*	81 *U*	81 *U*
2244	SD0127	09/12/2002	2	16 *U*	32 *U*	16 *U*	16 *U*	16 *U*	21	29	50	16 *U*	16 *U*	78 *U*	78 *U*
2265	SD0107	09/09/2002		18 *U*	35 *U*	18 *U*	18 *U*	18 *U*	51	50	100	18 *U*	18 *U*	86 *U*	86 *U*
2433	SD0041	08/12/2001		16 *U*	32 *U*	16 *U*	16 *U*	16 *U*	26	17	43	32 *U*	32 *U*	160 *U*	160 *U*
2433	SD0130	09/13/2002		17 *U*	33 *U*	17 *U*	17 *U*	17 *U*	32	34	66	17 *U*	17 *U*	95	95
2435	SD0102	09/09/2002		14 *U*	28 *U*	14 *U*	14 *U*	14 *U*	14 *U*	14 *U*	28 *U*	14 *U*	14 *U*	70 *U*	70 *U*
2440	SD0043	08/13/2001		17 *U*	33 *U*	17 *U*	17 *U*	17 *U*	190	88	280	33 *U*	33 *U*	170 *U*	170 *U*
2440	SD0131	09/13/2002		17 *U*	33 *U*	17 *U*	17 *U*	17 *U*	140	110	250	17 *U*	17 *U*	560	560
2441	SD0034	08/11/2001		18 *U*	36 *U*	18 *U*	18 *U*	18 *U*	20	18 *U*	20	36 *U*	36 *U*	180 *U*	180 *U*
2441	SD0123	09/12/2002		20 *U*	40 *U*	20 *U*	20 *U*	20 *U*	26	20 *U*	26	20 *U*	20 *U*	99 *U*	99 *U*
NASSCO															
NA01	SD0030	08/11/2001	1	28 *U*	56 *U*	28 *U*	28 *U*	28 *U*	370	260	630	56 *U*	56 *U*	640	640
NA01	SD0031	08/11/2001	2	29 *U*	57 *U*	29 *U*	29 *U*	29 *U*	360	220	580	57 *U*	57 *U*	570	570
NA02	SD0033	08/11/2001		29 *U*	58 *U*	29 *U*	29 *U*	29 *U*	150	140	290	58 *U*	58 *U*	290 *U*	290 *U*
NA03	SD0032	08/11/2001		29 *U*	58 *U*	29 *U*	29 *U*	29 *U*	330	250	580	58 *U*	58 *U*	540	540
NA04	SD0035	08/11/2001		30 *U*	59 *U*	30 *U*	30 *U*	30 *U*	250	180	430	59 *U*	59 *U*	390	390
NA05	SD0044	08/13/2001		24 *U*	47 *U*	24 *U*	24 *U*	24 *U*	140	96	240	47 *U*	47 *U*	240 *U*	240 *U*
NA06	SD0020	08/09/2001		280 *U*	550 *U*	280 *U*	280 *U*	280 *U*	1,400	290 *J*	1,700 *J*	550 *U*	550 *U*	2,900	2,900
NA07	SD0017	08/08/2001	1	270 *U*	540 *U*	270 *U*	270 *U*	270 *U*	490	270 *U*	490	54 *U*	54 *U*	750	750
NA07	SD0018	08/08/2001	2	270 *U*	530 *U*	270 *U*	270 *U*	570 *JN*	590	270 *U*	1,200 *JN*	53 *U*	53 *U*	500	500
NA08	SD0055	08/14/2001		32 *U*	64 *U*	32 *U*	32 *U*	32 *U*	210	170	380	64 *U*	64 *U*	330	330
NA09	SD0054	08/14/2001		33 *U*	65 *U*	33 *U*	33 *U*	33 *U*	230	180	410	65 *U*	65 *U*	330 *U*	330 *U*
NA10	SD0056	08/14/2001		22 *U*	44 *U*	22 *U*	22 *U*	22 *U*	170	130	300	44 *U*	44 *U*	270	270
NA11	SD0021	08/09/2001		26 *U*	52 *U*	26 *U*	26 *U*	26 *U*	170	100	270	52 *U*	52 *U*	340	340
NA12	SD0027	08/10/2001		25 *U*	49 *U*	25 *U*	25 *U*	25 *U*	120	95	220	49 *U*	49 *U*	250 *U*	250 *U*
NA13	SD0036	08/11/2001		28 *U*	55 *U*	28 *U*	28 *U*	28 *U*	130	110	240	55 *U*	55 *U*	280 *U*	280 *U*
NA14	SD0051	08/14/2001		23 *U*	46 *U*	23 *U*	23 *U*	23 *U*	120	93	210	46 *U*	46 *U*	230 *U*	230 *U*
NA15	SD0037	08/12/2001		27 *U*	53 *U*	27 *U*	27 *U*	27 *U*	320	160	480	53 *U*	53 *U*	340	340
NA16	SD0038	08/12/2001		28 *U*	56 *U*	28 *U*	28 *U*	28 *U*	450	210	660	56 *U*	56 *U*	570	570
NA17	SD0039	08/12/2001		29 *U*	58 *U*	29 *U*	29 *U*	29 *U*	640	310	950	58 *U*	58 *U*	650	650
NA18	SD0053	08/14/2001		27 *U*	53 *U*	27 *U*	27 *U*	27 *U*	590	280	870	53 *U*	53 *U*	840	840

Table B1-7. (cont.)

Station	Sample Number	Date	Field Split	PCB Aroclors® 1016	1221	1232	1242	1248	1254	1260	Total[a]	PCT Aroclors® 5432	5442	5460	Total[a]
NA19	SD0042	08/12/2001		28 *U*	56 *U*	28 *U*	28 *U*	28 *U*	430	170	600	56 *U*	56 *U*	280 *U*	280 *U*
NA20	SD0028	08/10/2001		19 *U*	37 *U*	19 *U*	19 *U*	19 *U*	120	77	200	37 *U*	37 *U*	190 *U*	190 *U*
NA21	SD0050	08/14/2001		23 *U*	46 *U*	23 *U*	23 *U*	23 *U*	150	120	270	46 *U*	46 *U*	230 *U*	230 *U*
NA22	SD0052	08/14/2001		20 *U*	39 *U*	20 *U*	20 *U*	20 *U*	200	150	350	39 *U*	39 *U*	200 *U*	200 *U*
NA23	SD0095	09/08/2002		28 *U*	56 *U*	28 *U*	28 *U*	28 *U*	600 *J*	530 *J*	1,100 *J*	28 *U*	28 *U*	1,000 *J*	1,000 *J*
NA24	SD0094	09/08/2002		25 *U*	50 *U*	25 *U*	25 *U*	25 *U*	260	270	530	25 *U*	25 *U*	350	350
NA25	SD0106	09/09/2002		21 *U*	41 *U*	21 *U*	21 *U*	21 *U*	87	96	180	21 *U*	21 *U*	150	150
NA26	SD0116	09/11/2002		22 *U*	44 *U*	22 *U*	22 *U*	22 *U*	82	110	190	22 *U*	22 *U*	190	190
NA27	SD0301	10/02/2002		20 *U*	39 *U*	20 *U*	20 *U*	20 *U*	270	340	610	39 *U*	39 *U*	480	480
NA28	SD0300	10/02/2002		18 *U*	36 *U*	18 *U*	18 *U*	18 *U*	290	340	630	36 *U*	36 *U*	550	550
NA29	SD0119	09/11/2002		25 *U*	49 *U*	25 *U*	25 *U*	25 *U*	160	170	330	25 *U*	25 *U*	400	400
NA30	SD0115	09/11/2002		22 *U*	43 *U*	22 *U*	22 *U*	22 *U*	220	160	380	22 *U*	22 *U*	170	170
NA31	SD0105	09/09/2002		20 *U*	40 *U*	20 *U*	20 *U*	20 *U*	85	83	170	20 *U*	20 *U*	100	100
Southwest Marine															
SW01	SD0001	08/06/2001		340 *U*	680 *U*	340 *U*	340 *U*	340 *U*	5,900	1,200	7,100	680 *U*	680 *U*	9,800	9,800
SW02	SD0005	08/06/2001	1	480 *U*	960 *U*	480 *U*	480 *U*	480 *U*	5,500	1,300	6,800	960 *U*	960 *U*	13,000	13,000
SW02	SD0006	08/06/2001	2	530 *U*	1,100 *U*	530 *U*	530 *U*	530 *U*	4,700	1,100	5,800	1,100 *U*	1,100 *U*	7,700	7,700
SW03	SD0009	08/07/2001		270 *U*	530 *U*	270 *U*	270 *U*	270 *U*	780	270 *U*	780	270 *U*	270 *U*	1,800	1,800
SW04	SD0012	08/07/2001		190 *U*	370 *U*	190 *U*	190 *U*	190 *U*	2,400	600	3,000	190 *U*	190 *U*	4,800 *J*	4,800 *J*
SW05	SD0003	08/06/2001		110 *U*	210 *U*	110 *U*	110 *U*	110 *U*	1,500	390	1,900	210 *U*	210 *U*	2,700	2,700
SW06	SD0002	08/06/2001		140 *U*	280 *U*	140 *U*	140 *U*	350	530	200	1,100	56 *U*	56 *U*	310	310
SW07	SD0004	08/06/2001		110 *U*	220 *U*	110 *U*	110 *U*	110 *U*	230	110 *U*	230	44 *U*	44 *U*	390	390
SW08	SD0016	08/08/2001		330 *U*	650 *U*	330 *U*	330 *U*	990 *JN*	2,400	640	4,000 *JN*	650 *U*	650 *U*	5,900	5,900
SW09	SD0007	08/06/2001		120 *U*	230 *U*	120 *U*	120 *U*	120 *U*	1,100	410	1,500	230 *U*	230 *U*	1,400	1,400
SW10	SD0008	08/06/2001		95 *U*	190 *U*	95 *U*	95 *U*	580	710	220	1,500	190 *U*	190 *U*	1,300	1,300
SW11	SD0048	08/13/2001		27 *U*	53 *U*	27 *U*	27 *U*	27 *U*	460	170	630	53 *U*	53 *U*	910	910
SW12	SD0010	08/07/2001		23 *U*	45 *U*	23 *U*	23 *U*	23 *U*	220	110	330	45 *U*	45 *U*	320	320
SW13	SD0022	08/09/2001		30 *U*	60 *U*	30 *U*	30 *U*	30 *U*	310	210	520	60 *U*	60 *U*	350	350
SW14	SD0024	08/10/2001		26 *U*	52 *U*	26 *U*	26 *U*	26 *U*	360	260	620	52 *U*	52 *U*	640	640
SW15	SD0023	08/10/2001		29 *U*	58 *U*	29 *U*	29 *U*	29 *U*	240	160	400	58 *U*	58 *U*	350	350
SW16	SD0025	08/10/2001		24 *U*	47 *U*	24 *U*	24 *U*	24 *U*	340	250	590	47 *U*	47 *U*	410	410
SW17	SD0047	08/13/2001		30 *U*	59 *U*	30 *U*	30 *U*	30 *U*	390	420	810	59 *U*	59 *U*	320	320
SW18	SD0046	08/13/2001		30 *U*	59 *U*	30 *U*	30 *U*	30 *U*	250	130	380	59 *U*	59 *U*	300 *U*	300 *U*
SW19	SD0011	08/07/2001		21 *U*	41 *U*	21 *U*	21 *U*	21 *U*	110	95	210	41 *U*	41 *U*	240	240
SW20	SD0059	08/15/2001		250 *U*	500 *U*	250 *U*	250 *U*	250 *U*	1,500	1,600	3,100	50 *U*	50 *U*	640	640
SW21	SD0019	08/09/2001		260 *U*	520 *U*	260 *U*	260 *U*	260 *U*	1,600	1,800	3,400	52 *U*	52 *U*	760	760
SW22	SD0060	08/15/2001		29 *U*	57 *U*	29 *U*	29 *U*	29 *U*	670	790	1,500	57 *U*	57 *U*	540	540
SW23	SD0058	08/15/2001		29 *U*	58 *U*	29 *U*	29 *U*	29 *U*	550	710	1,300	58 *U*	58 *U*	370	370
SW24	SD0015	08/08/2001		230 *U*	460 *U*	230 *U*	230 *U*	230 *U*	790	870	1,700	46 *U*	46 *U*	630	630
SW25	SD0057	08/15/2001		26 *U*	51 *U*	26 *U*	26 *U*	26 *U*	330	380	710	51 *U*	51 *U*	310	310

Table B1-7. (cont.)

Station	Sample Number	Date	Field Split	PCB Aroclors® 1016	1221	1232	1242	1248	1254	1260	Total[a]	PCT Aroclors® 5432	5442	5460	Total[a]
SW26	SD0014	08/08/2001		23 *U*	45 *U*	23 *U*	23 *U*	23 *U*	170	86	260	45 *U*	45 *U*	230 *U*	230 *U*
SW27	SD0045	08/13/2001		29 *U*	57 *U*	29 *U*	29 *U*	29 *U*	230	160	390	57 *U*	57 *U*	290 *U*	290 *U*
SW28	SD0029	08/11/2001		290 *U*	570 *U*	290 *U*	290 *U*	290 *U*	1,400	2,300	3,700	57 *U*	57 *U*	760	760
SW29	SD0110	09/09/2002		200 *U*	400 *U*	200 *U*	200 *U*	480	1,600	980	3,100	200 *U*	200 *U*	4,800 *J*	4,800 *J*
SW30	SD0135	09/14/2002		29 *U*	57 *U*	29 *U*	29 *U*	29 *U*	340	280	620	29 *U*	29 *U*	770	770
SW31	SD0122	09/11/2002		17 *U*	33 *U*	17 *U*	17 *U*	17 *U*	75	63	140	17 *U*	17 *U*	160	160
SW32	SD0108	09/09/2002		29 *U*	57 *U*	29 *U*	29 *U*	29 *U*	140	120	260	29 *U*	29 *U*	230	230
SW33	SD0118	09/11/2002		29 *U*	58 *U*	29 *U*	29 *U*	29 *U*	110	120	230	29 *U*	29 *U*	180	180
SW34	SD0117	09/11/2002		23 *U*	46 *U*	23 *U*	23 *U*	23 *U*	150	140	290	23 *U*	23 *U*	430	430
SW36	SD0180	11/07/2002		32 *U*	63 *U*	32 *U*	32 *U*	32 *U*	190 *J*	130	320 *J*	32 *U*	32 *U*	230	230

Note: All surface sediment samples were collected from a depth interval of 0–2 cm.

All results reported as μg/kg dry weight.

J - estimated
N - tentatively identified
PCB - polychlorinated biphenyl
PCT - polychlorinated terphenyl
U - undetected at quantitation limit shown

[a] Total PCB and total PCT for each sample is computed as the sum of Aroclors® according to the following rules: 1) if any Aroclor® is detected, all detected Aroclors® are summed; 2) if no Aroclor® is detected, the highest quantitation limit for any Aroclor® is used.

Table B1-8. PCB congener and homolog results for surface sediment samples

Station	Sample Number	Date	Field Split	PCB Congeners 18	28	37	44	49	52	66	70	74	77
Reference													
2229	SD0103	09/09/2002		0.056	0.17	0.092	0.21	0.33	0.39	0.65	0.40	0.22	0.082
2230	SD0104	09/09/2002		0.031	0.095	0.053	0.11	0.18	0.21	0.37	0.21	0.13	0.048
2231	SD0013	08/08/2001		0.12	0.37	0.19	0.27	0.46	1.8	0.025 *U*	0.025 *U*	0.025 *U*	0.25
2231	SD0134	09/14/2002		0.080	0.32	0.20	0.37	0.46	0.74	1.1	0.70	0.33	0.20
2240	SD0125	09/12/2002		0.10	0.47	0.25	0.40	0.68	0.84	1.4	0.74	0.38	0.16
2241	SD0128	09/12/2002		0.025 *U*	0.095	0.049	0.078	0.16	0.17	0.31	0.13	0.082	0.031
2243	SD0049	08/14/2001		0.047	0.17	0.088	0.15	0.31	0.35	0.62	0.27	0.14	0.075
2243	SD0124	09/12/2002		0.072	0.23	0.12	0.41	0.41	1.00	0.78	0.65	0.24	0.083
2244	SD0126	09/12/2002	1	0.092	0.19	0.096	0.23	0.33	0.52	0.58	0.39	0.18	0.063
2244	SD0127	09/12/2002	2	0.035	0.16	0.089	0.14	0.27	0.31	0.52	0.25	0.13	0.052
2265	SD0107	09/09/2002		0.055	0.025 *U*	0.089	0.30	0.43	0.63	0.80	0.56	0.27	0.11
2433	SD0041	08/12/2001		0.077	0.28	0.095	0.26	0.44	0.48	0.78	0.39	0.21	0.087
2433	SD0130	09/13/2002		0.081	0.28	0.12	0.24	0.37	0.47	0.76	0.44	0.23	0.072
2435	SD0102	09/09/2002		0.026	0.077	0.034	0.060	0.086	0.11	0.20	0.12	0.063	0.025 *U*
2440	SD0043	08/13/2001		0.47	1.0	0.39	1.8	2.3	3.4	2.9	2.8	1.1	0.47
2440	SD0131	09/13/2002		0.32	0.73	0.29	1.5	1.7	2.8	2.3	2.4	0.92	0.25
2441	SD0034	08/11/2001		0.089	0.21	0.057	0.15	0.22	0.28	0.41	0.27	0.13	0.050
2441	SD0123	09/12/2002		0.13	0.33	0.093	0.18	0.29	0.36	0.60	0.39	0.20	0.075
NASSCO													
NA01	SD0030	08/11/2001	1	0.84	1.7	0.58	4.8	4.3	10	5.9	7.0	2.4	0.82
NA01	SD0031	08/11/2001	2	0.60	1.3	0.56	4.5	4.2	9.7	6.0	6.3	2.3	0.83
NA01[b]	SD0136	09/14/2002											
NA02	SD0033	08/11/2001		0.25	0.78	0.38	1.7	1.9	4.3	3.4	3.7	1.4	0.50
NA03	SD0032	08/11/2001		0.65	1.7	0.59	3.8	4.3	7.8	6.1	5.5	2.3	0.90
NA04	SD0035	08/11/2001		0.75	1.9	0.52	3.2	4.2	6.2	5.5	4.2	1.8	0.66
NA05	SD0044	08/13/2001		0.31	0.84	0.35	2.1	2.6	4.2	3.7	3.1	1.3	0.49
NA06	SD0020	08/09/2001		2.5	4.9	1.2	13	13	25	20	21	8.7	1.6
NA06[b]	SD0101	09/08/2002											
NA07	SD0017	08/08/2001	1	2.3	3.7	0.85	9.2	12	19	11	12	4.8	1.0
NA07	SD0018	08/08/2001	2	2.5	4.0	0.86	8.0	11	17	13	12	5.2	1.3
NA08	SD0055	08/14/2001		0.66	1.6	0.49	3.7	5.0	9.5	5.4	5.5	2.1	0.65
NA09	SD0054	08/14/2001		0.83	1.6	0.55	3.6	3.9	7.8	5.7	5.7	2.3	0.66
NA10	SD0056	08/14/2001		0.24	0.74	0.28	1.9	2.0	3.7	3.1	2.6	1.1	0.41
NA11	SD0021	08/09/2001		0.44	1.1	0.36	2.4	2.8	4.4	4.2	3.4	1.6	0.51
NA12	SD0027	08/10/2001		0.25	0.76	0.30	2.2	3.3	3.7	5.7	3.9	1.8	0.63
NA13	SD0036	08/11/2001		0.22	0.80	0.39	1.2	1.6	2.7	3.1	2.5	1.2	0.50
NA13[b]	SD0120	09/11/2002											

Table B2-6. PCB and PCT results for sediment core samples

Station	Sample Number	Date	Field Split	Upper Depth (ft)	Lower Depth (ft)	PCB Aroclors®								PCT Aroclors®			
						1016	1221	1232	1242	1248	1254	1260	Total[a]	5432	5442	5460	Total[a]
NASSCO																	
NA01	SD0141	09/18/2002		0	2	250 U	490 U	250 U	250 U	250 U	1,400 J	990 J	2,400 J	250 U	250 U	2,500	2,500
NA01	SD0142	09/18/2002	1	2	4	240 U	470 U	240 U	240 U	240 U	1,600 J	1,200 J	2,800 J	240 U	240 U	1,700 J	1,700 J
NA01	SD0146	09/18/2002	2	2	4	240 U	470 U	240 U	240 U	240 U	1,800 J	1,300 J	3,100 J	240 U	240 U	1,500 J	1,500 J
NA01	SD0143	09/18/2002		5	5.5	21 U	41 U	21 U	21 U	21 U	280 J	240 J	520 J	21 U	21 U	330	330
NA02	SD0139	09/18/2002		0	2	19 U	38 U	19 U	19 U	19 U	250	240	490	19 U	19 U	380	380
NA02	SD0140	09/18/2002		2	3.7	13 U	26 U	13 U	13 U	13 U	56	46	100	13 U	13 U	71	71
NA04	SD0084	09/04/2002		0	2	22 U	43 U	22 U	22 U	390	550	520	1,500	22 U	22 U	660	660
NA04	SD0085	09/04/2002		2	4	22 U	44 U	22 U	22 U	310	670	620	1,600	44 U	44 U	690	690
NA04	SD0086	09/04/2002		4	6	230 U	460 U	230 U	230 U	650 J	1,300 J	880 J	2,800 J	230 U	230 U	1,500	1,500
NA04	SD0087	09/04/2002		6	8.3	200 U	400 U	200 U	200 U	1,200 J	2,100 J	1,300 J	4,600 J	400 U	400 U	2,400	2,400
NA06	SD0068	09/03/2002		0	2	20 U	39 U	20 U	20 U	390	720	470	1,600	200 U	200 U	1,400	1,400
NA06	SD0069	09/03/2002		2	3.9	130 U	260 U	130 U	130 U	580	730	380	1,700	130 U	130 U	1,200	1,200
NA09	SD0079	09/04/2002		0	2	220 U	430 U	220 U	220 U	2,100 J	3,300 J	1,900 J	7,300 J	220 U	220 U	7,200 J	7,200 J
NA09	SD0080	09/04/2002		2	4	220 U	440 U	220 U	220 U	2,300 J	4,200 J	2,500 J	9,000 J	220 U	220 U	6,400 J	6,400 J
NA09	SD0081	09/04/2002		4	6	210 U	410 U	210 U	210 U	5,100 J	6,500 J	2,800 J	14,000 J	210 U	210 U	8,800 J	8,800 J
NA09	SD0082	09/04/2002		6	8	17 U	34 U	17 U	17 U	60	140	86	290	17 U	17 U	400	400
NA13	SD0156	09/20/2002		0	2	15 U	30 U	15 U	15 U	15 U	100	110	210	15 U	15 U	190	190
NA13	SD0157	09/20/2002		2	3	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	13 U	13 U	61 U	61 U
NA16	SD0075	09/04/2002		0	2	230 U	450 U	230 U	230 U	1,000	1,600	1,100	3,700	230 U	230 U	2,900	2,900
NA16	SD0076	09/04/2002	1	2	4	210 U	410 U	210 U	210 U	660 J	1,400 J	700 J	2,800 J	210 U	210 U	1,500 J	1,500 J
NA16	SD0078	09/04/2002	2	2	4	210 U	420 U	210 U	210 U	1,300 J	2,300 J	1,200 J	4,800 J	210 U	210 U	6,300 J	6,300 J
NA16	SD0077	09/04/2002		4	6.1	19 U	37 U	19 U	19 U	46	69	48	160	19 U	19 U	140	140
NA17	SD0088	09/04/2002		0	2	28 U	55 U	28 U	28 U	180 J	750 J	620 J	1,600 J	55 U	55 U	700	700
NA17	SD0089	09/04/2002		2	4	15 U	30 U	15 U	15 U	270	610	340	1,200	30 U	30 U	350	350
NA17	SD0090	09/04/2002		4	5.1	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	24 U	24 U	120 U	120 U
NA19	SD0065	09/03/2002		0	2	240 U	470 U	240 U	240 U	360	1,700	1,100	3,200	24 U	24 U	560	560
NA19	SD0066	09/03/2002		2	4	150 U	290 U	150 U	150 U	340	890	550	1,800	150 U	150 U	2,700	2,700
NA19	SD0067	09/03/2002		4	5.8	14 U	27 U	14 U	14 U	180	410	250	840	140 U	140 U	780	780
NA20	SD0070	09/04/2002		0	2	20 U	39 U	20 U	20 U	73	210	200	480	20 U	20 U	160	160
NA20	SD0071	09/04/2002		2	4	21 U	42 U	21 U	21 U	110	280 J	300	690 J	21 U	21 U	210	210
NA20	SD0072	09/04/2002	1	4	6	17 U	33 U	17 U	17 U	190	260	330	780	17 U	17 U	260	260
NA20	SD0074	09/04/2002	2	4	6	17 U	34 U	17 U	17 U	160	290	350	800	17 U	17 U	200	200
NA20	SD0073	09/04/2002		6	8.1	16 U	32 U	16 U	16 U	57 J	160 J	180	400 J	16 U	16 U	170	170
NA21	SD0158	09/21/2002		0	2	24 U	47 U	24 U	24 U	380 J	820 J	680 J	1,900 J	24 U	24 U	510	510
NA21	SD0159	09/21/2002		2	4	21 U	41 U	21 U	21 U	21 U	160 J	300 J	460 J	21 U	21 U	180	180
NA21	SD0160	09/21/2002		4	6	15 U	29 U	15 U	15 U	15 U	34	34	68	15 U	15 U	73 U	73 U
NA21	SD0161	09/21/2002		6	7.6	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	12 U	12 U	59 U	59 U
NA23	SD0091	09/04/2002		0	2	29 U	57 U	29 U	29 U	29 U	510	500	1,000	57 U	57 U	1,000	1,000
NA23	SD0092	09/04/2002		2	4	16 U	31 U	16 U	16 U	220	340	270	830	31 U	31 U	420	420
NA24	SD0165	09/21/2002		0	2	23 U	46 U	23 U	23 U	23 U	70	87	160	23 U	23 U	180	180
NA24	SD0166	09/21/2002		2	4	13 U	26 U	13 U	13 U	13 U	13 U	13 U	26 U	13 U	13 U	65 U	65 U
NA25	SD0153	09/20/2002		0	2	15 U	29 U	15 U	15 U	15 U	20	27	47	15 U	15 U	72 U	72 U
NA25	SD0154	09/20/2002		2	4	13 U	26 U	13 U	13 U	13 U	13 U	13 U	26 U	13 U	13 U	63 U	63 U
NA25	SD0155	09/20/2002		4	5.2	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	12 U	12 U	60 U	60 U
NA26	SD0147	09/19/2002		0	2	15 U	29 U	15 U	15 U	15 U	67	74	140	15 U	15 U	130	130
NA26	SD0148	09/19/2002		2	4	15 U	29 U	15 U	15 U	15 U	15 U	15 U	29 U	15 U	15 U	72 U	72 U
NA26	SD0149	09/19/2002		4	6	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	13 U	13 U	61 U	61 U
NA26	SD0150	09/19/2002		6	7.5	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	12 U	12 U	59 U	59 U

Table B2-6. (cont.)

Station	Sample Number	Date	Field Split	Upper Depth (ft)	Lower Depth (ft)	PCB Aroclors®								PCT Aroclors®			
						1016	1221	1232	1242	1248	1254	1260	Total[a]	5432	5442	5460	Total[a]
NA29	SD0162	09/21/2002		0	2	17 U	33 U	17 U	17 U	43	150	150	340	17 U	17 U	180	180
NA29	SD0163	09/21/2002	1	2	4.4	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	13 U	13 U	61 U	61 U
NA29	SD0164	09/21/2002	2	2	4.4	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	13 U	13 U	61 U	61 U
NA30	SD0151	09/20/2002		0	2	16 U	32 U	16 U	16 U	16 U	68	83	150	16 U	16 U	80	80
NA30	SD0152	09/20/2002		2	3.4	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	13 U	13 U	63 U	63 U
NA31	SD0144	09/19/2002		0	2	13 U	26 U	13 U	13 U	13 U	13 U	13 U	26 U	13 U	13 U	64 U	64 U
NA31	SD0145	09/19/2002		2	3	5.9 U	12 U	5.9 U	5.9 U	5.9 U	5.9 U	5.9 U	12 U	12 U	12 U	59 U	59 U
Southwest Marine																	
SW01	SD0001	08/13/2002		0	2	170 U	330 U	170 U	170 U	840	460	260	1,600	33 U	33 U	230 J	230 J
SW01	SD0002	08/13/2002		2	4	14 U	28 U	14 U	14 U	14 U	14 U	14 U	28 U	28 U	28 U	140 U	140 U
SW01	SD0003	08/13/2002		4	5.4	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	24 U	24 U	120 U	120 U
SW02	SD0027	08/27/2002		0	2	19 U	37 U	19 U	19 U	610 J	780	480	1,900 J	190 U	190 U	1,600	1,600
SW02	SD0028	08/27/2002		2	4	15 U	29 U	15 U	15 U	15 U	18	15 U	18	15 U	15 U	72 U	72 U
SW02	SD0037	08/27/2002		4	4.9	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	13 U	13 U	61 U	61 U
SW04	SD0025	08/27/2002		0	2	150 U	290 U	150 U	150 U	1,300	1,200	610	3,100	150 U	150 U	2,300	2,300
SW04	SD0026	08/27/2002		2	4.1	1,500 U	2,900 U	1,500 U	1,500 U	16,000	13,000	6,500	36,000	1,500 U	1,500 U	24,000	24,000
SW08	SD0033	08/28/2002	1	0	2	1,900 U	3,800 U	1,900 U	1,900 U	9,300	7,000	4,100	20,000	1,900 U	1,900 U	19,000	19,000
SW08	SD0040	08/28/2002	2	0	2	950 U	1,900 U	950 U	950 U	12,000	8,700	4,400	25,000	1,900 U	1,900 U	35,000	35,000
SW08	SD0038	08/28/2002		2	4	1,400 U	2,800 U	1,400 U	1,400 U	15,000	12,000	6,600	34,000	1,400 U	1,400 U	33,000	33,000
SW08	SD0039	08/28/2002		4	6	130 U	250 U	130 U	130 U	1,100	600	290	2,000	130 U	130 U	2,800 J	2,800 J
SW08	SD0048	08/28/2002		6	6.5	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	24 U	24 U	120 U	120 U
SW10	SD0041	08/28/2002		0	2	17 U	33 U	17 U	17 U	54 J	190	140	380 J	33 U	33 U	550	550
SW10	SD0042	08/28/2002		2	2.9	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	24 U	24 U	120 U	120 U
SW12	SD0020A	08/27/2002		0	2	19 U	37 U	19 U	19 U	79 J	150	130	360 J	19 U	19 U	350	350
SW12	SD0021	08/27/2002		2	3.7	13 U	25 U	13 U	13 U	16	35	31	82	13 U	13 U	80	80
SW17	SD0017	08/26/2002		0	2	27 U	53 U	27 U	27 U	210 J	510	680	1,400 J	27 U	27 U	830	830
SW17	SD0018	08/26/2002		2	4	88 U	180 U	88 U	88 U	570 J	880 J	930 J	2,400 J	88 U	88 U	1,700	1,700
SW17	SD0019	08/26/2002		4	6.2	14 U	27 U	14 U	14 U	190 J	280	190	660 J	14 U	14 U	490	490
SW19	SD0029	08/28/2002		0	2	19 U	38 U	19 U	19 U	49 J	97	100	250 J	19 U	19 U	180	180
SW19	SD0030	08/28/2002		2	4	14 U	27 U	14 U	14 U	14 U	14 U	15	15	14 U	14 U	66 U	66 U
SW19	SD0031	08/28/2002		4	5.4	13 U	26 U	13 U	13 U	13 U	13 U	13 U	26 U	13 U	13 U	64 U	64 U
SW20	SD0004	08/13/2002		0	1.5	330 U	650 U	330 U	330 U	330 U	3,500	3,300	6,800	650 U	650 U	3,300 U	3,300 U
SW20	SD0005	08/13/2002		1.5	2.4	13 U	25 U	13 U	13 U	13 U	270	290	560	25 U	25 U	130 U	130 U
SW24	SD0006	08/13/2002		0	2	190 U	380 U	190 U	190 U	1,100 J	3,200 J	3,200 J	7,500 J	380 U	380 U	2,800	2,800
SW24	SD0007	08/13/2002		2	3	13 U	26 U	13 U	13 U	190	310	380	880	26 U	26 U	130 U	130 U
SW25	SD0008	08/13/2002		0	2	16 U	31 U	16 U	16 U	54	150	92 J	300 J	31 U	31 U	290	290
SW25	SD0009	08/13/2002		2	4.2	18 U	35 U	18 U	18 U	220	380	370	970	35 U	35 U	430	430
SW27	SD0014	08/14/2002	1	0	2	18 U	36 U	18 U	18 U	110	290	270	670	36 U	36 U	520	520
SW27	SD0016	08/14/2002	2	0	2	18 U	36 U	18 U	18 U	90	240	210 J	540 J	36 U	36 U	500	500
SW27	SD0015	08/14/2002		2	4.3	14 U	27 U	14 U	14 U	42	58	58	160	27 U	27 U	140 U	140 U
SW27	SD0013	08/14/2002		5.3	5.6	13 U	25 U	13 U	13 U	13 U	13 U	13 U	25 U	25 U	25 U	130 U	130 U
SW28	SD0010	08/14/2002		0	2	200 U	400 U	200 U	200 U	730 J	2,300 J	1,900 J	4,900 J	400 U	400 U	3,300	3,300
SW28	SD0011	08/14/2002		2	4	17 U	34 U	17 U	17 U	430	640	400	1,500	34 U	34 U	560	560
SW28	SD0012	08/14/2002		4	5.3	17 U	34 U	17 U	17 U	24	45	57	130	34 U	34 U	170 U	170 U
SW29	SD0043	08/28/2002		0	2	160 U	310 U	160 U	160 U	160 U	1,300 J	770 J	2,100 J	310 U	310 U	4,600 J	4,600 J
SW29	SD0044	08/28/2002		2	4	14 U	27 U	14 U	14 U	14 U	14 U	14 U	27 U	27 U	27 U	140 U	140 U
SW29	SD0045	08/28/2002		4	6	13 U	26 U	13 U	13 U	13 U	13 U	13 U	26 U	26 U	26 U	130 U	130 U
SW29	SD0046	08/28/2002		6	7	12 U	24 U	12 U	12 U	12 U	12 U	12 U	24 U	24 U	24 U	120 U	120 U
SW30	SD0055	08/29/2002		0	2	25 U	50 U	25 U	25 U	25 U	560	420	980	50 U	50 U	1,100	1,100
SW30	SD0056	08/29/2002		2	4	29 U	57 U	29 U	29 U	29 U	61	130	190	57 U	57 UJ	290 U	290 UJ

Table B2-6. (cont.)

Station	Sample Number	Date	Field Split	Upper Depth (ft)	Lower Depth (ft)	PCB Aroclors®								PCT Aroclors®			
						1016	1221	1232	1242	1248	1254	1260	Total[a]	5432	5442	5460	Total[a]
SW30	SD0057	08/29/2002		4	6	19 *U*	37 *U*	19 *U*	19 *U*	19 *U*	19 *U*	19 *U*	37 *U*	37 *U*	37 *UJ*	190 *U*	190 *UJ*
SW30	SD0058	08/29/2002		6	8	14 *U*	28 *U*	14 *U*	14 *U*	14 *U*	14 *U*	14 *U*	28 *U*	28 *U*	28 *UJ*	140 *U*	140 *UJ*
SW30	SD0060	08/29/2002		8	8.7	13 *U*	26 *U*	13 *U*	13 *U*	13 *U*	13 *U*	13 *U*	26 *U*	26 *U*	26 *UJ*	130 *U*	130 *UJ*
SW31	SD0024	08/27/2002		0	2	14 *U*	28 *U*	14 *U*	14 *U*	14 *U*	350	240	590	14 *U*	14 *U*	70 *U*	70 *U*
SW31	SD0034	08/27/2002		2	2.9	13 *U*	26 *U*	13 *U*	13 *U*	13 *U*	13 *U*	13 *U*	26 *U*	13 *U*	13 *U*	65 *U*	65 *U*
SW32	SD0051	08/29/2002		0	2	19 *U*	37 *U*	19 *U*	19 *U*	47 *J*	71	86	200 *J*	36 *U*	36 *U*	180 *U*	93 *J*
SW32	SD0059	08/29/2002		2	2.8	12 *U*	24 *U*	12 *U*	12 *U*	12 *U*	12 *U*	12 *U*	24 *U*	24 *U*	24 *UJ*	120 *U*	120 *UJ*
SW33	SD0032	08/28/2002		0	2	16 *U*	31 *U*	16 *U*	16 *U*	28 *J*	53	63	140 *J*	16 *U*	16 *U*	140 *J*	140 *J*
SW33	SD0047	08/28/2002		2	2.5	12 *U*	23 *U*	12 *U*	12 *U*	12 *U*	12 *U*	12 *U*	23 *U*	23 *U*	23 *U*	120 *U*	120 *U*
SW34	SD0052	08/29/2002	1	0	2	16 *U*	31 *U*	16 *U*	16 *U*	16 *U*	82	120	200	32 *U*	32 *U*	160 *J*	160 *J*
SW34	SD0054	08/29/2002	2	0	2	16 *U*	32 *U*	16 *U*	16 *U*	16 *U*	110 *J*	130 *J*	240 *J*	32 *U*	32 *U*	160 *U*	140 *J*
SW36	SD0022	08/27/2002		0	2	28 *U*	55 *U*	28 *U*	28 *U*	110 *J*	260 *J*	340 *J*	710 *J*	28 *U*	28 *U*	440	440
SW36	SD0023	08/27/2002		2	4.3	20 *U*	40 *U*	20 *U*	20 *U*	230 *J*	720	540	1,500 *J*	200 *U*	200 *U*	1,600	1,600

Note: All results reported as µg/kg dry weight.

J - estimated
PCB - polychlorinated biphenyl
PCT - polychlorinated terphenyl
U - undetected at quantitation limit shown

[a] Total PCB and total PCT for each sample is computed as the sum of Aroclors® according to the following rules: 1) if any Aroclor® is detected, all detected Aroclors® are summed; 2) if no Aroclor® is detected, the highest quantitation limit for any Aroclor® is used.

Table B2-7. PCB congener and homolog results for sediment core samples

Station	Sample Number	Date	Field Split	Upper Depth (ft)	Lower Depth (ft)	PCB Congeners										
						18	28	37	44	49	52	66	70	74	77	81
NASSCO																
NA01	SD0141	09/18/2002		0	2	6.2	14	4.2	29	25	53	42	53	22	4.3	1.2
NA01	SD0142	09/18/2002	1	2	4	11	23	6.1	35	32	50	51	65	29	4.9	0.94
NA01	SD0146	09/18/2002	2	2	4	11	23	6.3	34	32	51	51	64	29	4.8	1.1
NA01	SD0143	09/18/2002		5	5.5	0.88	2.5	0.60	4.7	4.9	9.5	6.6	10	3.8	0.62	0.24
NA02	SD0139	09/18/2002		0	2	0.98	2.3	0.84	0.025 *U*	5.3	8.6	8.5	7.9	3.8	0.78	0.23
NA02	SD0140	09/18/2002		2	3.7	0.48	0.92	0.24	1.3	1.5	2.0	2.4	2.3	1.2	0.14	0.039
NA04	SD0084	09/04/2002		0	2	11	20	2.4	18	21	27	30	23	12	2.1	0.36
NA04	SD0085	09/04/2002		2	4	4.2	9.0	2.3	7.9	9.1	13	19	17	8.4	2.7	0.41
NA04	SD0086	09/04/2002		4	6	7.2	18	5.4	30	31	49	45	51	24	5.8	0.90
NA04	SD0087	09/04/2002		6	8.3	21	39	8.6	65	59	100	83	110	48	7.1	1.9
NA06	SD0068	09/03/2002		0	2	4.3	8.5	1.7	17	6.5	28	24	28	12	1.6	0.65
NA06	SD0069	09/03/2002		2	3.9	10	19	3.7	32	12	53	43	57	24	2.3	1.2
NA09	SD0079	09/04/2002		0	2	46	71	12	40	36	100	130	170	71	8.5	3.1
NA09	SD0080	09/04/2002		2	4	43	64	14	46	39	240	160	240	93	12	5.2
NA09	SD0081	09/04/2002		4	6	83	130	26	71	56	310	230	330	140	17	5.2
NA09	SD0082	09/04/2002		6	8	0.39	0.59	0.14	1.1	0.38	1.9	1.5	2.0	0.81	0.11	0.035
NA09	SD0083	09/04/2002		8	8.8	0.14	0.21	0.050	0.14	0.12	0.36	0.55	0.79	0.29	0.038	0.025 *U*
NA13	SD0156	09/20/2002		0	2	0.44	0.96	0.27	2.4	2.1	5.1	3.2	4.0	1.6	0.35	0.16
NA13	SD0157	09/20/2002		2	3	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*
NA16	SD0075	09/04/2002		0	2	3.3	8.1	1.6	12	12	21	17	22	9.4	0.94	0.39
NA16	SD0076	09/04/2002	1	2	4	19	33	7.6	21	18	84	74	94	42	4.7	1.9
NA16	SD0078	09/04/2002	2	2	4	8.9	16	3.5	23	8.7	38	32	40	18	2.1	0.57
NA16	SD0077	09/04/2002		4	6.1	0.63	1.2	0.27	0.70	0.61	2.6	2.6	3.2	1.5	0.17	0.051
NA17	SD0088	09/04/2002		0	2	1.1	1.9	0.69	9.1	6.3	21	9.1	15	4.4	1.4	0.61
NA17	SD0089	09/04/2002		2	4	7.0	9.0	1.9	9.4	8.1	16	17	21	9.0	1.6	0.50
NA17	SD0090	09/04/2002		4	5.1	0.14	0.11	0.025 *U*	0.13	0.13	0.23	0.10	0.100	0.049	0.025 *U*	0.025 *U*
NA19	SD0065	09/03/2002		0	2	2.1	1.2	0.99	13	9.4	28	13	23	6.7	2.5	0.87
NA19	SD0066	09/03/2002		2	4	5.3	1.7	1.7	21	16	41	20	36	12	1.6	0.97
NA19	SD0067	09/03/2002		4	5.8	3.4	5.3	1.5	8.7	3.2	15	12	16	6.8	0.65	0.31
NA20	SD0070	09/04/2002		0	2	0.30	0.36	0.40	0.95	1.3	2.5	3.6	3.6	1.5	0.39	0.12
NA20	SD0071	09/04/2002		2	4	0.59	1.5	0.48	0.93	1.2	2.2	3.7	3.2	1.5	0.48	0.15
NA20	SD0072	09/04/2002	1	4	6	1.8	3.6	1.1	5.5	1.9	8.9	6.8	7.7	3.5	0.68	0.23
NA20	SD0074	09/04/2002	2	4	6	1.9	3.3	1.2	2.0	1.8	8.0	6.6	7.4	3.4	0.69	0.26
NA20	SD0073	09/04/2002		6	8.1	0.45	0.76	0.28	1.1	0.96	1.7	1.4	1.6	0.73	0.14	0.055
NA21	SD0158	09/21/2002		0	2	4.9	12	3.3	19	18	31	28	38	15	3.2	0.90
NA21	SD0159	09/21/2002		2	4	0.29	0.57	0.12 *U*	1.3	1.6	2.7	2.0	3.1	1.1	0.30	0.13
NA21	SD0160	09/21/2002		4	6	0.12	0.24	0.074	0.46	0.51	0.83	0.73	0.89	0.39	0.073	0.025 *U*
NA21	SD0161	09/21/2002		6	7.6	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*	0.025 *U*
NA23	SD0091	09/04/2002		0	2	1.4	2.9	0.72	4.3	4.2	8.0	8.2	8.7	3.4	1.00	0.29
NA23	SD0092	09/04/2002		2	4	4.0	7.9	1.5	12	9.7	20	16	21	8.2	1.4	0.51
NA23	SD0093	09/04/2002		4	4.7	0.19	0.28	0.052	0.39	0.65	0.79	0.71	0.71	0.29	0.045	0.025 *U*
NA24	SD0165	09/21/2002		0	2	0.26	0.64	0.18	1.2	1.3	2.3	2.1	1.8	0.80	0.22	0.071

Fact Sheet: Sources of Polychlorinated Biphenyls

Purpose

This fact sheet is intended to help Oregon Department of Environmental Quality (DEQ) project managers and City of Portland stormwater inspectors understand the types of industries, processes, and products that might be potential sources of polychlorinated biphenyls (PCBs). There are a variety of potential PCB sources in addition to more commonly recognized sources such as electrical transformer and capacitor oils and fluorescent light ballasts.

Background

PCBs are mixtures of synthetic organic chemicals that were commonly used for various applications from approximately 1929 until 1979 when the U.S. banned PCB manufacturing, processing, distribution, and use (EIP Associates, 1997). The U.S. was responsible for approximately half of the world's production of PCBs and imported approximately 50% of the remainder produced by other countries (minus exports) (EIP Associates, 1997; UNEP Chemicals, 1999). PCBs were produced and marketed in the U.S. under the trade names of Aroclor (produced by Monsanto Chemical Company) and Pyranol (produced by General Electric) (Nagpal, 1992). Because of health concerns, in 1971 Monsanto voluntarily restricted manufacturing of PCBs to use only in closed systems. Monsanto discontinued manufacture of PCBs in 1977, though PCBs continued to be imported into the U.S. until 1979 when the U.S. ban took effect (EIP Associates, 1997; ATSDR, 2000).

There are no natural sources of PCBs. Although their current commercial use is restricted in the U.S., they continue to be a common environmental contaminant because they are extremely stable.

Regulatory Framework

PCBs were regulated under a series of EPA actions culminating with a ban in 1979 on manufacturing, processing, distribution, and use of PCBs under the Toxic Substances Control Act (TSCA). Items such as transformers and hydraulic fluids were identified as high-risk sources and were targeted for accelerated phase-out. EPA anticipated that other lower-risk sources would eventually be removed from circulation as various products reached the end of their useful lives.

Certain current uses of PCBs are authorized under 40 CFR Part 761 and are summarized in Table 1:

TABLE 1

Current Authorized Uses of PCBs

Use	Comments
Transformers	Authorized use at any concentration though restrictions and regulatory requirements increase with higher PCB concentration thresholds.
Railroad Transformers	Transformers used in locomotives and self-propelled railcars. Authorized use at < 1,000 ppm; < 50 ppm if transformer coil is removed at any time.
Heat transfer systems, hydraulic systems, mining equipment	Authorized use at < 50 ppm
Natural gas pipelines	Authorized at < 50 ppm, or at > 50 ppm with additional requirements. PCBs may be present in natural gas compressors, scrubbers, filters, and in condensate.
Research & Development	Authorized primarily for purposes relating to environmental analysis, management, and disposal of PCBs. R&D for PCB products is prohibited.
Scientific Instruments	Examples include oscillatory flow birefringence & viscoelasticity instruments for the study of the physical properties of polymers, microscopy mounting fluids, microscopy immersion oil, and optical liquids.
Carbonless copy paper	Use of existing carbonless copy paper is permitted; manufacturing of new carbonless copy paper is not authorized.
Electromagnets, switches, voltage regulators, circuit breakers, reclosers, cable	No restrictions on existing use; restrictions on PCB concentrations if serviced and oil is removed or replaced.
Porous surfaces	EPA considers building materials, such as concrete, porous with respect to PCB leaks and spills. Porous building materials may be left in place following spills provided various conditions are met. Older industrial machinery often was designed to slowly leak (PCB-containing) hydraulic oil as a lubricant.

Source: EPA (2002)

Under 40 CFR Part 761, recycled PCBs are defined as "those PCBs which appear in the processing of paper products or asphalt roofing materials from PCB-contaminated raw materials". Recycled PCBs are subject to the following restrictions:

- No detectable concentrations of PCBs are permitted in asphalt roofing materials that leave the manufacturing site; and
- Manufactured and imported paper products must have an annual average of less than 25 ppm PCBs with a maximum of 50 ppm.

Some manufacturing processes may inadvertently generate PCBs. These typically include chemical processes that involve hydrocarbons, chlorine, and heat. Typical processes include production of chlorinated solvents, paints, printing inks, agricultural chemicals, plastics, and detergent bars. These processes may be defined as "excluded manufacturing processes" under 40 CFR Part 761 if the following conditions are met:

- Manufactured or imported products must contain < 25 ppm PCBs;
- Manufactured or imported detergent bars must contain < 5 ppm PCBs;
- PCB concentrations must be less than 10 ppm at the point which PCBs are released to ambient air;
- "...PCBs added to water discharged from a manufacturing site must be less than 100 micrograms per resolvable gas chromatographic peak per liter of water discharged"; and
- Disposal of process wastes with PCB concentrations > 50 ppm must be conducted in accordance with 40 CFR Part 761 Subpart D.

Sources of PCBs

In the U.S., the most commonly used Aroclors were: 1221, 1232, 1242, 1248, 1254, and 1260 (DEQ, 1997). These and other Aroclors were used in a variety of materials to enhance insulative properties, improve physical and chemical resistance, and act as plasticizers, coolants, and lubricants. Additional information about specific Aroclors is included in Table A-1 (see Attachment 1).

Approximate usage of PCBs in the US is summarized as follows (EIP Associates, 1997):

Closed system and heat transfer fluids (transformers, capacitors, fluorescent light ballasts, etc.): 60%

Plasticizers: 25%

Hydraulic fluids and lubricants: 10%

Miscellaneous uses: 5%

As shown in Table 2, PCBs were commonly used in a number of electrical, heat transfer, and hydraulic applications as well as a range of other applications.

TABLE 2

PCB Uses

Primary Applications	
Dielectric fluids and transformers	Used as insulating material, coolant, and for fire-resistant properties. Potential sources would be facilities which used, stored, and serviced electrical equipment and which used significant amounts of electricity. These facilities could include, but are not limited to: Electrical transmission and distribution facilities; electrical equipment maintenance facilities and salvage yards; rail yards; and manufacturing facilities (sawmills, pulp and paper mills, chemical manufacturing, shipyards, primary and secondary metals smelting and refining, etc.)
Capacitors	Present in industrial facilities, industrial machinery both fixed and mobile, and consumer products. Includes larger power-factor correction capacitors associated with transformers, manufacturing facilities, and commercial buildings (usually near high power-usage equipment such as computer rooms and heating and cooling units); and smaller electric motor-start capacitors used in industrial

	equipment and appliances such as hair dryers, air conditioners, refrigerators, power tools, and submersible well pumps. Also includes capacitors used in appliances and electronics such as televisions and microwave ovens.
Fluorescent light ballasts	PCB-containing capacitors were used in fluorescent light ballasts. PCB-containing asphaltic resin (potting material) was also utilized as insulating material for some ballasts.
Electromagnets	Oil-cooled electromagnets are constructed with coils immersed in transformer oil to prevent over-heating and shorting. Used in cranes for picking up metal and for metal separation in recycling operations (metal scrap yards, tire shredding, concrete crushing, slag operations, etc.).
Miscellaneous electrical equipment	Switches, voltage regulators, circuit breakers, reclosers, rectifiers, and some oil-cooled electric motors.
Heat transfer systems	Where oil is circulated through a non-contact system as a heat transfer medium for heating, cooling, and maintaining uniform temperature throughout a system or manufacturing process. Wide variety of applications in manufacturing industries including high-tech, asphalt, pulp and paper, metal products such as steel tubing and die casting, adhesives, chemicals, food processing, paint & coatings, textiles, etc.
Hydraulic fluids	Any application of hydraulic oil such as industrial equipment and machinery, commercial equipment, automotive brake fluid, etc.
Plasticizers	Used in polyvinyl chloride plastic, neoprene, chlorinated rubbers, laminating adhesives, sealants and caulking, joint compounds (concrete), etc.
Lubricants	Cutting oils, compressors, electrical equipment, oil-impregnated gaskets and filters; also currently present in low concentrations in recycled oil. Also used in vacuum pumps at high tech and electronics manufacturing facilities, research labs, and wastewater treatment plants.
Other applications of PCBs	
Dust control (dedusting agents)	Present in dust control formulations, and used oil historically used for dust suppression.
Pesticides	As an extender to extend the life of pesticides.
Fire retardants	Coatings on ceiling tiles, and textiles including ironing boards and yarn.
Paints, coatings	As plasticizers in paint, corrosion resistant paints for various applications including military/navy ships, corrosion resistant epoxy resins on metal surfaces, film casting solutions for electrical coatings, varnish, lacquers, and waterproofing coatings for various applications.
Carbonless copy paper	Used as an ink pigment carrier (microencapsulation of dye); when the top sheet was pressed down, ink and PCB oil were transferred to the copy.
Printing inks	Ink for newsprint and as a dye carrier; also used as a solvent for deinking newsprint for recycling.
Investment casting waxes	Used as wax extenders.
Wood treatment	May be present as an impurity in pentachlorophenol (Warrington, 1996).
Sources: ATSDR (2000), DEQ (1997), EIP Associates (1997), UNEP Chemicals (1999)	

Due to the long service life of many PCB-containing items and the use of PCBs in some durable, relatively inert products, PCB-containing materials will continue to be disposed of and processed in waste and recycling operations. Waste products and recycling operations that may process significant quantities of PCB-containing materials are described in Table 3:

TABLE 3

PCB Sources In Waste Materials And Recycling Operations

Material or Operation	Comments
Scrap metal recycling	Transformer shell salvaging; heat transfer and hydraulic equipment; and fluff (shredder waste from cars and appliances including upholstery, padding and insulation). Also present in non-ferrous metal salvaging as parts from PCB-containing electrical equipment, and oil & grease insulated electrical cable.
Auto salvage yards, auto crushing	Hydraulic fluid, brake fluid, recycled oil, capacitors, and oil-filled electrical equipment such as some ignition coils.
Repair activities	Shipyards (electrical equipment, hydraulic oil, paint, etc.), locomotive repair, heavy equipment repair facilities, auto repair, repair of manufacturing equipment, etc.
Used oil	May be present in used oil from various sources including auto salvage yards, automotive and heavy equipment repair shops, hydraulic equipment repair, industrial machinery repair, etc. Because some PCBs have been mixed with used oil, some recycled oils currently in circulation may contain PCBs at concentrations generally < 50 ppm. PCBs may also be present where used oil has been used for dust suppression/road oiling, weed control, and energy recovery.
Recycled paper	Paper may contain PCBs where carbonless copy paper has been used in recycling. However, PCB concentrations have decreased over time as the volume of unrecycled carbonless copy paper is reduced. Recycled paper containing PCBs has historically been used for food packaging (CWC, 1997). PCB concentrations in food packaging are restricted to 10 ppm unless an impermeable barrier is present between the packaging and food product (FDA, 2003).
Effluent	PCBs may be in wastewaters from manufacturing facilities and equipment such as chemical and pesticide facilities, pulp and paper mills, cooling waters from vacuum pumps and electric power generation facilities where leaks have occurred, and condensate from vacuum pumps and natural gas pipelines. Significant cleanup activities have been performed at natural gas pipeline compressor stations from discharges of condensate to ground and storm drainage systems (DOJ, 2002).
Asphalt roofing materials, tar paper, and roofing felt	Anticipated at generally very low concentrations where used oil containing PCBs has been used in asphalt mix.
Building demolition	Electrical equipment, joint caulking, oil & grease insulated cable, surface coatings as flame retardant and waterproofing.
Dredge spoils	From areas where contaminated sediments are present.
Landfills	Municipal and industrial solid waste; virtually all potential sources could be present, including waste materials and soils from remediation sites.
Wastewater treatment plant sludge	Derived from atmospheric deposition and stormwater, water supply systems, leaks and spills, leaching from coatings and plastics containing PCBs, PCBs in food and human waste.

Sources: EIP Associates (1997), EPA (2002), UNEP Chemicals (1999)

Releases of PCBs

Prior to the regulation of PCBs under the Toxic Substances Control Act (TSCA) in 1976, PCBs were released (both accidentally and intentionally) into the atmosphere, water, and land through sewers, smokestacks, stormwater runoff, spills, and direct application to the environment (for example, to reduce dust emissions and to extend the life of some agricultural pesticide formulations) (Flynn, 1997). Large volumes of PCBs have been introduced to the environment through the burning of PCB-containing products, vaporization from PCB-containing coatings and materials, releases into sewers and streams, improper disposal of PCB-containing equipment in non-secure landfill sites and municipal disposal facilities, and by other routes (such as ocean dumping) (ATSDR, 2001).

Based on the current regulation of PCBs, the current primary "new" sources of PCB contamination are limited to outdated or illegal landfills and scrap yards and leaks or explosions of electrical equipment and other equipment (such as locomotive transformers) that may still contain PCBs (ATSDR, 2001). Other sources are facilities or sites that were previously contaminated with PCBs (for example, contaminated sediments). From contaminated sites, PCBs are emitted and re-deposited to the environment via volatilization from water and soil, wet and dry depositions, and revolatilization (HSDB, 2003). These processes are discussed in further detail in Attachment 2.

Attachment 1 – Common Uses of Aroclors

Common uses of specific Aroclors are shown in Table A-1.

TABLE A-1
Common Uses of Aroclors

Aroclor Type	Use and Comments
A-1016	Capacitors
A-1221	Capacitors Gas Transmission Turbines Rubber Polyvinyl acetate - Improved quick-track and fiber-tear properties Polystyrene – Plasticizer Epoxy resins - Increased resistance to oxidation and chemical attack; better adhesive properties
A-1232	Hydraulic fluid Rubber Adhesives Polyvinyl acetate - Improved quick-track and fiber-tear properties
A-1242	Transformers Heat transfer Hydraulic fluid Gas transmission turbines Rubbers Carbonless copy paper Wax extenders Polyvinyl acetate - Improved quick-track and fiber-tear properties
A-1248	Hydraulic fluids Vacuum pumps Rubbers Polyvinyl chloride - Secondary plasticizers to increase flame retardence and chemical resistance Epoxy resins - Increased resistance to oxidation and chemical attack; better adhesive properties
A-1254	Transformers Capacitors

Attachment 2 – Fate and Transport of PCBs

The basic chemical structure of PCBs includes two benzene rings (known as the biphenyl) and between 1 and 10 chlorine atoms substituted on each of the benzene molecules. Figure 1 shows the basic structure of PCBs, where the numbers 2-6 and 2'-6' represent possible substitution locations for chlorine. There are a total of 209 individual PCB compounds (known as congeners) (Flynn, 1997). Typically, PCBs occur as mixtures of congeners (that is, Aroclors) (Bernhard and Petron , 2001). Aroclors are identified by number (such as 1254), with the last two digits representing the percent content of chlorine; higher Aroclor numbers reflect higher chlorine content (ATSDR, 2001).

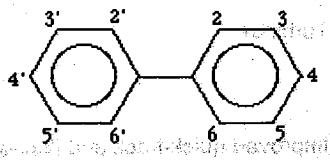


Figure 1. Basic PCB Structure

As discussed in the main text of this fact sheet, PCBs were emitted in large quantities before PCB manufacturing was banned in the U.S. Between 1930 and 1970, approximately 30,000 tons were released to air, 60,000 tons to fresh and coastal waters, and 300,000 tons to dumps and landfills (HSDB, 2003). Because of their extreme chemical and thermal stability, once they are introduced to the environment they remain there for years or even decades (ATSDR, 2000).

PCBs are nonpolar and therefore are only slightly soluble. This characteristic inhibits the transport of PCBs from soil to water (groundwater or surface water) and makes them bind strongly to soils. PCBs can be transported to surface water via entrainment of contaminated soil particles in surface water runoff. In water, a small portion of PCBs will dissolve, but the majority will bind to organic particles and bottom sediments (Nagpal, 1992). Although PCBs have a strong affinity for sediment, small amounts of PCBs are released from sediments to water over time (ATSDR, 2000). Once in the water, PCBs are also taken up by small organisms and fish. PCBs accumulate in the fatty tissue of these organisms.

PCBs have a relatively low vapor pressure. Despite their low volatility, PCBs do volatilize from both soil and water. This is a result of their widespread presence and extreme stability (DEQ, 1997). Once re-emitted, PCBs can be transported long distances in air, and then redeposited by settling or scavenging by precipitation. This cycling process continues indefinitely and is referred to as the grasshopper effect (EPA, 2001). It is estimated that there are currently 1,000 tons of PCBs cycling through the atmosphere over the U.S. (HSDB, 2003). Studies performed at Lake Michigan show that 80 percent of the PCBs entering the lake come from the air (Delta Institute, 2000). Additional evidence of the atmospheric deposition of PCBs is the presence of PCBs in sparsely populated areas of Canada and in Arctic polar bears (both far from point sources of PCB contamination) (Fiedler, 1997).

References

ATSDR. 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). November 2000. Agency for Toxic Substances and Disease Registry Web page: http://www.atsdr.cdc.gov/toxprofiles/tp17.html. Web page visited: July 2003.

ATSDR. 2001. Polychlorinated Biphenyls. February 2001. Agency for Toxic Substances and Disease Registry Web page: http://www.atsdr.cdc.gov/tfacts17.html. Web page visited: February 2003.

Bernhard, Teresa and Petron, Steve. 2001. Analysis of PCB Congeners vs. Aroclors in Ecological Risk Assessment. April 2001.

CWC. 1997. Mill-Based Residual Fiber For Use in Molded Pulp Technology. 1997. Report No. PA-97-2. Clean Washington Center web page: http://www.cwc.org/paper/pa_htm/PA97-2rpt.htm. Web page visited: July 2003

Delta Institute. 2000. PCBs. Delta Institute Web page: http://www.delta-institute.org/publications/PCBFS.pdf. Web page visited: March 2003.

DEQ. 1997. PCB Generic Remedies. December 1997. Eco-USA. 2002. PCBs. Eco-USA Web page: http://www.eco-usa.net/toxics/pcbs.shtml. Web page visited: February 2003.

DOJ. 2002. United States Settles With Natural Gas Pipeline Company. February 1, 2002. United States Department of Justice web page: http://www.usdoj.gov/opa/pr/2002/February/02_enrd_053.htm. Web page visited: July 2003.

EIP Associates. 1997. Polychlorinated Biphenyls (PCBs) Source Identification. Prepared by: EIP Associates, October 28, 1997. Prepared for: Palo Alto Regional Water Quality Control Plant. City of Palo Alto web page: http://www.city.palo-alto.ca.us/cleanbay/publications.html. Web page visited: July 2003.

EPA. 2001. Frequently Asked Questions About Atmospheric Deposition. September 2001.

EPA. 2002. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions. July 1, 2002. 40 CFR Part 761. EPA Office of Pollution Prevention & Toxics web page: http://www.epa.gov/opptintr/pcb/200240CFR761.pdf. Web page visited: July 2003.

FDA. 2003. Unavoidable Contaminants in Food for Human Consumption and Food-Packaging Material, SubPart B, Tolerances for Polychlorinated Biphenyls (PCBs). April 1, 2003. 21 CFR 109.30. National Archives and Records Administration, Code of Federal Regulations web page: http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi. Web page visited: July 2003.

Fiedler, Dr. Heidelore. 1997. Polychlorinated Biphenyls: Uses and Releases. July 1-4, 1997. Proceedings of the Subregional Awareness Raising Workshop on Persistent Organic Pollutants (POPs), St. Peterburg, Russian Federation. United Nations Environmental Program (UNEP) Chemicals web page: http://www.chem.unep.ch/pops/. Web page visited: July 2003.

Flynn, Leonard. 1997. Public Health Concerns about Environmental Polychlorinated Biphenyls (PCBs). American Council on Science and Health Web page: http://www.acsh.org/publications/reports/pcupdate2.html. Web page visited: February 2003.

HSDB. 2003. Polychlorinated Biphenyls. Compiled by the National Library of Medicine. Hazardous Substance Data Bank Web page: http://csi.micromedex.com/Data/HS/HS3945H.htm. Web page visited: February 2003.

Nagpal, N.K., Ph. D. 1992. Water Quality Criteria for Polychlorinated Biphenyls. January 1992. Ministry of Environment, Lands, and Parks, Province of British Columbia web page: http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/pcbs/index.html. Web page visited: July 2003.

UNEP Chemicals, 1999. Guidelines for the Identification of PCBs and Materials Containing PCBs, First Issue, August 1999. United Nations Environmental Program (UNEP) Chemicals web page: http://www.chem.unep.ch/pops/. Web page visited: July 2003.

Warrington, P.D., Ph. D. 1996. Water Quality Guidelines for Chlorophenols. November 1996. Ministry of Environment, Lands, and Parks, Province of British Columbia web page: http://wlapwww.gov.bc.ca/wat/wq/BCguidelines/chlorophenols/index.htm. Web page visited: July 2003.

TM 212
MAY 1974

MARINE INPUTS OF POLYCHLORINATED BIPHENYLS AND COPPER FROM VESSEL ANTIFOULING PAINTS

David R. Young
Theadore C. Heesen
Deirdre J. McDermott*
Paul E. Smokler

Preliminary results of a project financed in part with Federal funds from the Environmental Protection Agency under grant number R-801152. The contents do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendations for use.

Southern California Coastal Water Research Project
1500 East Imperial Highway
El Segundo, California 90245
(213) 322-3080

*Present Address: Lockheed Center for Marine Research
6350-A Yarrow Drive
Carlsbad, California 92008

BIBLIOGRAPHIC DATA SHEET	1. Report No. SCCWRP-TM212-74	2.	3. Recipient's Accession No. PB275412
4. Title and Subtitle Marine inputs of polychlorinated biphenyls and copper from vessel antifouling paints.			5. Report Date May 1974 6.
7. Author(s) David R. Young, Theadore C. Heesen, Deirdre J. McDermott, and Paul E. Smokler			8. Performing Organization Rept. No. SCCWRP-TM212-74
9. Performing Organization Name and Address Southern California Coastal Water Research Project 1500 E Imperial Highway El Segundo, CA 90245			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address Same as box 9			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstracts
During 1973 an estimated 37,000 recreational vessels (5-21 m long) were docked within 14 major marinas in southern California. Detailed surveys of major brands and quantities of antifouling paint applied to such craft and to commercial and naval vessels in Los Angeles/Long Beach and San Diego harbors were conducted. These studies revealed that approximately 300,000 liters of antifouling paint are applied anually to vessels in southern California. Only 7 of the 28 paints most commonly used yielded detectable PCB levels. Median concentrations of mixtures resembling Aroclor 1242 and 1254 were less than 0.3 and 0.7 mg/1, respectively, and the maximum PCB concentration measured was 40/mg/1. However, the median copper concentration in these paints was estimated to be 600 g/1, corresponding to an annual copper application rate of about 180 metric tons. This copper, which is designed to be available and toxic to marine organisms, may have a larger environmental impact than the 600 metric tons of copper discharged anually via municipal wastewaters.

17. Key Words and Document Analysis. 17a. Descriptors

Water pollution
marine ecology

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21.
Release unlimited	UNCLASSIFIED	
	20. Security Class (This Page) UNCLASSIFIED	22. Price A02-A01

INTRODUCTION

Vessel antifouling paints constitute a potentially signficant source of certain trace contaminants to coastal marine waters. For example, copper, mercury, and lead have been used extensively in bottom paints or primers, and relatively high concentrations of polychlorinated biphenyls (PCB) also have been found in such materials (Barry 1972; Young et al. 1973; McClure, personal communication*). Because of the extensive use of recreational, commercial, and naval vessels off southern California, the Coastal Water Project conducted a study of the application of antifouling paints to boats in marinas and harbors along this coast. Samples of the principal brands of paints used were obtained and analyzed for PCB. In addition, when possible, copper content was obtained from the paint can labels. The results of this survey have been incorporated into estimates of annual mass emission rates (or their upper limits) for these potential pollutants, and the values have been compared to past estimates for two other sources.

PROCEDURES AND RESULTS

Field Surveys

The southern California coastline has 14 major recreational marinas between Santa Barbara and the U.S./Mexico border (Figure 1); in addition, there are major harbors at Los Angeles and San Diego that contain almost all of the commercial and naval drydock facilities in the region. During 1971, the number of small craft then maintained in each marina was obtained from the appropriate harbor master (Table 1). This inventory was followed by a preliminary investigation into the usage of antifouling paints and other vessel-related materials in Marina del Rey, the second largest marina in southern California (Southern California Coastal Water Research Project 1973). During 1973, we conducted detailed investigations into antifouling paint usage at four marinas--Ventura Harbor and Oxnard-Channel Islands Harbor (Ventura County), Marina del Rey (Los Angeles County), and Newport Bay (Orange County). These anchorages accommodate more than half of the marine recreational craft moored in southern California.

---

* Dr. Vance McClure, National Marine Fisheries Service, Tiburon, Ca.

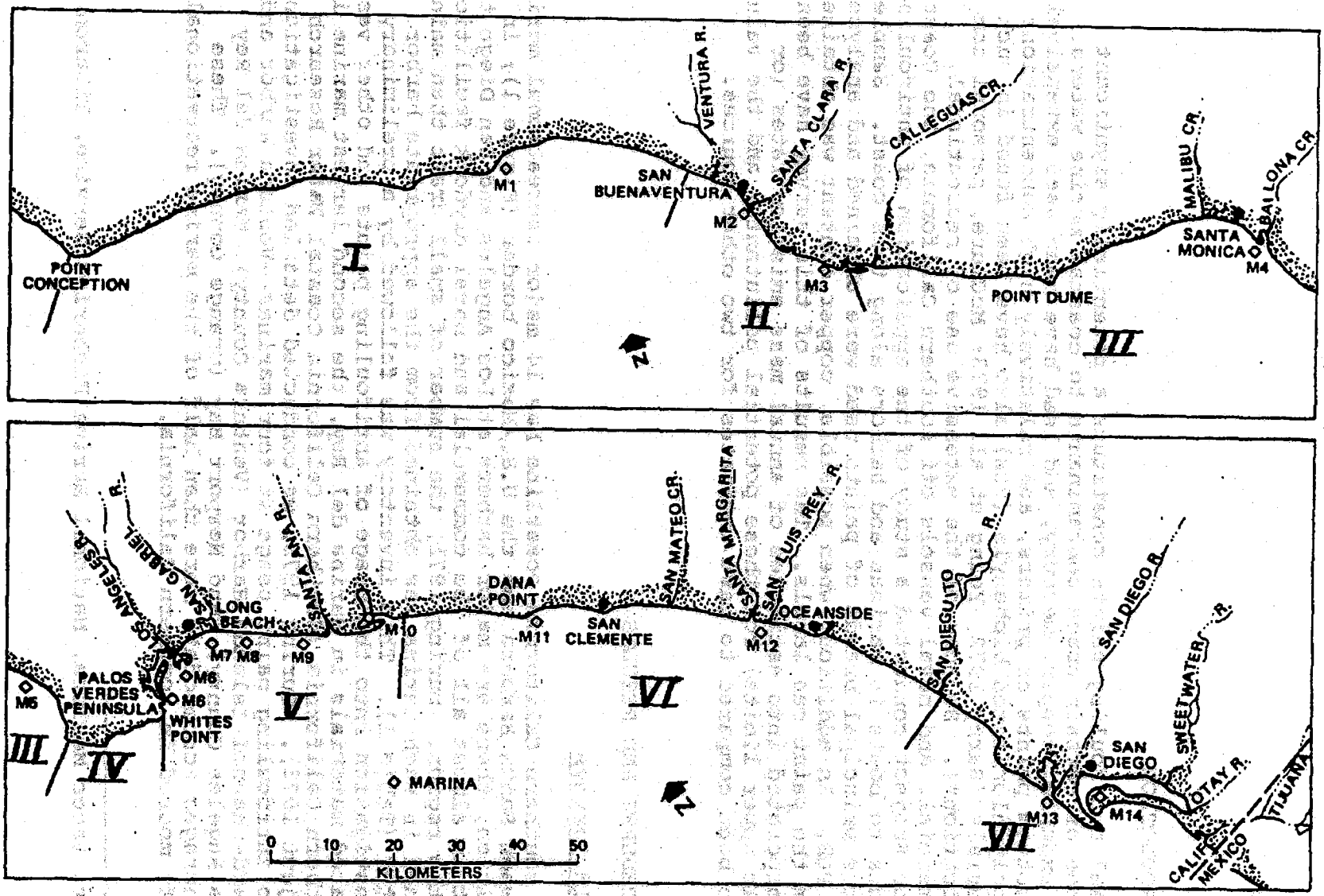


Figure 1. Southern California Marinas

Table 1

Number of Boats Harbored in Southern California Marinas, 1971.

Ref. No.[a]	Marina	No. of Boats[b]
M1	Santa Barbara Harbor	750
M2	Ventura Harbor	930
M3	Oxnard-Channel Islands Harbor	930[c]
M4	Los Angeles-Marina del Rey	5,500[d]
M5	Redondo Beach-King Harbor Marina	1,400
M6	San Pedro Bay-Los Angeles Harbor	3,400
M7	San Pedro Bay-Long Beach Harbor	2,530
M8	San Pedro Bay-Long Beach Marina	2,300
M9	Huntington Beach-Huntington Harbor	3,200
M10	Newport Bay-Newport Beach Harbor	8,000[e]
M11	Dana Point Harbor	550
M12	Oceanside Harbor	550
M13	San Diego-Mission Bay	1,500
M14	San Diego Bay	3,320
	TOTAL	34,860

a. Key to location on Figure 1.
b. Includes only 16- to 65-ft boats corresponding to U.S. Coast Guard Classes 1, 2, and 3. Boats smaller than 16 ft, which are U.S. Coast Guard Class A, are not included in this inventory.
c. 1973 estimate: 980 boats.
d. 1973 estimate: 6,000 boats.
e. 1973 estimate: 8,600 boats.

Information on boat size and type was generally not available; however, we located relatively detailed data on one recreational craft anchorage--Newport Bay.* This bay, which is located in approximately the middle of the Project's coastal study region, harbors almost 25 percent of the total number of small craft anchored in southern California; thus, we felt it would be reasonably representative of the other marinas of interest. Table 2 gives the results of an inventory of the numbers of power, sail, and hand-powered craft in several length classes moored in the Bay during winter 1971. Table 3 presents information on annual counts of craft of a number of different types anchored there between 1962 and 1971.

We used two methods to obtain estimates of the amounts of antifouling paint used. The first was to quantify directly the number of gallons of all major brands applied or sold annually in a marina area. The second was to obtain estimates of the average number of gallons of antifouling paint applied per boat and the number of boats painted annually in the area. In addition, data on the percentage use of each of the major brands was sought. Such information was obtained by visiting all of the boat "haul-out" yards in the marina under study and all of the retail paint and hardware stores in the vicinity of the marina. We obtained samples of paints currently in use and also collected paint scrapings at several of the yards.

During 1973, our detailed survey efforts were first directed to Marina del Rey. Only two haul-out yards and four retail suppliers of antifouling paints were located in the vicinity. Information obtained on principal brands used and estimated application rates is summarized in Table 4.

Following the collection of the information summarized in Table 4, we attempted to evaluate the completeness of the survey of antifouling paint usage on Marina del Rey craft. Paint retailers' estimates of the number of gallons applied per boat (averaging approximately 30 ft (10 m) in length) ranged from 0.5 to 1.5.** Taking an average figure of 1 gal. per boat, and assuming that sales by Retail Store No. 4 (Table 4) were similar to those of the other three local retailers (averaging about 100 gal./yr), the painting of approximately 400 boats is accounted for by retail paint sales. This compares to approximately 4,100 boats painted annually by the two boat yards. In addition, another 300 boats that did not require antifouling paint were inventoried in dry storage. As the

---

* Larry Miller, Newport Beach Chamber of Commerce, personal communication.

** Estimates from the haul-out yards were somewhat higher, averaging about 1.5 gal./boat.

Table 2

Estimated Numbers of Power, Sail, and Hand-powered Boats in Five Length Classes - Newport Bay, Winter 1971.

Length	Power	Sail	Hand-Powered	Total
Under 20 ft	2,000	2,060	1,040	5,100
20-29 ft	1,200	980	-	2,180
30-39 ft	730	430	-	1,160
40-49 ft	360	120	-	480
Over 50 ft	150	70	-	220
TOTAL	4,440	3,660	1,040	9,140

average reported interval between paintings was 12 months, approximately 4,800 (or 80 percent) of the estimated 6,000 craft maintained at Marina del Rey were accounted for in the survey. We do not presently know how much of the remainder is due to unattended craft, to craft painted elsewhere or at a reduced frequency, or to inaccuracies in the usage estimates. However, it does appear that most of the paint applied to small craft anchored in Marina del Rey was accounted for in this survey.

A corresponding approach at the other marinas studied was not possible because our surveys revealed that some of the haul-out yards obtained their paints from local retail stores. However, in light of the fact that about 90 percent of the (accountable) antifouling paint used on Marina del Rey craft was applied by local boat yards, we have assumed that this is the predominant source of antifouling paints utilized on small craft in the marinas. Results on bottom paint usage for Newport Bay and Ventura and Oxnard Harbors are presented in Tables 5 and 6.

To obtain estimates of antifouling paints used in southern California on commercial and naval vessels, we visited most of the major drydock facilities in Los Angeles-Long Beach Harbor and San Diego Harbor. Estimates of the quantities and types of major paints applied annually at these drydocks was obtained (Tables 7 and 8). Samples of these paints also were collected and analyzed for PCB.

Laboratory Technique

Wet Paint Extraction Methods. Most samples were extracted using a separatory funnel. A measured volume of the wet paint sample was pipetted into a 500-ml separatory funnel containing 100 ml of 15 percent diethyl ether in hexane (by volume). If the paint

Table 3

Annual Inventory of Recreational Craft in Newport Bay 1960-71.

	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960
Cabin Cruisers	2,036	2,018	2,076	2,029	1,966							
Motor Boats, Z-drives	790	771	642	746	682	2,743	2,462	2,462	2,705	2,522		
Sail-boats	3,703	3,562	3,308	3,129	3,129	3,055	2,585	2,266	2,208	2,119		
Out-boards	1,455	1,461	1,276	1,400	1,254	1,141	1,207	1,098	1,005	1,005		
Rowboats	964	804	738	903		969	895	825	864	1,047		
Canoes, Paddle Boards, Outriggers	58	54	38	47	27	20	34	20	21			
Kayaks, Pedaloes	41	82										
Dredges, Barges, Tugs	24	27	27	8	1	2			1			
House-boats	4	4	2				2					
Steam-boats	2	2	5	5								
Rafts, Floats	7	2	4									
Hull		2	1	1								
Rescue, Fire	6											
TOTAL	9,090	8,789	8,117	8,268	7,059	7,930	7,185	6,671	6,804	6,693	6,242	6,136

Table 4

Estimated Use of Antifouling Paints at Marina del Rey, 1973.

Supplier	Boats/ Year		Average Gal./Boat		Gal./ Year	Brand	Est. % of Total
Boatyard No. 1	3,000	x	1.5	=	4,500	Brolite Z-Spar	50
						Woolsey	50
Boatyard No. 2	1,100	x	1.5	=	1,650	Brolite Z-Spar	50
						Woolsey	50
Paint Retailer No. 1	100*		1		100	Brolite Z-Spar	-
						Woolsey	-
Paint Retailer No. 2	50*		1		50	Brolite Z-Spar	95
						Mariner's	5
Paint Retailer No. 3	150*		1		150	Brolite Z-Spar	75
						International	25
Paint Retailer No. 4	100*		-		100**	Brolite Z-Spar	-
						Woolsey	-
TOTAL	4,500				6,550		

*Boats per year equals gallons per year divided by average gallons per boat.
**No quantitative information released; value assumed from data for Retailers 1 through 3.

seemed to disperse easily when dropped into the ether-hexane mixture, the separatory funnel method of extraction was employed. On the other hand, if the wet paint sample formed a seemingly nonpermeable drop or plastic-like string, the separatory funnel method was not used, and the samples were extracted using the Soxhlet method.

Separatory Funnel Method. The separatory funnel was shaken for a period of 2 minutes with the ether-hexane mixture and the sample. The sample was allowed to settle to the bottom of the separatory funnel, and the extract was carefully decanted into a round-bottomed flask. Next, 100 ml of 6 percent diethyl ether in hexane was added to the 500-ml separatory funnel containing the sample and shaken for a period of 2 minutes. Again the extract was carefully decanted into the round-bottomed flask. The paint was shaken again with 100 ml of hexane, and the extract was again added to the round-bottomed flask. The sample was reduced in a Rotovapor to a volume suitable for a Florisil cleanup.

Table 5.
Estimated Use of Antifouling Paints
at Newport Bay, 1973.

Supplier	Boats per Year		Avg. Gal./ Boat		Gal./ Year	Brand	Est. % of Total
Boatyard							
1	550	x	1	=	550	Brolite Z-Spar	80
						Pettit	20
2	600		0.5		300	Pettit	100
3	1,040		1		1,040	Brolite Z-Spar	44
						Woolsey	20
						International	36
4	500		1		500	Brolite Z-Spar	60
						International	20
						Woolsey	15
						Pettit	5
5	600		1		600	International	40
						Woolsey	55
						Brolite Z-Spar	5
6	110		1.25		140	International	65
						Brolite Z-Spar	35
7	180		2		360	International	98
						Brolite Z-Spar	1
						Pettit	1
8	500		1.5		750	Brolite Z-Spar	50
						International	50
9	790		1		790	Brolite Z-Spar	5
						Mariners	35
						Pettit	45
						Woolsey	10
						International	5
10	560		0.5		280	Brolite Z-Spar	45
						Woolsey	45
						Pettit	10
11	100		3		300	Brolite Z-Spar	100
12	100		0.75		75	Pettit	100
TOTAL	5,630				5,680		
Paint Retailer							
1	-		-		300	Mariners	50
						Woolsey	50
2	-		1		3	Kuhls	100
3	-		0.75		600	Pettit	100
4	-		-		10	Brolite Z-Spar	-
						International	-
5	-		2		700	International	60
						Brolite Z-Spar	40

Table 5 (Continued)

Supplier	Boats per Year	Avg. Gal./ Boat	Gal./ Year	Brand	Est. % of Total
Paint Retailer (Cont.)					
6	-	-	1	Pettit	100
7	-	1	-*	International	-
				Brolite Z-Spar	-
8	-	-	900	Brolite Z-Spar	75
				International	25
9	-	1	300	Pettit	45
				Mariners	35
				Woolsey	10
				Brolite Z-Spar	5
				International	5
10	-	-	1	Brolite Z-Spar	100

*No estimate available.

Table 6.

Estimated Use of Antifouling Paints for Ventura and Oxnard Marinas, 1973.

Supplier	Boats per Year	Avg. Gal./ Boat	Gal./ Year	Brand	Est. % of Total
VENTURA HARBOR					
Boatyard	330	1	330	-	-
Paint Retailer	-	-	50	Brolite Z-Spar	100
OXNARD/CHANNEL ISLANDS HARBOR					
Boatyard	480*	3.25	1,560	-	-

*Boatyard recently changed ownership; therefore, this estimate is believed to significantly underestimate past and future usage.

Table 7.

Estimated Annual Use of Antifouling Paints on Commercial and Naval Vessels in Los Angeles-Long Beach Harbor.

Shipyard*	Ships/Year Commercial	Ships/Year Naval	Avg. Gal./Ship	Gallons/Year Commercial	Gallons/Year Naval	Gallons/Year Total	Brand	Est. % of Total
1	38	2	-	2,605**	355**	2,960	International	40
							Devoe-Reynolds	60
2	0	24	-	0	4,650**	4,650	International	-
							Devoe-Reynolds	-
							Proline	-
3	300	0	20	6,000	0	6,000	International 1609	40
							Devoe-Reynolds	30
							Proline 1080	30
4	52	0	44	2,290	0	2,290	International	10
							Devoe-Reynolds	90
5	-	-	-	-	-	3,980†	-	-
6	-	-	-	-	-	3,980†	-	-
7	0	25	270	0	6,750	6,750	Devoe-Reynolds 121/63	90
							Devoe-Reynolds 129/63	10
TOTAL						30,600		

*All are commercial shipyards, except for Shipyard 7 (U.S. Navy).
**Obtained directly from company records.
†Assuming average value for Shipyards 1-4.

Table 8.

Estimated Annual Use of Antifouling Paints on Commercial and Naval Vessels at Two of the Largest Shipyards in San Diego Harbor, 1972

	Commercial			Naval		
	Yard 1	Yard 2	Total	Yard 1	Yard 2	Total
Ships per Year	24	3		2	4	
Average Gallons per Ship	40	3,000		300	500	
Gallons per Year	960	9,000	9,960	600	2,000	2,600

Soxhlet Extraction Method. This method was used only when the separatory funnel method could not be used. The wet paint sample was spread out on aluminum foil and allowed to dry. After drying, the sample was extracted using the same method as that used on dry paint samples.

Dry Paint Extraction Method. Dry paint samples were Soxhlet extracted with hexane. The thimbles and hexane were added to the Soxhlet extraction apparatus, and the hexane was refluxed for a period of 2 hours to clean the apparatus. The rinse hexane was removed and replaced with clean hexane, and the samples were weighed into the cleaned thimbles. The Soxhlets were then refluxed for an 18-hour period. The extracts were concentrated in a Roto-vapor to a volume suitable for the Florisil clean-up column.

Florisil Cleanup. Activation of the Florisil was carried out using a pottery kiln. The temperature was set at a dial reading of 1300°F (705°C); this temperature setting on the kiln melts aluminum foil (which has a melting point of 659°C) and appears to be a satisfactory setting for the activation of Florisil. The Florisil was placed in 250-ml covered cricibles in the kiln and was baked for 4 hours after the kiln reached equilibrium temperature. The activated Florisil was stored under hexane until use.

Three inches of the slurried-activated Florisil were added to the cleanup chromatographic columns,* and 1/2 inch of anhydrous sodium sulfate was added over the Florisil. Samples were concentrated to a volume of approximately 50 ml and added to the Florisil column. The column was eluted with 45 ml of 6 percent diethyl ether in hexane.

Extraction Efficiency. One paint chip sample (Code P17, Table 10) with a high PCB concentration (about 15 percent on a dry weight basis) was extracted and re-extracted with a Soxhlet extraction apparatus. The PCB value for the second extraction was 0.01 percent of the total value of the first extraction. If all dried

* 25 mm o.d., 22 mm i.d., 400 mm length with sealed-in coarse porosity fritted disc, Kontes Glass Co., Vineland, N.J.

paint samples are assumed to have the same permeability, then the procedure for dry paint extraction may be assumed to be highly satisfactory. Because none of the wet paint samples analyzed showed any appreciable concentration of PCB, it was not possible to quantify extraction efficiency for such samples. However, double extractions were conducted on a number of wet paint samples. Based on the relative signals obtained in the double extractions, and the very high recovery observed for the dry paint sample, we concluded that the PCB concentrations (usually upper limit values) listed in Table 9 are representative.

RESULTS

Sample descriptions, measured PCB concentrations, measured densities, weight percentages of copper compounds listed on paint can labels, and estimated metallic copper content are presented in Table 9. Table 10 lists PCB concentrations measured in weathered antifouling paint samples obtained at boat haul-out yards.

Because no DDT compounds were ever identified in the paint samples, upper limit concentrations were not calculated. Such values could be estimated to be approximately one-tenth of the maximum PCB 1254 values.

DISCUSSION

Antifouling Paint Usage

As seen from the data presented in Table 1, the 1971 inventory of small craft harbored at marinas throughout the Bight generally was confirmed by the 1973 inventories conducted at Oxnard Harbor, Marina del Rey, and Newport Bay. The percentage increases in numbers were 5, 9, and 7 percent, respectively. Assuming that the median value of 7 percent for percentage increase over the 2-year period is representative, approximately 37,000 recreational boats* were harbored in southern California marinas during 1973. The intensive surveys conducted at Marina del Rey and Newport Bay, which together account for about 40 percent of this total, yielded remarkably similar results. For example, the 4,100 small craft painted in the two boatyards at Marina del Rey during 1973 constituted 68 percent of the total number of boats (6,000) harbored there. In comparison, the 5,630 small craft painted at the 12 boatyards at Newport Bay constituted 66 percent of the total number (8,600) harbored at the Bay during 1973. Similarly, the median values for estimated gallons of antifouling paint applied per boat at both anchorages and for both haulout yards and paint retailers were 1 gal./boat.

As discussed in the previous section, at Marina del Rey, the boatyards apparently accounted for about 90 percent of the antifouling paint used at the marina, and retail sales to individuals for pri-

* Generally between 16 and 65 ft (5 to 22 m) in length.

Table 9.

Measured Polychlorinated Biphenyl Concentrations and Estimated Copper Concentrations in Antifouling Paints Used in Southern California.

Code	Brand and Type	Extraction Method*	PCB (mg/l) 1242	PCB (mg/l) 1254	Cu_2O (%)	ρ (kg/l)	Cu (g/l)
Recreational							
	Brolite Z-Spar						
P23	2000	A	<0.06	<0.16	32.6	1.73	500
P48	Multitox	A	<0.05	1.6	35.7	1.70**	540
P34	Colortox	B	-	0.29	0	-	0
P50	Supertox	-			59.4	1.70**	900
P53	Killer (B-90)	A	<0.3	<0.6	69.0	1.70**	1,040
P40	Racing Bronze	-			26.7†	1.13	300
P27	Vinyl Cop	-			-	-	-
P37	A-1316 (1969)	-	<0.4	<1.2	-	-	-
	Woolsey						
P24	Vinelast (Blue)	A	<0.3	<1.0	42.0	1.63	610
P39	Vinelast (Red)	A	<0.1	<0.3	42.0	2.08	780
P1	OTT	-			0	-	0
P44	Tradewinds	-			24.0††	1.50	390
P46	Racing Finish	-			42.0	1.47	550
-	Super-Vinelast	-			48.0§	1.70**	730
P33	Neptune	-			68.0	2.68	1,620
-	Foul-Ban	-			40.0	1.70**	600
	International						
P28	Inter-lux 62	B	<0.2	<0.6	31.5	1.70**	480
P26	Bottomkote 69	A	<0.4	<1.1	43.5	1.92	740
P20	Vinyl-lux	A	<0.03	<0.07	45.0	2.24	900
P19	Tri-lux	B	<0.3	<1.0	0	1.70**	0
P18	Copper-lux	A	<0.06	<0.15	67.5	2.83	1,700
-	Inter-club	-			31.5	1.70**	480

*A = separatory funnel method; B = Soxhlet method.
**Median density assumed.
†Percent metallic copper.
††Plus 9% CuOH.
§Plus 3% CuOH.

Table 9 (Continued)

Code	Brand and Type	Extraction Method*	PCB (mg/l) 1242	PCB (mg/l) 1254	Cu_2O (%)	ρ (kg/l)	Cu (g/l)
	Pettit						
P25	Unepoxy	B	<0.01	<0.03	60.7	2.30	1,240
P51	Trinidad 75 (Red)	A	<0.09	<0.2	75.8	1.79	1,210
P31	Pacific Special	A	1.7	1.2	35.0	1.66	520
P41	Old Salem Vinylcide red	-			55.2	1.10	540
P36	Starline Antifouling Bronze	-			0	-	0
	Mariner's						
P2	1034 Lido	A	<0.3	<0.6	68.1	1.76	1,060
	Singapore						
P32	696 Blue	A	<0.4	<1.2	34.0	1.54	470
	Devoe-Reynolds						
P30	Navicote	A	<84	<220	47.8	2.20	940
P63	Triple C	A	12.0	28.0	24.6	1.51	330
Commercial							
	Devoe-Reynolds						
P54	Super Tropical	A	18	23	24.6	1.88	410
P58	3407	A	<0.005	<0.023	38.5	2.58	880
P59	213	A	<0.92	<0.29	36.2	1.70**	550
P60	121	A			70.3	1.74	1,100
P64	Hot Plastic	B	1.30	3.00	32.5	1.20	350
P55	Cold Plastic 105	B	<1.6	<4.0	40.3	1.34	480
-	3402	-			10.0	1.70**	150
	Amarcoat						
P62	Emeron 67	A	1.20	2.80	15.0	1.51	200
	Proline						
P57	1080	A	<0.17	<0.72	51.0	1.70**	770
Navy							
	Devoe-Reynolds						
P60	121/63	A	<0.1	<0.4	70.3	1.74	1,090
P61	129/63	A	<0.1	<0.4	63.2	1.24	690

*A = separatory funnel method; B = Soxhlet method. **Median density assumed.

Table 10.

Concentrations of Polychlorinated Biphenyls Measured in Bottom Paints Removed from Boats in Southern California Drydocks.

Boatyard	Code	Origin	Method	PCB (mg/dry kg) 1242	1254
Marina del Rey					
No. 1	P9	Fiberglass Hull	Sandblast	<0.1	3.0
	P10	Trashcan	Scrape	1.3	1.4
	P11	Trashcan	Scrape	9.5	3.5
	P12	Drain 1	-	<28	3,300
	P13	Drain 2	-	7.5	8.3
	P14	Drain 2	-	110	160
	P15	Wood Hull	Scrape	-	19
	P16	Wood Hull	Scrape	3,000	53,000
	P17	Wood Hull	Scrape	-	150,000
	P21	Yard	Scrape	<2.8	<0.3
	P22	Wood Hull	Scrape	<0.9	20
No. 2	P4	Wood Hull	Sandblast	<1.1	<1.1
	P8	Fiberglass Hull	Sandblast	<1.0	<4.2
Long Beach Harbor					
No. 5	P65	Wood Hull	Scrape	0.5	0.8
	P66	Wood Hull	Scrape	3.7	1.9

vate use accounted for the other 10 percent. Applying this factor to the boatyard statistics presented above, it is estimated that approximately 75 percent of the boats inventoried in the marinas of the Bight are painted annually, using on the average about 1 gal. of antifouling paint per boat. This implies that the application rate of antifouling paints to recreation craft along the southern California coast during 1973 was approximately:

$$37{,}000 \text{ boats inventoried} \times 0.75 \frac{\text{boats painted per year}}{\text{boats inventoried}} \times 1 \frac{\text{gallon paint}}{\text{boats painted}}$$

$$= 28{,}000 \text{ gal./yr}^*$$

Regarding the annual use of antifouling paint for commercial and naval vessels, as seen in Table 7, the estimated total for Los Angeles-Long Beach Harbor (San Pedro Bay) is 30,600 gal./yr. Table 8 presents data obtained for 1972 from records of the two largest shipyards in San Diego Bay; approximately 12,600 gal. of antifouling paint were used at these yards during that year. These results are in excellent agreement with those reported by Barry (1972) for the previous year; during 1971, a total of approximately 13,000 gal. of antifouling paint were applied to commercial and naval vessels in these two yards. As Barry's data imply that the total value for such vessels (excluding recreational craft) painted during 1971 in the Bay was approximately 19,400 gal., the estimated total annual use of antifouling paint on commercial and naval vessels at shipyards in the two bays is:

San Pedro Bay	=	30,600 gal./yr
San Diego Bay	=	19,400 gal./yr
Total	=	50,000 gal./yr

These two harbors contain the major shipyards located along the southern California coast.

PCB and Copper Inputs

As seen from Table 9, PCB 1242 or 1254 were detected in only 7 of the 28 wet paint samples analyzed. With the exception of Samples P54 and P63, whose total PCB concentrations each were approximately 40 mg/l, levels generally were the order of 1 mg/l or below. (Neglecting inequality signatures in Table 9, median values for PCB 1242 and 1254 were 0.3 mg/l and 0.7 mg/l, respectively.) When we combine these median values with the estimated quantities of antifouling paint applied annually to recreational, commercial, and naval vessels in marinas or harbors of the Bight, we obtain the estimated upper limits for PCB annual usage at each of the southern California anchorages shown in Table 11.

* One gallon equals 3.78 liters.

A corresponding calculation may be made for estimated copper usage. From the data presented in Table 9, the following summary of copper concentrations in antifouling paints is obtained:

Class	No. of Values	Cu (g/l)
Recreational	29	Median = 550 Range = 0-1,700 Mean = 660 $S_{\bar{x}}$ = 82
Commercial	9	Median = 480 Range = 150-1,100 Mean = 540 $S_{\bar{x}}$ = 110
Navy	2	Median = 890 Range = 690-1,090 Mean = 890 $S_{\bar{x}}$ = 200
Combined	40	Median = 550 Range = 0-1,700 Mean = 650 $S_{\bar{x}}$ = 65

These results are in reasonable agreement with those of Barry (1972); from his data, median concentrations for the above four categories are 610 (n = 21), 670 (n = 6), 1240 (n = 2), and 640 (n = 29). Although the naval vessel paints apparently contain somewhat more copper than do most paints used on the other types of craft, the results are generally quite similar. Until better data on usage of individual paints become available, it appears adequate to apply an average value for the copper content of antifouling paints used in the Bight. Combination of the results from Barry's study (overall median = 550 g/l) and from our study (overall median = 640 g/l) results in an estimated typical copper level of about 600 g/l. Using this figure, the estimated annual application rates of copper to vessel bottoms in each anchorage of the Bight have been calculated and are also listed in Table 11.

In Table 12, potential input rates of PCB and copper to the Bight through vessel paints are compared to those estimated for municipal wastewater (1971 data) and surface runoff (Water Year 1971-72) entering our coastal waters (Southern California Coastal Water Research Project 1973).

Table 11.

Estimated Annual Application Rates of PCB 1242, PCB 1254, and Copper to Recreational, Commercial, and Naval Vessels via Antifouling Paints at the Major Marinas and Harbors of the Bight, 1973.

Area	Anchorage	Paints* (gal./yr)	PCB (g/yr)** 1242	1254	Total	Copper† (metric tons/yr)
I	Santa Barbara Harbor	600	0.7	1.6	2.3	1.4
II	Ventura Harbor	750	0.8	2.0	2.8	1.7
	Oxnard Harbor	750	0.8	2.0	2.8	1.7
III	Marina del Rey	4,410	5.0	12	17	10
	Redondo-King Harbor	1,120	1.3	3.0	4.3	2.5
V	Huntington	2,560	2.9	6.8	9.7	5.8
	San Pedro Bay	37,200	42	98	140	84
	Newport Bay	6,410	7.3	17	24.3	15
VI	Dana Point Harbor	440	0.5	1.2	1.7	1.0
	Oceanside Harbor	440	0.5	1.2	1.7	1.0
VII	Mission Bay	1,200	1.4	3.2	4.6	2.7
	San Diego Bay	22,100	25	58	83	50
	TOTAL	77,980			<294	177

*Assuming (1) a 7% increase in the 1971 inventory values for recreational craft listed in Table 1; (2) 75% of the recreational craft are painted annually, using an average of 1 gal. of antifouling paint per boat. The values for San Pedro Bay and San Diego Bay (30,600 and 19,400 gal./yr, respectively) include estimates for commercial and naval vessels. One gallon is equivalent to 3.78 liters.

**Upper limit figures, based on median values not exceeding 0.3 and 0.7 mg/l for PCB 1242 and PCB 1254, respectively.

†Assuming that, on the average, the concentration of copper in antifouling paint is about 600 g/l.

Table 12. Estimated recent annual input rates of PCB and copper to seven coastal areas of the Bight via municipal wastewaters and surface runoff, and estimated application rates of vessel antifouling paints.

Area	Total PCB (kg/yr)			Copper (m tons/yr)		
	Waste-waters*	Runoff**	Paints	Waste-waters*	Runoff**	Paints
I	-	1	0.01	-	0.6	1.4
II	3	10	0.01	1	8	3.4
III	570	18	0.02	190	3	12.5
IV	6,000	-	-	290	-	-
V	3,000	214	0.17	66	6	105
VI	-	3	0.01	-	0.9	2.0
VII	110	-	0.09	20	-	52.7
TOTAL	9,700	250	0.3	570	19	180

* 1971 data.
** Data from Water Year 1971-72.

CONCLUSIONS

Because 1971-72 was an unusually dry year, the estimated inputs for surface runoff (Table 12) are thought to be lower by about a factor of two than those that would have occurred under normal rainfall conditions. Also, source control efforts by the municipal wastewater managers apparently have now reduced the 1971 total PCB annual inputs by about a factor of two or three. Nevertheless, it is apparent that surface runoff probably is not an important source of either PCB or copper relative to municipal wastewater inputs.

While use of antifouling paints obviously now contributes a trivial amount of PCB to the harbors of the Bight (Table 12), the potential input (application rate) of copper via antifouling paint is seen to be quite significant. Overall, this potential input is about one-third the total estimate for municipal wastewater, and in Area V (San Pedro Basin) and Area VII (San Diego), it exceeds the wastewater value. Although we cannot yet estimate with any reliability what fraction of the copper contained in antifouling paint actually is released to the marine environment, the fact that this

toxicant is deliberately added to the paint (in a matrix designed to gradually release the toxicant) to prevent fouling by marine invertebrates suggests that an important fraction of the copper applied is indeed released to the marine environment before repainting. In addition, during repainting, a significant fraction of bottom scrapings may be blown or washed into the harbor water.

There is some indication that copper concentrations in digestive glands of the intertidal mussel and in the liver tissue of Dover sole collected from the vicinities of the major harbors in the Bight are somewhat higher than estimated baseline concentrations (Figures 8-19 and 7-14, Southern California Coastal Water Research Project 1973). This hypothesis is now being further investigated.

ACKNOWLEDGMENTS

We gratefully acknowledge the assistance of Larry Miller, Newport Beach Chamber of Commerce, and Ray Berry, California Shipyards, in acquiring this data as well as the cooperation of most of the owners and operators of drydocks and retail paint outlets at the harbors we investigated. We also thank Project staff members Elliott Berkihiser and Robin Simpson for their respective efforts in chemical analysis and manuscript preparation.

REFERENCES

Barry, J. N., 1972. Wastes associated with shipbuilding and repair facilities in San Diego Bay. Staff report, Calif. Reg. Water Qual. Control Bd., San Diego Reg.

Southern California Coastal Water Research Project. 1973. The ecology of the Southern California Bight: Implications for water quality management. TR104, El Segundo, Calif.

Young, D.R., C.S. Young, and G.E. Hlavka. 1973. Sources of trace metals from highly urbanized southern California to the adjacent marine ecosystem. In Cycling and control of metals, Natl. Environ. Res. Center, Cincinnati, Ohio.

United States
Environmental Protection
Agency

Office of Enforcement and
Compliance Assurance

EPA 315-B-00-001
Summer 2000

EPA

A Guide for Ship Scrappers

Tips for Regulatory Compliance

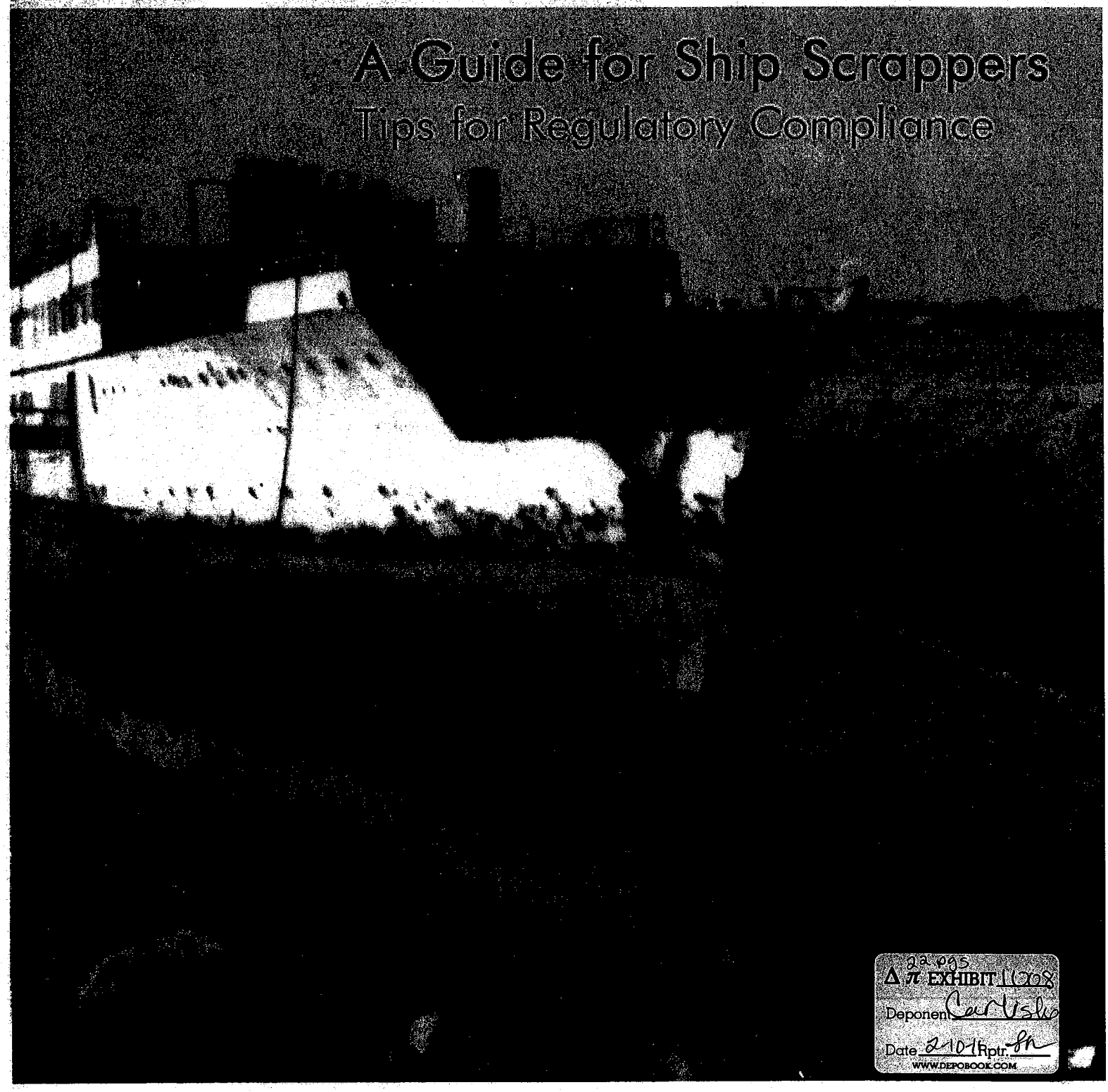


TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

1. INTRODUCTION

What is ship scrapping? According to OSHA, ship dismantling or breaking is "any breaking of a vessel's structure for the purpose of scrapping the vessel, including the removal of gear, equipment, or any component of a vessel" (29 CFR 1915.4).

1.1. THE GUIDE

What It Is; What It Does

This guide is intended to provide the site supervisor of a ship scrapping facility with a good understanding of the most pertinent *federal* environmental and worker safety and health requirements affecting ship scrapping/ship breaking operations. (*Specific* state requirements are not included.) The document provides guidance with reference to specific regulations, tips in shadow boxes • , and regulatory inspector highlights denoted by check boxes ☑.

Organization of the Guide

This guide is organized into 9 sections and 3 appendices. The document begins with a brief introduction and is then followed by a series of sections, each presenting key environmental and worker safety and health requirements for a major ship scrapping process. Each section was designed and developed to be used as independent guidance. These sections are as follows:

- *Section 2. Asbestos Removal and Disposal*
- *Section 3. Sampling, Removal and Disposal of Polychlorinated Biphenyls*
- *Section 4. Bilge and Ballast Water Removal*
- *Section 5. Oil and Fuel Removal and Disposal*
- Section 6. *Paint Removal and Disposal*
- *Section 7. Metal Cutting and Metal Recycling*
- *Section 8. Removal and Disposal of Miscellaneous Ship Machinery*

Section 9. Resources identifies sources, such as general and process-specific contacts, hotlines, publications, and Internet sites, where additional information and/or assistance can be obtained on environmental and worker safety and health requirements.

3. SAMPLING, REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs)

The sampling, removal, storage, and disposal of polychlorinated biphenyls (PCBs) is a primary environmental concern, as well as a worker health and safety concern, for your facility during ship scrapping. As described below, PCBs are found throughout older vessels and it is likely your ship scrapping facility will be faced with managing large quantities of PCBs. The following sections present background information on PCBs, discuss the effects of exposure to PCBs, and describe some of the regulatory requirements with which your facility must comply.

3.1 INFORMATION ABOUT PCBs

What are PCBs?

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. They are basically mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties. PCBs, which were domestically manufactured from 1929 until their manufacture was banned in 1979, can range in toxicity and vary in consistency from thin light-colored liquids to yellow or black waxy solids. While sold under the trade name "Arochlor," PCBs are known by many trade names. Common trade names for PCB dielectric fluids include, but are not limited to:

Aroclor	Clorphen	Hyvol	Pydraul
Aroclor B	Clophen	Inclor	Phyralene
Apirolio	Diaclor	Inerteen	Pyranol
Asbestol	Dk	Kaneclor	Pyroclor
Askarel*	Dykanol	Kennechlor	Saf-T-Kuhl
Adkarel	EEC-18	No-Flamol	Santotherm FR
Chlorextol	Elemex	Nepolin	Santovac 1 and 2
Chlorodiphenyl	Eucarel	Nonflammable Liquid	Therminol
Chlorinol	Fenclor	Phenoclor	

* Askarel is the generic name used for nonflammable insulating liquid in transformers and capacitors.

Why were PCBs widely used?

Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper; and many other applications. More than 1.5 billion pounds of PCBs were manufactured in the United States before production was stopped in 1979.

Where can PCBs be found on a ship?

Although no longer commercially produced in the United States, PCBs are found in solid (waxy) and liquid (oily) forms in equipment and materials on ships being scrapped. These equipment and materials which may contain PCBs in concentrations of at least 50 parts per million (ppm) include:

- Cable insulation
- Rubber and felt gaskets
- Thermal insulation material including fiberglass, felt, foam, and cork
- Transformers, capacitors, and electronic equipment with capacitors and transformers inside
- Voltage regulators, switches, reclosers, bushings, and electromagnets
- Adhesives and tapes
- Oil including electrical equipment and motors, anchor windlasses, hydraulic systems, and leaks and spills
- Surface contamination of machinery and other solid surfaces
- Oil-based paint
- Caulking
- Rubber isolation mounts
- Foundation mounts
- Pipe hangers
- Light ballasts
- Any plasticizers

How can exposure to PCBs occur?

PCBs can be ingested, inhaled, or absorbed through the skin. They circulate throughout the body and are stored in the body's fatty tissue. There are OSHA regulations governing exposure to PCBs in the workplace.

What are the dangers of exposure to PCBs?

PCBs are toxic and persistent. They have been shown to cause a variety of adverse health effects, such as cancer in animals, as well as a number of serious noncancer health effects in

animals (e.g., effects on the immune system, reproductive system, nervous system, and endocrine system). Studies in humans provide supportive evidence for potential carcinogenic and non-carcinogenic effects of PCBs. The different health effects of PCBs may be interrelated, as alterations in one system may have significant implications for the other systems of the body. In some cases, chloracne may occur in humans exposed to PCBs. Severe cases of chloracne are painful and disfiguring, and may be persistent.

It is very important to note that the composition of a PCB mixture changes following its release into the environment. The types of PCBs that bioaccumulate in fish and animals and bind to sediments tend to be the most carcinogenic components of PCB mixtures. As a result, people who ingest PCB-contaminated fish or animal products and touch PCB-contaminated sediment may be exposed to PCB mixtures that are even more toxic than the PCB mixtures contacted by workers and released into the environment.

EPA is also very concerned about the toxicity of the chemicals produced when PCBs are heated in fire-related incidents. The chemicals produced include polychlorinated dibenzofurans and polychlorinated dibenzo-p-dioxins, both of which are believed to be much more toxic than PCBs themselves.

3.2 WHO REGULATES PCBs?

- **EPA.** The Toxic Substances Control Act (TSCA) enacted in 1976 regulates commerce and protects human health and the environment by requiring testing of and establishing restrictions on certain potentially hazardous chemicals, including PCBs. PCBs are considered by EPA to be an unreasonable risk to health and the environment. Essentially, TSCA legislated true "cradle to grave" (i.e., from manufacture to disposal) management of PCBs in the United States.

  Note: Some states may regulate PCBs as hazardous wastes.

  Under Section 6(e) of TSCA, EPA is required to control the manufacture, processing, distribution in commerce, use, and disposal of PCBs. The TSCA regulations detailing the management requirements for PCBs are found in 40 CFR 761. Part 761 provides the definition, storage and disposal, cleanup policy, exemptions, general housekeeping, and reporting requirements for PCBs. EPA published amendments to 40 CFR 761 in the June 29, 1998 Federal Register [63 FR 35383-35474] which are broad and affect the sampling, analysis, and disposal of PCBs. The new amendments were effective August 28, 1998, and can be accessed at http://www.epa.gov/opptintr/pcb.

4. BILGE AND BALLAST WATER REMOVAL

An important activity during ship scrapping is the proper removal and disposal of wastewater, specifically bilge water and ballast water. The activities, if not conducted properly, may impact the environmental and present health and safety concerns for your workers.

4.1 INFORMATION ABOUT BILGE AND BALLAST WATER

The following section describes bilge water and ballast water, where they are found on a ship, and the potential human health and environmental impacts if they are not managed properly during removal and disposal.

What is bilge water and where is it found on a ship?

Typically, government-owned ships received for scrapping have minimal bilge water onboard. **Bilge water** consists of stagnant, dirty water and other liquids, such as condensed steam, and valve and piping leaks, that are allowed to drain to the lowest inner part of a ship's hull (i.e., the bilge). Bilge water may also be found in onboard holding tanks, often referred to as oily waste holding tanks or slop tanks.

Bilge water originates from many sources both when a ship is in operation and when a ship is being scrapped. It may contain pollutants, such as oil and grease, inorganic salts, and metals (e.g., arsenic, copper, chromium, lead, and mercury). When a ship is in operation, bilge water may originate from leaks and spills, steam condensate, and boiler blowdown. This drainage may include small quantities of oils, fuels, lubricants, hydraulic fluid, antifreeze, solvents, and cleaning chemicals. During ship scrapping, bilge water is created through the accumulation of rain water (because the decks are open) and the collection of water from fire lines that leak, are left open or are used to wet down compartments. Additional bilge water may be generated during asbestos removal and metal cutting activities.

What is ballast water and where is it found on a ship?

Ballast is typically water (e.g., port water, sea water) that is intentionally pumped into and carried in tanks to adjust a ship's draft, buoyancy, trim, and list, and to improve stability under various operating conditions. There can be several kinds of ballast water onboard a ship during its operation, including:

- *Clean ballast.* Clean ballast is seawater that has been pumped into dedicated ballast tanks. Because these tanks are dedicated to ballasting operations, the seawater is not mixed with fuel or oil. Clean ballast water may contain pollutants, such as metals (e.g., iron, copper, chromium) and chemical constituents. These can come from additives (e.g., flocculant chemicals that facilitate the separation of suspended silts) or from contact of the water with the piping systems and ballast tank coatings (e.g., epoxy coatings and rust inhibitors containing petroleum distillates). The concentration of these pollutants is expected to increase the longer the water is in the clean ballast system.

Types of Ballast: Ballast can consist of materials other than water, such as mud or concrete. Mud ballast usually refers to drilling mud used in the petroleum drilling industry to lubricate drill bits and remove drilling debris. This type of ballast is typically treated with lubricants and corrosion inhibitors. The term mud ballast may also refer to concrete, rock, water, and other forms of locked-in ballast.

- *Compensated fuel ballast*. During a ship's operation, compensated fuel ballast is seawater that is taken in by the ship to replace fuel as the fuel is used, thereby maintaining the ship's stability. The tanks are always full of fuel, seawater, or a combination of both. Depending on the seawater to fuel ratio at the time of scrapping, pollutants in compensated fuel ballast may include fuel, fuel additives (e.g., biocides added to control bacterial growth in the fuel oil), oil and grease, petroleum hydrocarbons and metals, which may result from leaching and corrosion of the fuel containment systems.

- *Dirty ballast*. Dirty ballast is created when seawater is pumped into empty fuel tanks for the purpose of increasing ship stability. The seawater mixes with residual fuel producing "dirty" ballast. Pollutants in dirty ballast may include residual fuel, fuel additives (e.g., biocides), oil and grease, petroleum hydrocarbons, and metals (e.g., copper, nickel, silver, and zinc).

Chromated ballast water: Sodium chromate may be added to ballast water to prevent algal growth at the time of vessel layup.

What are the potential impacts of bilge and ballast water discharges?

During a ship's operation, bilge and ballast water are routinely discharged by ships operating in U.S. coastal waters on a daily basis as regulated by the U.S. Coast Guard (USCG). The

criteria for a ship's discharge is 15 ppm total petroleum hydrocarbons (TPH). Through process knowledge, it is known that the presence of PCBs, oils, and Resource Conservation Recovery Act (RCRA) metals in regulated concentrations is not a standard occurrence. However, in the event that these pollutants are present at elevated concentrations in discharged bilge water and ballast water, there may be potential impacts to serious human health and environmental impacts. These are as described below:

- Bilge and ballast water may both contain **metals** which cannot be removed through treatment or environmental degradation. Metals, if ingested, can cause various human health problems such as lead poisoning and cancer. Additionally, consumption of contaminated seafood has resulted in exposure exceeding recommended safe levels.

- Bilge water may contain **toxic organics**, such as solvents and polychlorinated biphenyls (PCBs), which can be cancer-causing and lead to other serious ailments, such as kidney and liver damage, anemia, and heart failure. Discharges of toxic organics can also result in the release of poisonous gas, which occurs most often when acidic wastes react with other wastes in the discharge.

- Bilge water may contain **oils and fuels** which can poison fish and other marine organisms. Since these pollutants can float on the water's surface and be blown into the shoreline, they can physically cover plants and small animals thereby interfering with plant life cycles and the animal's respiration. Birds, fish, and other animals are known to abandon nesting areas soiled by pollution.

- Ballast water has the potential to contain **plants and animals**, including microorganisms and pathogens, that are native to the location where the water was brought aboard. When the ballast water is transported and discharged into another port or coastal area, the surviving organisms have the potential to impact the local ecosystem. The invasion of nonindigenous aquatic species (see box) is an environmental concern with ballast water discharges into U.S. harbors as it can cause significant changes to ecosystems, upset ecological balances, and cause serious

An Example of a Nonindigenous Aquatic Species - the Zebra Mussel. The most infamous ballast water stowaway is the zebra mussel. Originally from the Baltic Sea, and transferred commercially after the United States government lifted the Russian grain embargo in 1981, it now flourishes in the Great Lakes. Since 1991, the mussels have been altering the entire food web by removing vast amounts of basic food material from the ecosystem.

economic harm to U.S. marine, agricultural and recreational sectors.

4.2 WHO REGULATES BILGE AND BALLAST WATER REMOVAL?

Regulations governing the removal and disposal of bilge and ballast water and related activities (e.g., tank cleaning) are important for the protection of environment as they reduce the amount of pollutants released into the environment through wastewater and ensure proper management of wastes produced from wastewater treatment. Regulations also protect workers performing bilge and ballast removal activities (e.g., handling hazardous waste, performing tank cleaning in confined and enclosed spaces and dangerous atmospheres) during ship scrapping.

- **EPA.** EPA has regulatory oversight authority of bilge and ballast water discharges, under the following federal laws:

  S **Clean Water Act (CWA).** The CWA regulations establish limits on the pollutants that can be discharged by direct dischargers, including publicly-owned treatment works (POTW), and indirect dischargers.

  Direct dischargers. Direct dischargers are regulated under the National Pollutant Discharge Elimination System (NPDES) program (40 CFR 122). The NPDES program requires that all point source discharges to waters of the United States are covered under an NPDES permit. As of December 1999, EPA has authorized 43 states and one territory to administer the NPDES program.

  Indirect Dischargers. If your facility is an indirect discharger, it discharges wastewater into a sewer system that leads to a municipal treatment plant, also known as a POTW. The POTW typically is owned by the local municipality or a regional board or sewer authority. To address indirect discharges from industries to POTWs, EPA established the National Pretreatment Program as a component of the NPDES permitting program. The National Pretreatment Program is designed to reduce the level of pollutants discharged by industry and others into municipal sewer systems (which lead to POTWs), and thereby, reduce the amount of pollutants released into the environment through wastewater. The program requires industrial and commercial dischargers to treat or control pollutants in their wastewater prior to discharge to POTWs (40 CFR 403).

6. PAINT REMOVAL AND DISPOSAL

This section will address the removal and disposal of paints and other preservative coatings prior to metal cutting. Please note that in the context of ship scrapping, the removal of paints prior to cutting may, in certain circumstances, not be necessary. However, in those situations where it is necessary, there are specific requirements that must be followed. In addition, the removal of paints generates waste that must be managed and disposed of according to the appropriate solid waste and/or hazardous waste regulations.

6.1 INFORMATION ABOUT PAINTS AND PAINT REMOVAL

What types of paint and coatings are found on ships?

Paint and preservative coatings can be found on both interior and exterior surfaces of a ship. Particularly on older ships, paint may be flammable or may contain toxic compounds, such as polychlorinated biphenyls (PCBs), heavy metals (e.g., lead, barium, cadmium, chromium, and zinc), and pesticides. Lead compounds, such as red lead tetraoxide (Pb_3O_4) and lead chromate, have been used extensively in marine paint. In general, metal-based paints, some containing as much as 30 percent heavy metals, were intended to protect ship surfaces from corrosion due to exposure to the elements. Other paints containing pesticides, such as tributyl tin and organotin, have been used on the hulls of ships to prevent the buildup of sea organisms (e.g., bacteria, protozoa, barnacles, and algae).

Methods used to remove paints and coatings

Paints and coatings are typically removed using one of these three methods:

- **Chemical stripping**. Chemical stripping basically involves using solvents, such as methyl ethyl ketone and 1,1,1-trichloroethane, to remove the paint or coating. Solvents, which may be toxic or flammable, can be sprayed, wiped, or brushed on the surface and then removed, along with the paint or coating, using rags or wipes. Wastes generated from chemical stripping include contaminated or spent solvent, solvent residue or sludge, solvent-contaminated wipes/rags, and waste paint.

- **Abrasive blasting**. Using this method, paints and coatings are removed by blasting a surface with abrasives, such as copper slag, coal slag, steel grit, mineral grit, and steel shot. Blasting generates large amounts of dust, abrasive waste, and paint chips.

- **Mechanical removal.** This involves the use of power tools or flame to remove paints and coatings. The use of power tools, such as grinders, wire brushes, sanders, chipping hammers, needle guns, rotary peening tools, and other impact tools, generates waste such as dust and paint chips. Flame can also be used to remove certain paints or hardened preservative coatings, however, it should not be used on greasy or soft preservative coatings, or paints containing PCBs (see box).

The human health and environmental impacts associated with removing paints and coatings

> **Tip:** Paints containing PCBs cannot be removed with a torch or flame. This is considered open burning and is prohibited. Only non-thermal methods can be used to remove paints containing PCBs.

Chemicals and solvents used in stripping paints or coatings emit volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) to the atmosphere. Other removal methods (e.g., mechanical removal, abrasive blasting) generate dust, particulate matter, and emissions containing lead and other contaminants. These pollutants are hazardous to human health, potentially causing acute and chronic toxic effects in workers and possibly causing cancers. For example, lead can cause poisoning and long-term damage to the central nervous system. Though they can be absorbed and ingested, the main pathway of concern for these pollutants is inhalation.

Wastes (e.g., blasting residue, paint chips) generated from paint removal can have negative impacts on the environment if they are not properly contained and disposed of. If not contained by engineering controls, lead and other compounds from the waste may be discharged into nearby surface waters or may contaminate the soil at a facility.

6.2 WHO REGULATES PAINT REMOVAL AND DISPOSAL ACTIVITIES?

The activities associated with the removal and disposal of paint and other coatings are regulated because of their potential to release toxic pollutants, thereby potentially endangering both human health and the environment.

> **Note:** If paint contains PCBs, it may be regulated under the Toxic Substances Control Act (TSCA) at 40 CFR 761.

- **EPA.** EPA regulates paint removal and disposal activities through the Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA). Facilities that emit regulated amounts of air pollutants must obtain the appropriate permit and comply with all

U.S. Environmental Protection Agency **U.S. Maritime Administration**

This document is one section from the "National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs," published in May 2006. The reference number is EPA 842-B-06-002. You can find the entire document at http://www.epa.gov/owow/oceans/habitat/artificialreefs/index.html.

National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs

Polychlorinated Biphenyls (PCBs)

May 2006

POLYCHLORINATED BIPHENYLS (PCBs)

Narrative Clean-up Goal: Remove all manufactured products containing greater than or equal to (≥) 50 parts per million (ppm) of solid PCBs; remove all liquid PCBs regardless of concentration; remove all materials contaminated by PCB spills where the concentration of the original PCB source is ≥ 50 ppm.

What are PCBs?

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. PCBs, which were domestically manufactured from 1929 until their manufacture was banned in 1979, have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids. Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes, and carbonless copy paper; and many other industrial applications.

What are the potential environmental impacts of PCBs?

PCBs have been demonstrated to cause a variety of adverse health effects. PCBs have been shown to cause cancer in animals and have also been shown to cause a number of serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system, and other health effects. Studies in humans provide supportive evidence for potential carcinogenic and non-carcinogenic effects of PCBs. The different health effects of PCBs may be interrelated, as alterations in one system may have significant implications for the other systems of the body. EPA's peer reviewed cancer reassessment concluded that PCBs are probable human carcinogens. In addition, PCBs are persistent and bioaccumulative. PCBs bioaccumulate in fatty or lipid-rich tissues. PCBs have a limited solubility in aqueous solutions and PCBs can leach into a marine or aqueous environment (sediment and water column) where they can be taken up by organisms in the food web. PCBs bioaccumulate in fish and other animals; PCBs also bind to sediments. As a result, people who ingest fish may be exposed to PCBs that have been released into the environment and bioaccumulated in the fish they are ingesting.

There is a risk of human exposure during vessel preparation and after sinking the vessel. During vessel preparation, typical routes of human exposure include inhalation, accidental ingestion, or dermal contact. After sinking, exposure routes may be limited to accidental ingestion of or contact with contaminated water and sediments, or ingestion of contaminated fish, shellfish, or crustaceans. (See Appendix C)

Where are PCBs found on a ship?

Although no longer commercially produced in the United States, PCBs are most likely to be present in vessels deployed before the 1979 PCB ban. For such vessels, PCBs may be found in both the solid (waxy) and liquid (oily) forms in equipment and materials onboard ships. The equipment that may contain PCBs in concentrations of ≥ 50 ppm and the manufactured products containing ≥ 50 ppm of solid PCBs, include:

Materials and items that could contain solid PCBs

- Cable insulation
- Rubber and felt gaskets
- Thermal insulation material including fiberglass, felt, foam, and cork
- Voltage regulators, switches, reclosers, bushings, and electromagnets
- Electronic equipment, switchboards, and consoles
- Adhesives and tapes
- Oil-based paint
- Caulking
- Rubber isolation mounts
- Foundation mounts
- Pipe hangers
- Plastics

Materials and items that could contain liquid PCBs

- Oil used in electrical equipment and motors, anchor windlasses, hydraulic systems, and leaks and spills from such items

Materials and items that could contain either liquid or solid PCBs

- Transformers, capacitors, and electronic equipment with capacitors and transformers inside
- Fluorescent light ballasts
- Surface contamination of machinery and other solid surfaces

Items containing PCBs may be found throughout a ship and are not always easily identifiable or readily accessible. PCBs may be found in a variety of shipboard materials, but the location and concentration can vary from item to item and within classes of items. PCB-containing materials also are likely to vary from ship to ship, and even ships in the same class can contain differing types and amounts of PCB-containing materials. While these materials may be found throughout a ship, several areas on ships may have an increased likelihood of containing PCB-bearing materials: areas or rooms subject to high heat or fire situations such as boiler rooms, engine rooms, electrical/radio rooms, weapons storage areas, or areas with hydraulic equipment. Be aware that these pieces of equipment or systems are vulnerable to leaks and spills, which could leave spill residues behind and contaminate porous materials (e.g., carpet, wood, rubber/plastic mats, paint).

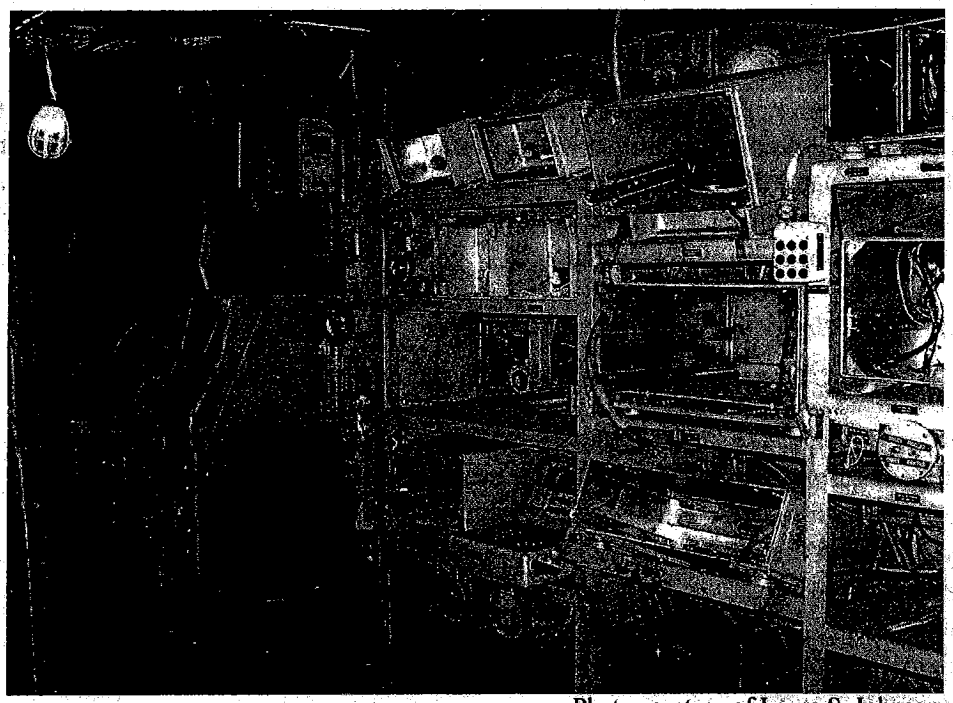


Photo courtesy of Laura S. Johnson

Ex-USS Oriskany electronic equipment stripped of capacitors and transformers.

How should the vessel be prepared; what are the appropriate BMPs for PCBs?

PCBs are regulated for disposal under 40 CFR Part 761, and will be discussed in this context. The PCB regulations require manufactured products containing ≥ 50 ppm of solid PCBs (PCB bulk product waste) and materials contaminated by spills of liquids containing PCBs (PCB remediation waste) to be properly disposed. Although the ship itself is being "reused" or "recycled" as an artificial reef, the PCBs must be properly disposed. Disposal requirements for each type of PCB waste are referenced below (also see Appendix B).

Where there is reason to suspect that equipment or manufactured products containing solid PCBs may contain PCBs ≥ 50 ppm, either remove the equipment or component from the vessel, or provide proof that the equipment or component is free of PCBs, unless a PCB bulk product waste disposal approval has been obtained under 40 CFR 761.62(c) (see below).

Under TSCA regulations, a spill of liquids containing PCBs ≥ 50 ppm is considered an illegal disposal of PCBs. Material(s) contaminated by such a spill must be cleaned or removed and disposed of, unless a risk-based disposal approval has been obtained under 40 CFR 761.61(c). Spill residues and materials contaminated by these spills are regulated differently than bulk product waste (see below).

The design and implementation of a representative sampling and analytical plan can help determine the presence or absence of PCBs in materials containing solid PCBs at ≥ 50 ppm or materials containing PCBs as the result of spills. If the data from the sampling and analytical

plan indicates the absence of PCBs, the ship and its components are not subject to the PCB provisions of TSCA.

Liquid Materials Manufactured with PCBs

Remove all liquid-filled electrical equipment suspected of containing PCBs or PCB-contaminated dielectric fluid, regardless of PCB concentration. Materials such as lubricating oils and greases used for winches and cargo-handling machinery, hydraulic fluids, heat transfer fluids, and waste oils should be removed from the vessel in accordance with the guidance in the "Oil and Fuel" section of this document.

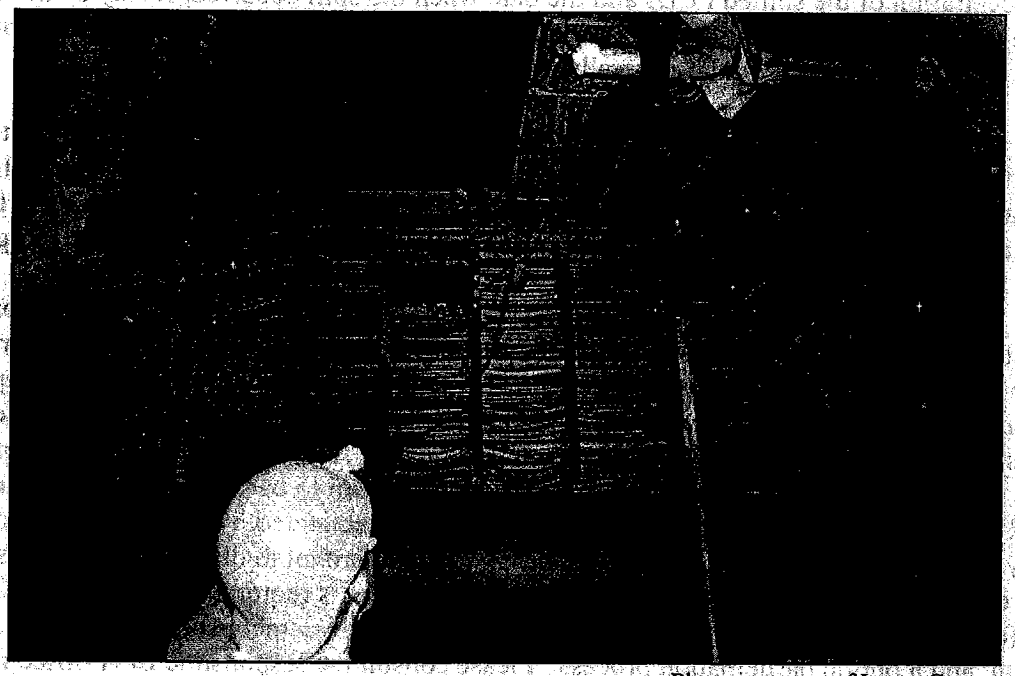


Photo courtesy of Laura Casey

Engine room electrical cabling on the ex-USS Oriskany.

Manufactured Products Containing Solid PCBs

Remove all manufactured products containing ≥ 50 ppm of solid PCBs, which includes, but is not limited to, felt gasket and faying material, cables, paints, rubber gaskets, as well as battle lanterns and fluorescent light ballasts.

Thermally removing PCB-containing materials is generally not authorized without prior written approval. Because PCB sampling and analytical procedures can be expensive and time consuming, there may be situations when the cost of sampling and analysis far exceeds the cost for removal and disposal. In some cases, vessel-to-reef projects have shown that removal of all electrical cables and wires suspected of containing PCBs was the most economical course of action.

While the complete removal of all manufactured products containing ≥ 50 ppm of solid PCBs is recommended, EPA recognizes that in some vessels it may not be feasible to identify and remove every such item. If such materials cannot be feasibly identified and/or removed, an application to EPA for a risk-based approval to dispose of the PCB bulk product waste in a marine environment for purposes of creating an artificial reef is required pursuant to 40 CFR 761.62(c). (EPA's decision includes consideration of a risk assessment submitted by the applicant, and a public participation process. Please consult the responsible EPA office for more information.)[3]

Materials Containing PCBs as a Result of Spills

Remove all materials containing ≥ 50 ppm of PCBs due to PCB spills. In addition, depending on the concentration of the spilled PCBs and the date when the spill occurred, it may be necessary to remove materials currently containing less than 50 ppm of PCBs due to spills.[4] If it is not known when a spill occurred, you should generally assume that it occurred after July 1, 1979.

During vessel clean-up/preparation, attention should be directed to locations on the ship that are known to house equipment and systems that typically contain PCB liquids. Because such equipment or systems are vulnerable to leaks and spills during the lifetime of the vessel, the areas surrounding the equipment or systems are likely contaminated by liquids containing PCBs.

If there is no information regarding whether a spill occurred and/or the PCB concentration of any spilled liquid, design and implement a representative sampling plan to verify that there are no PCBs present in the areas surrounding the liquid-filled equipment or systems. If the sampling results indicate presence of PCBs as a result of a spill of liquids containing PCBs, remove the spill residue and the materials contaminated by the spill (e.g., remove paint from a contaminated surface such as a metal deck, strip the contaminated area down to bare metal in accordance with 40 CFR 761.79(b)(i)(B)). If spill residues or materials contaminated by PCB spills cannot be feasibly removed, an application to EPA for a risk-based approval to dispose of the PCBs in a marine environment for purposes of creating an artificial reef is required pursuant to 40 CFR 761.61(c). (EPA's decision includes consideration of a risk assessment submitted by the applicant, and a public participation process. Please consult the responsible EPA office for more information (see footnote # 3).)

---

[3] Any vessel owner and/or sponsor should carefully consider the amount of time, resources and financial commitments necessary to address the identification, removal, and disposal of non-liquid PCB-containing materials and materials contaminated by spills of liquids containing PCBs before finally deciding if a vessel is suitable for reefing, and well in advance of commencing clean-up. EPA strongly recommends vessel owners and/or sponsors to begin discussions as soon as possible with the PCB coordinator for the EPA Region in which the vessel is proposed to be sunk. A list of EPA's current PCB coordinators may be found at www.epa.gov/pcb/coordin.html.

[4] For PCB spills that occurred between April 18, 1978, and July 1, 1979, and where the original source was ≥ 500 ppm PCBs, remove all materials containing any concentration of PCBs. For PCB spills that occurred after July 1, 1979, and where the original source was ≥ 50 ppm PCBs, remove all materials containing any concentration of PCBs. Remove all materials currently containing ≥ 50 ppm PCBs as a result of spills (of any concentration) that occurred prior to April 18, 1978. Consult the PCB regulations at 40 CFR 761.3, 761.50(b)(3) and 761.61.

federal register

Friday
December 10, 1999

Part III

Environmental Protection Agency

40 CFR Part 761

Use Authorization for, and Distribution in Commerce of, Non-liquid Polychlorinated Biphenyls; Notice of Availability; Partial Reopening of Comment Period; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 761

[OPPTS–66009F; FRL–6064–7]

RIN 2070–AD27

Use Authorization for, and Distribution in Commerce of, Non-liquid Polychlorinated Biphenyls; Notice of Availability; Partial Reopening of Comment Period

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule; notice of data availability; partial reopening of comment period.

SUMMARY: This action announces the availability of data that were submitted to EPA after the comment period closed for the December 6, 1994 proposal on the disposal of polychlorinated biphenyls (PCBs). This action also solicits additional information on the potential risks of exposure to PCBs, and the use and concentration of PCBs found in certain non-liquid PCB (NLPCB) applications. In the proposal of December 6, 1994, EPA solicited comment on a provision that would authorize the use of certain NLPCB applications (i.e., proposed § 761.30(q)). In addition to authorizing these uses, the proposed provision would have required compliance with several conditions (e.g., notification, marking, air monitoring and standard wipe tests, remediation, repair and/or removal, reporting and recordkeeping requirements). EPA is particularly interested in data regarding the PCB concentration and route(s) of exposure to PCBs found in the NLPCB applications that are the subject of this action and the associated risks of exposure. This action starts a 120–day data submission period which will be followed by an additional 90–day period for public comment on existing and new data submissions. Since EPA may rely on the data submissions that are generated as a result of this action to develop a final rule to authorize the use of these NLPCB applications, the Agency is providing the additional 90–day comment period for parties who are interested in reviewing and commenting on any of the existing or newly submitted data.

DATES: Data submissions must be received by EPA on or before April 10, 2000. Comments must be received by EPA on or before July 7, 2000.

ADDRESSES: Comments may be submitted by mail, electronically, or in person. Please follow the detailed instructions for each method as provided in Unit III. of the "SUPPLEMENTARY INFORMATION" section. To ensure proper receipt by EPA, it is imperative that you identify docket control number OPPTS–66009F in the subject line on the first page of your response.

FOR FURTHER INFORMATION CONTACT: *For general information contact*: Christine Augustyniak, Associate Director, Environmental Assistance Division (Mail Code 7408), Office of Pollution Prevention and Toxics, Rm. E–543B, Environmental Protection Agency, 401 M St., SW., Washington, DC 20460; telephone: (202) 554–1404, TDD: (202) 554–0551, e-mail: TSCA-Hotline@epa.gov.

For technical information contact: Peggy Reynolds, Environmental Protection Agency, (Mail Code 7404), 401 M St., SW., Washington, DC 20460; telephone: (202) 260–3965, fax: (202) 260–1724, e-mail: reynolds.peggy@epa.gov.

SUPPLEMENTARY INFORMATION:

I. Does this Action Apply to Me?

You may be affected by this supplemental action if you own, use, process or distribute PCBs in commerce. Affected categories and entities include:

Category	Examples of Affected Entities
Industry	Electroindustry manufacturers, end-users of electricity and general contractors
Utilities and rural electric cooperatives	Electric power and light companies
Individuals, Federal, State, and Municipal Governments	Individuals and agencies which own, use, process and distribute PCBs in commerce

This table is not exhaustive, but lists the types of entities that could potentially be affected by this action. Other types of entities may also be interested in this action. To determine whether your entity is affected by this action, carefully examine the applicability criteria in Title 40 of the Code of Federal Regulations (CFR), part 761. If you have any questions regarding the applicability of this action to a particular entity, you should consult the applicable regulations, or the technical contact listed in "FOR FURTHER INFORMATION CONTACT" for the referenced final rule.

II. How Can I Get Additional Information, Copies of this Document, and Support Documents?

1. *Electronically*. You may obtain electronic copies of this document on the Internet from the EPA Home Page at http://www.epa.gov. An electronic copy of this document can be found under the "Federal Register-Environmental Documents" listing and the date of the publication of this document in the Federal Register (http://www.epa.gov/fedrgstr/EPA-TOX/1999/).

2. *In person*. The official record for this action, including the public version, has been established under docket control number OPPTS–66009F. The official record also includes all material and submissions filed under docket control number OPPTS–66009C, the record for the referenced final rule. The public version of the record, including printed, paper versions of any electronic comments, which does not include any information claimed as confidential business information (CBI), is available for inspection in the TSCA Nonconfidential Information Center, Northeast Mall Rm. NE–B607, 401 M St., SW., Washington, DC. The Center is open from noon to 4 p.m., Monday through Friday, excluding legal holidays. The telephone number of the Center is (202) 260–7099.

III. How and to Whom Do I Submit Comments?

You may submit comments through the mail, in person, or electronically. To ensure proper receipt by EPA, it is

imperative that you identify docket control number OPPTS–66009F in the subject line on the first page of your response.

1. *By mail.* Submit your comments to: Document Control Office (7407), Office of Pollution Prevention and Toxics (OPPT), Environmental Protection Agency, 401 M St., SW., Washington, DC 20460.

2. *In person or by courier.* Deliver your comments to: OPPT Document Control Office (DCO) in the East Tower Rm. G-099, Waterside Mall, 401 M St., SW., Washington, DC. The DCO is open from 8 a.m. to 4 p.m., Monday through Friday, excluding legal holidays. The telephone number for the DCO is 202–260–7093.

3. *Electronically.* You may submit your comments electronically by e-mail to: "oppt.ncic@epa.gov," or mail your computer disk to the address identified above. Do not submit any information electronically that you consider to be CBI. Electronic comments must be submitted as an ASCII file avoiding the use of special characters and any form of encryption. Comments will also be accepted on standard computer disks in Wordperfect 6.1/8.0 or ASCII file format. All comments in electronic form must be identified by the docket control number OPPTS–66009F. Electronic comments may also be filed online at many Federal Depository Libraries.

IV. How Should I Handle CBI Information That I Want to Submit to the Agency?

Do not submit any information electronically that you consider to be CBI. You may claim information that you submit to EPA in response to this document as CBI by marking any part or all of that information as CBI. Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2. In addition to one complete version of the comment that includes any information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public version of the official record. Information not marked confidential will be included in the public version of the official record without prior notice. If you have any questions about CBI or the procedures for claiming CBI, please consult the technical person identified in the "FOR FURTHER INFORMATION CONTACT" section.

V. What Does this Action Do?

This action announces the availability of data that were submitted to EPA after the comment period closed for the December 6, 1994 proposed rule (59 FR 62788) (FRL–4167–1). These data, as described below, are available for review and comment. This action also solicits additional information and comment on the potential risks of exposure to PCBs, and the use and concentration of PCBs found in the non-liquid PCB (NLPCB) applications that are the subject of this action. EPA proposed to amend its rules under the Toxic Substances Control Act (TSCA) to authorize the use of NLPCBs and their distribution in commerce, and to impose related information collection requirements. These issues had also been discussed in the Advanced Notice of Proposed Rulemaking (ANPR) of June 10, 1991 (56 FR 26740).

In advocating the removal of the conditions that were included in the December 6, 1994 proposal (e.g., notification, marking, air monitoring and standard wipe tests, remediation, repair and/or removal, reporting and recordkeeping requirements), some commenters submitted supplemental data that they claim showed that these NLPCB uses "do not pose a risk above acceptable measures." However, EPA did not include this use authorization in the final rule which was published on June 29, 1998 (63 FR 35384) (FRL–5726–1) because insufficient data were available to enable the Agency to make the no unreasonable risk finding for many of the NLPCB uses. These data submissions, as well as an assessment of those data are available for inspection (see the listing of reference documents at Unit VIII. of this action) in the TSCA Public Docket Office. In the absence of data which could be used to determine whether a correlation exists between PCB bulk sample results and PCB surface contamination, several conservative assumptions were used in the draft risk document (see Ref. 23 "Revised Draft, Assessment of Risks Associated with Proposed PCB Use Authorizations"). The Agency solicits public comment on these materials, and in particular, would appreciate comments, which are supported by data, regarding the draft risk analysis.

VI. What Non-liquid PCB Uses Are of Interest to EPA?

In the ANPR (June 10, 1991), EPA solicited information on unauthorized uses of NLPCBs in existing applications, and in the NPRM of December 6, 1994 (59 FR 62788), EPA solicited comments regarding a provision which would authorize the use of these NLPCBs. Items not authorized by the regulations but currently in use and identified as containing PCBs include, but are not limited to, some wool felt insulating materials, plastics, paint formulations, small rubber parts, adhesive tape, insulating materials used in electrical cabling, fluorescent light ballast potting materials, gaskets in heating, ventilation and air conditioning and other duct systems, caulking, coatings for ceiling tiles, flooring and floor wax/sealants, roofing and siding materials, adhesives, waterproofing compounds, anti-fouling compounds, fire retardant coatings, coal-tar enamel coatings for steel water pipe and underground storage tanks (i.e., American Water Works Association (AWWA) Standard C203 coal tar enamel), and any number of other chemical uses such as additives and plasticizers. The PCB contamination in these various products was reported to range from <1 to 688,498 parts per million (ppm). EPA is interested in data for those NLPCBs that do not satisfy the criteria for excluded PCB products, recycled PCBs, or inadvertently generated PCBs (i.e., generally historic uses of PCBs at concentrations of <50 ppm PCB) which are authorized by the current regulations. (For a detailed discussion, see 40 CFR 761.3 for the definitions of "excluded PCB products" and "recycled PCBs." Also see the definition for "excluded manufacturing processes" at 40 CFR 761.3, the regulatory requirements for excluded manufacturing processes at 40 CFR 761.185 and 761.187, and the requirements for inadvertently generated PCBs at 40 CFR 761.193.)

A brief description of the non-liquid PCB uses which have been reported to EPA follows. Limited information regarding many of these products is contained in the NPRM (see 59 FR 62809–62811, December 6, 1994), as well as the comments and data that were submitted to EPA in response to the ANPR and NPRM (OPPTS-66009/66009A) and are summarized below. The following descriptions also reflect information gained by EPA over the course of implementing the PCB program. Additional non-liquid PCB products, when discovered, may also be covered by this use authorization. Therefore, information concerning unauthorized NLPCB uses which have not been identified above are also of interest and may be submitted to the Agency.

- *Insulation (e.g., wool felt, foam rubber and fiberglass) and sound-dampening materials.* These materials have been found to contain PCBs at concentrations which exceed 50 ppm. Wool felt and foam rubber insulation, as well as sound-dampening materials have been discovered in naval vessels and may include ships of all types, as well as nuclear submarine reactor

compartments. PCB concentrations were reported to range from <1 ppm to a high of 688,498 ppm (Ref. 15). Fiberglass insulation containing PCBs has been found in federally owned buildings at various concentrations. Bulk PCB concentrations were reported to range between <1 to 39,158 ppm, and surface contamination was reported to range between 7.5 to 188 micrograms per 100 square centimeters. All air samples were reported by the submitter as being below the analytical detection limit which was generally reported as 0.97 micrograms per cubic meter (Ref. 3). The use of PCB-contaminated fiberglass insulation may be widespread throughout the United States.

• *Plastics, small foam rubber and rubber parts, adhesive tape, and insulating materials used in electrical cabling.* PCBs may be in many of the components of electric cable at concentrations ranging from <1 ppm PCBs to 280,000 ppm PCBs (Refs. 15 and 16). In addition to electrical applications, these components may be in widespread use in marine and industrial applications. It is not clear whether PCB-containing cables would be found in residential settings.

• *Paint formulations.* During the 1950–1960 time frame, PCBs were added to paint formulations as drying oils (resins) and plasticizers or softening agents (liquids) in concentrations that range from 10–12% PCBs (100,000–120,000 ppm) to 20–30% PCBs (200,000–300,000 ppm). Concrete surfaces and equipment, as well as marine or waterproofing applications, used at Federal installations and in the manufacturing and industrial sectors may have painted surfaces contaminated with PCBs. Data provided to EPA indicate that PCBs have been found in dried paint at concentrations that range from <1 ppm to 97,000 ppm (Refs. 9 and 13).

• *Fluorescent light ballast potting materials.* Older fluorescent lamps (i.e., manufactured prior to 1978) may contain a small PCB Capacitor with 100% PCBs (i.e., 1,000,000 ppm) and/or petroleum-asphalt insulating material contaminated with PCBs (Ref. 6).

• *Gaskets in heating, ventilation and air conditioning (HVAC) and other duct systems.* It is not known whether this particular PCB application represents a widespread use. PCBs were discovered in older government buildings at concentrations of 18,900 ppm (Ref. 16); however, given the generic nature of the specifications for this material, these gaskets also may have been installed in commercial and industrial buildings. Additionally, ventilation system gasket materials made from processed cork that have been contaminated with PCBs at concentrations up to 6,400 ppm PCB have been found on naval vessels (Ref. 15).

• *Coatings for ceiling tiles.* Ceiling tiles contaminated with PCBs have been found at educational institutions with surface level PCB concentrations at a maximum of 53 ppm. However, the availability and dissemination in the marketplace of this material is not known.

• *Flooring and floor wax/sealants.* A commenter indicated that these materials have been found to contain PCBs; however, little else is known about specific PCB concentrations, application(s) or its availability and dissemination in the marketplace (Ref. 2).

• *Roofing and siding materials.* This material was manufactured and marketed worldwide as Robertson Protected Metal (RPM) and Galbestos to airlines, railroads, chemical plants, steel mills, mines, industrial/manufacturing facilities, and military facilities. PCB concentrations have been found to range from <2 ppm to 30,000 ppm (59 FR 62809).

• *Caulking and grout.* Very little is known about contaminated caulking and grout, their specific applications and dissemination in the marketplace. Samples of caulking that have been contaminated with PCBs have been found in a setting previously used as a school at a maximum concentration of 310,000 ppm PCBs (Ref. 12). Likewise, grout has been found in the joints and cracks of a water reservoir at 2,700 ppm PCB and on marine vessels at concentrations which range from <1 to 9,100 ppm PCB (Ref. 15) in the mess room and other onboard locations.

• *Waterproofing compounds, anti-fouling compounds, and fire retardant coatings.* These non-liquid uses of PCBs have been found in military, marine and other applications; PCB concentrations have been found as high as 59,000 ppm PCB.

• *Coal-tar enamel coatings for steel water pipe and underground storage tanks (i.e., AWWA C203 coal tar enamel).* This coating was previously approved for use by EPA pursuant to the Safe Drinking Water Act and has been used in some older Army, municipal and other water supply systems. The PCB concentration in this enamel may range from non-detect to 1,264 ppm (Refs. 11 and 26). EPA withdrew and thereby invalidated its list of acceptable drinking water products on April 7, 1990, and since that time, individual States have had the authority to regulate the sale and/or use of specific products. The Agency has never used its authority under TSCA to control the use of this indirect additive to a drinking water system.

VII. What Data Are Currently Available to EPA?

The following table provides information on the maximum PCB concentrations found in sample data that have been submitted to EPA. A review of this table, along with the criteria discussions that follow, will give you some indication of the NLPCBs that EPA could possibly authorize under the TSCA PCB regulations and the data that would be useful in order to evaluate the risks of exposure to PCBs associated with specific NLPCB uses. Unit VI. of this action provides additional guidance on the type of data that EPA needs to finalize a NLPCB use authorization.

Table 1.—Maximum PCB Concentrations From Sample Data

Material	Bulk Sample (mg/kg or ppm)	Standard Wipe Sample (µg/100 cm²)	Air Sample (µg/cm³)
Adhesive tape	1,400	No data available	No data available
Anti-fouling compounds	No data available	No data available	No data available
Caulking	310,000	No data available	No data available
Ceiling tiles	53	1.3	No data available

Table 1.—Maximum PCB Concentrations From Sample Data—Continued

Material	Bulk Sample (mg/kg or ppm)	Standard Wipe Sample (µg/100 cm²)	Air Sample (µg/cm³)
Cloth/paper insulating material	12,000	No data available	No data available
Coal-tar enamel coatings	1,264	No data available	No data available
Dried paint	63,300[1] 97,000[2]	2,560[1] 40[2]	No data available No data available
Fiberglass insulation[3]	39,158	188	<0.97
Fire retardant coatings	No data available	No data available	No data available
Flooring and floor wax/sealant	No data available	No data available	No data available
Fluorescent light ballast potting material	No data available	No data available	No data available
Foam rubber insulation	13,100	No data available	No data available
Foam rubber parts	1,092	No data available	No data available
Grout	9,100	No data available	No data available
Insulating materials in electric cable	280,000	No data available	No data available
Plastics/plasticizers	13,000	30[4]	No data available
Processed cork ventilation system gasket material	6,400	No data available	No data available
Roofing/siding material	22,000	No data available	No data available
Rubber parts	84,000	No data available	No data available
Sound-dampening material	No data available	No data available	No data available
Thermal insulation	73,000	No data available	No data available
Waterproofing compounds	No data available	No data available	No data available
Wool felt gaskets	688,498	No data available	No data available

[1] Non-degraded gray chlorinated rubber-based paint, Federal specification TT-P-912; PCBs added presumably to prevent brittleness.
[2] Semi-gloss paint; white and light blue, Amercoat 33HB with red Amercoat 86 primer.
[3] Athough sampling results for this material are available from the docket, these data were not available at the time the draft risk analysis was completed.
[4] Surface PCB concentration taken from wipe samples of plastic cable.

EPA's criteria for authorizing a NLPCB use. EPA will apply certain criteria to test data results when determining whether a material that is suspected of containing PCBs should be authorized for use. For instance, EPA has received some data that would not satisfy the criteria stated below. These data showed positive wipe sample results from contamination of the surface by PCBs. However, the bulk sample did not contain PCBs. This type of information is not useful for authorizing a NLPCB application. EPA believes these results indicate contamination due to a PCB spill rather than contamination associated with the manufacture of a product containing PCBs. EPA will not authorize the use of spilled PCBs. If you own items that have been contaminated as a result of a spill, you should either decontaminate or dispose of the item(s). The objective of the use authorization is to allow the continued use of those PCB-containing materials that do not pose an unreasonable risk. The use of these materials is currently unauthorized. Since some items currently being considered for the NLPCB use authorization may be contaminated with PCBs due to their proximity to PCB liquids, as opposed to being a PCB containing item, EPA intends to use the following criteria for determining whether materials suspected of containing PCBs should actually be considered for the NLPCB use authorization.

- If the bulk sample contains PCBs, but the wipe sample does not contain detectable levels of PCBs, then the PCBs have not significantly migrated from the material onto the surface. If there are no PCBs present on the surface, then it is assumed that no significant releases of PCBs to air are occurring. Therefore, air sampling would not be necessary. In

this situation, there would most likely be a low risk of exposure to PCBs, since PCBs are being released from the material at a low or non-existent rate. EPA could most likely authorize this use without some or all of the conditions listed in the proposal (see 59 FR 62857).

- If the bulk sample contains PCBs that are migrating out onto the surface, then the wipe sample will be expected to contain PCBs. Likewise, if the PCBs are being released from the surface into the air, then the air sample will be expected to contain PCBs. Note that the air sample will most likely contain PCBs at more dilute concentrations than those in the surface levels. EPA may or may not authorize this use, depending on the risk of exposure to PCBs.
- If neither the bulk nor the wipe sample contains PCBs, but the air sample does contain PCBs, then the PCBs are most likely from a source other than the material being tested. EPA cannot use these data to support a use authorization.
- If there are no PCBs in the bulk sample, but the wipe sample contains PCBs, then the PCBs are most likely from a spill rather than from the material being tested. EPA cannot use these data to support a use authorization.

The following chart provides a summary of the criteria that EPA will use to authorize the use of certain non-liquid PCBs.

Table 2.—Criteria for Authorizing the Use of NLPCBs

Bulk Sample	Wipe Sample	Air Sample	Possible Result
Contains PCBs	No PCBs	No PCBs or data are not available	PCBs not being released; possible authorization for use
Contains PCBs	Contains PCBs	Contains PCBs	PCBs are being released from the material; use authorization depends on risk levels
No PCBs	No PCBs	Contains PCBs	PCB contamination from another source
No PCBs	Contains PCBs	May or may not contain PCBs	PCBs due to a spill

In addition to the risk of developing cancer, PCBs also have significant non-carcinogenic effects, including neurotoxicity, reproductive and developmental toxicity, immune system suppression, liver damage, skin irritation, and endocrine disruption. These toxic effects should also be considered when assessing risk (Ref. 27). Therefore, in addition to evaluating the cancer risks associated with these NLPCB uses, the Agency intends to consider the potential non-cancer effects. It should be noted, however, that the Agency is currently conducting a reassessment of the non-carcinogenic effects of PCBs in order to determine whether the reference dose (RfD) factors for PCBs currently in the Agency's Integrated Risk Information System (IRIS) can be updated. It is possible, therefore, that the current RfDs may not be retained. Therefore, detection limits that are estimated using the current RfDs may not be low enough after the Agency's re-evaluation is complete. Thus, achieving the lowest possible detection limits is the recommended course of action in order to avoid reanalyzing samples if these RfDs are lowered.

VIII. What Data Does EPA Need?

EPA received some very useful data, but much of these data do not address the Agency's objective of assessing the risk of exposure due to the use of PCBs in a particular product. For example, wipe samples from the wall of a ship's engine room or air samples from living quarters cannot be used to evaluate the risk from air handling system gaskets when other potential sources of PCBs may be present on the ship or when no gaskets containing PCBs are present in the ship's handling system. It would be useful to have both surface results and bulk sampling results so that possible relationships between bulk and surface concentrations could be better defined. EPA also needs a better understanding of the individual sampling results including summary statistics such as range, median mean, standard deviation, and geometric mean in order to better determine if the results are representative of the sample population. Likewise, it is necessary to know the population characteristics with respect to PCB concentration, number of data points collected within a population, and how those data points represent the overall population of the items in use.

EPA would like to use the data to assess exposure via dermal contact and inhalation for most materials, as well as via incidental ingestion, as appropriate (e.g., paint chips). Surface samples are preferable for estimating dermal exposures because they reflect the PCB concentrations that individuals actually contact. EPA has data on a limited number of uses for which there are both bulk PCB concentrations and surface concentrations for the same material. Therefore, information on both bulk sample concentrations and wipe sample concentrations would be useful for defining the relationship between bulk and surface samples for use in dermal exposure assessments. Bulk sample data are also needed to assess incidental ingestion for some materials. EPA has no data on the volatilization or entrainment of PCBs from individual uses. This information would greatly facilitate the estimation of inhalation risk. Preliminary estimates were based on theoretical calculations, often employing very conservative approaches (Refs. 23 and 24). Also, the data EPA is currently using to assess dermal and inhalation risk for most uses is relatively old. Newer data would be useful in providing updated estimates.

As suggested earlier, EPA is interested in being able to detect cancer risks at or below 1×10^{-6} and non-carcinogenic hazards at or below a hazard index of 1. Because traditional sampling techniques may not have sufficiently low practical limits of quantitation (PQL) for EPA to determine that these NLPCB uses do not pose unreasonable risks, the approach to sampling may require much larger surface areas, much larger air volumes, or much more sensitive chemical analysis procedures than previously used. Consideration should also be given to achieving the lowest possible detection limits because of potential changes to the current RfDs.

Prior to finalizing a rule that would authorize the conditional use of these materials, the Agency is soliciting public review of and comment on the data that were submitted subsequent to

the official comment period for the December 6, 1994 NPRM. Data supporting a non-conditional use authorization for NLPCBs (i.e., a provision which would eliminate or minimize notification, marking, air monitoring and standard wipe test, remediation, repair and/or removal, reporting and recordkeeping requirements) may be submitted for the use of PCBs in any of the various applications identified above. A listing of the data elements that are required for this analysis is provided below. Please note that due to the uncertainty associated with updating the reference dose (RfD) for PCBs, the following discussions focus solely on the risk of developing cancer. In the absence of an updated RfD, the Agency is inclined to continue to use conservative risk assumptions for issues associated with the use of PCBs.

1. *Wipe sample data for each of the products (or classes of products, i.e., paint) for which use would be authorized.* Data should be collected from products that are known to contain PCBs (i.e., based on bulk sample results or from historic knowledge). Also, the detection limits for these materials should be sufficiently low to ensure that the cancer risks and non-carcinogenic hazards can be calculated down to less than 1×10^{-6} and below 1, respectively (note that the current RfDs for PCBs are likely to change), in order for the NLPCB use to be authorized. EPA recommends using the lowest achievable detection limit possible.

2. *Transfer data.* Information on the transfer of PCBs to human skin from the non-liquid PCBs listed in Table 1 of Unit V.

3. *Air monitoring data for each of the products (or classes of products, i.e., paint) for which use would be authorized.* Data should be collected from products that are known to contain PCBs (i.e., based on bulk sample results or from historic knowledge). Also, the detection limits for these materials should be sufficiently low to ensure that the cancer risks and non-carcinogenic hazards can be calculated down to less than 1×10^{-6} and below 1, respectively. EPA recommends using the lowest achievable detection limit possible.

Each product (or class of products, i.e., paint) sampled must contain high enough concentrations of PCBs in their bulk sample to be representative of the highest concentrations of PCBs in the product (or class of products, i.e., paint). For example, commenters provided information that paint formulations with 10-12% PCBs were recommended in the commercial formulation manuals. Therefore, EPA is especially interested in wipe sample and air monitoring data for products such as paints with bulk sample levels of 10-12% PCBs. In addition to the collected data, EPA requests the sampling plan that was used in collecting the data and a description of the quality assurance/quality control procedures that were applied to the data set.

In order to facilitate EPA's review of the data (i.e., bulk, standard wipe, and air sample results) on NLPCB containing materials, you should consider the following in order to judge the adequacy of your data submissions:

- Are the bulk and wipe samples of specific materials (i.e., uses) rather than of areas (e.g., engine room, mess deck/galley, berthing, pilot house, etc.)?
- Do you have corresponding samples (i.e., both bulk and wipe samples) for the specific materials?
- Did you collect air samples using procedures for chamber testing in order to differentiate PCBs that offgas from specific materials rather than from PCBs that are in ambient air?

EPA recommends using the lowest achievable detection limit possible so that cancer risks of 1×10^{-6} or non-cancer hazards of 1 may be detected. The detection limits at these risk levels may be estimated using cancer slope factors or reference doses for PCBs developed by EPA. The lower of the detection limits based on either cancer or non-cancer endpoints should be used to ensure that both types of effects could be detected.

If commenters and/or data submitters would like to submit comments or data anonymously, EPA will accept anonymous comments and data submissions (e.g., via a third party). However, it is important that EPA be able to contact someone should questions arise concerning the collection methodology, analytical procedures or other technical issues, even if through a third party.

IX. List of Reference Documents

The following documents are available in the combined docket for OPPTS–66009 (OPPTS–66009A, OPPTS–66009B and OPPTS–66009C). Documents identified with an asterisk were submitted to EPA after the official comment period for the proposed rule had closed. Since these data will be used in the Agency's decision making process, this listing is intended to ensure ample opportunity for public review and comment on pertinent documents.

1. Aluminum Company of America. Comments from Connie Glover Ritzert to the TSCA Nonconfidential Information Center, USEPA. Subject: Comments on Proposed Amendments to the TSCA PCB Regulations (59 FR 62788) - OPPS[sic]-66009A; FRL–4167–1 (May 3, 1995) (see C1-239, Table 3).

2. Consumers Power. Comments from William L. Beckman to the TSCA Nonconfidential Information Center, USEPA. Subject: Document Control Number OPPTS-66009A; FRL-4167-1, U.S. Environmental Protection Agency, December 6, 1994, Proposed Amendment to 40 CFR Part 761, Disposal of Polychlorinated Biphenyls (PCBs) (May 4, 1995) (see C1-179).

3. General Services Administration. Letter from David Spannbauer to Barry Breen, Federal Facilities Enforcement, USEPA, Subject: PCBs in Fiberglass Insulation in Federally Owned Buildings (1994) With Enclosures (see B3-032).*

4. General Services Administration. Letter from Casey Jones to Robert Harding, Section Chief, Toxic Substance Branch, USEPA, Subject: PCB Contamination at the Wallace F. Bennett Federal Building (date not discernible) With Enclosure (see B3-033).*

5. General Services Administration. Letter from Casey Jones to Kim Le, USEPA, Subject: Update on PCB Contaminated Insulation at the Wallace F. Bennett Federal Building (February 2, 1994) With Enclosure (see B3-034).*

6. Kominsky, John, NIOSH et al. "Polychlorinated Biphenyl Contamination Resulting from Fluorescent Light Ballast Burnout (Draft)." (April 14, 1986) (see C3-010).

7. Larcom, B.J.; Cline, J.M.; Merrill, E.A.; Jederberg, W.W.; Still, W.R. "Risk Assessment of Polychlorinated Biphenyls On-board Navy Ships." A report prepared for the U.S. Navy. AL/OE-TR-1996-0153. WRAIR-TR-NMRI-96-72 (1996) (see C3-001).*

8. Parsons Engineering Science, Inc. "Risk Review Paper, Evaluation of Existing Data for PCBs in Non-liquid Material (NLPCBs)." A report prepared for Environmental Management Directorate, Robins Air Force Base, GA and Air Force Material Command Under USAF Contract No. F41624-94-D-8136, Delivery Order No. 0069 (1997) (see C3-002).*

9. Ropes Gray. Letter from Mark A. Greenwood to Mr. John H. Smith, USEPA. Subject: Response to Data Request on PCBs in Paint (July 21, 1998) (see C3-017).*

10. Ross, M.; Mangum, S.; Adema, C. "Sampling and Analysis of Polychlorinated Biphenyls (PCBs) in Navy Ship Cables." A report prepared by the Naval Sea Systems Command, Code 05V, Report No. 9510, Ser. 6110/121 (1993) (see C1-107, Enclosure 11).

11. U.S. Army. Comments from Lewis D. Walker to Joseph S. Carra, USEPA. Subject: Comments on Proposed Polychlorinated Biphenyl Rule (May 2, 1995) (see C1-260).

12. U.S. Army Corps of Engineers, New England Division. "Final Site Investigation Report for Campbell, Lyle, Stone and Otis Memorial Schools, Bourne, MA." A report prepared by Stone and Webster Environmental Technology and Services under Delivery Order 17, Contract No. DACW33-94-D-007 (1996) (see B3-001).*

13. U.S. Department of Energy. Letter from Thomas T. Traceski to Mr. John Melone, USEPA. Subject: Results of Testing at the Savannah River Site (October 29, 1988) (see C3-018).*

14. U.S. Department of Energy, Schenactady Naval Reactors Office. Letter from A.R. Seepo to Kim Tisa, USEPA Region 1. Subject: Documentation of Research Regarding Historical Uses of PCBs in Paint (April 19, 1995) (see C3-004).

15. U.S. Department of the Navy. Electronic submission; CD-ROM containing spreadsheets of PCB sample results, Excel for Office 97. Samples taken from various naval vessels; Files: PCBEPA01.XLS (see Sheet 1) and PCBEPA02.XLS (see Sheet 1) (see C3-019).*

16. U.S. Department of Transportation, Maritime Administration. Appendices from Report No. MA-ENV-820-96003; Appendix D, Sampling and Analysis (January 1997) and Appendix E, Survey of Ships and Materials (July 1997) (see B3-030).*

17. U.S. Department of Transportation, U.S. Coast Guard. Memorandum from Alan M. Steinman, Chief, Office of Health and Safety to Chief, Office of Engineering, Logistics and Development. Subject: Health Risk Evaluation of 65' WYTL and 82' WPB Class Cutters (January 18, 1996) With Enclosure: "PCB Health Risk Evaluation of 65' WYTL and 82' WPB Class Cutters, Office of Health and Safety, Safety and Environmental Health Division, January 1996." (see B3-031).*

18. Versar Inc. Memo from Linda Phillips to Tony Baney, USEPA. Subject: Review of PCB Data for DOE Savannah River Site (November 13, 1998) (see B3-038).*

19. Versar Inc. Memo from Linda Phillips to Tony Baney, USEPA. Subject: Review of Ropes Gray Sampling Data (October 12, 1998) (see B3-037).*

20. Versar Inc. Memo from Linda Phillips to Peggy Reynolds, USEPA. Subject: Data Submissions for Risk Analysis for Authorized Uses of PCBs (December 8, 1998) (see B3-039).*

21. Versar Inc. Memo from Linda Phillips to John Smith, USEPA. Subject: Review of Air Force Risk Assessment (November 10, 1997) (see B3-035).*

22. Versar Inc. Memo from Linda Phillips to John Smith, USEPA. Subject: Review of U.S. Coast Guard PCB Risk Assessment (March 13, 1998) (see B3-036).*

23. Versar, Inc. "Revised Draft, Assessment of Risks Associated with Proposed PCB Use Authorizations." A report prepared for the U.S. Environmental Protection Agency under Contract No. 68-W6-0023, Work Assignment No. III-3 (March 12, 1999) (see B3-040).*

24. Versar, Inc. "Revised Preliminary Draft, Assessment of Risks Associated with Proposed PCB Use Authorizations." A report prepared for the U.S. Environmental Protection Agency under Contract No. 68-W6-0023, Work Assignment No. II-9 (October 14, 1997) (see E3-021).*

25. Westinghouse Savannah River Company. Letter from Nancy Lowry to David K. Hannemann, USEPA. Subject: Detailed Information on PCB Analyses of Painted Surfaces (May 28, 1997) (see C3-005).*

26. U.S. Army Corps of Engineers. Comments from Daniel R. Burns to the TSCA Nonconfidential Information Center, USEPA. Subject: Comments on the Proposed Rule on the Disposal of Polychlorinated Biphenyls (April 20, 1995) (see C1-139).

27. U.S. Environmental Protection Agency. PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures, EPA/600/P-96/001 (September 1996) (See B3-026).*

28. Midwest Research Institute. "Polychlorinated Biphenyl Analysis of Cable Samples from U.S. Navy Ships." A report prepared for the U.S. Environmental Protection Agency under Contract No. 68-DO-0137, Work Assignment No. 30 (August 14, 1992) (See B3-043)*.

List of Subjects in 40 CFR Part 761

Environmental protection, Hazardous substances, Polychlorinated biphenyls, Reporting and recordkeeping requirements.

Dated: November 29, 1999.

Susan H. Wayland,

Deputy Assistant Administrator for Prevention, Pesticides and Toxic Substances.

[FR Doc. 99–32079 Filed 12–9–99; 8:45 am]

BILLING CODE 6569–50–F

DRAFT REPORT

TO THE

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

ON

GUIDELINES FOR THE CONTROL OF

SHIPYARD POLLUTANTS

PREPARED BY

ENVIRONMENTAL PROTECTION AGENCY

NATIONAL FIELD INVESTIGATIONS CENTER - DENVER

JULY 1, 1974

INTRODUCTION

At the request of the San Diego Regional Water Quality Control Board (SDRWQCB) through Region IX, EPA, the National Field Investigations Center-Denver conducted investigations of San Diego, California shipyards from March 18 to April 5, 1974. The objective of the investigations was an evaluation of shipyard facilities and waste control practices and the influence of these practices on San Diego Bay water quality factors, for the purpose of developing a model NPDES permit for San Diego commercial shipyards.

Studies conducted by SDRWQCB (Barry, 1972) and others have documented contamination of San Diego Bay sediments by high concentrations of heavy metals (arsenic, copper, mercury, nickel, and zinc) especially in areas of shipbuilding and ship repair activity. It was reported that the primary source of these toxic pollutants was primers and anti-fouling paints removed (by blasting or other methods) from ship hulls at repair facilities. In the SDRWQCB report, the uptake, accumulation, and toxicity of copper, lead, zinc, arsenic, mercury, nickel and chromium by marine organisms were detailed.

Most wastewaters in the San Diego Bay area are presently collected by intercepter sewers, treated, and discharged into the open Pacific Ocean, rather than into the Bay. Formerly, much wastewater was discharged directly to the Bay. For these reasons, at least one shipyard official has expressed the opinion that high concentrations of metals in San Diego Bay sediments could have been deposited in times past, either from presently abandoned sewer outfalls or from discontinued shipyard operations.

To evaluate the influence of pollutants from shipyards on San Diego Bay, samples of solid materials (spent abrasives, hull scrapings, etc.) and wastewater discharges were collected from shipyards, and sediment cores and marine biota were collected from the Bay in the immediate vicinities of shipyards. Spent abrasives (including old primer and antifouling paint) from these shipyards contained consistently high concentrations of copper, zinc, lead, and chromium, and high, but somewhat variable, concentrations of cadmium, tin, mercury, and arsenic (Table 1). Similarly, sediment cores taken along transects directly out into the Bay from these shipyards also contained high metals concentrations (Table 2). Analysis of sediment core data reveals that the highest heavy metals concentrations generally occurred at the surface of the core (rather than deeper in the bottom of the Bay), and at locations on the transects nearest the shipyards. Metals concentrations diminished with distance from shore and with depth in the Bay bottom. Microscopic examination of these sediments revealed a similar pattern: freshly blasted abrasive and paint chips were most evident in surficial sediments nearest the shipyards. Sediments from locations farther out into the Bay contained progressively lower densities of abrasives, and these abrasives were more weathered. There were no definite trends in the distribution of specific metals, reflecting the diversity of composition of antifouling paints used on ship hulls.

Water samples were collected from some of the limited number of wastewater outfalls located at San Diego Bay shipyards. Concentrations of heavy metals were extremely high in these samples (Table 3), reflecting the fact that the water had contacted materials cleaned from ship and boat hulls before being discharged. A leaching test of limited extent and duration (spent abrasive from 5 shipyards exposed to relatively uncontaminated seawater for 12 days) demonstrated that heavy metals, especially copper and zinc, may readily dissolve from materials removed from ship hulls (Table 4).

Marine biota were collected from San Diego Bay in the immediate vicinities of shipyards. The flesh of grazing molluscs (Crepidula) from these areas contained high metals concentrations, and the flesh of filter-feeding sea squirts generally contained lesser concentrations (Table 5).

It is concluded that San Diego Bay is being polluted by heavy metals from shipyards, and that the most significant source of these pollutants is materials (antifouling paints and primers) removed from ship hulls. It was the intent of Congress in establishing the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) that the discharge of pollutants from all sources including shipyards be abated and, where technologically and economically feasible, eliminated. The following sections of this report detail methods by which abatement of pollutant discharges from shipyards may be accomplished, and present a model permit for application to San Diego ship repair and shipbuilding facilities.

Reference

Barry, Joseph N. 1972.
Staff report on wastes associated with shipbuilding and repair facilities in San Diego Bay. California Regional Water Quality Control Board, San Diego Region. 46 pp.

TABLE I

CONCENTRATIONS OF HEAVY METALS IN SOLID MATERIALS (SPENT ABRASIVE AND OLD PAINT AND PRIMER) FROM SAN DIEGO BAY SHIPYARDS

Sample Location	Date Collected	Metal Concentration (mg/kg)							
		Cd	Cr	Cu	Pb	Sn	Zn	Hg	As
Kettenburg sump	3/27/74	13	4.5	14,000	2,600	38	4,100	190	220
Harbor near bow*	3/26/74	2.2	720	2,300	1,300	170	1,300	8.4	23
port side midship		1.8	170	3,800	940	62	660	14	15
near stern		2.5	370	5,500	3,300	100	1,500	7.0	0.5
Campbell	3/26/74								
3,000 ton dock									
near bow		1.4	670	2,300	610	210	840	2.7	8
port side midship		2.0	1,200	3,300	3,100	250	1,300	4.0	19
starboard midship		3.0	1,500	2,800	1,000	220	560	11	8
near stern		3.3	1,300	3,200	1,000	240	680	9.1	20
1,100 ton dock									
near bow		1.1	32	1,400	230	150	320	0.4	12
port side midship		1.4	43	3,300	280	170	870	0.7	17
starboard midship*		1.5	34	1,200	200	140	1,200	< 0.1	0.3
near stern		1.5	60	3,000	1,100	140	1,300	0.5	4
NASSCO	3/27/74								
dry dock, composite		3.1	51	4,200	900	180	1,100	0.8	18
marine railway, bow		1.4	38	10,000	3,000	130	400	1.6	< 0.2
midship*		2.3	50	10,000	1,500	100	520	0.9	2
stern		2.3	49	17,000	3,000	140	740	2.1	7
Navy graving dock, composite*	3/28/74	2.4	13	1,200	31	130	8,800	0.1	< 0.2
San Diego Marine									
marine railway composite*	3/28/74	3.6	580	6,000	1,200	200	1,000	0.2	< 0.2

*Subsamples used in leaching tests

TABLE 2

HEAVY METALS CONCENTRATIONS IN SEDIMENT CORES
SAN DIEGO BAY

Sample Location	Date	Transect Number	Distance from Shore (ft)	Core Number	Depth from Surface of Core(in)	Metal Concentration (mg/kg)							
						Cd	Cr	Cu	Pb	Sn	Zn	Hg	As
NASSCO marine railway	3/29/74	1	20	1	surf.	0.7	43	1,390	810	48	400	1.6	17
			20	1	9	1.6	93	1,530	1,320	91	630	3	[illegible]
			100	2	surf.	2.6	87	660	450	32	520	5	6
			100	2	12	2.4	98	560	490	<20	530	2	[illegible]
			100	2	24	1.3	38	180	94	<20	150	1.3	17
			200	3	surf.	5.3	35	570	330	<20	690	24	[illegible]
			200	3	12	4.6	320	160	290	<20	1,910	11	6
			200	3	24	7.2	69	100	460	<20	1,010	16	12
			300	4	surf.	6.0	140	480	370	<20	870	8.3	[illegible]
			300	4	12	4.2	95	320	180	<20	630	5.2	5
			300	4	24	7.0	160	470	340	<20	1,020	3.5	[illegible]
			400	5	surf.	4.4	89	290	240	46	650	7.6	8
			400	5	12	6.1	48	360	550	<20	1,590	6.7	2
NASSCO shipway	4/4/74	11	100	1	surf.	<0.5	77	220	120	<20	490	1.9	8
			100	1	12	<0.5	16	73	56	<20	130	1.3	2
			200	2	surf.	<0.5	71	130	110	<20	240	2.8	9
			200	2	12	<0.5	90	150	85	<20	340	5.6	7

*Insufficient Sample

TABLE 2

HEAVY METALS CONCENTRATIONS IN SEDIMENT CORES
SAN DIEGO BAY
(CONTINUED)

Sample Location	Date	Transect Number	Distance from Shore (ft)	Core Number	Depth from Surface of Core (in)	Metal Concentration (mg/kg) Cd	Cr	Cu	Pb	Sn	Zn	Hg	Ag
Campbell concrete drydock	4/1/74	2	30	1	surf.	2.7	27	150	350	<20	450	0.85	3
			30	1	12	1.6	48	130	540	<20	470	4.4	5
			30	1	24	1.5	23	110	64	35	150	12	0.4
			100	2	surf.	1.5	15	180	130	43	250	3.6	0.3
			100	2	12	4.4	86	110	140	44	280	1.1	2
			100	2	24	1.9	45	22	67	<20	170	4.3	5
			200	3	surf.	1.3	32	69	53	<20	160	0.6	0.5
			200	3	12	5.1	62	140	130	<20	410	4.6	3
			200	3	24	4.6	83	92	130	<20	320	1.2	3
			300	4	surf.	3.1	56	140	130	<20	180	1.6	7
			300	4	12	3.0	49	110	110	<20	240	1.0	4
			300	4	24	5.4	100	160	140	52	360	1.6	5
			400	5	surf.	3.0	57	150	120	67	310	1.6	5
			400	5	12	4.0	29	110	100	<20	270	3.7	8
			400	5	24	3.9	15	72	45	<20	210	1.4	3

TABLE 2

HEAVY METALS CONCENTRATIONS IN SEDIMENT CORES
SAN DIEGO BAY
(CONTINUED)

Sample Location	Date	Transect Number	Distance from Shore (ft)	Core Number	Depth from Surface of Core (in)	Metal Concentration (mg/kg) Cd	Cr	Cu	Pb	Sn	Zn	Hg	As
Campbell marine railway	4/1/74	3	20	1	surf.	1.9	55	400	120	28	290	1.0	14
			100	2	surf.	3.1	12	310	170	66	360	4.3	12
			100	2	12	4.3	9.5	150	140	<20	310	4.3	6
			100	2	24	3.3	69	190	110	56	290	4.5	10
			200	3	surf.	2.9	140	170	170	49	300	2.3	7
			200	3	12	1.6	6.8	55	48	<20	220	2.0	4
			200	3	24	3.5	18	160	120	<20	460	2.3	37
			300	4	surf.	2.4	66	190	170	<20	290	2.4	13
			300	4	12	3.7	67	110	110	46	280	2.5	7
			300	4	24	3.8	82	130	140	63	210	2.8	7
			400	5	surf.	1.2	12	86	48	<20	150	0.98	3
			400	5	12	1.7	45	69	84	34	170	1.0	4
			400	5	24	0.5	1.9	19	7.7	<20	77	0.48	2
Harbor Boat & Yacht east marine railway	4/2/74	4	20	1	surf.	2.4	200	1,420	880	64	1,210	1.1	0.4
			20	1	12	3.6	52	1,910	600	52	2,010	33	47
			100	2	surf.	2.5	150	830	370	57	690	8.0	14
			100	2	12	3.7	54	560	110	74	790	4.4	29
			[illegible]	[illegible]	surf.	1.6	78	240	300	46	380	2.8	6

TABLE 2

HEAVY METALS CONCENTRATIONS IN SEDIMENT CORES
SAN DIEGO BAY
(CONTINUED)

Sample Location	Date	Transect Number	Distance from Shore (ft)	Core Number	Depth from Surface of Core(in)	Metal Concentration (mg/kg) Cd	Cr	Cu	Pb	Sn	Zn	Hg	As
Harbor Boat & Yacht east marine railway	4/2/74	4	200	3	12	1.4	5.9	240	32	80	120	4.6	23
			300	4	surf.	0.8	41	210	66	47	150	6.3	17
			300	4	12	<0.5	8.8	70	13	28	35	2.5	4
			400	5	surf.	0.8	18	110	41	<20	160	2.5	6.2
Harbor Boat & Yacht west marine railway	4/2/74	5	20	1	surf.	2.9	74	1,240	590	89	920	12	10
			20	1	12	2.7	37	890	200	<20	650	23	14
			100	2	surf.	1.8	83	620	220	46	520	8.4	13
			100	2	12	<0.5	8.0	3	1.9	<20	15	0.12	0.4
			200	3	surf.	2.6	5.2	3	1.3	<20	13	0.07	0.3
			200	3	12	3.9	7.8	4	3.9	<20	13	3.8	3
			200	3	24	1.4	26	92	8.3	<20	150	3.8	9
Kettenburg west marine railway	4/3/74	6	20	1	surf.	2.0	5.1	5,500	760	74	960	39	43
			20	1	12	2.0	10	1,620	430	<20	610	39	96
			20	1	24	2.2	33	230	610	42	390	48	36
			100	2	surf.	2.3	66	1,400	210	<20	560	13	22
			200	3	surf.	1.8	47	410	130	<20	270	9.8	10
			200	3	12	1.2	24	110	41	38	90	120	0.3

TABLE 2

HEAVY METALS CONCENTRATIONS IN SEDIMENT CORES
SAN DIEGO BAY
(CONTINUED)

Sample Location	Date	Transect Number	Distance from Shore (ft)	Core Number	Depth from Surface of Core(in)	Metal Concentration (mg/kg) Cd	Cr	Cu	Pb	Sn	Zn	Hg	As
Kettenburg west marine railway	4/3/74	6	300	4	surf.	4.0	71	500	100	54	480	10	
			300	4	12	3.0	30	220	88	91	340	14	
Kettenburg east of yard drain	4/3/74	7	20	1	surf.	2.8	45	570	140	41	410	23	
			20	1	12	1.1	16	140	43	<20	160	15	
			100	2	surf.	2.0	23	150	43	49	170	9.6	
			100	2	12	2.2	40	240	91	45	260	8.8	
			200	3	surf.	1.1	25	71	43	33	130	2.4	
			200	3	12	1.0	14	93	66	<20	140	2.7	
			300	4	surf.	2.6	57	330	85	65	380	7.5	
			300	4	12	12	73	380	77	49	360	11	
Navy off graving dock gates	4/4/74	8	20	1	surf.	6.8	71	330	130	53	550	2.2	
			20	1	12	7.0	130	600	220	56	780	3.5	
			100	2	surf.	5.6	52	250	130	71	290	2.3	
			100	2	12	5.5	29	170	130	<20	260	3.3	
			200	3	surf.	4.4	44	210	64	49	310	11	
			200	3	12	3.6	36	110	3.3	33	230	1.5	
			200	3	24	3.1	28	140	8.5	<20	240	2.3	

TABLE 2

HEAVY METALS CONCENTRATIONS IN SEDIMENT CORES
SAN DIEGO BAY
(CONTINUED)

Sample Location	Date	Transect Number	Distance from Shore (ft)	Core Number	Depth from Surface of Core (in)	Metal Concentration (mg/kg) Cd	Cr	Cu	Pb	Sn	Zn	Hg	As
Navy off graving dock gates	4/4/74	8	300	4	surf.	5.0	29	140	57	33	330	3.0	?
			300	4	12	3.2	26	110	6	49	300	3.1	?
			400	5	surf.	2.1	33	55	41	30	130	1.1	?
Navy 120 ft from graving dock, 50 ft to either side of Transect No. 8.	4/4/74	9	120	1	surf.	4.9	9.9	170	49	<20	160	2.3	?
			120	1	12	4.6	95	2,070	690	<20	1,590	4.1	?
			120	2	surf.	5.6	34	210	42	36	520	1.8	?
			120	2	12	8.6	120	330	320	39	620	3.0	?
Navy 250 ft. from graving dock, 50 ft to either side of Transect No. 8	4/4/74	10	250	1	surf	5.4	47	180	44	29	390	2.2	?
			250	1	12	5.7	97	1,330	160	48	420	1.0	?
			250	2	surf.	17	93	230	130	44	420	3.3	?
			250	2	12	6.7	110	210	110	31	470	2.8	?

TABLE 3

METALS CONCENTRATIONS IN EFFLUENTS AND RECEIVING WATERS
SAN DIEGO BAY SHIPYARDS

Sample Description	Date	Metal Concentration (mg/l)							
		Cd	Cr	Cu	Pb	Sn	Zn	As	Hg
Kettenburg, sump influent 1 hr after rain (0930)	3/27/74	<0.01	0.06	11	0.56	<1	1.1	0.20	40
sump influent during hull cleaning (1125)	3/27/74	<0.01	0.04	6.1	0.31	<1	0.47	0.13	44
sump influent no hull cleaning (1420)	3/27/74	<0.01	0.05	3.7	0.35	<1	0.80	0.07	38
sump effluent 1 hr after rain (0930)	3/27/74	<0.01	0.21	32	2.2	<1	3.7	0.21	200
sump effluent during hull cleaning (1125)	3/27/74	0.02	0.34	57	4.1	<1	6.1	0.52	930
sump effluent no hull cleaning (1420)	3/27/74	<0.01	0.09	11	0.88	<1	1.6	0.15	130
Navy, air scrubber discharge, bow	3/28/74	<0.01	0.07	2.0	0.43	<1	0.96	<0.01	3.0
midship	3/28/74	<0.01	0.03	0.30	0.02	<1	2.6	<0.01	2.0
stern	3/28/74	<0.01	<0.01	0.02	0.01	<1	0.05	<0.01	21
graving dock sump discharge after 1 minute pumping (0930)	4/4/74	0.05	0.04	0.14	0.19	16	0.35	<0.01	<0.1
graving dock sump discharge after 5 minutes pumping (0934)	4/4/74	0.05	0.03	0.11	0.14	16	0.35	<0.01	<0.1
receiving water, 30 ft off graving dock (1020)	4/4/74	0.06	0.03	0.03	0.20	18	0.14	<0.01	<0.1
graving dock sump discharge after 1 minute pumping (1501)	4/4/74	0.06	0.04	0.14	0.18	16	0.60	<0.01	1.1
graving dock sump discharge after 5 minutes pumping (1505)	4/4/74	0.05	0.05	0.20	0.09	14	0.52	<0.01	<0.1

TABLE 4

RESULTS OF LEACHING TESTS.
SPENT ABRASIVE (APPROXIMATELY 100 GRAMS) EXPOSED TO SEAWATER (APPROXIMATELY 1 LITER)
COLLECTED FROM SAN DIEGO BAY NEAR SHELTER ISLAND
EXPOSURE PERIOD APRIL 3, 1974 TO APRIL 15, 1974

Sample Location	Date Collected	Metal Concentration (mg/l)						
		Cd	Cr	Cu	Pb	Sn	Zn	As
Harbor Boat and Yacht	3/26/74	<0.01	0.04	2.7	0.06	<1	0.46	0.08
Campbell Industries	3/26/74	<0.01	0.01	2.2	0.03	<1	1.2	<0.01
NASSCO	3/27/74	<0.01	0.03	3.1	0.05	<1	0.38	<0.01
Navy	3/28/74	<0.01	<0.01	<0.01	0.07	<1	0.45	<0.01
San Diego Marine Construction	3/28/74	<0.01	0.02	1.1	0.07	<1	0.08	0.01
Seawater Blank	4/3/74	0.12	0.14	0.05	0.12	<1	0.07	<0.01

TABLE 5

METALS CONCENTRATIONS IN MARINE ORGANISMS COLLECTED

FROM VICINITIES OF SAN DIEGO BAY SHIPYARDS

Sample Description	Date	Metal Concentration (mg/kg)							
		Cd	Cr	Cu	Pb	Zn	Sn	As	Hg
Kettenburg molluscs (Crepidula)	4/3/74	2.1	2.4	260	7.0	100	130		
Kettenburg sea squirts	4/3/74	0.1	13	150	14	92	110		
NASSCO molluscs (Crepidula)	3/29/74	4.7	1.6	270	2.2	260	<20		
NASSCO sea squirts	3/29/74	Insufficient Sample							
Campbell molluscs (Crepidula)	4/1/74	2.6	5.9	290	9.3	95	240		
Campbell sea squirts	4/1/74	0.5	13	19	5.6	29	150		
Harbor molluscs (Crepidula)	4/2/74	1.1	2.9	210	2.5	74	190		
Harbor sea squirts	4/2/74	<0.1	9.5	28	8.7	41	66		
Navy - molluscs (Crepidula)	4/4/74	Insufficient Sample						Insufficient Sample	Insufficient Sample
Navy - sea squirts	4/4/74	0.2	16	8	9.9	6.7	<20		
Alcohol (Preservative) Blank(mg/l)	4/4/74	<0.01	<0.01	<0.01	<0.01	<0.01	<1	<0.01	<0.1

RATIONALE FOR WATER POLLUTION CONTROL AT SAN DIEGO SHIPBUILDING AND SHIP REPAIR FACILITIES.

INTRODUCTION

The Federal Water Pollution Control Act Amendments of 1972 (5) require that the discharge of all pollutants be controlled insofar as is technically and economically feasible. In addition, the Act requires that all point sources discharging to the waters of the U.S., including the territorial seas, apply for a NPDES (National Pollutant Discharge Elimination System) permit. One such class of point sources includes the shipbuilding and repair industry.

A search of published information, representing such varied locations as Pearl Harbor, Hawaii, San Diego and Newport Bay, California, Baltimore Harbor, Maryland and the James and Elizabeth Rivers in Virginia, indicated high concentrations of pollutants, primarily heavy metals in sediments in the vicinity of shipyards (2, 10, 17, 19, 20, 21 and 23). This relationship was subsequently verified and additional information gained by the EPA, NFIC-D field surveys in San Diego, California and Newport News, Virginia. The NFIC-D studies also included inspections of 25 shipyards on the East and West Coasts and Hawaii. The emphasis in this work was to characterize existing wastewater discharges, assess presence of pollutants in sediments of receiving waters, observe current pollution abatement programs, and evaluate pollution control needs.

The characteristics of sanitary wastes, cooling water and boiler blowdown are well documented in the literature and a detailed description is not within the scope of this rationale. However, from the NFIC-D field surveys and other available references, the characteristics of liquid discharges from ship repair operations may be described. Basically, discharges from graving docks during blasting and painting operations contain metals in both the particulate and soluble form. In addition, some blast grit is carried by water within the dock resulting in the discharge of suspended and settleable solids. While floating drydocks and marine railways may not have the confined liquid discharges as do graving docks, the pollutants reaching the receiving water are the same in character.

Control and treatment technology measures are presented in terms of types of wastes generated and production process or type of structure used for repair of building (i.e., graving docks, floating drydocks, marine railways, shipways and vertical hoists). As may be noted in the discussion which follows, the control measures rely heavily on the segregation of wastewaters and general housekeeping. It is the firm belief of NFIC-D that this is a defensible and responsible approach.

As control and treatment measures are presented, it may be noted that numerical effluent limitations have previously been established for the discharge of all sanitary wastes and the discharge of cooling water and boiler blowdown from onshore facilities. Shipbuilding and repair wastes on the other hand are to be controlled by good housekeeping practices which will essentially eliminate the discharge of pollutants. This, coupled with the fact that discharges from floating drydocks, marine railways, some shipways and vertical hoists, are not discharged in a manner such that representative sampling can be accomplished, has resulted in the recommendation of an alternative approach to numerical effluent limitations. Therefore, each shipyard will be required to submit a WATER POLLUTION CONTROL PLAN detailing the control measures to be applied in the operation of shipbuilding and repair facilities including graving docks, floating drydocks, marine railways, shipways and vertical hoists. The plan must address each of the waste source categories listed below if they exist at the facility, detailing specific methods by which pollution from these sources will be controlled. Also to be included in the plan is a schedule setting forth the earliest time by which the control measures can be implemented and the times for any intermediate steps leading to complete implementation. The objective in handling each of the waste sources is stated in the following section along with a method of meeting the objective. It is recognized that other control mehtods may exist. These alternative methods will be acceptable provided the objectives are accomplished.

why not discharged then?

to what degree? 7-1-77?

what are objectives?

CONTROL AND TREATMENT TECHNOLOGY

On-Shore Waste Sources

Sanitary Wastes

In compliance with the Federal Water Pollution Control Act Amendments of 1972, information defining secondary treatment was published in the Federal Register, August 17, 1973 (4). The requirements for secondary treatment set forth August 17, 1973, must be met no later than July 1, 1977 (5). These requirements will be applied to sanitary wastes from shipyards whether these emanate from shore facilities or ships being repaired. ~~Pretreatment standards were published in the Federal Register on November 8, 1973 regulating discharges to municipal systems~~.

Cooling Water and Boiler Blowdown

? in misc. liquid waste ?

what source? - not covered in drafts dated

Effluent guidance for cooling water discharges and boiler blowdown has been suggested by E.P.A. (22). The guidance rationale centers upon in-plant measures to control the discharge of corrosion inhibiting substances. Suggested interim effluent limitations are based on using only enough additive to adequately protect the system against corrosion and by developing tighter process techniques within the individual cooling systems or by changing to a different base corrosion inhibitor.

Suggested final effluent limitations are at levels which will not adequately protect cooling systems against corrosion. Therefore, three alternatives exist for meeting final limitations. First, the discharge may be treated. Second, new inhibitors without pollutional significance may be developed. Third, the discharge may be eliminated (22).

Miscellaneous Industrial Wastes

Miscellaneous industrial activities, for example metal plating operations, for which effluent limitations have been established may exist at individual shipyards. In these cases, limitations for the particular standard industrial classification apply. Where effluent guidelines are not yet established for the particular industrial classification, limitations will be applied as soon as they are proposed.

Wastes from Shipbuilding and Repair Facilities

Shipbuilding and repair facilities refer to those facilities within a shipyard at which ships are docked for repair or new ships are constructed. Common names of these facilities are; graving docks, floating drydocks, marine railways, and shipways. In addition, other repair facilities may be used including boat hoists of various types.

Graving Docks

A graving dock is a basin into which a ship may be floated. Usually constructed of concrete, the basin is isolated from the adjacent waterway with a gate. Permanently installed pumps dewater the dock and the ship comes to rest on previously positioned keel blocks. Drainage channels in the floor slope to a common point and convey water to the dewatering pumps. After dewatering is completed and during ship repair or new construction, miscellaneous water sources within the dock also drain to the sump and are discharged to the receiving water via pumps which are commonly referred to as drainage pumps or stripping pumps.

Sanitary Wastes - Shipboard sanitary wastes must be collected and must receive secondary treatment prior to discharge. In order to minimize the potential for leaching and other transport of metals from spent abrasive[1] and new paint, this liquid waste should not contact the floor of the graving dock.

For the proper handling of shipboard sanitary wastes, several alternatives exist. One, sanitary wastes may be discharged directly to a shipyard sewer system. Two, until sewer lines are available at dockside, sanitary wastes may be discharged to a holding tank for subsequent

---

[1]The term spent abrasive as used throughout this rationale refers to used blast grit mixed with particles of scale, rust, old paint and marine growths removed from ships during blasting operations.

removal from the graving dock and drainage to a sewer system. In either case preventing sanitary wastes from contacting the dock floor eliminates leaching and other transport of metals from spent abrasive. Conduits for sanitary wastes have been observed leaking at their point of connection to the hull. This condition is not acceptable and water-tight connections are necessary.

Cooling Water - Again the objective is to eliminate the opportunity for leaching and other transport of metals. The practice of allowing cooling water to cascade to the floor of the dock is unacceptable. A water-tight connection fitting at the hull and a conveyance hose are necessary. Cooling water may be discharged directly to the graving dock sump or receiving water. The important point, however, in the handling of shipboard cooling water in graving docks is to eliminate contact with spent abrasive.

Hydrostatic Relief Water - Contact between relief water and the dock floor must be minimized to preclude leaching and other transport of metals from spent abrasive. Many graving docks are designed to allow continuous hydrostatic relief. This reduces the load on structural members thereby resulting in economy of construction. The relief water, though normally of high quality, may create problems depending on the design of the relief system. It is not uncommon for relief systems to be designed such that relief water does not contact the floor of the graving dock (11, 25). In other systems, however, relief water enters the dock at many different points and flows across the floor of the graving dock in sheetflow to a drainage gutter. In the latter case, relief water is allowed to contact spent abrasive and new paint, thus providing an opportunity for leaching and other transport of heavy metals. In-plant control in the form of collection of relief water and direct discharge to the drainage sump or receiving water will eliminate this opportunity.

Gate Leakage - Invariably some leakage occurs around the graving dock gate. The main drainage channel leading to the sump is normally located within 100 feet of the gate. This area often times accumulates spent abrasive and new paint on the dock floor. As gate leakage water flows to the drainage channel in sheetflow, another opportunity for pollution from heavy metals is provided. The objective is to eliminate this opportunity by preventing gate leakage water from contacting spent abrasive.

To solve this problem a means of intercepting leakage water must be provided. Angle iron sealed to the dock floor immediately inside the gate would be effective in conveying leakage water to one side of the dock. Once in this position, leakage water will flow to the drainage sump with a minimum of contact with spent abrasive.

Floating Materials and Settleable Solids - Floating wastes are often discharged from graving docks. New paint, oil and grease, and miscellaneous floating artifacts are carried by drainage water to the graving dock sump and may be discharged during repair activities and dewatering. Similarly, settleable solids are discharged during the above intervals of activity.

The discharge of floating materials and settleable solids must be eliminated. In-plant control measures may be used to eliminate the discharge of floating materials and minimize the discharge of settleable solids. These wastes may be eliminated from the sumping discharge with a baffle and weir arrangement. A baffle and weir installed in the drainage channel will trap floating pollutants and gross settleable solids for subsequent removal just prior to flooding. Removable sediment traps are being used effectively in drainage channels (15) and may require less maintenance than weirs.

Air Scrubber Water - Internal tank blasting results in the discharge of ventilation air laden with particulates. Where removal of particulates is practiced, either wet scrubbers or bag house collectors are usually used. When wet scrubbers are used scrubbing waters must not contact spent abrasive. This objective may be accomplished by conveyance of scrubbing waters directly to the drainage gutter. Where wet scrubbing is used a sump should be provided to remove particulates from the water. The use of bag house collectors eliminates this water source entirely.

Trash - Miscellaneous trash accumulates on the floor of graving docks during shipbuilding and ship repair operations. If not removed prior to undocking, this material is discharged during dewatering and ship launching. The discharge of trash must be eliminated. Two possible methods of accomplishing this objective are the diligent use of waste receptacles or a thorough cleanup of trash prior to flooding.

Spent Abrasive and New Paint - The most significant pollutants from shipyards are the heavy metals present in spent abrasive. Spent abrasive accumulates on the floor of the graving dock during blasting and painting operations. The old paint particles present in the used grit are a potential source of pollution. With a much greater surface area exposed than was present while on the hull, the old paint is subject to leaching of heavy metals. The objective is to prevent the possibility for the discharge of spent abrasive, leaching and other transport of heavy metals.

Because blasting is followed almost immediately by painting, some new paint is also present in the form of a thin coating on the surface of the spent abrasive. The quantity of new paint mixed with spent abrasive is directly related to the quantity of heavy metals subject to leaching.

Estimates have been made of paint losses indicating approximately 5 percent of the total paint to be applied to the hull is lost to the drydock and can be discharged to the receiving water. These losses include: paint spilled within the drydock; excess applied paint which drips to the floor of the dock; overspray due to improper use of spray equipment; and wind carried paint which lands in the dock.

The discharge of heavy metals can essentially be eliminated by in-plant control measures. The primary control measure necessary is the thorough cleanup of spent abrasive prior to vessel launching. Shipyard inspections conducted by NFIC-D revealed that cleanup prior to vessel launching is currently being accomplished at several graving docks. The degree of cleanup ranges from that attainable with front-end loaders to broom clean conditions. In order to essentially eliminate the discharge of spent abrasive and consequently heavy metals, cleanup to broom clean conditions must be accomplished prior to vessel launching.

An important consideration in the cleanup of spent abrasive is timing. Dry cleanup of spent abrasive must be accomplished in order to eliminate the opportunity for leaching and other transport of heavy metals. The previously discussed control measures will enhance cleanup conditions by preventing water sources from contacting spent abrasive. One additional water source, that of precipitation, however, is uncontrollable. The leaching potential of precipitation bears special consideration in order to rationally determine cleanup timing. Precipitation chemistry has been studied in the inland areas of the U.S. (1,3,6,8,9,12 and 18) and on both Coasts (7,13,16 and 24). Findings indicate there is a general increase in the acidity of precipitation from west to east across the U.S. (8,14 and 18). While the pH of rainwater on the West Coast is normally 4.5 to 5.5, East Coast measurements indicate even greater acidity with pH ranging approximately one unit lower.

The fact that the above described acidic precipitation is capable of leaching heavy metals from spent abrasive, is rationale enough for making every reasonable effort to eliminate their contact. Thus, spent abrasive must be removed from the dock to broom clean conditions as soon as is technically possible. Because blasting and painting is carried out almost continuously and concurrently, cleanup likewise must be accomplished by sections as soon as blasting and painting of that section is completed.

Various cleanup techniques have been used. Small front-end loaders are effective in removing the bulk of spent abrasive and are used at many shipyards. Brooms and shovels are also used as a follow up to loaders at several yards. The suggestion has been made to treat the floors of concrete docks with an epoxy seal coat to enhance dry cleanups. Vacuum devices have been used (15), however the exceptionally large units necessary to pick up wet abrasive have proven unsatisfactory. New, smaller mobile vacuum cleaners and low profile sweepers which sweep the material into a hooper will no doubt also find application.

The disposal of spent abrasive must be accomplished in such a manner that surface water and ground water is protected. Where landfilling is the method of disposal used, strict compliance with local regulations must be maintained.

Floating Dry Docks

Ship repair and maintenance and occasionally new ship construction is accomplished on floating drydocks. A floating drydock is a structure consisting of a platform and associated ballast tanks used to raise ships above water level for work requiring exposure of the entire hull. By flooding the ballast tanks, the dock platform is allowed to sink beneath the water surface to the desired level. A ship is then moved over the dock and positioned in accordance with preset keel blocks on the dock platform. This position is maintained as the ballast tanks are dewatered and the drydock floated. Floating drydocks are constructed of wood, steel or concrete and may be designed to operate as a single unit with a continuous platform or as multiple units with a sectional platform. Liquids discharged onto the platform flow in sheetflow to the end of the dock or to intermediate outlets commonly located along either side of the platform.

The similarities between graving docks and floating drydocks are such that the in-plant control measures and requirements for sanitary wastes, cooling water, air scrubber water, trash and spent abrasive are identical. Spent abrasive is currently being removed from some floating drydocks to broom clean conditions prior to vessel launching and the detailed requirements set forth for graving docks also apply to floating drydocks. Obviously relief water and gate leakage are water sources which do not exist on floating drydocks and are therefore not addressed. Floating wastes are not considered from floating drydocks because application of the control measures discussed essentially eliminates liquid from the working surface and thus precludes the discharge of floating wastes. At least one shipyard has provided control of wastewater by converting one of the shoreside ballast tanks to an optional holding tank, conveying wastewaters to it by trimming the dock shoreside and pumping out the tank for subsequent disposal.

Marine Railways

A marine railway consists of an inclined groundway extending into the water with a support structure that moves on the groundway tracks via wheels or roller trains. The support unit is lowered into the water to a proper depth and the ship is moved into position. Motor driven hoisting equipment moves the unit shoreward until the ship comes to rest on preset keel blocks. As the ship is drawn up the railway and out of the water, ballast blocks are set on either side of the keel for additional support.

Pollutants generated in the operation of marine railways originate in the blasting, scrubbing, washing, or painting of vessels. These pollutants are carried to the receiving water by tidal action, precipitation, wind, and miscellaneous flows of water used in the work area. At railways without working platforms, pollutants fall directly to the shore or water. At platform-type railways, pollutants fall to the shore or water, either directly beyond the platform and through openings in the platform, or indirectly during platform cleanup.

To prevent pollutional materials from falling into the tidal zone or into the water, vessels on marine railways must be hauled beyond the tidal plane whenever possible. In addition, the contact of waste materials with the shore or water must be prevented to the greatest extent possible. Methods by which this may be accomplished include, but are not limited to: 1) filling or covering the spaces between planks to prevent materials from falling through; 2) use of plywood sections to cover openings along the keel; 3) use of shrouding or temporary platforms under the stern.

Materials which contact the shore must be removed frequently to prevent their being washed into the receiving water. This can be accomplished by use of small front-end loaders or shovels. Cleanups can be expedited by installation of a smooth impervious surface beneath the way. A weir located in the tidal zone behind the ship would retain much of the spent abrasive that had escaped removal from shore. Such a weir should extend as high above the ground surface as possible without interferring with railway operation. Accumulated solids would be removed frequently from behind the weir.

Shipways

The term shipway is sometimes used synonomously with graving dock as defined earlier in this rationale. However, for purposes of this rationale, shipway is herein defined as a way which is used for the construction of new ships. Normally inclined, the shipway may be either entirely above water level or it may be partially below the water surface and isolated from the adjacent waterway by means of a gate.

For a description of the water pollution control measures applicable to shipways reference is made to earlier sections of this rationale. Specifically, shipways entirely above water level are analogous to marine railways and the appropriate rationale applies. On the other hand shipways partially below water level are very similar to graving docks and thus the graving dock rationale applies.

Vertical Hoists

Various types of vertical hoists are used at small boat repair facilities. Boats are lifted from the water and moved to an area on shore where the repair work is accomplished. Wastes generated at the repair area include marine growths and old paint removed from boat hulls.

The control measures presented previously in this rationale are also applicable to these small boat repair facilities and must accomplish the elimination of repair wastes from entering the receiving water. Control must accomplish thorough cleanup to broom clean conditions of old paint and abrasive where applicable.

COMPLIANCE DETERMINATION

Selection of Pollutant Parameters

Major categories of wastewater parameters of pollutional significance for the shipbuilding and repair industries include:

Solids
1. suspended solids
2. settleable solids

Metals (particulate and dissolved)
1. lead
2. chromium
3. arsenic
4. copper
5. zinc
6. mercury
7. tin
8. cadmium

Oil and grease
Flow (volume of discharge)
pH

Other parameters not listed may be of significance in on-shore facilities employing production processes covered by established effluent guidelines. These parameters will be included by application of the individual treatment standards and monitoring requirements developed for the appropriate industrial category. For example, if a shipbuilding facility included a discharge from a metal plating operation, guidelines for the metal plating industry would be applied. In addition, compliance with established federal, state, and local regulations for the treatment, pretreatment, and monitoring of other wastes (such as sewage and cooling water) will be required.

Basis for Selection

Solids

Much of the pollutional material emanating from shipyards, especially repair facilities, is in the form of solids. Blasting abrasives, dry paint and primer, and marine fouling organisms form the bulk of these solids, which may be either suspended or settleable.

Metals

Materials containing heavy metals are used extensively on ships and in shipyards to inhibit fouling and boring marine organisms and to inhibit corrosion. Red lead and zinc chromate are widely used primers. Antifouling paints depend on the toxicity of heavy metals for their effectiveness; copper, tin, mercury, and arsenic may constitute a significant portion of antifouling paints. When ship hulls are refinished old antifouling paints and primers are removed, and some of this material may enter the water either as solids or dissolved pollutants. Arsenic compounds are applied to wooden structures to inhibit marine boring organisms, and, industrial grade zinc commonly contains cadmium. All of these pollutants may enter waterways from shipyards in quantities damaging to the marine environment.

Oil and Grease

Bilges, ballast and fuel tanks, engines, and metal fabricating operations (such as rolling mills) are potentially significant sources of oil and grease in shipyards.

Flow

To assess the quantities of pollutional materials in liquid discharges, it will be necessary to quantify the volumes of water discharged.

pH

To protect aquatic life, the pH of wastewaters from shipyards should be between 6 and 9 standard units.

Monitoring Requirements

Repair Facilities

Graving docks - to determine the quantity of wastes discharged, water samples will be collected monthly during flooding and dewatering of graving docks for undocking. Samples will consist of composites of grab samples collected at 15-minute intervals during flooding and dewatering periods sufficient to characterize the wastes. During the flooding process, samples will be collected from the flooding ports. During the dewatering process, samples will be collected from the discharge ports (if not submerged) or from the dewatering pumps. The volumes of flow, and parameter concentrations will be reported for both the flooding and dewatering process in order that net pollutant loads can be ascertained. Samples will be analyzed for suspended and settleable solids, particulate and dissolved metals, oil and grease, and pH. Total volume of water flooded and discharged will be calculated for each undocking and will be reported.

Once per month, samples will be collected of drainage wastewaters (relief water, gate leakage, shipboard wastes, wash water, precipitation, etc.) discharged from graving dock sumps. During a 24-hour period when conditions of greatest pollution potential exist (when hulls are being sandblasted or painted and during periods of heavy rainfall if they occur), a sample will be collected from each drainage. The pH of each of these samples will be measured, and a sample will be analyzed for oil and grease content. These grab samples will then be composited and analyzed for suspended and settleable solids, and particulate and dissolved metals. The volume of water discharged from the sump pump during the 24-hour period, and the total volume discharged during the month, will be reported.

If sanitary wastes are collected and discharged to publicly owned facilities, established pretreatment and monitoring requirements will be met. If treated sanitary wastes are discharged to the receiving water, monitoring conditions imposed in the effluent guidelines for secondary sewage treatment facilities will be required.

Floating Dry Docks, Marine Railways and Other Ship Repair Facilities - Because the control of process wastes from dry docks, marine railways and other repair facilities will require the diligent application of efficient housekeeping procedures, monitoring will consist of surveillance. To assure that the WATER POLLUTION CONTROL PLAN for the facility is followed strictly, frequent unannounced verification inspections will be conducted by the permit issuing agency. Further, it will be a condition of all permits issued to ship repair facilities that a responsible company official certify monthly that all conditions of the WATER POLLUTION CONTROL PLAN have been applied without material deviation.

Shipbulding Facilities

Those facilities with graving docks or partially submerged shipways will be required to monitor flooding, dewatering, and sump discharges twice annually in the manner required at facilities used for ship repair. Monitoring of shipway drainage discharges shall be conducted during periods of greatest pollutional potential (i.e., when hulls are primed or painted and during periods of heavy rainfall if they occur). Parameters to be measured and sampling schedule during a 24-hour period shall be as required for graving dock drainage discharges.

Compliance Schedule

The permits to be issued under this guidance will cover repair facilities and graving dock or shipway portions of shipbuilding facilities. Other portions of shipbuilding facilities should be covered by other guidance or final or proposed effluent guidelines.

Ship repair facilities and construction facilities with graving docks or shipways will be required to submit a WATER POLLUTION CONTROL PLAN to the permit-issuing agency. The plan must give consideration to all of the factors discussed in the rationale section of this document, emphasizing ways in which wastewaters may be segregated and spent abrasive, old paint and primer, and other solids may be removed from the facility. It is anticipated that the plan can be submitted within three months after the date of permit issuance and implemented (segregation of wastewaters and instigation of housekeeping procedures) within six months of the date of permit issuance.

Control of sanitary wastes will require inclusion in the above PLAN, in that interim disposal methods must be devised to prevent the discharge of sanitary wastes to dock surfaces. In addition, all sanitary wastes ultimately must receive secondary treatment. At shipyards that do not presently have on-shore facilities for sanitary waste treatment or transport of wastes to such facilities, secondary treatment will be achieved by June 30, 1977, with submission of construction schedules within six months after the date of permit issuance and submission of progress reports at six-month intervals until implementation of secondary treatment or pretreatment. Shipyards with existing facilities will be required to meet more stringent schedules and achieve implementation at earlier dates.

Monitoring of discharges from shipyards will commence immediately after issuance of the permit. Monitoring data will be submitted twice annually to the permit-issuing agency. Monthly certification of compliance with the PLAN will be retained by the permittee, with copies submitted twice annually to the issuing agency, however, material deviation from the PLAN will be reported to the permit-issuing agency immediately.

APPLICATION OF RATIONALE TO NPDES PERMIT ISSUANCE

The control of process wastes from the flooding and dewatering phases of graving docks and shipways, and from floating dry docks, marine railways, and other repair facilities depends on segregation of wastewaters and collection and disposal of spent abrasive and other solid materials. As an NPDES permit condition, the permittee will be required to submit within three months after time of permit issuance a detailed WATER POLLUTION CONTROL PLAN to the permit-issuing agency and to initate commitments within the plan within six months after permit issuance. Such plan must give detailed consideration to all appropriate factors discussed in the Rationale section of this document, emphasizing specific methods by which wastewaters will be segregated and waste solids will be collected and removed. Compliance monitoring will consist of surveillance; that is, frequent unannounced inspections which will be conducted by representatives of the permit-issuing agency. In addition, a responsible company official will certify compliance with all conditions of the plan on a monthly basis. Failure to comply with all conditions of the WATER POLLUTION CONTROL PLAN will be considered a violation of the permit, requiring evaluation for potential enforcement action.

Self-monitoring, as detailed in the Compliance Determination section of this document, of graving dock and shipway drainage discharges will require sampling (monthly at repair facilities, twice annually at shipbuilding facilities) of wastewater discharges. Monitoring will commence immediately after issuance of the permit and will continue until the expiration date of the permit. Self-monitoring data in conjunction with compliance monitoring inspections will be used to determine compliance with the plan and with other conditions of the permit.

Treatment and monitoring of waste discharges covered in established effluent guidelines (such as those for cooling water discharges, etc.) must conform to the requirements of the appropriate waste category. In addition, compliance with established federal, state, and local regulations for treatment, pretreatment, and monitoring will be required.

Initial permits will not contain specific effluent limitations. However, if monitoring data indicate that such limitations are warranted, the permits may be modified to include limitations.

References

1. Adam, J. R., R. Cataneo, D. F. Gatz and R. G. Semonin, 1973. Study of Rainout of Radioactivity in Illinois. Illinois State Water Survey.

2. Distribution of Metals in Baltimore Harbor Sediments. Technical Report 59, Annapolis Field Office Region III Environmental Protection Agency. January, 1974.

3. Eaton, J. S., Gene E. Likens and F. Herbert Bormann, 1973. Throughfall and Stemflow Chemistry in a Northern Hardwood Forest. J. Ecol. 61, 495-508.

4. Environmental Protection Agency-Water Programs-Secondary Treatment Information. Federal Register, Vol. 38:159, August 17, 1973.

5. Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500. 92nd Congress S. 2770, October 18, 1972.

6. Fisher, D. W., A. W. Gambell, G. E. Likens and F. H. Bormann, 1968. Atmospheric Contributions to Water Quality of Streams in the Hubbard Brook Experimental Forest, New Hampshire. Water Resources Research 4:5, 1115.

7. The Interactions of Precipitation With SO_2-Related Air Pollution. Technical Note #1, Institute for Environmental Studies, University of Washington, March 19, 1974.

8. Likens, Gene E., F. Herbert Bormann and Noye M. Johnson, 1972. Acid Rain. Environment, 14:2, 33.

9. Likens, Gene E., 1972. The Chemistry of Precipitation in the Finger Lakes Region. Cornell University Water Resources and Marine Sciences Center Ithaca, New York.

10. Mathewson, James H., Naval Contributions to Toxic Metal Pollution in San Diego Bay. Final report of study initiated June 18, 1972. (Mimeo)

11. Millard, Charles F. and Jay J. Hassani, 1971. Graving Dock for 300,000-ton Ships. Civil Engineering, 41,6:71

12. Personal Communication, Letter, J. S. Eaton, Cornell University. April 26, 1974.

13. Personal Communication, Letter, John M. Miller, U. S. Dept. of Comerce-NOAA. May 2, 1974.

References (cont.)

14. Personal Communication, Telcon, John Eaton, Cornell University. April 23, 1974.
15. Pollutional Effects of Drydock Discharges, by Engineering-Science, Inc., October, 1973.
16. Riley, Harold Lee, 1972. The pH of Rainwater: A Preliminary Study of the Temporal Influences of Air Quality and Meteorology on the Composition of Rainwater in Seattle. M.S. Thesis, University of Washington.
17. Barry, Joseph N., 1972. Staff Report on Wastes Associated with Shipbuilding and Repair Facilities in San Diego Bay. California Regional Water Quality Control Board, San Diego Region.
18. Student Rain Survey Results Are In. Current Science 59:14, 1974.
19. Study of Channel Sediments, Baltimore Harbor (Norfolk District), York River Entrance Channel. Virginia Institute of Marine Science, 1972.
20. Study of Channel Sediments, James River. Virginia Institute of Marine Science, June, 1971.
21. A Study of Sediments and Soil Samples from Pearl Harbor Area. Naval Civil Engineering Laboratory, Port Hueneme, California. March, 1973.
22. Suggested Interim and Final Effluent Guidance for Cooling Water Discharges. U.S. EPA Region IV, October 1, 1973.
23. Summary Report, Lower James River Basin Comprehensive Water Quality Management Study, by Engineering-Science, Inc., February 22, 1974.
24. Vandervort, Robert, 1972. Design, Construction, Operation, and Evaluation of a Rainwater Collection and Sampling System. M.S. Thesis, University of Washington.
25. Zola, S. P. and P. M. Boothe, 1960. Design and Construction of Navy's Largest Drydock, Journal of the Waterways and Harbors Division-ASCE. 86:53

PART I

Permit No. ST012345
Application No. ST012345

MODEL

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"), and appropriate state statutes

XYZ Shipyards, Inc.

is authorized to discharge from a facility located at

Pier 999
San Diego, California 92100

to receive waters named

San Diego Bay

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on January 1, 1975.

This permit and the authorization to discharge shall expire at midnight, December 31, 1979.

Signed this 1st day of January, 1975.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/75 and lasting through 6/30/75
the permittee is authorized to discharge from waste source(s) serial number(s) 001 (graving dock used for ship repair).
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations (1) kg/day (lbs/day) Daily Avg	Daily Max	Other Units (Specify) Daily Avg	Daily Max	Monitoring Requirements (2) Measurement Frequency	Sample Type
Flow (volume)	N/A	N/A	N/A	N/A	1/month (3)	calculated (3)
Solids	N/A	N/A	N/A	N/A	1/month	composite
suspended solids	N/A	N/A	N/A	N/A	1/month	composite
settleable solids	N/A	N/A	N/A	N/A	1/month	composite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	1/month	composite
lead	N/A	N/A	N/A	N/A	1/month	composite
chromium	N/A	N/A	N/A	N/A	1/month	composite
arsenic	N/A	N/A	N/A	N/A	1/month	composite
copper	N/A	N/A	N/A	N/A	1/month	composite
zinc	N/A	N/A	N/A	N/A	1/month	composite
mercury	N/A	N/A	N/A	N/A	1/month	composite
tin	N/A	N/A	N/A	N/A	1/month	composite
cadmium	N/A	N/A	N/A	N/A	1/month	composite
Oil and grease	N/A	N/A	N/A	N/A	1/month	grab

The pH shall be monitored 1/month.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at the flooding ports and at the discharge ports (if not submerged) or dewatering pumps.

(1) See Part III-1.
(2) To facilitate calculation of net discharge of pollutant loads, samples will be taken at 15-minute intervals during flooding and dewatering before and after undocking a ship.
(3) Total volume flooded and total volume discharged (other than drainage discharges) will be calculated for each month.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 7/1/75 and lasting through 12/31/79 the permittee is authorized to discharge from waste source(s) serial number(s) 001 (graving dock used for ship repair.)
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations (1) kg/day (lbs/day) Daily Avg	Discharge Limitations (1) kg/day (lbs/day) Daily Max	Discharge Limitations (1) Other Units (Specify) Daily Avg	Discharge Limitations (1) Other Units (Specify) Daily Max	Monitoring Requirements (2) Measurement Frequency	Monitoring Requirements (2) Sample Type
Flow (volume)	N/A	N/A	N/A	N/A	1/month (3)	calculated (3)
Solids	N/A	N/A	N/A	N/A	1/month	composite
suspended solids	N/A	N/A	N/A	N/A	1/month	composite
settleable solids	N/A	N/A	N/A	N/A	1/month	composite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	1/month	composite
lead	N/A	N/A	N/A	N/A	1/month	composite
chromium	N/A	N/A	N/A	N/A	1/month	composite
arsenic	N/A	N/A	N/A	N/A	1/month	composite
copper	N/A	N/A	N/A	N/A	1/month	composite
zinc	N/A	N/A	N/A	N/A	1/month	composite
mercury	N/A	N/A	N/A	N/A	1/month	composite
tin	N/A	N/A	N/A	N/A	1/month	composite
cadmium	N/A	N/A	N/A	N/A	1/month	composite
Oil and grease	N/A	N/A	N/A	N/A	1/month	grab

The pH shall not be less than 6 standard units nor greater than 9 standard units and shall be monitored 1/month.

Observation ?

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at the flooding ports and at the discharge ports (if not submerged) or dewatering pumps.

(1) See Part III-1.
(2) To facilitate calculation of net discharge of pollutant loads, samples will be taken at 15-minute intervals during flooding and dewatering before and after undocking a ship.
(3) Total volume flooded and total volume discharged (other than drainage discharges) will be calculated for each month.

B. SCHEDULE OF COMPLIANCE - Serial No. 001

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Submit WATER POLLUTION CONTROL PLAN(1)	4/1/75
Implement PLAN	7/1/75
Certify compliance with PLAN(2)	8/1/75, monthly thereafter
Submit copies of compliance certification	1/1/76 (6-month interval thereafter)

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

(1) See Part III-2.
(2) See Part III-3.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/75 and lasting through 6/30/75
the permittee is authorized to discharge from waste source(s) serial number(s) 002 (graving dock used for ship repair).
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations(1) kg/day (lbs/day) Daily Avg	Discharge Limitations(1) kg/day (lbs/day) Daily Max	Discharge Limitations(1) Other Units (Specify) Daily Avg	Discharge Limitations(1) Other Units (Specify) Daily Max	Monitoring Requirements Measurement Frequency	Monitoring Requirements Sample Type
Flow (volume)	N/A	N/A	N/A	N/A	1/month(2)	calculated(4)
Solids	N/A	N/A	N/A	N/A	1/month	composite
suspended solids	N/A	N/A	N/A	N/A	1/month	composite
settleable solids	N/A	N/A	N/A	N/A	1/month	composite
Metals (particulate and dissolved)						
lead	N/A	N/A	N/A	N/A	1/month	composite
chromium	N/A	N/A	N/A	N/A	1/month	composite
arsenic	N/A	N/A	N/A	N/A	1/month	composite
copper	N/A	N/A	N/A	N/A	1/month	composite
zinc	N/A	N/A	N/A	N/A	1/month	composite
mercury	N/A	N/A	N/A	N/A	1/month	composite
tin	N/A	N/A	N/A	N/A	1/month	composite
cadmium	N/A	N/A	N/A	N/A	1/month	composite
Oil and grease	N/A	N/A	N/A	N/A	1/month	grab(3)

The pH shall be monitored monthly. At least three (3) pH measurements will be taken at intervals equally spaced during the sampling period.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at the graving dock drainage discharge.

(1) See Part III-1.
(2) When (if) conditions of greatest pollutional potential exist, a sample of each graving dock drainage pumping cycle during a 24-hour period will be analyzed for solids and metals.
(3) Oil and grease measurements will be made on grab samples taken from one of the drainage pumping cycles.
(4) The total volume of drainage discharged during the 24-hour sampling period, and during the month, will be reported.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 7/1/75 and lasting through 12/31/79, the permittee is authorized to discharge from waste source(s) serial number(s) 002 (graving dock used for ship repair).

Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations[1] kg/day (lbs/day)		Discharge Limitations[1] Other Units (Specify)		Monitoring Requirements Measurement Frequency	Monitoring Requirements Sample Type
	Daily Avg	Daily Max	Daily Avg	Daily Max		
Flow (volume)	N/A	N/A	N/A	N/A	1/month[2]	calculated[4]
Solids	N/A	N/A	N/A	N/A	1/month	composite
suspended solids	N/A	N/A	N/A	N/A	1/month	composite
settleable solids	N/A	N/A	N/A	N/A	1/month	composite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	1/month	composite
lead	N/A	N/A	N/A	N/A	1/month	composite
chromium	N/A	N/A	N/A	N/A	1/month	composite
arsenic	N/A	N/A	N/A	N/A	1/month	composite
copper	N/A	N/A	N/A	N/A	1/month	composite
zinc	N/A	N/A	N/A	N/A	1/month	composite
mercury	N/A	N/A	N/A	N/A	1/month	composite
tin	N/A	N/A	N/A	N/A	1/month	composite
cadmium	N/A	N/A	N/A	N/A	1/month	composite
Oil and grease	N/A	N/A	N/A	N/A	1/month	grab[3]

The pH shall not be less than 6 standard units nor greater than 9 standard units and shall be monitored monthly. At least three (3) pH measurements will be taken at intervals equally spaced during the sampling period.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at the graving dock drainage discharge.

(1) See Part III-1.
(2) When (if) conditions of greatest pollutional potential exist, a sample of each graving dock drainage pumping cycle during a 24-hour period will be analyzed for solids and metals.
(3) Oil and grease measurements will be made on grab samples taken from one of the drainage pumping cycles.
(4) The total volume of drainage discharged during the 24-hour sampling period, and during the month, will be reported.

B. SCHEDULE OF COMPLIANCE - Serial No. 002

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Submit WATER POLLUTION CONTROL PLAN(1)	4/1/75
Implement PLAN	7/1/75
Certify compliance with PLAN(2)	8/1/75, monthly thereafter
Submit copies of compliance certificates	1/1/76, 6-month intervals thereafter

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

(1) See Part III-2
(2) See Part III-3

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/75 and lasting through 6/30/75.
the permittee is authorized to discharge from waste source(s) serial number(s) 003 (graving dock used for shipbuilding)
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations[1] kg/day (lbs/day)		Other Units (Specify)		Monitoring Requirements[2]	
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow (volume)	N/A	N/A	N/A	N/A	2/year	calculated
Solids	N/A	N/A	N/A	N/A	2/year	composite
suspended solids	N/A]	N/A	N/A	N/A	2/year	composite
settleable solids	N/A	N/A	N/A	N/A	2/year	composite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	2/year	composite
lead	N/A	N/A	N/A	N/A	2/year	composite
chromium	N/A	N/A	N/A	N/A	2/year	composite
arsenic	N/A	N/A	N/A	N/A	2/year	composite
copper	N/A	N/A	N/A	N/A	2/year	composite
zinc	N/A	N/A	N/A	N/A	2/year	composite
mercury	N/A	N/A	N/A	N/A	2/year	composite
tin	N/A	N/A	N/A	N/A	2/year	composite
cadmium	N/A	N/A	N/A	N/A	2/year	composite
Oil and grease	N/A	N/A	N/A	N/A	2/year	grab

The pH shall be monitored 2/year.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at flooding ports and at discharge ports (if not submerged) or dewatering pumps.

(1) See Part III-1.
(2) To facilitate calculation of net discharge of pollutant loads, samples will be taken at 15-minute intervals during flooding and dewatering before and after undocking a ship.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 7/1/75 and lasting through 12/31/79
the permittee is authorized to discharge from waste source(s) serial number(s) 003 (graving dock used for shipbuilding)
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations (1) kg/day (lbs/day)		Other Units (Specify)		Monitoring Requirements (2) Measurement Frequency	Sample Type
	Daily Avg	Daily Max	Daily Avg	Daily Max		
Flow (volume)	N/A	N/A	N/A	N/A	2/year	calculated
Solids	N/A	N/A	N/A	N/A	2/year	composite
suspended solids	N/A	N/A	N/A	N/A	2/year	composite
settleable solids	N/A	N/A	N/A	N/A	2/year	compposite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	2/year	composite
lead	N/A	N/A	N/A	N/A	2/year	composite
chromium	N/A	N/A	N/A	N/A	2/year	composite
arsenic	N/A	N/A	N/A	N/A	2/year	composite
copper	N/A	N/A	N/A	N/A	2/year	composite
zinc	N/A	N/A	N/A	N/A	2/year	composite
mercury	N/A	N/A	N/A	N/A	2/year	composite
tin	N/A	N/A	N/A	N/A	2/year	composite
cadmium	N/A	N/A	N/A	N/A	2/year	composite
Oil and grease	N/A	N/A	N/A	N/A	2/year	grab

The pH shall not be less than 6 standard units nor greater than 9 standard units and shall be monitored 2/year.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at flooding ports and at discharge ports (if not submerged) or dewatering pumps.

(1) See Part III-1.
(2) To facilitate calculation of net discharge of pollutant loads, samples will be taken at 15-minute intervals during flooding and dewatering before and after undocking a ship.

B. SCHEDULE OF COMPLIANCE - Serial No. 003

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Submit WATER POLLUTION CONTROL PLAN(1)	4/1/75
Implement PLAN	7/1/75
Certify compliance with PLAN(2)	8/1/75, monthly thereaft
Submit copies of compliance certification	1/1/76, 2/year thereafte

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

(1) See Part III-2
(2) See Part III-3

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/75 and lasting through 6/30/75
the permittee is authorized to discharge from waste source(s) serial number(s) 004 (shipway with drainage discharge).
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations(1) kg/day (lbs/day)		Other Units (Specify)		Monitoring Requirements	
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow (volume)	N/A	N/A	N/A	N/A	2/year(2)	calculated
Solids	N/A	N/A	N/A	N/A	2/year	composite
suspended solids	N/A	N/A	N/A	N/A	2/year	composite
settleable solids	N/A	N/A	N/A	N/A	2/year	composite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	2/year	composite
lead	N/A	N/A	N/A	N/A	2/year	composite
chromium	N/A	N/A	N/A	N/A	2/year	composite
arsenic	N/A	N/A	N/A	N/A	2/year	composite
copper	N/A	N/A	N/A	N/A	2/year	composite
zinc	N/A	N/A	N/A	N/A	2/year	composite
mercury	N/A	N/A	N/A	N/A	2/year	composite
tin	N/A	N/A	N/A	N/A	2/year	composite
cadmium	N/A	N/A	N/A	N/A	2/year	composite
Oil and grease	N/A	N/A	N/A	N/A	2/year	grab(3)

The pH shall be monitored 2/year.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at shipway drainage discharge.

(1) See Part III-1.
(2) When (if) conditions of greatest pollutional potential exist, a sample of each shipway drainage pumping cycle during a 24-hour period will be analyzed for solids and metals.
(3) Oil and grease measurements will be made on grab samples taken from one of the drainage pumping cycles.
(4) The total volume of drainage discharged during the 24-hour sampling period, and during the month, will be reported.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 7/1/75 and lasting through 12/31/79
the permittee is authorized to discharge from waste source(s) serial number(s) 004 (shipway with drainage discharge).
Such waste source(s) shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations (1) kg/day (lbs/day)		Other Units (Specify)		Monitoring Requirements	
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow (volume)	N/A	N/A	N/A	N/A	2/year (2)	calculated
Solids	N/A	N/A	N/A	N/A	2/year	composite
suspended solids	N/A	N/A	N/A	N/A	2/year	composite
settleable solids	N/A	N/A	N/A	N/A	2/year	composite
Metals (particulate and dissolved)	N/A	N/A	N/A	N/A	2/year	composite
lead	N/A	N/A	N/A	N/A	2/year	composite
chromium	N/A	N/A	N/A	N/A	2/year	composite
arsenic	N/A	N/A	N/A	N/A	2/year	composite
copper	N/A	N/A	N/A	N/A	2/year	composite
zinc	N/A	N/A	N/A	N/A	2/year	composite
mercury	N/A	N/A	N/A	N/A	2/year	composite
tin	N/A	N/A	N/A	N/A	2/year	composite
cadmium	N/A	N/A	N/A	N/A	2/year	composite
Oil and grease	N/A	N/A	N/A	N/A	2/year	grab (3)

The pH shall not be less than 6 standard units nor greater than 9 standard units and shall be monitored 2/year.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): at shipway drainage discharge.

(1) See Part III-1.
(2) When (if) conditions of greatest pollutional potential exist, a sample of each shipway drainage pumping cycle during a 24-hour period will be analyzed for solids and metals.
(3) Oil and grease measurements will be made on grab samples taken from one of the drainage pumping cycles.
(4) The total volume of drainage discharged during the 24-hour sampling period, and during the month, will be reported.

B. SCHEDULE OF COMPLIANCE - Serial No. 004

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Submit WATER POLLUTION CONTROL PLAN(1)	4/1/75
Implement PLAN	7/1/75
Certify compliance with PLAN(3)	8/1/75, monthly thereafter
Submit copies of compliance certification	1/1/76, 2/year thereafter

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

(1) See Part III-2
(2) See Part III-3

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/75 and lasting through 6/30/75
the permittee is authorized to discharge from waste source serial number(s) 005 (floating dry dock), 006 (marine railway) and 007 (other repair facility).

Such waste source shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations(1)	Monitoring Requirements(2)
(1) See Part III-1 and Part III-2	N/A	N/A
(2) See Part III-3.		

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 7/1/75 and lasting through 12/31/79
the permittee is authorized to discharge from waste source serial number(s) 005 (floating dry dock) 006 (marine railway) and 007 (other repair facility).

Such waste source shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations[1]	Monitoring Requirements[2]
(1) See Part III-1 and Part III-2.	N/A	N/A
(2) See Part III-3 and Part III-4		

There shall be no discharge of floating solids or visible foam in other than trace amounts.

B. SCHEDULE OF COMPLIANCE - Serial No. 005, 006 and 007

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Submit WATER POLLUTION CONTROL PLAN(1)	4/1/75
Implement PLAN	7/1/75
Certify compliance with PLAN(2)	8/1/75, monthly thereafter
Submit copies of compliance certification	1/1/76, 2/year thereafter

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

(1) See Part III-2
(2) See Part III-3

C. MONITORING AND REPORTING

1. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. *Reporting*

Monitoring results obtained during the previous 6 months shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postamarked no later than the 28th day of the month following the completed reporting period. The first report is due on 8/1/75. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

3. *Definitions*

4. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. *Additional Monitoring by Permittee*

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequncy shall also be indicated.

7. *Records Retention*

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

A. MANAGEMENT REQUIREMENTS

1. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

6. *Removed Substances*

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

7. *Power Failures*

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. *Right of Entry*

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. *Transfer of Ownership or Control*

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

3. *Availability of Reports*

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. *Toxic Pollutants*

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

OTHER REQUIREMENTS

1. Discharge limitations are not established at this time. However, if monitoring results establish that discharge limitations are warranted, this permit may be modified to include such limitations.

2. The permittee shall submit a WATER POLLUTION CONTROL PLAN for graving docks, shipways, floating dry docks, marine railways, and other

(Continued)

OTHER REQUIREMENTS Continued

2. ship repair facilities. Such PLAN must give consideration to all of the factors discussed in the "Rationale for Water Pollution Control at Shipbuilding and Ship Repair Facilities" supplied with this permit, emphasizing segregation of wastewaters and cleanup and removal of waste solids from the facility.

3. A responsible company official shall certify monthly that all conditions of the WATER POLLUTION CONTROL PLAN have been met.

SOUTHWEST MARINE

NPDES PERMIT

MARINE SEDIMENT MONITORING AND REPORTING

ANNUAL REPORT

AUGUST 2000

REPORT SERIES #13

REPORT PREPARED FOR SOUTHWEST MARINE BY:

ECOSYSTEMS MGT. ASSOC. INC.
2270 CAMINO VIDA ROBLE #L
CARLSBAD CA 92009
Tel: (760) 438-8682
Fax: (760) 438-8684
e-mail: neilm@abac.com
www.eco-m.com

SOUTHWEST MARINE

NPDES PERMIT
MARINE SEDIMENT MONITORING AND REPORTING

TABLE OF CONTENTS

1.0 INTRODUCTION

In response to the State Water Resource Control Board Order No. WQ-88-4, the San Diego Regional Water Quality Control Board (*SDRWQCB*) has determined that a sediment monitoring program shall be added to the National Pollutant