FIELD FISH DATA FORM

Exponent®

Sheet ___ of ___

Site ______________________

Station/Transect ID ______________________

Precipitation ______________________

Collection Method ______________________

Contract No. ______________________

Date ______________________

Time ______________________

Personnel ______________________

Species	Fish No.	Length (mm)	Weight (g)	Age	Sex[a]	Reproductive Condition	Sample No.	Tag No.	Parasites / Deformities / Lesions / Comments

[a]M = Male
F = Female
U = Unknown

Decoding Key = ______ ______________

______ ______________

______ ______________

______________ *Print name* ______________ *Signature* ______ *Date*

California Regional Water Quality Control Board
San Diego Region

Internet Address: http://www.swrcb.ca.gov/rwqcb9
9174 Sky Park Court, Suite 100, San Diego, California 92123
Phone (858) 467-2952 • FAX (858) 571-6972

Winston H. Hickox
cretary for
ironmental
Protection

Gray Davis
Governor

REC'D NOV 15 2002

November 14, 2002

CERTIFIED-RETURN RECEIPT REQUESTED
7099 3400 0015 9996 9952

Ms. Laura Hunter
Environmental Health Coalition
1717 Kettner Boulevard, #100
San Diego, CA 92101

CERTIFIED-RETURN RECEIPT REQUESTED
7099 3400 0015 9997 0132

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

Dear Ms. Hunter and Mr. Reznik:

REGIONAL BOARD RESPONSE TO COMMENTS ON AUGUST 28, 2002 LETTER FROM SAN DIEGO BAY COUNCIL REGARDING THE NASSCO AND SOUTHWEST MARINE DRART PHASE 2 FIELD SAMPLING PLAN

As you know, on August 22, 2002 the Regional Board held a stakeholder group meeting to discuss the NASSCO and Southwest Marine workplan titled *"Draft Field Sampling Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation"* (July 2002). Stakeholders that participated in the meeting included San Diego Bay Council (Environmental Health Coalition, San Diego Chapter of the Sierra Club, and San Diego Audubon Society), NASSCO and Southwest Marine shipyards, Exponent (technical consultant for the shipyards), Department of Fish and Game, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration (NOAA), Office of Environmental Health Hazard Assessment (OEHHA), and the U.S. Navy. The objectives of the meeting were to formally present the draft plan for the final phase of field sampling to the stakeholder group and receive comments.

Because Bay Council was not able to completely review the sampling plan and could not provide final comments at the meeting, the Regional Board allowed Bay Council additional time to review the sampling plan and submit written comments by August 30, 2002. We received your written comments dated August 28, 2002 and have carefully considered your concerns and recommendations. Our responses to your comments are provided below.

1. General objection to stalling the clean up decision in order to conduct expensive risk assessments.

Comment from San Diego Bay Council:
As we have said before, conducting an outrageously expensive risk assessment, designed and executed in a manner that is heavily manipulated to retain uncertainty in the process is unnecessary, of questionable relevance, and is not supported by our organizations. The law is clear. The presumption of cleanup is to background and background is defined by sediment contamination levels already established by staff.

Regional Board Response:
We do not agree with San Diego Bay Council that the human health and ecological risk assessments are heavily manipulated to retain uncertainty in the process. The Regional Board's technical approach to evaluating the fate, transport, and effects of chemicals which potentially bioaccumulate, bioconcentrate, or biomagnify is based upon the most current recommended ecological risk assessment principles, guidance and policies, promulgated by state and national agencies (US EPA, NOAA, DTSC, Department of Fish and Game, OEHHA, and the State Water Resources Control Board). Under this approach, remedial objectives for cleanup of the shipyard contaminated sediments will be evaluated and selected on the basis of conformance with State Board Resolution 92-49 as well as providing protection of human health and the environment. In evaluating risk to human and ecological receptors and beneficial uses of San Diego Bay we will consider selection of alternative remedial actions, which provide a complete and permanent cleanup, and which do not allow the reintroduction of contaminated sediments or associated chemicals. We have also reviewed a significant amount of literature in developing the guidelines for the shipyard sediment assessment. We can provide specific citations and documentation, if there are specific questions or concerns with regard to the ecological risk assessment approach that has been adopted. In addition, as you know, we have been consulting with the Natural Resource Trustee Agencies on a regular basis to ensure that the risk assessments will provide technically valid information to establish sediment cleanup levels protective of the environment and public health.

We agree that the Regional Board must apply State Board Resolution 92-49 when establishing cleanup levels for NASSCO and Southwest Marine. Resolution 92-49 is interpreted to presumptively require cleanup of contaminated sediment to background cleanup levels. However, the resolution is flexible and allows the Regional Board substantial discretion in setting cleanup levels. Cleanup levels less stringent than background levels are permissible if cleanup to background is technologically and economically infeasible and as long as the cleanup levels less stringent than background levels are protective of San Diego Bay beneficial uses. This interpretation is consistent with the legal opinion provided by the State Board's Office of Chief Counsel (OCC) interpreting Resolution 92-49 with respect to contaminated sediments. A copy of OCC's letter is attached.

2. Any recalculation of background should be based on large data sets based on samples taken by independent agencies.

Comment from San Diego Bay Council:
We are concerned about conducting additional testing of the background stations in order to recalculate the background levels already established by the staff. We are concerned about the lack of a clearly stated sampling and analysis objective or disclosure about how this data will be used once collected. Again, we repeat our request that the input of Dr. Russell Fairey be solicited on establishing background levels for the Bay. The BPTCP data set is the largest on the Bay and it included both potential toxic sites and baywide conditions in its sampling design.

Regional Board Response:
The Regional Board has established background sediment chemistry levels using sediment quality data from 12 Bight'98 stations to define background conditions for NASSCO and Southwest Marine shipyards. The background levels and criteria used to select these stations are described in the March 6, 2002 Regional Board letter titled *"Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards"* (attached). In that letter we stated that the background level for total PCBs (<0.02 mg/kg) is considered an interim level until the detection limit issues are resolved with the City of San Diego's laboratory. The laboratory reevaluated the Bight'98 PCB data and determined that the 12 reference stations had PCB concentrations below detection but could not be quantified due to the extraction method used at that time. Consequently, the Regional Board directed NASSCO and Southwest Marine to resample all 12 reference stations and analyze the samples for total PCBs and for the other shipyard chemicals of concern (metals, total PAHs, butyltin species, and total petroleum hydrocarbons). Analyzing the full suite of chemicals rather than just total PCBs provides information on temporal trends and allows the Regional Board the flexibility to use current (and past) data for establishing background sediment chemistry levels for NASSCO and Southwest Marine. The additional sediment quality information is also useful in improving the statistical basis for defining site-specific sediment chemistry background conditions at the shipyard sites.

The determination of background conditions for San Diego Bay to incorporate into sediment cleanup level decisions is an evolving process. We are currently evaluating sediment quality data from several monitoring programs such as the BPTCP and Bight'98 to factor into this determination. We are also in the process of contracting with Southern California Coastal Water Research Project (SCCWRP) to conduct studies to determine naturally-occurring and ambient background conditions in San Diego Bay. Naturally-occurring background refers to the chemical concentrations of sediments prior to the bay's industrialization (i.e., pre-industrial levels) and ambient background refers to "clean" sediments not totally free of anthropogenic inputs (i.e., includes non-point discharges but excludes known point sources). The results of these studies may not be available to incorporate into the current shipyard investigation process. Our current position is that sediment quality data collected from the 12 Bight 98 stations described in our March 6 letter provides the best available information for defining site-specific background conditions at the NASSCO and Southwest Marine shipyard sites.

Our discussions are continuing with Dr. Fairey and others regarding the suitability of the five reference stations used by the shipyards for statistical comparisons. These comparisons will determine whether the sediment quality data collected at the shipyard sites are significantly greater than background conditions. The five reference stations are a subset of the 12 Bight'98 stations used to define background conditions for NASSCO and Southwest Marine shipyards. We are evaluating several approaches to resolve this issue and will keep you apprised of any final decisions we make on this matter.

3. Uptake of contaminants by gobies should be analyzed in the Ecological Risk Assessment.

Comment from San Diego Bay Council:
It is clear that gobies (even though hard to catch) are the most direct link between toxic sediments and the higher trophic levels. Gobies also have the highest site fidelity of all the fish discussed. Therefore, we strongly recommend that they be added to the assessment.

Regional Board Response:
The Regional Board previously reached agreement with the Natural Resource Trustee Agencies that gobies should be included in the ecological risk assessment if they could be found in sufficient numbers and directed NASSCO and Southwest Marine to include gobies as one of the primary target species. We discussed this issue extensively with the Natural Resource Trustee Agencies and the consensus was that the high degree of site fidelity associated with gobies would provide for a more ecologically relevant risk evaluation. The Natural Resource Trustee Agencies also recognized that gobies might not be present in sufficient numbers at the shipyard sites due to the lack of shallow water depths along the shipyard bulkheads. As such, other species were identified as backup species in the event that gobies were found to be present in insufficient numbers. Attached is a table from the final Phase 2 workplan that summarizes the primary and secondary target species for the ecological risk assessment, human health risk assessment, and fish histopathology study. This table was developed in consultation with the Natural Resource Trustee Agencies.

The shipyard's consultant conducted the fish collection fieldwork from September 25-29, 2002 in accordance with the final Phase 2 workplan. The Regional Board and the Department of Fish and Game were present throughout the field activities for observation and decision-making purposes. Various techniques such as otter trawls, beach seines, and fish traps were used to attempt to collect the gobies. Based on the fish collection efforts conducted at the shipyard sites gobies were not found in sufficient numbers for use in the ecological risk assessment. Only one goby was caught near shore within the shipyard leaseholds and no gobies were caught in the outer leasehold. Spotted sand bass, anchovies, and topsmelt were found to be the most abundant species present at the shipyard sites. Accordingly, these species are being used for the ecological risk assessment.

4. Human Health Risk Assessment

Comment from San Diego Bay Council:
In all cases, the Human Health Risk Assessment (HHRA) must assume those consumption patterns and quantities for the subsistence and the most at-risk consumer of fish. We were very troubled to hear the representative of OEHHA state that the assessment should be conducted, not on how people do eat fish but on how they should eat fish. This is completely untenable. In San Diego, we are fortunate to have a large southeast asian immigrant community as well as indigenous, Latinos, and a large community from Africa. Stews, raw and whole fish consumption, and other non-fillet-only based consumption patterns can be found in these communities.

Regional Board Response:
OEHHA is the State of California agency that is responsible for developing and providing risk managers in state and local government agencies with toxicological and medical information relevant to decisions involving public health. One of OEHHA's functions and responsibilities include making recommendations to the State Water Resources Control Board with respect to sport and commercial fishing in areas where fish may be contaminated. Because of OEHHA's technical expertise in public health, the Regional Board relies on their guidance when making decisions on human health risks from pollutants. We are confident that the input we receive from OEHHA is technically valid and highly protective of public health.

To address the concern on the fish dietary intake of ethnic groups, the data from both whole body and fillet analyses will be used for the human health risk assessment. Furthermore, the analyses will include both the edible tissue and whole body for the crab and/or lobsters. Attached is a table from the final Phase 2 workplan that summarizes the primary and secondary target species for the ecological risk assessment, human health risk assessment, and fish histopathology study. This table was developed in consultation with the Natural Resource Trustee Agencies. See Footnote e regarding whole body and fillet analyses.

5. Pore Water should be analyzed as a factor in assessing impacts to beneficial uses.

Comment from San Diego Bay Council:
We believe that violations of water quality standards for pore water constitute a known impact to beneficial uses. We believe that part of the sampling design for Phase 2 should include pore water analysis to determine where pore water exceeds water quality standards. It would be especially

important to conduct pore water samples where the previous data was equivocal i.e. high chemistry and no toxicity.

Regional Board Response:
We have previously provided responses to this comment in our January 15, 2002 letter titled "Regional Board Response to Comments on August 21, 2001 Letter and October 10, 2001 List of Questions from San Diego Bay Council Regarding the NASSCO and Southwest Marine Sediment Investigation Workplan." See Regional Board responses on Comment #2 – Sampling for Dilution Series, Pore Water, and Fish Tissue (August 21, 2001 letter) and Comment #2 – Pore Water Testing, Dilution Series Test (October 10, 2001 letter).

6. Assess liver bile for PAH Metabolites.

Comment from San Diego Bay Council:
While fish histopathology on livers will show long-term and high level impacts of PAH exposure, bile analysis will show lower levels and recent exposure to PAH. This should be conducted on fish that are analyzed.

Regional Board Response:
The Regional Board previously reached agreement with the Natural Resource Trustee Agencies that fish bile analysis should be performed as part of the histopathology study and directed NASSCO and Southwest Marine to include this analysis. We discussed the issue of bile analysis in detail with the Natural Resource Trustee Agencies and the consensus was that fish bile analysis for PAH metabolites is needed to more fully evaluate the potential risk of PAHs to fish and possibly higher trophic level receptors. The fish bile analysis will address the concern whether fish are being exposed to PAHs from the shipyard sites.

7(a). PAH Analysis for EqP

Comment from San Diego Bay Council:
It appears that no EqP will be established for PAH as there are no water quality criteria for PAH. The lack of formal WQC is no excuse to drop analysis of a toxic substance that has severely contaminated and degraded our waterways. There are numbers that should be used for this analysis or very protective numbers could be developed to be used for this purpose.

Regional Board Response:
In our June 1, 2001 guidelines titled *"Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards"* we directed the shipyards to analyze the pore water for PAHs. Page 14 of the guidelines provides that:

> *"Pore water samples shall be measured for metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyltin species, PCBs/PCTs, **PAHs**, TPH, and any other chemical constituent associated with shipbuilding and repair activities believed to be present in bay sediment."*

During the August 22 and 23, 2002 meetings we reconfirmed the requirement to sample the pore water for PAHs and requested that the shipyards analyze PAHs in pore water while the Regional Board identify a PAH water quality objective for the protection of aquatic life. We identified a PAH water quality objective of 2.71 micrograms per liter (ug/L) in consultation with staff from the State Water Resources Control Board and the USEPA. This PAH objective was derived from 34 specific PAHs recommended in the USEPA final draft document titled *"Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: PAH Mixtures"* (April 2000). We have directed NASSCO and Southwest Marine to use this total PAH objective when developing PAH cleanup values using the Equilibrium Partitioning approach.

7(b). Impacts from PAHs

Comment from San Diego Bay Council:
There are a lot of impacts from PAH that are getting overlooked in the analysis in Phase 2. First, that PAH are toxic to fish embryos. Second, there is phototoxicity of PAH. Third, there are new biomarkers for PAH. Fourth, there is evidence of endocrine disruption caused by PAH.

Regional Board Response:
We recognize that there are many types of biological indicators that evaluate impacts from PAHs on aquatic life, however, we believe the current indices identified for the shipyard investigation are adequate and will allow us to determine whether PAHs are adversely affecting fish health. These indices were selected in consultation with the Natural Resource Trustee Agencies and consist of histopathological analyses that examine fish bile, gill, liver, kidney, and gonad. Our rationale and guidelines are provided in the July 16, 2002 Regional Board letter titled *"Assessment of Bioaccumulation and Risk to Fish Health from Sediment Contaminants at NASSCO and Southwest Marine Shipyards."* A copy of this letter is attached.

8. Any impacts to RARE species must be elevated as a concern.

Comment from San Diego Bay Council:
The cumulative and incremental risk must be the concern and for rare species, it is even more significant since those are the species that are already close to the brink of extinction from the cumulative impacts. Given the precarious state of the rare species in the bay the standard should be that any impact is significant because it adds to an already unacceptable cumulative burden.

Regional Board Response:
We agree with San Diego Bay Council that cumulative and incremental risk for rare (and endangered) species is of concern. The general approach that the Regional Board has developed for contaminated sediment cleanups in San Diego Bay has multiple elements and actions. It is focused upon the identification and remediation of marine sediment pollutants at specific sites (such as NASSCO and Southwest Marine shipyards). The Regional Board also seeks to identify bay-wide pollution to address the overall and cumulative impact(s) of contaminated sediments to the beneficial uses designated for San Diego Bay.

The shipyard ecological risk assessments are site-specific; however, the risks posed by the added exposure a species could potentially receive from other contaminated sites is being addressed. Cumulative risks are considered in the analysis of fish tissue residues and in the overall bay-wide effort to assess and remediate contaminated sediments. Because fish are highly mobile, especially those typically consumed by rare and endangered species; they are likely being exposed to pollution in multiple areas of the bay. While the tissue residues of these fish are assumed to come from just the subject site (a conservative approach typically used in ecological risk assessments), the tissue residues used in the shipyard study are actually representing cumulative exposure received from other contaminated areas. Thus, the estimated chemical intake for fish-eating receptors of concern (such as the federally endangered California brown pelican and California least tern used in the shipyard risk assessment) accounts for cumulative and incremental risk.

In addition, the Regional Board is fully engaged with obtaining remediation of contaminated sediments in San Diego Bay. The Board has obtained cleanup of contaminated sediments at seven different sites in San Diego Bay over the past 10 years and there are a number of current sites where work towards remediation is progressing. These sites include designated Toxic Hot Spots requiring TMDL development, Department of Defense sites, and a number of bayfront private industries. The aggregate effect of remediation at these sites (and at future sites) will further assure the full protection of aquatic-dependent wildlife (including threatened and endangered species).

With respect to NASSCO and Southwest Marine shipyards, the Regional Board supports the approach for cumulative and incremental risk assessment for fully protected species through the following process. The federal and state natural resource trustee agencies (and other experts) have provided information, consultation, and professional advice on federally/state listed threatened and endangered species and habitats of concern in/adjacent to the shipyard leaseholds. This information has been evaluated and used in the development of the ecological risk assessment, including the selection of receptors of concern, exposure assessment data, field sampling plans, and evaluation of chemicals of concern. The Regional Board will continue to coordinate and consult with the Federal/State natural resource trustees on further decisions and interpretations of risk assessment data, as the risk assessment evaluation continues. We will consult with and discuss potential cleanup alternatives, and consider the Federal/State recommendations for cleanup selection for the protection of threatened and endangered species. With early and complete coordination with the Federal/State natural resource trustees, we believe that consultation/assessment/ integration of measures and alternatives in the site cleanup can be incorporated to provide complete protection to, and not lead to further decline of, the species of concern (e.g., non-jeopardy opinion). This opinion by the trustees will involve consideration of both the direct project effects to the species as well as its habitat. Concurrence by the Federal/State natural resource trustees will be, in part, based upon the adequacy and robustness of the ecological risk assessment in its consideration of the potential effects of contaminated sediment exposure from NASSCO and Southwest Marine shipyards.

Should you have any questions, or require additional information, please contact either Mr. Tom Alo of my staff at (858) 636-3154 or Mr. Alan Monji of my staff at (858) 637-7140.

Sincerely,

JOHN H. ROBERTUS
Executive Officer

JHR:dtb:clc:tca

Attachments: Applicability of State Board Resolution 92-49 in Setting Sediment Cleanup Levels. State Water Resources Control Board Office of Chief Counsel. February 22, 2002.

Assessment of Bioaccumulation and Risk to Fish Health from Sediment Contaminants at NASSCO and Southwest Marine Shipyards. Regional Water Quality Control Board – San Diego Region. July 16, 2002.

Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards. Regional Water Quality Control Board – San Diego Region. March 6, 2002.

Table 9 – Fish and Invertebrate Species by Study from final workplan titled *"Field Sampling Plan Addendum for the NASSCO and Southwest Marine Detailed Sediment Investigation."* Exponent. September 2002.

cc: Ed Kimura, San Diego Chapter of the Sierra Club
Jim Peugh, San Diego Audubon Society
Marco Gonzalez, Surfrider Foundation, San Diego Chapter

Mike Chee, NASSCO
Shaun Halvax, Southwest Marine
Dreas Nielsen, Exponent
Michael Martin, Department of Fish and Game
Michael Anderson, Department of Toxic Substances Control
Scott Sobiech, U.S. Fish and Wildlife
Robert Brodburg, Office of Environmental Health Hazard Assessment
Denise Klimas, National Oceanic and Atmospheric Administration
Donald MacDonald, National Oceanic and Atmospheric Administration
Mark Meyers, National Oceanic and Atmospheric Administration

NASSCO File No.:	03-0066.05
Southwest Marine File No.:	03-0137.05

ATTACHMENTS

TO: John Robertus, Executive Officer
San Diego Regional Water Quality
Control Board
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124-13234

/s/

FROM: Craig M. Wilson
Chief Counsel
OFFICE OF CHIEF COUNSEL

DATE: February 22, 2002

SUBJECT: APPLICABILITY OF STATE BOARD RESOLUTION 92-49 IN SETTING SEDIMENT CLEANUP LEVELS

I.
QUESTIONS PRESENTED

You have asked the following questions with respect to State Water Resources Control Board (State Board) Resolution 92-49:

A. Does State Board Resolution 92-49 apply to setting cleanup levels for bay bottom contaminated sediments? If so, does the Resolution require cleanup to background sediment concentrations, or just background water column concentrations?

B. If Resolution 92-49 does apply, what are the limitations, if any, to its application? What discretion does a regional board have in designating cleanup levels for sediments less stringent than background conditions?

II.
BRIEF RESPONSE

A. A regional board must apply Resolution 92-49 when setting cleanup levels for contaminated sediments if such sediments threaten beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste.[1] Contaminated sediments must be cleaned up to background sediment quality unless it would be technologically or economically infeasible to do so.

B. Resolution 92-49 is flexible and permits a regional board to set alternative cleanup levels less stringent than background concentrations if attainment of background concentrations is infeasible. Any such alternative cleanup level may not unreasonably affect beneficial uses and must comply with all applicable Water Quality Control Plans and Policies. The Resolution allows for consideration of adverse impacts of any cleanup itself as well as natural attenuation if cleanup goals can be met in a reasonable time.

III.
BACKGROUND

The San Diego Regional Board (Regional Board) is currently involved in determining remediation strategies and cleanup levels at various sites within San Diego Bay. Environmental interest groups appearing before the Regional Board have taken the position that under Resolution 92-49, the Regional Board must require cleanup of contaminated sediments to attain background sediment chemistry levels as defined by an off-site reference station. Dischargers argue that Resolution 92-49 applies to water quality and not sediment quality and that attainment of background water quality conditions may not require restoration of background sediment quality conditions. Presumably, in this context, the dischargers interpret the term "water quality" to refer to the concentrations of dissolved or suspended wastes in water associated with contaminated sediment; e.g., in the water column or sediment pore water (the water between particles that make up the bottom sediment).

IV.
DISCUSSION

A. Technical Issues

State Board Division of Water Quality (DWQ) staff have indicated that (1) in most cases the exposure route leading to sediment related toxicity is unknown; and (2) in addition to direct contact with, or ingestion of, water containing dissolved or suspended wastes, routes of exposure that lead to toxic effects can include sediment ingestion and direct contact with contaminated sediment particles. The DWQ assessment is supported by the U.S. Environmental Protection Agency (EPA) which has noted that pore water exposures underestimate the toxicity of sediment bound pollutants that are minimally

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[1] As used in this memorandum, the term "contaminated sediments" is intended to refer to sediments that either meet the definition of "contamination" under Water Code 13050(k) or that create, or threaten to create, a condition of "pollution" under section 13050 (l).

soluble in water.[2] EPA has also recognized that sediment ingestion is an exposure route. [3]

B. Legal Issues

1. Porter-Cologne Jurisdiction

The Porter-Cologne Act is replete with provisions intended to protect beneficial uses from impacts from contaminated sediment. As discussed below, Porter-Cologne jurisdiction extends beyond water column effects to require the reasonable protection of beneficial uses from discharges of waste to waters of the state.

2. Water Code Section 13304

Water Code Section 13304 requires a person to clean up waste or abate the effects of the waste if so ordered by a regional board in the following circumstances: if there has been a discharge in violation of waste discharge requirements, or if a person has caused or permitted waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates or threatens to create a condition of pollution or nuisance. "Pollution" is defined as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects . . . the waters for beneficial uses . . . ."[4]

The legislative history of the Porter-Cologne Act states in commentary on the definition of "pollution" that "it is the unreasonable effect upon beneficial uses of water, caused by waste, that constitutes pollution."[5] This history expresses the intent that if a person discharges waste into waters of the state and beneficial uses of the water are thereby harmed - then pollution exists even if water column concentrations are not effected by wastes that have settled in sediment.

Settled wastes associated with sediments are some of the most harmful to beneficial uses of waters; e.g., PCBs, pesticides and mercury. If regional board authority under section 13304 were limited to effects on the water column, a regional board could not require cleanup if a discharger dumped into a bay pure PCBs, which due to their insolubility, sunk to the bottom and adsorbed onto sediment particles - resulting in lethal effects to aquatic organisms ingesting or otherwise contacting these sediments.

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[2] See EPA's Contaminated Sediment Management Strategy, pp. 21 and 75, EPA-823-R-98-001, April 1998.

[3] See "The Particle Size Distribution of Toxicity in Metal-Contaminated Sediments, http://es.epa.gov/ncerqa_abstracts/grants/98/envchem/ranville.html.

[4] Water Code section 13050(l).

[5] Final Report of the Study Panel to the California State Water Resources Control Board, 1969, p. 30.

This is inconsistent with the remedial goals of the Porter-Cologne Act to protect beneficial uses of the waters of the state.

State Board Resolution 92-49 describes the policies and procedures that apply to the cleanup and abatement of all types of discharges subject to Water Code Section 13304. These include discharges, or threatened discharges, to surface and groundwater. The Resolution requires dischargers to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality or the best water quality that is reasonable if background levels of water quality cannot be restored, considering economic and other factors. In approving any alternative cleanup levels less stringent than background, regional boards must apply section 2550.4 of Title 23 of the California Code of Regulations.[6] Section 2550.4 provides that a regional board can only approve cleanup levels less stringent than background if the regional board finds that it is technologically or economically infeasible to achieve background. Resolution 92-49 further requires that any alternative cleanup level shall: (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial uses of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.[7]

3. Water Code Section 13307

Water Code section 13307, the statutory mandate that led to the adoption of Resolution 92-49, directed the State Board to establish a policy for the investigation and cleanup of discharges of hazardous substances that create or threaten to create a condition of contamination, pollution, or nuisance. "Contamination" is defined as a condition that creates a public health hazard resulting from the disposal of waste, whether or not waters of the state are affected.[8] As noted above, the State Board, consistent with legislative history, has exercised discretion to interpret the term "pollution" broadly to cover effects beyond the water column to protect beneficial uses of waters of the state from discharges of waste. However, given the expansive statutory definition of "contamination" as applying to disposal sites that pose a hazard to the public whether or not waters are affected, no discretionary interpretation is needed to reach the conclusion that Resolution 92-49 applies to more than the water column. Given the bioaccumulation risk posed by many contaminants in sediment, section 13307 requires regional boards to apply Resolution 92-49 in a way that ensures, at a minimum, that any sediment cleanup is protective of public health – whether or not water column concentrations are

[6] Resolution 92-49, Section III.G.

[7] *Id.*

[8] Water Code section 13050(k).

elevated above background concentrations as a result of contact with contaminated sediments.

4. *State Policy for Water Quality Control*

Statutory requirements for state water quality control policy are set forth in section 13142 of the Water Code. The section provides that such policy shall consist of any or all of: (1) water quality principles and guidelines; (2) water quality objectives; and (3) other principles and guidelines deemed essential by the State Board. This broad discretion suggests legislative intent to protect beneficial uses from more than water column effects when a waste discharge threatens such uses. This principle is reflected in the State Board Policy for Implementation of Toxics Standards and the rescinded Enclosed Bays and Estuaries Plan, discussed below, which apply specifically to sediments. With respect to the coastal marine environment, Water Code section 13142.5 provides that wastewater discharges shall be controlled to protect beneficial uses.

5. *Toxic Hot Spots Legislation*

In 1989, the Legislature added Chapter 5.6 to Division 7 of the Water Code.[9] Chapter 5.6 requires the State Board and regional boards to plan for the cleanup of "toxic hot spots." "Toxic hot spots" are defined as "locations in enclosed bays [and other waters] the pollution or contamination of which affects the interests of the state, and where hazardous substances have accumulated in the water or sediment to levels which . . . may adversely affect the beneficial uses of the bay [or other waters] . . . or (3) exceeds adopted water quality or sediment quality objectives."[10] Section 13390 expresses the legislative intent: "It is the intent of the Legislature that the state board and the regional boards establish programs that provide maximum protection for existing and future beneficial uses of bay and estuarine waters." (Emphasis added.)

Water Code section 13393 requires the State Board to adopt sediment quality objectives using the procedures that apply to the adoption of Water Quality Control Plans. Although the Legislature drew a distinction between water quality objectives and sediment objectives in section 13391.5(e), it appears to have been to clarified that the State Board must set objectives that specifically apply to this part of the aquatic environment over which the State Board has jurisdiction, and which had not received the same degree of attention as the more traditional numeric water column objectives found in Water Quality Control Plans. This interpretation is consistent with Water Code section 13181 and the EPA view, discussed below, that sediment criteria are a

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[9] Water Code section 13390 et seq.

[10] Water Code section 13391.5(e).

subset of water quality criteria. Once the sediment objectives are adopted, any sediment cleanup would have to ensure that these objectives are met.
The State Board's Consolidated Toxic Hot Spots Cleanup Plan (Hot Spots Plan) directs the regional boards to implement Resolution 92-49 when implementing the remedial portions of the Hot Spots Plan.[11] The focus of the Hot Spots Plan is on sediment remediation; it provides that: "[c]andidate and known toxic hot spots are locations (sites *in* waters of the State) in enclosed bays, estuaries or the ocean."[12] (Emphasis added.) The State Board intended the term "waters of the state" to be interpreted broadly to include contaminated sediments in these waters. For any dredging project involving contaminated sediments, section 13396(b) prohibits the discharge of dredge spoils in any location "that may cause significant adverse effects to aquatic life, fish, shellfish, or wildlife or may harm the beneficial uses of the receiving waters." There is no condition that the prohibition only applies to harm related to water column effects.

The clear message of the Toxic Hot Spots legislation is that the State Board and regional boards must develop a plan for the cleanup of "toxic hot spots" most of which involve contaminated sediments. The fact that the Legislature did not provide any additional sources of authority to the State Board or regional boards that would allow them to require cleanup of such sites suggests that it viewed the boards' existing powers as broad enough to require cleanup when beneficial uses of the state's waters are threatened by a discharge of waste.

6. *Water Code Section 13181*

Water Code section 13181 directs the State Board to propose a program that includes methods for determining the sources of pollution in coastal watersheds, bays, estuaries, and coastal waters. The proposed program must include methods for determining the degree of improvement or degradation in coastal water quality over time with respect to water quality objectives, sediment quality guidelines, tissue contaminant burden guidelines and health standards. This indicates legislative intent that water quality includes sediment quality.

7. *Judicial Opinions*

The courts have concluded that provisions determining the scope of a regulatory statute must be broadly construed to accomplish the purposes of the statute.[13] The Court of Appeals in *Lake Madrone Water District* v. *State Water Resources Control Board* indicated its support for the proposition that Porter-Cologne jurisdiction extends beyond water column effects by citing with approval an Attorney General opinion on

[11] Hot Spots Plan, p. 6.

[12] *Id.* at p. 12.

[13] *Harvey v. Davis* (1968) 69 Cal.2d 362, 370-71 (1968).

this point.[14] In Opinion No. 55-237, the Attorney General concluded that a discharge of fine-grained materials constituted pollution where the only harm to beneficial uses occurred when these materials settled out on the bottom of a reservoir. The reservoir was used to recharge groundwater and the fine-grained materials sealed the porous surface of the bottom of the reservoir thereby interfering with groundwater recharge. The Attorney General reasoned that a causal relationship existed between the discharge and the impairment even though the immediate cause of the reduction in recharge was the change in the quality of the absorbing surface on the bottom of the reservoir. Applying this same reasoning, the Attorney General also concluded that water was polluted where spawning beds were covered by these same materials - even where there was no effect on the water column.

8. *State Board Policies and Orders*

The State Board has consistently interpreted its jurisdiction as extending beyond the water column where beneficial uses are affected by a discharge of waste. The Enclosed Bays and Estuaries Plan, 91-13 WQ (EBE Plan) (which was rescinded on grounds unrelated to sediment issues), contained the following objectives under the heading "Narrative Water Quality Objectives:" "(1) the concentrations of toxic pollutants in the water column, sediments, or biota shall not adversely affect beneficial uses. (2) Enclosed bays and estuarine communities and populations, including vertebrate, invertebrate, and plant species, shall not be degraded as the result of the discharge of waste." Either of these objectives would be violated if a benthic organism were harmed as a result of the direct contact with, or ingestion of, pollutants in sediment, even if water column or sediment pore water pollutant concentrations were zero. In Order WQ 92-09, the State Board noted that although the EBE Plan did not establish numeric objectives for sediment, Resolution 92-49 required cleanup levels low enough to ensure that these narrative sediment objectives would not be violated.[15]

9. *The Clean Water Act*

EPA is in the process of adopting federal sediment criteria under the authority of Clean Water Act section 304(a), which directs EPA to develop "criteria for *water quality* . . .on the kind and extent of . . . effects . . . which may be expected from the presence of pollutants in any body of water."[16] In 1997, EPA submitted a report to Congress entitled "The Incidence and Severity of Sediment Contamination in Surface Waters of the United States." Section 304 and the EPA report suggest that EPA views sediment criteria as water quality criteria, and that the agency considers contaminated sediments to be contained *in* surface waters to the same degree as a dissolved or

[14] 209 Cal.App. 3d 163, 169 (1989).

[15] Petition of Environmental Health Coalition and Eugene J. Sprofera, September 17, 1992.

[16] EPA's Contaminated Sediment Management Strategy, pp. 21 and 75.

suspended pollutant. Thus, it is clear that EPA would favor an interpretation of the Water Code that is consistent with the Clean Water Act by including the power to regulate more than the water column where necessary to protect beneficial uses of waters of the state from the effects of waste. EPA has indicated that it will publish numeric sediment quality criteria, as guidance, with the intent that states will use the criteria in interpreting existing narrative toxicity water quality criteria. EPA also has noted that states could adopt these federal sediment criteria as state water quality standards.[17]

The Clean Water Act, defines pollution to include "alteration of the chemical, physical, biological, and radiological integrity of water."[18] This definition is analogous to the Porter-Cologne definition, in that pollution is defined to include a change in water. Responding to an attempt by the Federal Energy Regulatory Commission to restrict state authority narrowly to water chemistry issues, and to deny states broader authority over water quality, EPA observed:

> "[P]rotection of water quality involves far more than just addressing water chemistry. Rather, protection of water quality includes protection of the multiple elements which together make up aquatic systems including the aquatic life, wildlife, wetlands, and other aquatic habitat, vegetation, and hydrology required to maintain the aquatic system. Relevant water quality issues include the toxicity and bioaccumulation of pollutants, the diversity and composition of the aquatic species, entrapment of pollutants in sediment, stormwater and non-point source impacts, habitat loss, and hydrological changes."[19]

The United States Supreme Court recognized that water quality, under the Clean Water Act should be broadly construed:

> "In many cases, water quantity is closely related to water quality; a sufficient lowering of water quantity in a body of water could destroy all of its designated uses, be it for drinking water, recreation, or . . . as a fishery. In any event, there is recognition in the Clean Water Act that reduced stream flow; *i.e*, diminishment of water quantity, can constitute pollution. This broad conception of pollution – one which expressly evinces Congress' concern with the physical and biological integrity of

[17] *Id*. at p. 22.

[18] 33 U.S.C. § 1362(19).

[19] Letter from LuJuana Wilcher, Assistant Administrator, United States Environmental Protection Agency to Hon. Lois Cashell, Secretary FERC (Jan. 18, 1991).

water – refutes [the] assertion that the Act draws a sharp distinction between the regulation of water "quantity" and water "quality."[20]

10. State Board Policy for Implementation of Toxics Standards

The State Board Policy for Implementation of Toxics Standards (the SIP) provides that mixing zones shall not result in "objectionable bottom deposits."[21] This term is defined as "an accumulation of materials . . . on or near the bottom of a water body which creates conditions that adversely impact aquatic life, human health, beneficial uses, or aesthetics. These conditions include, but are not limited to, the accumulation of pollutants in the sediments . . . ."[22] There is no requirement that the adverse impact result from exposure to pollutants in the water column or sediment pore water. Consequently, if the harm resulted from direct contact with, or ingestion of, contaminated sediments, a discharge that resulted in this condition would violate the SIP. This recently adopted Policy reaffirms the Board's long-standing conclusion that its water quality jurisdiction extends beyond water column effects.

V.
REGIONAL BOARD DISCRETION IN SETTING CLEANUP LEVELS

Given these considerations, Resolution 92-49 should be interpreted to presumptively require cleanup of contaminated sediment to background sediment levels. However, the Resolution is flexible and allows a regional board to exercise substantial discretion in setting cleanup levels. Cleanup levels less stringent than background levels are permissible if cleaning up to those levels is technologically or economically infeasible – as long as the less stringent cleanup level is protective of beneficial uses. Beneficial uses must be protected not only from exposure to sediment-derived pollutants in the water column or sediment pore water, but also pollutants in, or on, the sediment particles that can adversely affect aquatic organisms and/or human health through bioaccumulation when such organisms ingest contaminated sediments or come in direct contact with such sediments.

Resolution 92-49 requires alternative cleanup levels less stringent than background to, among other factors, "be consistent with maximum benefit to the people of the state" and requires consideration of "all demands being made and to be made on the waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible." This determination is made on a case-by-case basis and is based on considerations of reasonableness under the circumstances at the site. [23] Finally, the State

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[20] *PUD No. 1* v. *Washington Department of Ecology* (1994) 511 U.S. 700, 719.

[21] SIP at p. 15.

[22] *Id.* at Appendix 1-4.

[23] See SWRCB Order No. WQ 92-09.

Board has indicated that Resolution 92-49 does not require immediate compliance with cleanup goals.[24] Rather, the Resolution provides that a regional board must approve any cleanup proposal that the regional board finds will "have a substantial likelihood to achieve compliance, within a reasonable time frame, with cleanup goals."[25] In the context of underground tank cleanups, the State Board has concluded that "a reasonable time" may be decades where natural attenuation is the proposed cleanup approach.[26]

Although each cleanup project must be evaluated by a regional board on a case-by-case basis, the State Board, in Order WQ 92-09, recognized the infeasibility of dredging to background sediment concentrations at the Paco Terminals site in San Diego Bay. Key considerations included the cost of attaining a background sediment cleanup goal and the expected harm to beneficial uses that would result from the large-scale dredging that would be necessary to achieve background sediment levels.[27] Such harm may be expected due to physical disturbance of habitat and re-suspension of pollutants into the water column. More recently, in its response to comments on the Hot Spots Plan, the State Board indicated that regional boards would have significant discretion in determining when a site was adequately remediated. A commenter wanted to know if background levels would be required or some higher level. The State Board response noted that either of those levels could be selected by a regional board at its discretion.[28]

VI. CONCLUSION

Regional boards must apply Resolution 92-49 when setting cleanup levels for contaminated sediments if such sediments threaten beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste. Contaminated sediments must be cleaned up to levels consistent with background sediment quality unless it would be technologically or economically infeasible to do so. Any such alternative cleanup level may not unreasonably affect beneficial uses and must comply with all applicable Water Quality Control Plans and Policies. In setting alternative cleanup levels, regional boards must balance various factors. Resolution 92-49 allows for consideration of adverse impacts of cleanup as well as natural attenuation if cleanup goals can be met in a reasonable time.

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[24] SWRCB Order No. WQ-98-08-UST.

[25] Resolution 92-49, Section III.A

[26] See Note 25 at p. 12.

[27] See Note 15 at p. 4.

[28] Functional Equivalent Document for the Consolidated Toxic Hot Spots Cleanup Plan, p. 353.

bc: Ted Cobb, OCC
Tim Regan, OCC
Debbie Matulis, OCC

TJRegan/mmjohnson/dmatulis
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July 16, 2002

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Mr. Mike Chee
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CERTIFIED-RETURN RECEIPT REQUESTED
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Mr. Sandor Halvax
Southwest Marine Inc.
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Dear Mr. Chee and Mr. Halvax:

ASSESSMENT OF BIOACCUMULATION AND RISK TO FISH HEALTH FROM SEDIMENT CONTAMINANTS AT NASSCO AND SOUTHWEST MARINE SHIPYARDS

This is a follow-up to my December 24, 2001 letter to NASSCO and Southwest Marine regarding the assessment of aquatic-dependent wildlife risks at NASSCO and Southwest Marine shipyards. In that letter, I indicated that it would be necessary in the Phase 2 bioaccumulation studies to assess the potential adverse effects of sediment chemical contaminants on fish health due to the uptake of these contaminants. Accordingly, pursuant to Water Code Section 13267, I am directing NASSCO and Southwest Marine to submit to the Regional Board by October 31, 2002 a technical report that addresses the potential for contaminant bioaccumulation in fish and the associated risks to fish health in accordance with the guidelines described in Section B below. The October 31 submittal date is contingent upon implementing field activities by the end of August 2002.

A. RATIONALE FOR FISH BIOACCUMULATION AND HEALTH RISK STUDY

The need to address this issue is discussed in a memorandum dated August 24, 2001 from Dr. Mike Anderson of Department of Toxic Substance Control – Human and Ecological Risk Division (HERD) commenting on the Regional Board's August 3, 2001 public workshop on Exponent's workplan titled "*Workplan for the NASSCO and Southwest Marine Detailed Sediment Investigation*" received by the Regional Board in July 2001 (Exponent 2001a). A copy of Dr. Anderson's memorandum was previously forwarded to you. The Regional Board, Dr.

Michael Martin of California Department of Fish and Game (DFG), Ms. Denise Klimas of the National Oceanic and Atmospheric Administration (NOAA) Coastal Protection and Restoration Division, and Mr. Scott Sobiech of U.S. Fish and Wildlife Service (F&W) also concur with Dr. Anderson's views that Exponent's workplan should be modified to address the potential for bioaccumulation of contaminants in fish and the impacts to fish health from the sediments at NASSCO and Southwest Marine shipyards. The guidelines provided in this letter were jointly developed by the Regional Board and the above mentioned Natural Resource Trustee Agency representatives.

Further investigation is needed to properly assess the impacts of contaminants on resident fish at NASSCO and Southwest Marine based on the following information:

- Sediment chemistry concentrations for total polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) at NASSCO and Southwest Marine exceed background sediment quality conditions for San Diego Bay.
- Sediment chemistry concentrations for PAHs and PCBs at NASSCO and Southwest Marine exceed suggested sediment quality thresholds that predict adverse effects in fish.
- Examination of the chemical concentrations in *Macoma* tissue relative to the chemical concentrations in sediment indicates that bioaccumulation of chemicals is occurring at NASSCO and Southwest Marine.

A.1 Background Sediment Quality Conditions

Background sediment chemistry conditions for San Diego Bay were established in my March 6, 2002 letter titled "*Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards*" (RWQCB 2002). The San Diego Bay background sediment concentration was set at 1,200 parts per billion (ppb, dry weight) for PAHs and at 200 ppb for PCBs. The background PAH concentration was exceeded at all stations (n = 43) at both NASSCO and Southwest Marine shipyards. The total PAHs concentration at the 43 surface sediment sample locations ranged from 1,900 ppb to 66,000 ppb. Similarly, the PCB background concentration was exceeded at all stations at NASSCO and Southwest Marine shipyards. The total PCB concentrations within the two shipyards ranged from 230 ppb to 7,100 ppb (Exponent 2001b).

A.2 Sediment Quality Thresholds

The sediment chemistry data submitted in Exponent's Technical Memorandum 1 indicates contaminants are present at levels that may be harmful to marine/estuarine fish within the designated study area. Specifically, sediment PAH concentrations exceed a suggested sediment quality threshold of 1,000 ppb for PAHs at every NASSCO and Southwest Marine sample station except for the reference stations (Johnson 2000). Studies conducted in Puget Sound determined that a substantial risk exists for liver disease, spawning inhibition, reduced egg viability and growth inhibition to English sole (*Pleuronectes vetulus*) when PAH concentrations in the sediment exceed the suggested 1,000 ppb PAH threshold (Johnson 2000). Furthermore, studies on chinook salmon (*Oncorhynchus tshawytscha*) resulted in a PCB threshold value of 300 ppb (for total organic carbon (TOC) at 2 percent dry weight) for PCBs (Meador 2000). Of the 43 sample locations analyzed for PCBs at NASSCO and Southwest Marine, the average TOC was 2.13 percent and 38 sample locations exceeded the suggested PCB threshold.

A.3 Bioaccumulation in *Macom*a Tissue

From the 28-day bioaccumulation *Macoma* tissue information submitted by Exponent, a correlation exists between sediment chemical concentrations and tissue bioaccumulation. A good relationship was found between the sediment chemical concentration and *Macoma* tissue concentration for lead and tributyltin, low molecular weight polycyclic aromatic hydrocarbons (LPAHs), high molecular weight polycyclic aromatic hydrocarbons (HPAHs), and PCBs. Based on the *Macoma* test data there is a potential for the contaminants at NASSCO and Southwest Marine Shipyards to move up the food chain to higher receptors such as fish.

B. GUIDELINES FOR ASSESSMENT OF BIOACCUMULATION & RISK TO FISH HEALTH

The purpose of this study is to determine whether sediment contaminants at NASSCO and Southwest Marine cause:

- Bioaccumulation in the tissue of resident fish found within the leaseholds;
- Adverse health impacts on resident fish at NASSCO and Southwest Marine Shipyards when compared against resident fish collected from a reference area in San Diego Bay.

B.1 Workplan

A workplan shall be developed and approved by the Regional Board and the Resource Agencies prior to conducting field-sampling activities. The workplan shall be developed in accordance with the information provided in Sections B.2 through B.7.

B.2 Target Species

From information provided in Myers et al. 1993 and Myers et al. 1994 dealing with San Diego Bay histopathological studies, it appears the fish species with the most predictable relationship between sediment contamination and histopathological effects are the white croaker *(Genyonemus lineatus)* and the black croaker *(Cheilotrema saturnum)*. These species recommendations were also confirmed in a recent phone conversation with Dr. Myers (Myers 2002). Some alternative fish species that may be considered in place of the above mentioned fish include the yellowfin croaker *(Umbrina roncador)* and various species of gobies (Gobiidae).

The diamond turbot (*Hypsopsetta guttulata*), spotted turbot (*Pleuronichthys ritteri*), California halibut (*Paralichthys californicus*), barred sand bass (*Paralabrax nebulifer*), and spotted sand bass (*Paralabrax maculatofasciatus*) were all initially considered for this part of the shipyard evaluation. However, Myers et al. 1993 found these species are less desirable for fish tissue and fish health studies because of their lack of sensitivity and other life history factors.

In Technical Memorandum 4, Exponent proposed to use the Dover sole (*Microstomus pacificus*) as one of the fish species that fit the required characteristics (Exponent 2001c). In multiple fish surveys of San Diego Bay conducted by Dr. Larry Allen between July 1994 and April 1999, Dover sole were not found in any region of the Bay at any time (Allen 1999). Therefore, the Dover sole is probably not a suitable species for fish bioaccumulation and health risk studies in San Diego Bay.

B.3 Number of Species

An appropriate number of fish of each species shall be collected from the NASSCO and Southwest Marine leasehold for the fish bioaccumulation and health risk study (Myers et al. 1993 and Myers et al. 1994). Since the sediment PAH, bioaccumulative metals, and PCB values tend to be higher in certain areas within the NASSCO and Southwest Marine leasehold, the fish collection shall focus on areas where bioaccumulative chemical concentrations in the sediment are significantly higher than other areas within the study area.

B.4 Species Characteristics

For analytical purposes and statistical comparisons, the collected fish should be mature, all of the same species, be of similar length/weight, collected in the same general area, and collected during the same time of the year. Fish age must be accounted for when examining the contaminant induced effects on fish bioaccumulation and fish health risk because age is a risk factor that influences the histopathology (Myers et al. 1993). For age determination, otoliths shall be collected from a subset of the total number of specimens from an entire sampling event for a particular fish species collected at a selected location. Collection methods shall be consistent with the methods described in NOAA's NS&T Technical Memorandum NOS ORCA 71 (NOAA 1993a). The table below describes the age and length at which maturity is expected in the target species.

Species	Spawning Season	Age of Maturity (Years)	Approximate Length (inches) Where Sexual Maturity Begins
White croaker	November – April**	1-4*	5.5 for males** 6 for females**
Black croaker	Late spring – early fall*	No data	10 both sexes*
Yellowfin croaker	Summer*	No data	9 both sexes*
Gobies	Species dependent	Species dependent	Species dependent
Barred sand bass	April – November**	3-5**	7-10.5 both sexes**
Spotted sand bass	May – September**	1-1.4**	7.8 males 6.7 females **

(*Love 1996)
(**Leet et al. 2001)

B.5 Analysis

Fish health indices (i.e., biomarkers) shall be proposed for each of the fish species listed in Section B.4. Examples of potential biomarkers include examination of histopathological liver lesions, examination of histopathological kidney lesions, gonad lesions, and/or analyses of the metabolites in fish bile. The proposed biomarkers will be reviewed and approved by the Regional Board and the Resource Agencies.

Whole body chemical analysis and lipid analysis shall also be a part of the fish tissue bioaccumulation and health risk study. Whole body analysis for all of the contaminants of concern shall be conducted to assess the exposure to predatory fish by their prey, smaller fish. Lipid analysis also shall be done for this assessment because the lipid content of fish influences accumulation of lipophilic contaminants. With both lipid data and organic carbon concentrations in the sediments, accumulation factors (Biota Sediment Accumulation Factors or BSAFs) can be estimated. Collection of tissue for the whole body chemical analysis and lipid analysis shall be consistent with methods outlined in NOAA's National Status and Trends Program for Marine Environmental Quality (NS&T) Technical Memorandum NOS ORCA 71 (NOAA 1993a). Modifications to the recommended protocols shall be explained and supported by relevant literature citations.

B.6 Reference Station Comparison

For comparisons against the fish collected within the leasehold of NASSCO and Southwest Marine, an appropriate number of fish of one or more of the selected species shall be collected in the general vicinity of one of the reference stations. Based on information in Exponent's

Technical Memorandum 1, the reference stations with the lowest concentrations of PCBs and PAHs are Reference Stations 1 and 5 (Exponent 2001b). Reference Station 1 is more similar to the shipyard sediment in grain size (40.8% fine grains) than Reference Station 5 (28.0% fine grains). Based on the sediment chemistry data and the grain size characteristics, Reference Station 1 or Reference Station 5 shall be used as the reference area for the fish bioaccumulation and health risk study. The reference station selection should take into account the target species and their habitat preferences at the time of the field collection.

B.7 Evaluation Approach

An initial scoping phase shall be conducted at NASSCO and Southwest Marine to determine if the target fish species are appropriate and are available at the proposed time of collection in sufficient numbers to meet the requirements provided in these guidelines. It is recognized that collecting an appropriate number of the target fish species may prove a challenge because of the patterns and life history of fish living within NASSCO and Southwest Marine leasehold. A reasonable effort shall be made to collect the target species. Determination of a reasonable effort will be made by Regional Board staff in consultation with Dr. Michael Martin and Dr. Robert Lea, DFG. Factors to be considered in determining if sufficient collection effort has been made by NASSCO and Southwest Marine will include:

- Expertise of consultants with collection of marine and estuarine fish
- Methods used in collection
- Time of year sampling occurs
- Number of sampling efforts
- Duration of sampling efforts

If the initial scoping phase determines that the recommended croaker or gobiide species listed in Section B.2 are not present in sufficient numbers, an alternative fish evaluation shall be conducted. The alternative evaluation shall use either the barred sand bass (*P. nebulifer*) or the spotted sand bass (*P. maculatofasciatus*) and the analyses described in Sections B.4 and B.5 shall be conducted on these alternative target species.

If you have any questions, or require additional assistance, please contact Alan Monji of my staff at (858) 637-7140 or Mr. Tom Alo of my staff at (858) 636-3154.

Sincerely,

JOHN H. ROBERTUS
Executive Officer

JHR:dtb:tca:atm

cc: Dr. Michael Martin, California Department of Fish and Game
Mr. Scott Sobiech, U.S. Fish and Wildlife
Dr. Michael Anderson, Department of Toxic Substances Control - Human and Ecological Risk Division
Ms. Denise Klimas, National Oceanic and Atmospheric Administration

C. REFERENCES

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RWQCB. 2002. Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards. California Regional Water Quality Control Board, San Diego Region.

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March 6, 2002

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Mr. Sandor Halvax
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Dear Mr. Chee and Mr. Halvax:

BACKGROUND REFERENCE CONDITIONS FOR ASSESSMENT AND REMEDIATION OF CONTAMINATED SEDIMENTS AT NASSCO AND SOUTHWEST MARINE SHIPYARDS

As you know by letter dated June 1, 2001, I directed NASSCO and Southwest Marine to conduct a contaminated sediment investigation in accordance with the attached document, *"Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards, June 1, 2001."* These guidelines require that NASSCO and Southwest Marine evaluate the feasibility of various cleanup alternatives including complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).

The Regional Board has historically used sediment chemistry concentrations at off-site reference station(s) as a surrogate for characterizing background water quality conditions in sediment cleanup investigations. The focus on sediment chemistry for defining background water quality conditions is based on several factors:

- Pollution effects from contaminated sediment extend beyond those associated with sediment – derived pollutants in the water column or sediment pore water. Pollutants in the sediment itself, as measured by sediment chemistry, can lead to toxic and bioaccumulation effects from sediment ingestion and direct contact with contaminated sediment particles.

- Sediment chemistry concentrations are preferred over water quality concentrations because they are less variable spatially and temporally.
- The definition of background water quality conditions establishes the benchmark for complete removal of all of the waste discharged and sediment chemistry is an important consideration in determining this benchmark.

The Regional Board, with the assistance of the Southern California Coastal Water Research Project (SCCWRP), has identified a new set of reference sites in San Diego Bay from the 1998 Southern California Bight Regional Monitoring Project (Bight'98). These reference sites can be used to establish an expanded definition of background water quality conditions in terms of sediment chemistry, toxicity, and benthic community structure. The criteria used to select the Bight'98 reference stations are summarized in the attached document.

We have determined, based on the reasons described in the attached document, that the background water quality conditions defined by the Bight'98 reference sites should replace the original background water quality conditions defined by reference station REF-03. Accordingly, pursuant to Directive No. 2 of Resolution Nos. 2001-02 and 2001-03, the Bight'98 reference sites shall serve as the "Background Reference Stations" representing background conditions at NASSCO and Southwest Marine. Furthermore, NASSCO and Southwest Marine shall direct their site-specific studies in accordance with the following newly defined background conditions for sediment chemistry, toxicity, and benthic community structure:

Contaminant[a]	**Background Sediment Concentrations Dry Weight (mg/kg) (Upper 95% Confidence Interval)**	**Expected Background Toxicity Conditions**[b]	**Expected Background Benthic Community Conditions**
Copper	84	Amphipod Survival Rate Between 89%-96%	Data Not Yet Available[c]
Zinc	142		
Lead	31		
PCBs	<0.20[d]		
Mercury	0.39		
Arsenic	11		
Cadmium	0.21		
Chromium	46		
Nickel	17		
Silver	0.72		
PAHs	1.2		

(a) Contaminants listed are associated with shipbuilding and repair activities believed to be present in bay sediment. It should be noted that butyltin species, polychlorinated triphenyls, and total petroleum hydrocarbons (also associated with shipbuilding and repair activities) are not listed because Bight'98 did not analyze for these contaminants.
(b) Based on cleanup to the background sediment concentrations determined by the Bight'98 reference sites.
(c) It is anticipated that analysis of the Bight'98 benthic data will be completed in February 2002.
(d) The laboratory is currently reevaluating the analytical data for PCBs due to detection limit issues. The sediment background concentration for PCBs is considered an interim value until these issues are resolved.

If you have any questions, or require additional assistance, please contact Mr. Tom Alo of my staff at (858) 636-3154.

Sincerely,

JOHN H. ROBERTUS
Executive Officer

JHR:dtb:tca

Attachment: Background Water Quality Conditions for NASSCO and Southwest Marine Shipyards as Determined by Reference Station REF-03 and Bight'98 Reference Sites

NASSCO File No.:	03-0066.05
Southwest Marine File No.:	03-0137.05

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ATTACHMENT

BACKGROUND WATER QUALITY CONDITIONS FOR NASSCO AND SOUTHWEST MARINE SHIPYARDS AS DETERMINED BY REFERENCE STATION REF-03 AND BIGHT'98 REFERENCE SITES

I. Introduction

Elevated levels of pollutants exist in the bay bottom sediments adjacent to NASSCO and Southwest Marine shipyards. The concentrations of these pollutants cause or threaten to cause a condition of pollution that harms aquatic life beneficial uses designated for San Diego Bay. The concentrations of these pollutants may also present aquatic-dependent wildlife and human health risks from exposure to pollutants through the food chain attributable to the contaminated sediment.

The Regional Board is requiring NASSCO and Southwest Marine shipyards to perform an investigation to determine the nature and extent of the waste discharges, the biological effects and human health risk associated with bay sediments containing pollutants resulting from the discharges, and appropriate cleanup and abatement measures. The investigation will include an evaluation of the feasibility of various cleanup alternatives including complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).

The Regional Board, with the assistance of the Southern California Coastal Water Research Project (SCCWRP), has identified a set of reference sites in San Diego Bay that can be used to establish an expanded definition of background water quality conditions in terms of sediment chemistry, toxicity, and benthic community structure. The objectives of this document are to:

- Describe the basis for the Regional Board's requirement under State Water Resources Control Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304,* to evaluate the alternative of complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).
- Provide a description of the methodology used to select Reference Station REF-03 as the reference station that was representative of background sediment chemistry concentrations for NASSCO and Southwest Marine.
- Provide a summary of the criteria used to select a subset of Bight'98 reference stations to determine alternate background sediment chemistry concentrations for NASSCO and Southwest Marine.
- Discuss the rationale for replacing the original definition of background water quality conditions defined by Station REF-03 with the background water quality conditions defined by the Bight'98 reference sites.

II. Cleanup to Attain Background Water Quality Conditions

The Regional Board designates cleanup levels for contaminated bay sediment sites in accordance with State Water Resources Control Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304.* Resolution No. 92-49 is a state policy that establishes policies and procedures for investigation and cleanup and abatement under Water Code Section 13304. The Resolution establishes the basis for determining cleanup levels of waters of the State and sediments that impact waters of the State.

Resolution No. 92-49 provides that dischargers are required to cleanup and abate the effects of discharges… "in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored...". Alternative cleanup levels less stringent than background must, among other things, not unreasonably affect present and anticipated beneficial uses of waters of the State. The Resolution also includes procedures to investigate the nature and horizontal and vertical extent of a discharge and procedures to determine appropriate cleanup and abatement measures.

Under the terms of Resolution 92-49 the Regional Board is required to have a presumptive cleanup goal to require cleanup to attain background water quality conditions. The Regional Board will establish a cleanup level above background water quality conditions, only if the Board determines that it is technologically or economically infeasible to achieve background water quality conditions. If the Regional Board makes such a determination, the Board will then select a cleanup level that is based on the lowest levels which are technologically or economically achievable and that will not unreasonably affect present and anticipated beneficial uses of waters of the Region. This approach provides for determining and establishing a level of water quality protection, which is reasonable without allowing or causing an unreasonable effect on water quality.

Under the terms of Resolution No. 92-49, the Regional Board is requiring NASSCO and Southwest Marine to evaluate the feasibility of various cleanup alternatives including complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge). The Regional Board has historically used sediment chemistry concentrations at off-site reference station(s) as a surrogate for characterizing background water quality conditions in sediment cleanup investigations. The focus on sediment chemistry for defining background water quality conditions is based on several factors:

- Pollution effects from contaminated sediment extend beyond those associated with sediment – derived pollutants in the water column or sediment pore water. Pollutants in the sediment itself, as measured by sediment chemistry, can lead to toxic and bioaccumulation effects from sediment ingestion and direct contact with contaminated sediment particles.
- Sediment chemistry concentrations are preferred over water quality concentrations because they are less variable spatially and temporally.
- The definition of background water quality conditions establishes the benchmark for complete removal of all of the waste discharged and sediment chemistry is an important consideration in determining this benchmark.

III. Criteria Used to Select Reference Station REF-03

The Regional Board considered the use of three reference stations (REF-01, REF-02, and REF-03) as the background reference station. These reference stations are designated as NPDES sampling locations for all shipyard and boatyard facilities located in San Diego Bay and are located in areas that would not be influenced by shipyard discharges. Reference station REF-01 is located on the west side of San Diego Bay off the Naval Ocean Systems Center pier, reference station REF-02 is located on the north side of San Diego Bay at the Cortez Marina in Harbor Island's west basin, and reference station REF-03 is located on the northeast side of San Diego Bay at the end on the Broadway pier.

The Regional Board conducted a statistical analysis using the Student's t-test to compare the sediment conditions from the three NPDES reference stations to the sediment conditions at NASSCO and Southwest Marine from urban runoff. Sediment conditions from urban runoff is evaluated on a yearly basis at NASSCO and Southwest Marine as required by the NPDES monitoring programs for the shipyards. Station NSS-STD-01 is sampled in the vicinity of stormdrain SW-9 and is located on the south side of the NASSCO facility near Chollas Creek. Station SWM-STD-01 is sampled in the vicinity of stormdrain SW-4 and is located near the bulkhead between Piers 3 and 4 at Southwest Marine.

The objective of the statistical analysis was to identify a reference station that most closely represents sediment conditions that would exist within the NASSCO and Southwest Marine leaseholds prior to waste discharges (per Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*). The sediments in the vicinity of NPDES stations NSS-STD-01 and SWM-STD-01 are assumed to be mostly affected by watershed runoff and have minimal influence by shipyard discharges. The contaminants that were used in the statistical analysis consist of five metals (copper, zinc, mercury, lead, and TBT) and five PAHs (pyrene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perlyene, and chrysene).

Based on the results of the statistical analysis, the sediment chemistry at reference station REF-03 had the least number of chemicals (3 of 10 chemicals) that were statistically different when compared to the sediment chemistry at NPDES stations NSS-STD-01 and SWM-STD-01. Consequently, REF-03 was selected as the background reference station. A summary of the statistical analysis is provided in Appendix E of the February 16, 2001 Regional Board report titled *Final Regional Board Report, Shipyard Sediment Cleanup Levels, NASSCO and Southwest Marine Shipyards, San Diego Bay.*

The sediment from reference station REF-03 is monitored on a semiannual basis as required by the NPDES permit for the shipyards. The results of 13 rounds of sediment sampling were used to calculate the weighted average background levels. Weighted averages were used to account for the historical data collected from the NPDES monitoring programs. Sediment data collected within 2 years were given twice the weight of data collected greater than 2 years. The background sediment levels are shown below.

Contaminant	REF-03 Background Sediment Concentrations Dry Weight (mg/kg)
Copper	87.5
Zinc	139
Lead	41
PCBs	0.12
Mercury	0.57

IV. Criteria Used to Select Bight'98 Reference Stations

Recently, sediment quality triad data from the 1998 Southern California Bight Regional Monitoring Project (Bight'98) became available to the Regional Board. Bight'98 is part of an effort to provide an integrated assessment to determine the spatial extent and magnitude of ecological disturbances on the mainland shelf of the Southern California Bight and is an expansion of the 1994 Southern California Bight Pilot Project (Bight '94). The triad of data from the Bight'98 study includes synoptic measurements of sediment chemistry, toxicity, and benthic infauna. The Regional Board, with the assistance of the Southern California Coastal Water Research Project (SCCWRP), identified a subset of reference sites in San Diego Bay from the Bight'98 study and consequently developed alternate sediment background concentrations for NASSCO and Southwest Marine. The screening criterion used to select the subset of Bight'98 reference stations is detailed below.

Candidate reference sites were selected using the results of the Bight'98 monitoring survey. Forty-six randomly selected stations in San Diego Bay were sampled during Bight'98 and analyzed for sediment characteristics, chemistry, toxicity, and benthic infauna (Figure 1). A stepwise screening method was conducted in three phases in order to obtain a pool of candidate sites representing a range of habitat characteristics and locations. An overview of the Bight'98 reference station selection process is shown on Figure 2.

In phase I, all 46 Bight'98 stations were evaluated on the basis of desired habitat characteristics, lack of acute toxicity, low overall contamination (mean Effects Range Median [ERM] quotient), and diverse benthic infauna. The phase I selection process identified five of the cleanest stations (level 1) among the Bight'98 data set; however, the grain size (10-49% fines) of these stations were relatively restricted (Table 1). The phase I screening steps were:

1. Select stations with grain size (% silt + clay) characteristics that were within the range present at the study sites (NASSCO fines 4%-85% and Southwest Marine fines 2%-87%).
2. Of the remaining stations, select only stations with no toxicity to amphipods.
3. Of the remaining stations, select one third of the stations with the lowest overall contamination level (mean ERM quotient <0.13). The ERM quotient value of 0.13 was selected because it represented the boundary for the cleanest 1/3 of the stations. In comparison to the mean ERM quotient classifications published by Long and MacDonald (*1998. Predicting the toxicity in marine sediments with numerical sediment quality guidelines. Environmental Toxicology and Chemistry 17, 4.*), the quotient value of 0.13 falls into the "medium-low" priority classification (0.11 – 0.50). The "medium-low" classification indicates that there is a 30% probability that the sediment is toxic based on amphipod survival tests. The "low" priority classification is <0.10, which indicates that there is a 12% probability that the sediment is toxic based on amphipod survival tests.
4. Of the remaining stations, select the five that contain the greatest diversity of infauna (>50 species per sample). These five stations were identified as phase I stations. Analysis of the benthic community data for Bight'98 has not been completed, so the relationship between specific indicators of benthos condition in the bay (e.g., diversity and abundance) and contaminant impact is not known. For the purposes of this analysis, it was assumed that the least impacted stations in the bay would contain the greatest number of species.

The phase II selection procedure was applied in an effort to identify potential reference stations containing finer grain size characteristics. This process differs from phase I in that only stations containing relatively high % fines were included and the criteria for contamination level and species diversity were modified in order to retain a sufficient number of stations (5) for further evaluation. The phase II screening steps were:

1. Select stations with grain size in the upper range of that present at the study site (51-87%).
2. Of the remaining stations, select only stations with no toxicity to amphipods.
3. Of the remaining stations, select one third of the stations with the lowest overall contamination level (mean ERM quotient <0.20). The ERM quotient value of 0.20 was selected because it represented the boundary for the cleanest 1/3 of the stations. In comparison to the mean ERM quotient classifications published by Long and MacDonald (1998), the quotient value of 0.20 falls into the "medium-low" priority classification (0.11 – 0.50).
4. Of the remaining stations, select the five that contain the greatest diversity of infauna (>40 species per sample). These five stations were identified as phase II stations.

None of the stations selected in phases I or II were located in the central portion of San Diego Bay. A third selection round was then conducted in order to identify candidate reference sites in the central portion of San Diego Bay. The 16 Bight' 98 stations in this region were screened using the following steps:

1. Select stations with grain sizes that were within the range present at the study sites.
2. Of the remaining stations, select only stations with no toxicity to amphipods.
3. Of the remaining stations, select the stations with the lowest overall contamination level (mean ERM quotient <0.20). The ERM quotient value of 0.20 was selected because it represented the boundary for the cleanest 1/3 of the stations. In comparison to the mean ERM quotient classifications published by Long and MacDonald (1998), the quotient value of 0.20 falls into the "medium-low" priority classification (0.11 – 0.50).
4. Of the remaining stations, select the five that contain the greatest diversity of infauna (>39 species per sample). These five stations were identified as phase III stations.

The locations of the phase I, II, and III stations are shown in Figure 3. The characteristics of these stations are summarized in Table 1.

A subset of 12 stations from Table 1 is recommended for use in determining the background sediment chemistry concentrations for the NASSCO and Southwest Marine sites. The recommended stations were selected to best satisfy the objectives of varied characteristics, multiple locations within the bay, low contaminant concentrations, low toxicity, and healthy benthos.

Three of 15 candidate stations that are not recommended for use had characteristics that were deemed somewhat undesirable. Station 2225 was located in a marina (potential impacts from boating activities), station 2442 had a relatively high PAH concentration (4,950 micrograms per kilogram), and station 2238 was located in an area that may be influenced by the South Bay Power Plant.

The background sediment chemistry concentrations for NASSCO and Southwest Marine were calculated using the upper 95% confidence interval of the mean values of the 12 reference sites. The background concentrations for the chemicals of concern are shown below (mean and upper 95% confidence interval).

Contaminant[a]	Mean (Bight'98 Data) Dry Weight (mg/kg)	Upper 95% Confidence Interval (Bight' 98 Data) Dry Weight (mg/kg)
Copper	46	84
Zinc	87	142
Lead	19	31
PCBs	--	<0.20[b]
Mercury	0.20	0.39
Arsenic	5.2	11
Cadmium	0.08	0.21
Chromium	25	46
Nickel	7.9	17
Silver	0.30	0.72
PAHs	0.24	1.2

(a) Contaminants listed are associated with shipbuilding and repair activities believed to be present in bay sediment. It should be noted that butyltin species, polychlorinated triphenyls, and total petroleum hydrocarbons (also associated with shipbuilding and repair activities) are not listed because Bight'98 did not analyze for these contaminants.
(b) The laboratory is currently reevaluating the analytical data for PCBs due to detection limit issues. The sediment background concentration for PCBs is considered an interim value until these issues are resolved.

V. Rationale for Replacing Original Background Concentrations

The Regional Board has determined based on the reasons described below that the background sediment chemistry concentrations defined by the Bight'98 reference sites should replace the original background sediment chemistry concentrations defined by REF-03.

- *Toxicity and Benthic Infauna Data.* REF-03 was one of three NPDES reference locations considered by the Regional Board during reference station selection (detailed in the February 16, 2001 Regional Board report titled *Final Regional Board Report, Shipyard Sediment Cleanup Levels, NASSCO and Southwest Marine Shipyards, San Diego Bay*). REF-03 was selected based solely on chemistry data. The NPDES monitoring program for all shipyard and boatyard facilities does not require collection of toxicity and the benthic infauna data at the three NPDES reference locations. Accordingly, this information was not available for use in the reference station selection. Collection of synoptic measurements of sediment chemistry, toxicity, and benthic infauna (triad approach) is essential to assess the relative quality of sediments and to determine whether impacts are related to chemical contamination. Each component of the triad complements the other two and together all three components provides an integrated assessment of the quality of the sediment. Without the triad of data it is difficult to draw conclusions on the presence or absence of toxicity and on the condition of benthic communities at REF-03, and whether these biological effects, if present, are due to pollutant concentrations or confounding effects (e.g., elevated ammonia concentrations, propeller wash, etc.). Consequently, NASSCO and Southwest Marine should use the Bight'98 data to represent background water quality conditions because: (1) The triad approach was incorporated into the study, (2) Supporting data indicates low toxicity and healthy benthic communities at the recommended background stations, and (3) The triad of data would allow the Regional Board to define background water quality conditions in terms of sediment chemistry, toxicity, and benthic community structure. Cleanup to the Bight'98 sediment concentrations would likely result in sediment conditions having a mean amphipod survival rate between 89%-96% (using a 95% confidence interval) in 10-day amphipod tests (representative of low toxicity).

The background condition for the benthic community cannot be defined at this time because analysis of the Bight'98 benthic data has not been completed. It is anticipated that the analysis will be completed in February 2002. Additionally, the Bight'98 program is currently developing a Benthic Response Index (BRI) for bays and harbors, which will likely be used to define the benthos background conditions in San Diego Bay. This document will be modified to include this information when the benthic data becomes available.

- *Grain Size Distribution.* The grain size distributions at NASSCO (sampled on 10/15/98) and Southwest Marine (sampled on 6/10/99) range from 2%-87% for fine-grained sediments and 13%-98% for coarse-grained sediments. In order to account for this spatial variability multiple reference locations with similar grain size distributions must be identified and potentially used to represent background conditions for the two shipyards. The current background sediment chemistry concentrations established for NASSCO and Southwest Marine are based on a single sampling location (REF-03) that has a specific grain size characteristic (65% fine-grained and 35% coarse-grained, as sampled on 10/15/98). Consequently, NASSCO and Southwest Marine should use the Bight'98 data to represent background conditions because the 12 recommended reference stations more closely represent the shipyard's sediment grain size distribution.

VI. Background Conditions to be used in NASSCO and Southwest Marine Sediment Study

Based on the foregoing, the Bight'98 reference sites should serve as the "Background Reference Stations" representing background water quality conditions at NASSCO and Southwest Marine. Furthermore, NASSCO and Southwest Marine should direct their site-specific studies in accordance with the newly defined background conditions. The final background conditions for NASSCO and Southwest Marine as defined by sediment chemistry, toxicity, and benthic community structure are as follows:

Contaminant[a]	Background Sediment Concentrations Dry Weight (mg/kg)	Expected Background Toxicity Conditions[b]	Expected Background Benthic Community Conditions
Copper	84	Amphipod Survival Rate Between 89%-96%	Data Not Yet Available[c]
Zinc	142		
Lead	31		
PCBs	<0.20[d]		
Mercury	0.39		
Arsenic	11		
Cadmium	0.21		
Chromium	46		
Nickel	17		
Silver	0.72		
PAHs	1.2		

(a) Contaminants listed are associated with shipbuilding and repair activities believed to be present in bay sediment. It should be noted that butyltin species, polychlorinated triphenyls, and total petroleum hydrocarbons (also associated with shipbuilding and repair activities) are not listed because Bight'98 did not analyze for these contaminants.

(b) Based on cleanup to the background sediment concentrations determined by the Bight'98 reference sites.

(c) It is anticipated that analysis of the Bight'98 benthic data will be completed in February 2002.

(d) The laboratory is currently reevaluating the analytical data for PCBs due to detection limit issues. The sediment background concentration for PCBs is considered an interim value until these issues are resolved.

Table 1. Characteristics of candidate reference sites for San Diego Bay[(1)]. The characteristics of the NASSCO and Southwest Marine study sites are also shown.

Station/ Area	Level	% Fines	Cu mg/kg	Zn mg/kg	Pb mg/kg	PCBs ug/kg	Hg mg/kg	ERMq[(2)]	# Species
NASSCO		2-87							
Southwest Marine		4-85							
2435	1	49	28.4	64.4	7.10	<20	0.123	0.07	59
2229	1	43	58.9	99.3	24.5	<20	0.315	0.12	62
2440	1	38	41.8	81.1	20.6	<20	0.235	0.09	58
2230	1	10	16.1	38.3	10.8	<20	0.379	0.06	71
2231	1	31	58.1	92.5	21.6	<20	0.224	0.10	70
2441	2	79	71.8	123	21.9	<20	0.190	0.13	84
2225*	2	57	127	130	22.1	<20	0.691	0.19	69
2442*	2	79	77.7	139	21.1	<20	0.176	0.14	52
2238*	2	57	55.1	143	18.1	<20	0.169	0.12	41
2433	2	71	71.6	126	21.0	<20	0.263	0.14	58
2241	3	18	59.2	103.7	26.3	<20	0.213	0.16	44
2244	3	20	41.8	82.4	15.4	<20	0.177	0.12	48
2265	3	13	18.0	43.2	12.0	<20	0.065	0.06	48
2243	3	35	38.8	81.2	19.9	<20	0.239	0.09	47
2240	3	44	47.4	103	22.5	<20	0.263	0.11	40

* Stations 2225, 2442, and 2238 were not used to calculate the background concentrations (mean and upper 95% confidence interval).

(1) The Bight'98 data (% fines, chemistry, and # species) presented in this table are not final values until they are made public by the Bight'98 Steering Committee. As such, these values are subject to change.

(2) ERM quotient values were calculated using chemicals that have published ERM values (Long et. al., 1995).

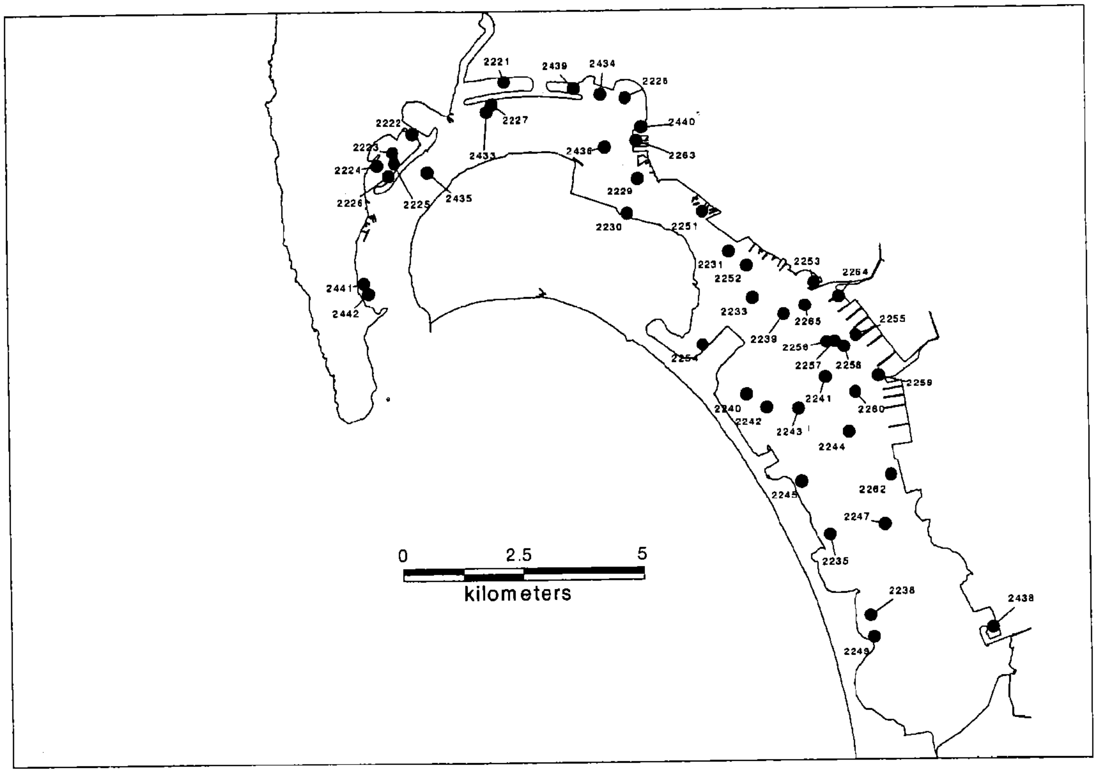

Figure 1 - Location of San Diego Bay stations analyzed as part of the Bight'98 regional survey.

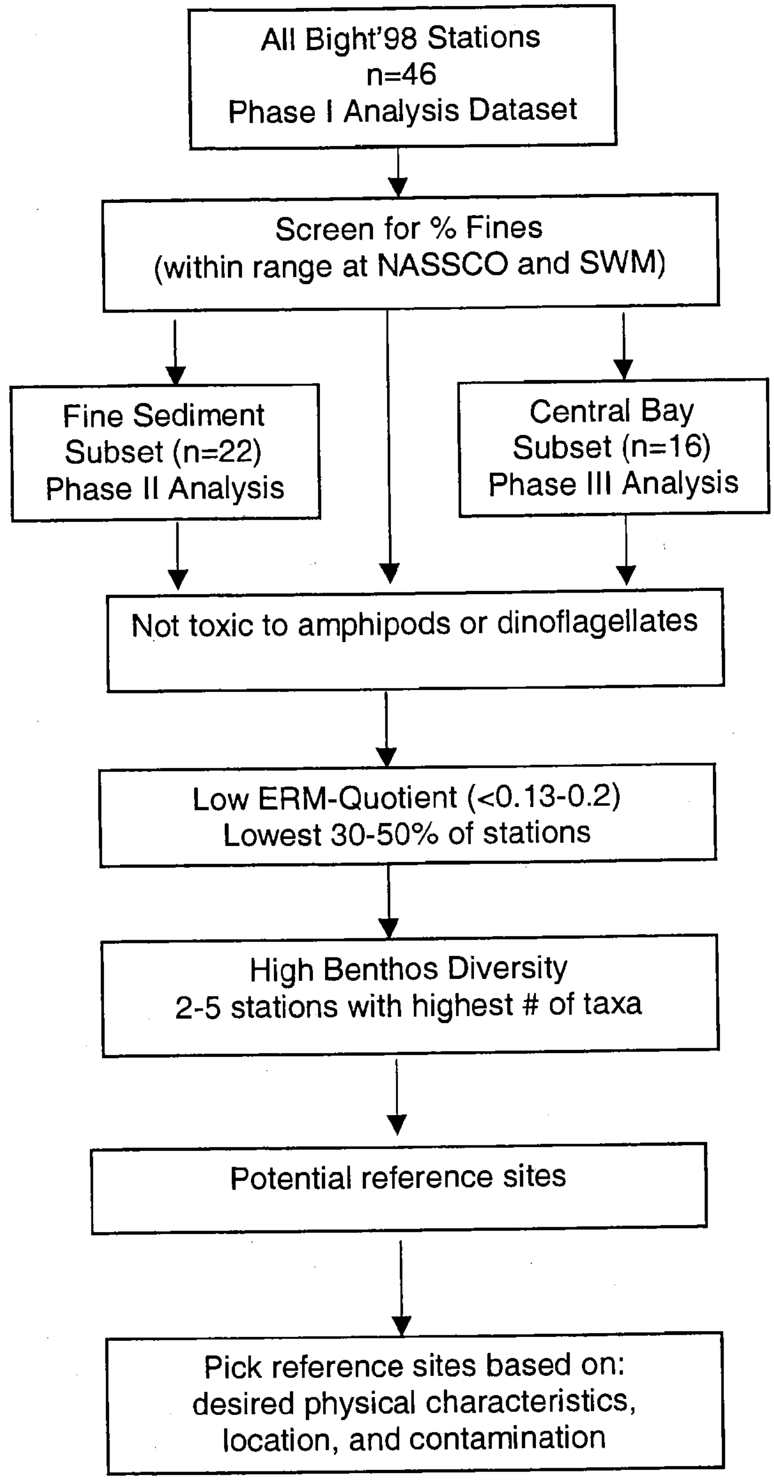

Figure 2 - Overview of reference site selection process. The selection process was applied to three groups of Bight'98 stations from San Diego Bay.

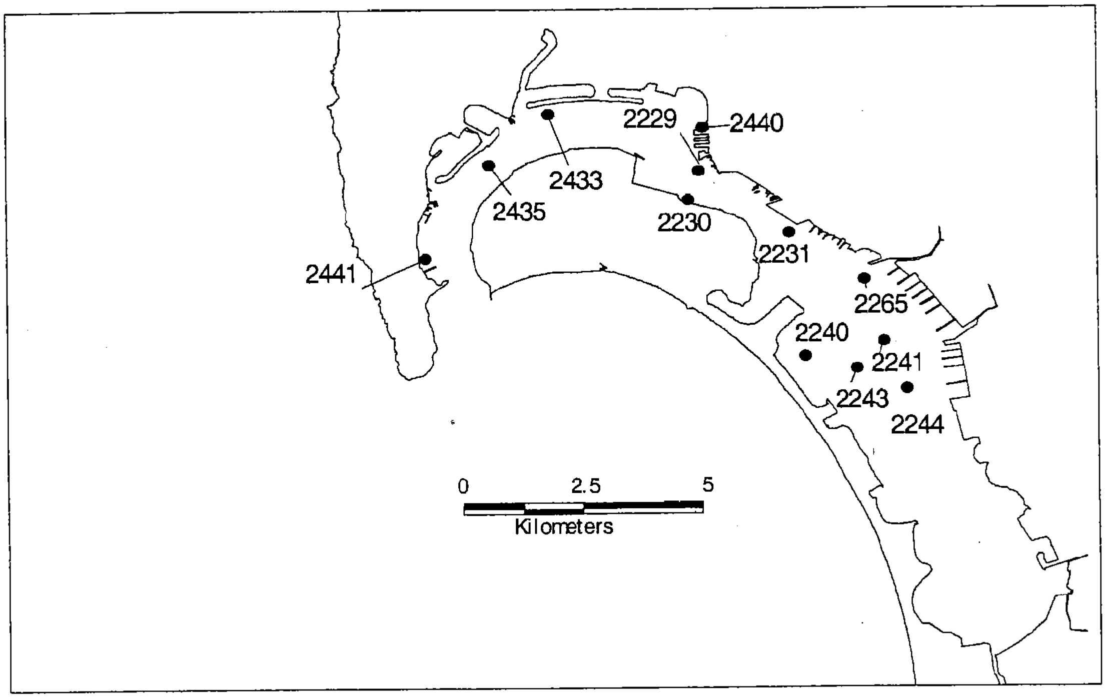

Figure 3 - Location of 12 recommended Bight'98 stations for use in defining background conditions for the NASSCO and Southwest Marine sediment study.

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Table 9. Fish and invertebrate species by study[a]

Tissue Study	Receptor	Fish Tissue: Primary target species	Fish Tissue: Alternate target species	Invertebrates
Fish histopathology[b]	NA	White croaker, black croaker	Goby, barred sand bass, spotted sand bass	
Ecological risk assessment[c]	Large piscivorous birds (California brown pelican, western grebe), cormorant	Goby, croaker[d]	Sand bass[d], Pacific sardine, small perch, herring, Northern anchovy, topsmelt	
	Small piscivorous birds	Goby, Pacific sardine	Small perch, herring, northern anchovy, topsmelt	
	Benthivorous birds (surf scoter)			Benthic mussel soft tissue
	Marine mammals (California sea lion)	Goby, white croaker, black croaker	Barred sand bass, spotted sand bass	
Human health risk assessment[e]	Humans	White croaker, black croaker	Barred sand bass, spotted sand bass, black and barred surfperch, halibut, corbina, Scorpaenidae (scorpionfish, rockfish, and bocaccio), turbot	Crab (or lobster) edible tissue and whole body

Note: NA - not applicable

[a] In addition to the animal tissue shown in this table, eelgrass will be collected to evaluate exposure to sea turtles.

[b] Histopathological analyses will consist of examination of fish gill, liver, kidney, and gonad. External lesions will also be noted and bile analyzed for fluorescent aromatic compounds.

[c] Data from whole body analyses will be used for the ecological risk assessment.

[d] Within the appropriate prey size range for the receptor.

[e] Data from both whole body and fillet analyses will be used for the human health risk assessment.

California Regional Water Quality Control Board
San Diego Region

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November 14, 2002

CERTIFIED-RETURN RECEIPT REQUESTED
7099 3400 0015 9996 9952

Ms. Laura Hunter
Environmental Health Coalition
1717 Kettner Boulevard, #100
San Diego, CA 92101

CERTIFIED-RETURN RECEIPT REQUESTED
7099 3400 0015 9997 0132

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

Dear Ms. Hunter and Mr. Reznik:

REGIONAL BOARD RESPONSE TO COMMENTS ON AUGUST 28, 2002 LETTER FROM SAN DIEGO BAY COUNCIL REGARDING THE NASSCO AND SOUTHWEST MARINE DRART PHASE 2 FIELD SAMPLING PLAN

As you know, on August 22, 2002 the Regional Board held a stakeholder group meeting to discuss the NASSCO and Southwest Marine workplan titled *"Draft Field Sampling Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation"* (July 2002). Stakeholders that participated in the meeting included San Diego Bay Council (Environmental Health Coalition, San Diego Chapter of the Sierra Club, and San Diego Audubon Society), NASSCO and Southwest Marine shipyards, Exponent (technical consultant for the shipyards), Department of Fish and Game, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration (NOAA), Office of Environmental Health Hazard Assessment (OEHHA), and the U.S. Navy. The objectives of the meeting were to formally present the draft plan for the final phase of field sampling to the stakeholder group and receive comments.

Because Bay Council was not able to completely review the sampling plan and could not provide final comments at the meeting, the Regional Board allowed Bay Council additional time to review the sampling plan and submit written comments by August 30, 2002. We received your written comments dated August 28, 2002 and have carefully considered your concerns and recommendations. Our responses to your comments are provided below.

1. General objection to stalling the clean up decision in order to conduct expensive risk assessments.

Comment from San Diego Bay Council:
As we have said before, conducting an outrageously expensive risk assessment, designed and executed in a manner that is heavily manipulated to retain uncertainty in the process is unnecessary, of questionable relevance, and is not supported by our organizations. The law is clear. The presumption of cleanup is to background and background is defined by sediment contamination levels already established by staff.

Regional Board Response:
We do not agree with San Diego Bay Council that the human health and ecological risk assessments are heavily manipulated to retain uncertainty in the process. The Regional Board's technical approach to evaluating the fate, transport, and effects of chemicals which potentially bioaccumulate, bioconcentrate, or biomagnify is based upon the most current recommended ecological risk assessment principles, guidance and policies, promulgated by state and national agencies (US EPA, NOAA, DTSC, Department of Fish and Game, OEHHA, and the State Water Resources Control Board). Under this approach, remedial objectives for cleanup of the shipyard contaminated sediments will be evaluated and selected on the basis of conformance with State Board Resolution 92-49 as well as providing protection of human health and the environment. In evaluating risk to human and ecological receptors and beneficial uses of San Diego Bay we will consider selection of alternative remedial actions, which provide a complete and permanent cleanup, and which do not allow the reintroduction of contaminated sediments or associated chemicals. We have also reviewed a significant amount of literature in developing the guidelines for the shipyard sediment assessment. We can provide specific citations and documentation, if there are specific questions or concerns with regard to the ecological risk assessment approach that has been adopted. In addition, as you know, we have been consulting with the Natural Resource Trustee Agencies on a regular basis to ensure that the risk assessments will provide technically valid information to establish sediment cleanup levels protective of the environment and public health.

We agree that the Regional Board must apply State Board Resolution 92-49 when establishing cleanup levels for NASSCO and Southwest Marine. Resolution 92-49 is interpreted to presumptively require cleanup of contaminated sediment to background cleanup levels. However, the resolution is flexible and allows the Regional Board substantial discretion in setting cleanup levels. Cleanup levels less stringent than background levels are permissible if cleanup to background is technologically and economically infeasible and as long as the cleanup levels less stringent than background levels are protective of San Diego Bay beneficial uses. This interpretation is consistent with the legal opinion provided by the State Board's Office of Chief Counsel (OCC) interpreting Resolution 92-49 with respect to contaminated sediments. A copy of OCC's letter is attached.

2. Any recalculation of background should be based on large data sets based on samples taken by independent agencies.

Comment from San Diego Bay Council:
We are concerned about conducting additional testing of the background stations in order to recalculate the background levels already established by the staff. We are concerned about the lack of a clearly stated sampling and analysis objective or disclosure about how this data will be used once collected. Again, we repeat our request that the input of Dr. Russell Fairey be solicited on establishing background levels for the Bay. The BPTCP data set is the largest on the Bay and it included both potential toxic sites and baywide conditions in its sampling design.

Regional Board Response:
The Regional Board has established background sediment chemistry levels using sediment quality data from 12 Bight'98 stations to define background conditions for NASSCO and Southwest Marine shipyards. The background levels and criteria used to select these stations are described in the March 6, 2002 Regional Board letter titled *"Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards"* (attached). In that letter we stated that the background level for total PCBs (<0.02 mg/kg) is considered an interim level until the detection limit issues are resolved with the City of San Diego's laboratory. The laboratory reevaluated the Bight'98 PCB data and determined that the 12 reference stations had PCB concentrations below detection but could not be quantified due to the extraction method used at that time. Consequently, the Regional Board directed NASSCO and Southwest Marine to resample all 12 reference stations and analyze the samples for total PCBs and for the other shipyard chemicals of concern (metals, total PAHs, butyltin species, and total petroleum hydrocarbons). Analyzing the full suite of chemicals rather than just total PCBs provides information on temporal trends and allows the Regional Board the flexibility to use current (and past) data for establishing background sediment chemistry levels for NASSCO and Southwest Marine. The additional sediment quality information is also useful in improving the statistical basis for defining site-specific sediment chemistry background conditions at the shipyard sites.

The determination of background conditions for San Diego Bay to incorporate into sediment cleanup level decisions is an evolving process. We are currently evaluating sediment quality data from several monitoring programs such as the BPTCP and Bight'98 to factor into this determination. We are also in the process of contracting with Southern California Coastal Water Research Project (SCCWRP) to conduct studies to determine naturally-occurring and ambient background conditions in San Diego Bay. Naturally-occurring background refers to the chemical concentrations of sediments prior to the bay's industrialization (i.e., pre-industrial levels) and ambient background refers to "clean" sediments not totally free of anthropogenic inputs (i.e., includes non-point discharges but excludes known point sources). The results of these studies may not be available to incorporate into the current shipyard investigation process. Our current position is that sediment quality data collected from the 12 Bight 98 stations described in our March 6 letter provides the best available information for defining site-specific background conditions at the NASSCO and Southwest Marine shipyard sites.

Our discussions are continuing with Dr. Fairey and others regarding the suitability of the five reference stations used by the shipyards for statistical comparisons. These comparisons will determine whether the sediment quality data collected at the shipyard sites are significantly greater than background conditions. The five reference stations are a subset of the 12 Bight'98 stations used to define background conditions for NASSCO and Southwest Marine shipyards. We are evaluating several approaches to resolve this issue and will keep you apprised of any final decisions we make on this matter.

3. Uptake of contaminants by gobies should be analyzed in the Ecological Risk Assessment.

Comment from San Diego Bay Council:
It is clear that gobies (even though hard to catch) are the most direct link between toxic sediments and the higher trophic levels. Gobies also have the highest site fidelity of all the fish discussed. Therefore, we strongly recommend that they be added to the assessment.

Regional Board Response:
The Regional Board previously reached agreement with the Natural Resource Trustee Agencies that gobies should be included in the ecological risk assessment if they could be found in sufficient numbers and directed NASSCO and Southwest Marine to include gobies as one of the primary target species. We discussed this issue extensively with the Natural Resource Trustee Agencies and the consensus was that the high degree of site fidelity associated with gobies would provide for a more ecologically relevant risk evaluation. The Natural Resource Trustee Agencies also recognized that gobies might not be present in sufficient numbers at the shipyard sites due to the lack of shallow water depths along the shipyard bulkheads. As such, other species were identified as backup species in the event that gobies were found to be present in insufficient numbers. Attached is a table from the final Phase 2 workplan that summarizes the primary and secondary target species for the ecological risk assessment, human health risk assessment, and fish histopathology study. This table was developed in consultation with the Natural Resource Trustee Agencies.

The shipyard's consultant conducted the fish collection fieldwork from September 25-29, 2002 in accordance with the final Phase 2 workplan. The Regional Board and the Department of Fish and Game were present throughout the field activities for observation and decision-making purposes. Various techniques such as otter trawls, beach seines, and fish traps were used to attempt to collect the gobies. Based on the fish collection efforts conducted at the shipyard sites gobies were not found in sufficient numbers for use in the ecological risk assessment. Only one goby was caught near shore within the shipyard leaseholds and no gobies were caught in the outer leasehold. Spotted sand bass, anchovies, and topsmelt were found to be the most abundant species present at the shipyard sites. Accordingly, these species are being used for the ecological risk assessment.

4. Human Health Risk Assessment

Comment from San Diego Bay Council:
In all cases, the Human Health Risk Assessment (HHRA) must assume those consumption patterns and quantities for the subsistence and the most at-risk consumer of fish. We were very troubled to hear the representative of OEHHA state that the assessment should be conducted, not on how people do eat fish but on how they should eat fish. This is completely untenable. In San Diego, we are fortunate to have a large southeast asian immigrant community as well as indigenous, Latinos, and a large community from Africa. Stews, raw and whole fish consumption, and other non-fillet-only based consumption patterns can be found in these communities.

Regional Board Response:
OEHHA is the State of California agency that is responsible for developing and providing risk managers in state and local government agencies with toxicological and medical information relevant to decisions involving public health. One of OEHHA's functions and responsibilities include making recommendations to the State Water Resources Control Board with respect to sport and commercial fishing in areas where fish may be contaminated. Because of OEHHA's technical expertise in public health, the Regional Board relies on their guidance when making decisions on human health risks from pollutants. We are confident that the input we receive from OEHHA is technically valid and highly protective of public health.

To address the concern on the fish dietary intake of ethnic groups, the data from both whole body and fillet analyses will be used for the human health risk assessment. Furthermore, the analyses will include both the edible tissue and whole body for the crab and/or lobsters. Attached is a table from the final Phase 2 workplan that summarizes the primary and secondary target species for the ecological risk assessment, human health risk assessment, and fish histopathology study. This table was developed in consultation with the Natural Resource Trustee Agencies. See Footnote e regarding whole body and fillet analyses.

5. Pore Water should be analyzed as a factor in assessing impacts to beneficial uses.

Comment from San Diego Bay Council:
We believe that violations of water quality standards for pore water constitute a known impact to beneficial uses. We believe that part of the sampling design for Phase 2 should include pore water analysis to determine where pore water exceeds water quality standards. It would be especially

important to conduct pore water samples where the previous data was equivocal i.e. high chemistry and no toxicity.

Regional Board Response:
We have previously provided responses to this comment in our January 15, 2002 letter titled "Regional Board Response to Comments on August 21, 2001 Letter and October 10, 2001 List of Questions from San Diego Bay Council Regarding the NASSCO and Southwest Marine Sediment Investigation Workplan." See Regional Board responses on Comment #2 – Sampling for Dilution Series, Pore Water, and Fish Tissue (August 21, 2001 letter) and Comment #2 – Pore Water Testing, Dilution Series Test (October 10, 2001 letter).

6. Assess liver bile for PAH Metabolites.

Comment from San Diego Bay Council:
While fish histopathology on livers will show long-term and high level impacts of PAH exposure, bile analysis will show lower levels and recent exposure to PAH. This should be conducted on fish that are analyzed.

Regional Board Response:
The Regional Board previously reached agreement with the Natural Resource Trustee Agencies that fish bile analysis should be performed as part of the histopathology study and directed NASSCO and Southwest Marine to include this analysis. We discussed the issue of bile analysis in detail with the Natural Resource Trustee Agencies and the consensus was that fish bile analysis for PAH metabolites is needed to more fully evaluate the potential risk of PAHs to fish and possibly higher trophic level receptors. The fish bile analysis will address the concern whether fish are being exposed to PAHs from the shipyard sites.

7(a). PAH Analysis for EqP

Comment from San Diego Bay Council:
It appears that no EqP will be established for PAH as there are no water quality criteria for PAH. The lack of formal WQC is no excuse to drop analysis of a toxic substance that has severely contaminated and degraded our waterways. There are numbers that should be used for this analysis or very protective numbers could be developed to be used for this purpose.

Regional Board Response:
In our June 1, 2001 guidelines titled *"Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards"* we directed the shipyards to analyze the pore water for PAHs. Page 14 of the guidelines provides that:

*"Pore water samples shall be measured for metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyltin species, PCBs/PCTs, **PAHs**, TPH, and any other chemical constituent associated with shipbuilding and repair activities believed to be present in bay sediment."*

During the August 22 and 23, 2002 meetings we reconfirmed the requirement to sample the pore water for PAHs and requested that the shipyards analyze PAHs in pore water while the Regional Board identify a PAH water quality objective for the protection of aquatic life. We identified a PAH water quality objective of 2.71 micrograms per liter (ug/L) in consultation with staff from the State Water Resources Control Board and the USEPA. This PAH objective was derived from 34 specific PAHs recommended in the USEPA final draft document titled *"Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: PAH Mixtures"* (April 2000). We have directed NASSCO and Southwest Marine to use this total PAH objective when developing PAH cleanup values using the Equilibrium Partitioning approach.

7(b). Impacts from PAHs

Comment from San Diego Bay Council:
There are a lot of impacts from PAH that are getting overlooked in the analysis in Phase 2. First, that PAH are toxic to fish embryos. Second, there is phototoxicity of PAH. Third, there are new biomarkers for PAH. Fourth, there is evidence of endocrine disruption caused by PAH.

Regional Board Response:
We recognize that there are many types of biological indicators that evaluate impacts from PAHs on aquatic life, however, we believe the current indices identified for the shipyard investigation are adequate and will allow us to determine whether PAHs are adversely affecting fish health. These indices were selected in consultation with the Natural Resource Trustee Agencies and consist of histopathological analyses that examine fish bile, gill, liver, kidney, and gonad. Our rationale and guidelines are provided in the July 16, 2002 Regional Board letter titled *"Assessment of Bioaccumulation and Risk to Fish Health from Sediment Contaminants at NASSCO and Southwest Marine Shipyards."* A copy of this letter is attached.

8. Any impacts to RARE species must be elevated as a concern.

Comment from San Diego Bay Council:
The cumulative and incremental risk must be the concern and for rare species, it is even more significant since those are the species that are already close to the brink of extinction from the cumulative impacts. Given the precarious state of the rare species in the bay the standard should be that any impact is significant because it adds to an already unacceptable cumulative burden.

Regional Board Response:
We agree with San Diego Bay Council that cumulative and incremental risk for rare (and endangered) species is of concern. The general approach that the Regional Board has developed for contaminated sediment cleanups in San Diego Bay has multiple elements and actions. It is focused upon the identification and remediation of marine sediment pollutants at specific sites (such as NASSCO and Southwest Marine shipyards). The Regional Board also seeks to identify bay-wide pollution to address the overall and cumulative impact(s) of contaminated sediments to the beneficial uses designated for San Diego Bay.

The shipyard ecological risk assessments are site-specific; however, the risks posed by the added exposure a species could potentially receive from other contaminated sites is being addressed. Cumulative risks are considered in the analysis of fish tissue residues and in the overall bay-wide effort to assess and remediate contaminated sediments. Because fish are highly mobile, especially those typically consumed by rare and endangered species; they are likely being exposed to pollution in multiple areas of the bay. While the tissue residues of these fish are assumed to come from just the subject site (a conservative approach typically used in ecological risk assessments), the tissue residues used in the shipyard study are actually representing cumulative exposure received from other contaminated areas. Thus, the estimated chemical intake for fish-eating receptors of concern (such as the federally endangered California brown pelican and California least tern used in the shipyard risk assessment) accounts for cumulative and incremental risk.

In addition, the Regional Board is fully engaged with obtaining remediation of contaminated sediments in San Diego Bay. The Board has obtained cleanup of contaminated sediments at seven different sites in San Diego Bay over the past 10 years and there are a number of current sites where work towards remediation is progressing. These sites include designated Toxic Hot Spots requiring TMDL development, Department of Defense sites, and a number of bayfront private industries. The aggregate effect of remediation at these sites (and at future sites) will further assure the full protection of aquatic-dependent wildlife (including threatened and endangered species).

With respect to NASSCO and Southwest Marine shipyards, the Regional Board supports the approach for cumulative and incremental risk assessment for fully protected species through the following process. The federal and state natural resource trustee agencies (and other experts) have provided information, consultation, and professional advice on federally/state listed threatened and endangered species and habitats of concern in/adjacent to the shipyard leaseholds. This information has been evaluated and used in the development of the ecological risk assessment, including the selection of receptors of concern, exposure assessment data, field sampling plans, and evaluation of chemicals of concern. The Regional Board will continue to coordinate and consult with the Federal/State natural resource trustees on further decisions and interpretations of risk assessment data, as the risk assessment evaluation continues. We will consult with and discuss potential cleanup alternatives, and consider the Federal/State recommendations for cleanup selection for the protection of threatened and endangered species. With early and complete coordination with the Federal/State natural resource trustees, we believe that consultation/assessment/ integration of measures and alternatives in the site cleanup can be incorporated to provide complete protection to, and not lead to further decline of, the species of concern (e.g., non-jeopardy opinion). This opinion by the trustees will involve consideration of both the direct project effects to the species as well as its habitat. Concurrence by the Federal/State natural resource trustees will be, in part, based upon the adequacy and robustness of the ecological risk assessment in its consideration of the potential effects of contaminated sediment exposure from NASSCO and Southwest Marine shipyards.

Should you have any questions, or require additional information, please contact either Mr. Tom Alo of my staff at (858) 636-3154 or Mr. Alan Monji of my staff at (858) 637-7140.

Sincerely,

JOHN H. ROBERTUS
Executive Officer

JHR:dtb:clc:tca

Attachments: Applicability of State Board Resolution 92-49 in Setting Sediment Cleanup Levels. State Water Resources Control Board Office of Chief Counsel. February 22, 2002.

Assessment of Bioaccumulation and Risk to Fish Health from Sediment Contaminants at NASSCO and Southwest Marine Shipyards. Regional Water Quality Control Board – San Diego Region. July 16, 2002.

Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards. Regional Water Quality Control Board – San Diego Region. March 6, 2002.

Table 9 – Fish and Invertebrate Species by Study from final workplan titled *"Field Sampling Plan Addendum for the NASSCO and Southwest Marine Detailed Sediment Investigation."* Exponent. September 2002.

cc: Ed Kimura, San Diego Chapter of the Sierra Club
Jim Peugh, San Diego Audubon Society
Marco Gonzalez, Surfrider Foundation, San Diego Chapter

Mike Chee, NASSCO
Shaun Halvax, Southwest Marine
Dreas Nielsen, Exponent
Michael Martin, Department of Fish and Game
Michael Anderson, Department of Toxic Substances Control
Scott Sobiech, U.S. Fish and Wildlife
Robert Brodburg, Office of Environmental Health Hazard Assessment
Denise Klimas, National Oceanic and Atmospheric Administration
Donald MacDonald, National Oceanic and Atmospheric Administration
Mark Meyers, National Oceanic and Atmospheric Administration

NASSCO File No.:	03-0066.05
Southwest Marine File No.:	03-0137.05

ATTACHMENTS

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/s/

FROM: Craig M. Wilson
Chief Counsel
OFFICE OF CHIEF COUNSEL

DATE: February 22, 2002

SUBJECT: APPLICABILITY OF STATE BOARD RESOLUTION 92-49 IN SETTING SEDIMENT CLEANUP LEVELS

I. QUESTIONS PRESENTED

You have asked the following questions with respect to State Water Resources Control Board (State Board) Resolution 92-49:

A. Does State Board Resolution 92-49 apply to setting cleanup levels for bay bottom contaminated sediments? If so, does the Resolution require cleanup to background sediment concentrations, or just background water column concentrations?

B. If Resolution 92-49 does apply, what are the limitations, if any, to its application? What discretion does a regional board have in designating cleanup levels for sediments less stringent than background conditions?

II. BRIEF RESPONSE

A. A regional board must apply Resolution 92-49 when setting cleanup levels for contaminated sediments if such sediments threaten beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste.[1] Contaminated sediments must be cleaned up to background sediment quality unless it would be technologically or economically infeasible to do so.

B. Resolution 92-49 is flexible and permits a regional board to set alternative cleanup levels less stringent than background concentrations if attainment of background concentrations is infeasible. Any such alternative cleanup level may not unreasonably affect beneficial uses and must comply with all applicable Water Quality Control Plans and Policies. The Resolution allows for consideration of adverse impacts of any cleanup itself as well as natural attenuation if cleanup goals can be met in a reasonable time.

III.
BACKGROUND

The San Diego Regional Board (Regional Board) is currently involved in determining remediation strategies and cleanup levels at various sites within San Diego Bay. Environmental interest groups appearing before the Regional Board have taken the position that under Resolution 92-49, the Regional Board must require cleanup of contaminated sediments to attain background sediment chemistry levels as defined by an off-site reference station. Dischargers argue that Resolution 92-49 applies to water quality and not sediment quality and that attainment of background water quality conditions may not require restoration of background sediment quality conditions. Presumably, in this context, the dischargers interpret the term "water quality" to refer to the concentrations of dissolved or suspended wastes in water associated with contaminated sediment; e.g., in the water column or sediment pore water (the water between particles that make up the bottom sediment).

IV.
DISCUSSION

A. Technical Issues

State Board Division of Water Quality (DWQ) staff have indicated that (1) in most cases the exposure route leading to sediment related toxicity is unknown; and (2) in addition to direct contact with, or ingestion of, water containing dissolved or suspended wastes, routes of exposure that lead to toxic effects can include sediment ingestion and direct contact with contaminated sediment particles. The DWQ assessment is supported by the U.S. Environmental Protection Agency (EPA) which has noted that pore water exposures underestimate the toxicity of sediment bound pollutants that are minimally

[1] As used in this memorandum, the term "contaminated sediments" is intended to refer to sediments that either meet the definition of "contamination" under Water Code 13050(k) or that create, or threaten to create, a condition of "pollution" under section 13050 (l).

soluble in water.[2] EPA has also recognized that sediment ingestion is an exposure route. [3]

B. Legal Issues

1. Porter-Cologne Jurisdiction

The Porter-Cologne Act is replete with provisions intended to protect beneficial uses from impacts from contaminated sediment. As discussed below, Porter-Cologne jurisdiction extends beyond water column effects to require the reasonable protection of beneficial uses from discharges of waste to waters of the state.

2. Water Code Section 13304

Water Code Section 13304 requires a person to clean up waste or abate the effects of the waste if so ordered by a regional board in the following circumstances: if there has been a discharge in violation of waste discharge requirements, or if a person has caused or permitted waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates or threatens to create a condition of pollution or nuisance. "Pollution" is defined as "an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects . . . the waters for beneficial uses . . . ."[4]

The legislative history of the Porter-Cologne Act states in commentary on the definition of "pollution" that "it is the unreasonable effect upon beneficial uses of water, caused by waste, that constitutes pollution."[5] This history expresses the intent that if a person discharges waste into waters of the state and beneficial uses of the water are thereby harmed - then pollution exists even if water column concentrations are not effected by wastes that have settled in sediment.

Settled wastes associated with sediments are some of the most harmful to beneficial uses of waters; e.g., PCBs, pesticides and mercury. If regional board authority under section 13304 were limited to effects on the water column, a regional board could not require cleanup if a discharger dumped into a bay pure PCBs, which due to their insolubility, sunk to the bottom and adsorbed onto sediment particles - resulting in lethal effects to aquatic organisms ingesting or otherwise contacting these sediments.

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[2] See EPA's Contaminated Sediment Management Strategy, pp. 21 and 75, EPA-823-R-98-001, April 1998.

[3] See "The Particle Size Distribution of Toxicity in Metal-Contaminated Sediments, http://es.epa.gov/ncerqa_abstracts/grants/98/envchem/ranville.html.

[4] Water Code section 13050(l).

[5] Final Report of the Study Panel to the California State Water Resources Control Board, 1969, p. 30.

This is inconsistent with the remedial goals of the Porter-Cologne Act to protect beneficial uses of the waters of the state.

State Board Resolution 92-49 describes the policies and procedures that apply to the cleanup and abatement of all types of discharges subject to Water Code Section 13304. These include discharges, or threatened discharges, to surface and groundwater. The Resolution requires dischargers to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality or the best water quality that is reasonable if background levels of water quality cannot be restored, considering economic and other factors. In approving any alternative cleanup levels less stringent than background, regional boards must apply section 2550.4 of Title 23 of the California Code of Regulations.[6] Section 2550.4 provides that a regional board can only approve cleanup levels less stringent than background if the regional board finds that it is technologically or economically infeasible to achieve background. Resolution 92-49 further requires that any alternative cleanup level shall: (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial uses of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.[7]

3. *Water Code Section 13307*

Water Code section 13307, the statutory mandate that led to the adoption of Resolution 92-49, directed the State Board to establish a policy for the investigation and cleanup of discharges of hazardous substances that create or threaten to create a condition of contamination, pollution, or nuisance. "Contamination" is defined as a condition that creates a public health hazard resulting from the disposal of waste, whether or not waters of the state are affected.[8] As noted above, the State Board, consistent with legislative history, has exercised discretion to interpret the term "pollution" broadly to cover effects beyond the water column to protect beneficial uses of waters of the state from discharges of waste. However, given the expansive statutory definition of "contamination" as applying to disposal sites that pose a hazard to the public whether or not waters are affected, no discretionary interpretation is needed to reach the conclusion that Resolution 92-49 applies to more than the water column. Given the bioaccumulation risk posed by many contaminants in sediment, section 13307 requires regional boards to apply Resolution 92-49 in a way that ensures, at a minimum, that any sediment cleanup is protective of public health – whether or not water column concentrations are

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[6] Resolution 92-49, Section III.G.

[7] *Id.*

[8] Water Code section 13050(k).

elevated above background concentrations as a result of contact with contaminated sediments.

4. *State Policy for Water Quality Control*

Statutory requirements for state water quality control policy are set forth in section 13142 of the Water Code. The section provides that such policy shall consist of any or all of: (1) water quality principles and guidelines; (2) water quality objectives; and (3) other principles and guidelines deemed essential by the State Board. This broad discretion suggests legislative intent to protect beneficial uses from more than water column effects when a waste discharge threatens such uses. This principle is reflected in the State Board Policy for Implementation of Toxics Standards and the rescinded Enclosed Bays and Estuaries Plan, discussed below, which apply specifically to sediments. With respect to the coastal marine environment, Water Code section 13142.5 provides that wastewater discharges shall be controlled to protect beneficial uses.

5. *Toxic Hot Spots Legislation*

In 1989, the Legislature added Chapter 5.6 to Division 7 of the Water Code.[9] Chapter 5.6 requires the State Board and regional boards to plan for the cleanup of "toxic hot spots." "Toxic hot spots" are defined as "locations in enclosed bays [and other waters] the pollution or contamination of which affects the interests of the state, and where hazardous substances have accumulated in the water or sediment to levels which . . . may adversely affect the beneficial uses of the bay [or other waters] . . . or (3) exceeds adopted water quality or sediment quality objectives."[10] Section 13390 expresses the legislative intent: "It is the intent of the Legislature that the state board and the regional boards establish programs that provide maximum protection for existing and future beneficial uses of bay and estuarine waters." (Emphasis added.)

Water Code section 13393 requires the State Board to adopt sediment quality objectives using the procedures that apply to the adoption of Water Quality Control Plans. Although the Legislature drew a distinction between water quality objectives and sediment objectives in section 13391.5(e), it appears to have been to clarified that the State Board must set objectives that specifically apply to this part of the aquatic environment over which the State Board has jurisdiction, and which had not received the same degree of attention as the more traditional numeric water column objectives found in Water Quality Control Plans. This interpretation is consistent with Water Code section 13181 and the EPA view, discussed below, that sediment criteria are a

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[9] Water Code section 13390 et seq.

[10] Water Code section 13391.5(e).

subset of water quality criteria. Once the sediment objectives are adopted, any sediment cleanup would have to ensure that these objectives are met.
The State Board's Consolidated Toxic Hot Spots Cleanup Plan (Hot Spots Plan) directs the regional boards to implement Resolution 92-49 when implementing the remedial portions of the Hot Spots Plan.[11] The focus of the Hot Spots Plan is on sediment remediation; it provides that: "[c]andidate and known toxic hot spots are locations (sites *in* waters of the State) in enclosed bays, estuaries or the ocean."[12] (Emphasis added.) The State Board intended the term "waters of the state" to be interpreted broadly to include contaminated sediments in these waters. For any dredging project involving contaminated sediments, section 13396(b) prohibits the discharge of dredge spoils in any location "that may cause significant adverse effects to aquatic life, fish, shellfish, or wildlife or may harm the beneficial uses of the receiving waters." There is no condition that the prohibition only applies to harm related to water column effects.

The clear message of the Toxic Hot Spots legislation is that the State Board and regional boards must develop a plan for the cleanup of "toxic hot spots" most of which involve contaminated sediments. The fact that the Legislature did not provide any additional sources of authority to the State Board or regional boards that would allow them to require cleanup of such sites suggests that it viewed the boards' existing powers as broad enough to require cleanup when beneficial uses of the state's waters are threatened by a discharge of waste.

6. *Water Code Section 13181*

Water Code section 13181 directs the State Board to propose a program that includes methods for determining the sources of pollution in coastal watersheds, bays, estuaries, and coastal waters. The proposed program must include methods for determining the degree of improvement or degradation in coastal water quality over time with respect to water quality objectives, sediment quality guidelines, tissue contaminant burden guidelines and health standards. This indicates legislative intent that water quality includes sediment quality.

7. *Judicial Opinions*

The courts have concluded that provisions determining the scope of a regulatory statute must be broadly construed to accomplish the purposes of the statute.[13] The Court of Appeals in *Lake Madrone Water District* v. *State Water Resources Control Board* indicated its support for the proposition that Porter-Cologne jurisdiction extends beyond water column effects by citing with approval an Attorney General opinion on

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[11] Hot Spots Plan, p. 6.

[12] *Id.* at p. 12.

[13] *Harvey v. Davis* (1968) 69 Cal.2d 362, 370-71 (1968).

this point.[14] In Opinion No. 55-237, the Attorney General concluded that a discharge of fine-grained materials constituted pollution where the only harm to beneficial uses occurred when these materials settled out on the bottom of a reservoir. The reservoir was used to recharge groundwater and the fine-grained materials sealed the porous surface of the bottom of the reservoir thereby interfering with groundwater recharge. The Attorney General reasoned that a causal relationship existed between the discharge and the impairment even though the immediate cause of the reduction in recharge was the change in the quality of the absorbing surface on the bottom of the reservoir. Applying this same reasoning, the Attorney General also concluded that water was polluted where spawning beds were covered by these same materials - even where there was no effect on the water column.

8. *State Board Policies and Orders*

The State Board has consistently interpreted its jurisdiction as extending beyond the water column where beneficial uses are affected by a discharge of waste. The Enclosed Bays and Estuaries Plan, 91-13 WQ (EBE Plan) (which was rescinded on grounds unrelated to sediment issues), contained the following objectives under the heading "Narrative Water Quality Objectives:" "(1) the concentrations of toxic pollutants in the water column, sediments, or biota shall not adversely affect beneficial uses. (2) Enclosed bays and estuarine communities and populations, including vertebrate, invertebrate, and plant species, shall not be degraded as the result of the discharge of waste." Either of these objectives would be violated if a benthic organism were harmed as a result of the direct contact with, or ingestion of, pollutants in sediment, even if water column or sediment pore water pollutant concentrations were zero. In Order WQ 92-09, the State Board noted that although the EBE Plan did not establish numeric objectives for sediment, Resolution 92-49 required cleanup levels low enough to ensure that these narrative sediment objectives would not be violated.[15]

9. *The Clean Water Act*

EPA is in the process of adopting federal sediment criteria under the authority of Clean Water Act section 304(a), which directs EPA to develop "criteria for *water quality* . . .on the kind and extent of . . . effects . . . which may be expected from the presence of pollutants in any body of water."[16] In 1997, EPA submitted a report to Congress entitled "The Incidence and Severity of Sediment Contamination in Surface Waters of the United States." Section 304 and the EPA report suggest that EPA views sediment criteria as water quality criteria, and that the agency considers contaminated sediments to be contained *in* surface waters to the same degree as a dissolved or

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[14] 209 Cal.App. 3d 163, 169 (1989).

[15] Petition of Environmental Health Coalition and Eugene J. Sprofera, September 17, 1992.

[16] EPA's Contaminated Sediment Management Strategy, pp. 21 and 75.

suspended pollutant. Thus, it is clear that EPA would favor an interpretation of the Water Code that is consistent with the Clean Water Act by including the power to regulate more than the water column where necessary to protect beneficial uses of waters of the state from the effects of waste. EPA has indicated that it will publish numeric sediment quality criteria, as guidance, with the intent that states will use the criteria in interpreting existing narrative toxicity water quality criteria. EPA also has noted that states could adopt these federal sediment criteria as state water quality standards.[17]

The Clean Water Act, defines pollution to include "alteration of the chemical, physical, biological, and radiological integrity of water."[18] This definition is analogous to the Porter-Cologne definition, in that pollution is defined to include a change in water. Responding to an attempt by the Federal Energy Regulatory Commission to restrict state authority narrowly to water chemistry issues, and to deny states broader authority over water quality, EPA observed:

> "[P]rotection of water quality involves far more than just addressing water chemistry. Rather, protection of water quality includes protection of the multiple elements which together make up aquatic systems including the aquatic life, wildlife, wetlands, and other aquatic habitat, vegetation, and hydrology required to maintain the aquatic system. Relevant water quality issues include the toxicity and bioaccumulation of pollutants, the diversity and composition of the aquatic species, entrapment of pollutants in sediment, stormwater and non-point source impacts, habitat loss, and hydrological changes."[19]

The United States Supreme Court recognized that water quality, under the Clean Water Act should be broadly construed:

> "In many cases, water quantity is closely related to water quality; a sufficient lowering of water quantity in a body of water could destroy all of its designated uses, be it for drinking water, recreation, or . . . as a fishery. In any event, there is recognition in the Clean Water Act that reduced stream flow; *i.e*, diminishment of water quantity, can constitute pollution. This broad conception of pollution – one which expressly evinces Congress' concern with the physical and biological integrity of

[17] *Id.* at p. 22.

[18] 33 U.S.C. § 1362(19).

[19] Letter from LuJuana Wilcher, Assistant Administrator, United States Environmental Protection Agency to Hon. Lois Cashell, Secretary FERC (Jan. 18, 1991).

water – refutes [the] assertion that the Act draws a sharp distinction between the regulation of water "quantity" and water "quality."[20]

10. State Board Policy for Implementation of Toxics Standards

The State Board Policy for Implementation of Toxics Standards (the SIP) provides that mixing zones shall not result in "objectionable bottom deposits."[21] This term is defined as "an accumulation of materials . . . on or near the bottom of a water body which creates conditions that adversely impact aquatic life, human health, beneficial uses, or aesthetics. These conditions include, but are not limited to, the accumulation of pollutants in the sediments . . . ."[22] There is no requirement that the adverse impact result from exposure to pollutants in the water column or sediment pore water. Consequently, if the harm resulted from direct contact with, or ingestion of, contaminated sediments, a discharge that resulted in this condition would violate the SIP. This recently adopted Policy reaffirms the Board's long-standing conclusion that its water quality jurisdiction extends beyond water column effects.

V.
REGIONAL BOARD DISCRETION IN SETTING CLEANUP LEVELS

Given these considerations, Resolution 92-49 should be interpreted to presumptively require cleanup of contaminated sediment to background sediment levels. However, the Resolution is flexible and allows a regional board to exercise substantial discretion in setting cleanup levels. Cleanup levels less stringent than background levels are permissible if cleaning up to those levels is technologically or economically infeasible – as long as the less stringent cleanup level is protective of beneficial uses. Beneficial uses must be protected not only from exposure to sediment-derived pollutants in the water column or sediment pore water, but also pollutants in, or on, the sediment particles that can adversely affect aquatic organisms and/or human health through bioaccumulation when such organisms ingest contaminated sediments or come in direct contact with such sediments.

Resolution 92-49 requires alternative cleanup levels less stringent than background to, among other factors, "be consistent with maximum benefit to the people of the state" and requires consideration of "all demands being made and to be made on the waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible." This determination is made on a case-by-case basis and is based on considerations of reasonableness under the circumstances at the site. [23] Finally, the State

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[20] *PUD No. 1* v. *Washington Department of Ecology* (1994) 511 U.S. 700, 719.

[21] SIP at p. 15.

[22] *Id.* at Appendix 1-4.

[23] See SWRCB Order No. WQ 92-09.

Board has indicated that Resolution 92-49 does not require immediate compliance with cleanup goals.[24] Rather, the Resolution provides that a regional board must approve any cleanup proposal that the regional board finds will "have a substantial likelihood to achieve compliance, within a reasonable time frame, with cleanup goals."[25] In the context of underground tank cleanups, the State Board has concluded that "a reasonable time" may be decades where natural attenuation is the proposed cleanup approach.[26]

Although each cleanup project must be evaluated by a regional board on a case-by-case basis, the State Board, in Order WQ 92-09, recognized the infeasibility of dredging to background sediment concentrations at the Paco Terminals site in San Diego Bay. Key considerations included the cost of attaining a background sediment cleanup goal and the expected harm to beneficial uses that would result from the large-scale dredging that would be necessary to achieve background sediment levels.[27] Such harm may be expected due to physical disturbance of habitat and re-suspension of pollutants into the water column. More recently, in its response to comments on the Hot Spots Plan, the State Board indicated that regional boards would have significant discretion in determining when a site was adequately remediated. A commenter wanted to know if background levels would be required or some higher level. The State Board response noted that either of those levels could be selected by a regional board at its discretion.[28]

VI.
CONCLUSION

Regional boards must apply Resolution 92-49 when setting cleanup levels for contaminated sediments if such sediments threaten beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste. Contaminated sediments must be cleaned up to levels consistent with background sediment quality unless it would be technologically or economically infeasible to do so. Any such alternative cleanup level may not unreasonably affect beneficial uses and must comply with all applicable Water Quality Control Plans and Policies. In setting alternative cleanup levels, regional boards must balance various factors. Resolution 92-49 allows for consideration of adverse impacts of cleanup as well as natural attenuation if cleanup goals can be met in a reasonable time.

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[24] SWRCB Order No. WQ-98-08-UST.

[25] Resolution 92-49, Section III.A

[26] See Note 25 at p. 12.

[27] See Note 15 at p. 4.

[28] Functional Equivalent Document for the Consolidated Toxic Hot Spots Cleanup Plan, p. 353.

bc: Ted Cobb, OCC
Tim Regan, OCC
Debbie Matulis, OCC

TJRegan/mmjohnson/dmatulis
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July 16, 2002

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Mr. Sandor Halvax
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Dear Mr. Chee and Mr. Halvax:

ASSESSMENT OF BIOACCUMULATION AND RISK TO FISH HEALTH FROM SEDIMENT CONTAMINANTS AT NASSCO AND SOUTHWEST MARINE SHIPYARDS

This is a follow-up to my December 24, 2001 letter to NASSCO and Southwest Marine regarding the assessment of aquatic-dependent wildlife risks at NASSCO and Southwest Marine shipyards. In that letter, I indicated that it would be necessary in the Phase 2 bioaccumulation studies to assess the potential adverse effects of sediment chemical contaminants on fish health due to the uptake of these contaminants. Accordingly, pursuant to Water Code Section 13267, I am directing NASSCO and Southwest Marine to submit to the Regional Board by October 31, 2002 a technical report that addresses the potential for contaminant bioaccumulation in fish and the associated risks to fish health in accordance with the guidelines described in Section B below. The October 31 submittal date is contingent upon implementing field activities by the end of August 2002.

A. RATIONALE FOR FISH BIOACCUMULATION AND HEALTH RISK STUDY

The need to address this issue is discussed in a memorandum dated August 24, 2001 from Dr. Mike Anderson of Department of Toxic Substance Control – Human and Ecological Risk Division (HERD) commenting on the Regional Board's August 3, 2001 public workshop on Exponent's workplan titled "*Workplan for the NASSCO and Southwest Marine Detailed Sediment Investigation*" received by the Regional Board in July 2001 (Exponent 2001a). A copy of Dr. Anderson's memorandum was previously forwarded to you. The Regional Board, Dr.

Michael Martin of California Department of Fish and Game (DFG), Ms. Denise Klimas of the National Oceanic and Atmospheric Administration (NOAA) Coastal Protection and Restoration Division, and Mr. Scott Sobiech of U.S. Fish and Wildlife Service (F&W) also concur with Dr. Anderson's views that Exponent's workplan should be modified to address the potential for bioaccumulation of contaminants in fish and the impacts to fish health from the sediments at NASSCO and Southwest Marine shipyards. The guidelines provided in this letter were jointly developed by the Regional Board and the above mentioned Natural Resource Trustee Agency representatives.

Further investigation is needed to properly assess the impacts of contaminants on resident fish at NASSCO and Southwest Marine based on the following information:

- Sediment chemistry concentrations for total polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) at NASSCO and Southwest Marine exceed background sediment quality conditions for San Diego Bay.
- Sediment chemistry concentrations for PAHs and PCBs at NASSCO and Southwest Marine exceed suggested sediment quality thresholds that predict adverse effects in fish.
- Examination of the chemical concentrations in *Macoma* tissue relative to the chemical concentrations in sediment indicates that bioaccumulation of chemicals is occurring at NASSCO and Southwest Marine.

A.1 Background Sediment Quality Conditions

Background sediment chemistry conditions for San Diego Bay were established in my March 6, 2002 letter titled "*Background Reference Conditions for Assessment and Remediation of Contaminated Sediments at NASSCO and Southwest Marine Shipyards*" (RWQCB 2002). The San Diego Bay background sediment concentration was set at 1,200 parts per billion (ppb, dry weight) for PAHs and at 200 ppb for PCBs. The background PAH concentration was exceeded at all stations (n = 43) at both NASSCO and Southwest Marine shipyards. The total PAHs concentration at the 43 surface sediment sample locations ranged from 1,900 ppb to 66,000 ppb. Similarly, the PCB background concentration was exceeded at all stations at NASSCO and Southwest Marine shipyards. The total PCB concentrations within the two shipyards ranged from 230 ppb to 7,100 ppb (Exponent 2001b).

A.2 Sediment Quality Thresholds

The sediment chemistry data submitted in Exponent's Technical Memorandum 1 indicates contaminants are present at levels that may be harmful to marine/estuarine fish within the designated study area. Specifically, sediment PAH concentrations exceed a suggested sediment quality threshold of 1,000 ppb for PAHs at every NASSCO and Southwest Marine sample station except for the reference stations (Johnson 2000). Studies conducted in Puget Sound determined that a substantial risk exists for liver disease, spawning inhibition, reduced egg viability and growth inhibition to English sole (*Pleuronectes vetulus*) when PAH concentrations in the sediment exceed the suggested 1,000 ppb PAH threshold (Johnson 2000). Furthermore, studies on chinook salmon (*Oncorhynchus tshawytscha*) resulted in a PCB threshold value of 300 ppb (for total organic carbon (TOC) at 2 percent dry weight) for PCBs (Meador 2000). Of the 43 sample locations analyzed for PCBs at NASSCO and Southwest Marine, the average TOC was 2.13 percent and 38 sample locations exceeded the suggested PCB threshold.

A.3 Bioaccumulation in *Macom*a Tissue

From the 28-day bioaccumulation *Macoma* tissue information submitted by Exponent, a correlation exists between sediment chemical concentrations and tissue bioaccumulation. A good relationship was found between the sediment chemical concentration and *Macoma* tissue concentration for lead and tributyltin, low molecular weight polycyclic aromatic hydrocarbons (LPAHs), high molecular weight polycyclic aromatic hydrocarbons (HPAHs), and PCBs. Based on the *Macoma* test data there is a potential for the contaminants at NASSCO and Southwest Marine Shipyards to move up the food chain to higher receptors such as fish.

B. GUIDELINES FOR ASSESSMENT OF BIOACCUMULATION & RISK TO FISH HEALTH

The purpose of this study is to determine whether sediment contaminants at NASSCO and Southwest Marine cause:

- Bioaccumulation in the tissue of resident fish found within the leaseholds;
- Adverse health impacts on resident fish at NASSCO and Southwest Marine Shipyards when compared against resident fish collected from a reference area in San Diego Bay.

B.1 Workplan

A workplan shall be developed and approved by the Regional Board and the Resource Agencies prior to conducting field-sampling activities. The workplan shall be developed in accordance with the information provided in Sections B.2 through B.7.

B.2 Target Species

From information provided in Myers et al. 1993 and Myers et al. 1994 dealing with San Diego Bay histopathological studies, it appears the fish species with the most predictable relationship between sediment contamination and histopathological effects are the white croaker *(Genyonemus lineatus)* and the black croaker *(Cheilotrema saturnum)*. These species recommendations were also confirmed in a recent phone conversation with Dr. Myers (Myers 2002). Some alternative fish species that may be considered in place of the above mentioned fish include the yellowfin croaker *(Umbrina roncador)* and various species of gobies (Gobiidae).

The diamond turbot (*Hypsopsetta guttulata*), spotted turbot (*Pleuronichthys ritteri*), California halibut (*Paralichthys californicus*), barred sand bass (*Paralabrax nebulifer*), and spotted sand bass (*Paralabrax maculatofasciatus*) were all initially considered for this part of the shipyard evaluation. However, Myers et al. 1993 found these species are less desirable for fish tissue and fish health studies because of their lack of sensitivity and other life history factors.

In Technical Memorandum 4, Exponent proposed to use the Dover sole (*Microstomus pacificus*) as one of the fish species that fit the required characteristics (Exponent 2001c). In multiple fish surveys of San Diego Bay conducted by Dr. Larry Allen between July 1994 and April 1999, Dover sole were not found in any region of the Bay at any time (Allen 1999). Therefore, the Dover sole is probably not a suitable species for fish bioaccumulation and health risk studies in San Diego Bay.

B.3 Number of Species

An appropriate number of fish of each species shall be collected from the NASSCO and Southwest Marine leasehold for the fish bioaccumulation and health risk study (Myers et al. 1993 and Myers et al. 1994). Since the sediment PAH, bioaccumulative metals, and PCB values tend to be higher in certain areas within the NASSCO and Southwest Marine leasehold, the fish collection shall focus on areas where bioaccumulative chemical concentrations in the sediment are significantly higher than other areas within the study area.

B.4 Species Characteristics

For analytical purposes and statistical comparisons, the collected fish should be mature, all of the same species, be of similar length/weight, collected in the same general area, and collected during the same time of the year. Fish age must be accounted for when examining the contaminant induced effects on fish bioaccumulation and fish health risk because age is a risk factor that influences the histopathology (Myers et al. 1993). For age determination, otoliths shall be collected from a subset of the total number of specimens from an entire sampling event for a particular fish species collected at a selected location. Collection methods shall be consistent with the methods described in NOAA's NS&T Technical Memorandum NOS ORCA 71 (NOAA 1993a). The table below describes the age and length at which maturity is expected in the target species.

Species	Spawning Season	Age of Maturity (Years)	Approximate Length (inches) Where Sexual Maturity Begins
White croaker	November – April**	1-4*	5.5 for males** 6 for females**
Black croaker	Late spring – early fall*	No data	10 both sexes*
Yellowfin croaker	Summer*	No data	9 both sexes*
Gobies	Species dependent	Species dependent	Species dependent
Barred sand bass	April – November**	3-5**	7-10.5 both sexes**
Spotted sand bass	May – September**	1-1.4**	7.8 males 6.7 females **

(*Love 1996)
(**Leet et al. 2001)

B.5 Analysis

Fish health indices (i.e., biomarkers) shall be proposed for each of the fish species listed in Section B.4. Examples of potential biomarkers include examination of histopathological liver lesions, examination of histopathological kidney lesions, gonad lesions, and/or analyses of the metabolites in fish bile. The proposed biomarkers will be reviewed and approved by the Regional Board and the Resource Agencies.

Whole body chemical analysis and lipid analysis shall also be a part of the fish tissue bioaccumulation and health risk study. Whole body analysis for all of the contaminants of concern shall be conducted to assess the exposure to predatory fish by their prey, smaller fish. Lipid analysis also shall be done for this assessment because the lipid content of fish influences accumulation of lipophilic contaminants. With both lipid data and organic carbon concentrations in the sediments, accumulation factors (Biota Sediment Accumulation Factors or BSAFs) can be estimated. Collection of tissue for the whole body chemical analysis and lipid analysis shall be consistent with methods outlined in NOAA's National Status and Trends Program for Marine Environmental Quality (NS&T) Technical Memorandum NOS ORCA 71 (NOAA 1993a). Modifications to the recommended protocols shall be explained and supported by relevant literature citations.

B.6 Reference Station Comparison

For comparisons against the fish collected within the leasehold of NASSCO and Southwest Marine, an appropriate number of fish of one or more of the selected species shall be collected in the general vicinity of one of the reference stations. Based on information in Exponent's

Technical Memorandum 1, the reference stations with the lowest concentrations of PCBs and PAHs are Reference Stations 1 and 5 (Exponent 2001b). Reference Station 1 is more similar to the shipyard sediment in grain size (40.8% fine grains) than Reference Station 5 (28.0% fine grains). Based on the sediment chemistry data and the grain size characteristics, Reference Station 1 or Reference Station 5 shall be used as the reference area for the fish bioaccumulation and health risk study. The reference station selection should take into account the target species and their habitat preferences at the time of the field collection.

B.7 Evaluation Approach

An initial scoping phase shall be conducted at NASSCO and Southwest Marine to determine if the target fish species are appropriate and are available at the proposed time of collection in sufficient numbers to meet the requirements provided in these guidelines. It is recognized that collecting an appropriate number of the target fish species may prove a challenge because of the patterns and life history of fish living within NASSCO and Southwest Marine leasehold. A reasonable effort shall be made to collect the target species. Determination of a reasonable effort will be made by Regional Board staff in consultation with Dr. Michael Martin and Dr. Robert Lea, DFG. Factors to be considered in determining if sufficient collection effort has been made by NASSCO and Southwest Marine will include:

- Expertise of consultants with collection of marine and estuarine fish
- Methods used in collection
- Time of year sampling occurs
- Number of sampling efforts
- Duration of sampling efforts

If the initial scoping phase determines that the recommended croaker or gobiide species listed in Section B.2 are not present in sufficient numbers, an alternative fish evaluation shall be conducted. The alternative evaluation shall use either the barred sand bass (*P. nebulifer*) or the spotted sand bass (*P. maculatofasciatus*) and the analyses described in Sections B.4 and B.5 shall be conducted on these alternative target species.

If you have any questions, or require additional assistance, please contact Alan Monji of my staff at (858) 637-7140 or Mr. Tom Alo of my staff at (858) 636-3154.

Sincerely,

JOHN H. ROBERTUS
Executive Officer

JHR:dtb:tca:atm

cc: Dr. Michael Martin, California Department of Fish and Game
Mr. Scott Sobiech, U.S. Fish and Wildlife
Dr. Michael Anderson, Department of Toxic Substances Control - Human and Ecological Risk Division
Ms. Denise Klimas, National Oceanic and Atmospheric Administration

C. REFERENCES

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March 6, 2002

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Dear Mr. Chee and Mr. Halvax:

BACKGROUND REFERENCE CONDITIONS FOR ASSESSMENT AND REMEDIATION OF CONTAMINATED SEDIMENTS AT NASSCO AND SOUTHWEST MARINE SHIPYARDS

As you know by letter dated June 1, 2001, I directed NASSCO and Southwest Marine to conduct a contaminated sediment investigation in accordance with the attached document, *"Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards, June 1, 2001."* These guidelines require that NASSCO and Southwest Marine evaluate the feasibility of various cleanup alternatives including complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).

The Regional Board has historically used sediment chemistry concentrations at off-site reference station(s) as a surrogate for characterizing background water quality conditions in sediment cleanup investigations. The focus on sediment chemistry for defining background water quality conditions is based on several factors:

- Pollution effects from contaminated sediment extend beyond those associated with sediment – derived pollutants in the water column or sediment pore water. Pollutants in the sediment itself, as measured by sediment chemistry, can lead to toxic and bioaccumulation effects from sediment ingestion and direct contact with contaminated sediment particles.

- Sediment chemistry concentrations are preferred over water quality concentrations because they are less variable spatially and temporally.
- The definition of background water quality conditions establishes the benchmark for complete removal of all of the waste discharged and sediment chemistry is an important consideration in determining this benchmark.

The Regional Board, with the assistance of the Southern California Coastal Water Research Project (SCCWRP), has identified a new set of reference sites in San Diego Bay from the 1998 Southern California Bight Regional Monitoring Project (Bight'98). These reference sites can be used to establish an expanded definition of background water quality conditions in terms of sediment chemistry, toxicity, and benthic community structure. The criteria used to select the Bight'98 reference stations are summarized in the attached document.

We have determined, based on the reasons described in the attached document, that the background water quality conditions defined by the Bight'98 reference sites should replace the original background water quality conditions defined by reference station REF-03. Accordingly, pursuant to Directive No. 2 of Resolution Nos. 2001-02 and 2001-03, the Bight'98 reference sites shall serve as the "Background Reference Stations" representing background conditions at NASSCO and Southwest Marine. Furthermore, NASSCO and Southwest Marine shall direct their site-specific studies in accordance with the following newly defined background conditions for sediment chemistry, toxicity, and benthic community structure:

Contaminant[(a)]	**Background Sediment Concentrations Dry Weight (mg/kg) (Upper 95% Confidence Interval)**	**Expected Background Toxicity Conditions**[(b)]	**Expected Background Benthic Community Conditions**
Copper	84	Amphipod Survival Rate Between 89%-96%	Data Not Yet Available[(c)]
Zinc	142		
Lead	31		
PCBs	<0.20[(d)]		
Mercury	0.39		
Arsenic	11		
Cadmium	0.21		
Chromium	46		
Nickel	17		
Silver	0.72		
PAHs	1.2		

(a) Contaminants listed are associated with shipbuilding and repair activities believed to be present in bay sediment. It should be noted that butyltin species, polychlorinated triphenyls, and total petroleum hydrocarbons (also associated with shipbuilding and repair activities) are not listed because Bight'98 did not analyze for these contaminants.
(b) Based on cleanup to the background sediment concentrations determined by the Bight'98 reference sites.
(c) It is anticipated that analysis of the Bight'98 benthic data will be completed in February 2002.
(d) The laboratory is currently reevaluating the analytical data for PCBs due to detection limit issues. The sediment background concentration for PCBs is considered an interim value until these issues are resolved.

If you have any questions, or require additional assistance, please contact Mr. Tom Alo of my staff at (858) 636-3154.

Sincerely,

JOHN H. ROBERTUS
Executive Officer

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Attachment: Background Water Quality Conditions for NASSCO and Southwest Marine Shipyards as Determined by Reference Station REF-03 and Bight'98 Reference Sites

NASSCO File No.:	03-0066.05
Southwest Marine File No.:	03-0137.05

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ATTACHMENT

BACKGROUND WATER QUALITY CONDITIONS FOR NASSCO AND SOUTHWEST MARINE SHIPYARDS AS DETERMINED BY REFERENCE STATION REF-03 AND BIGHT'98 REFERENCE SITES

I. Introduction

Elevated levels of pollutants exist in the bay bottom sediments adjacent to NASSCO and Southwest Marine shipyards. The concentrations of these pollutants cause or threaten to cause a condition of pollution that harms aquatic life beneficial uses designated for San Diego Bay. The concentrations of these pollutants may also present aquatic-dependent wildlife and human health risks from exposure to pollutants through the food chain attributable to the contaminated sediment.

The Regional Board is requiring NASSCO and Southwest Marine shipyards to perform an investigation to determine the nature and extent of the waste discharges, the biological effects and human health risk associated with bay sediments containing pollutants resulting from the discharges, and appropriate cleanup and abatement measures. The investigation will include an evaluation of the feasibility of various cleanup alternatives including complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).

The Regional Board, with the assistance of the Southern California Coastal Water Research Project (SCCWRP), has identified a set of reference sites in San Diego Bay that can be used to establish an expanded definition of background water quality conditions in terms of sediment chemistry, toxicity, and benthic community structure. The objectives of this document are to:

- Describe the basis for the Regional Board's requirement under State Water Resources Control Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304,* to evaluate the alternative of complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge).
- Provide a description of the methodology used to select Reference Station REF-03 as the reference station that was representative of background sediment chemistry concentrations for NASSCO and Southwest Marine.
- Provide a summary of the criteria used to select a subset of Bight'98 reference stations to determine alternate background sediment chemistry concentrations for NASSCO and Southwest Marine.
- Discuss the rationale for replacing the original definition of background water quality conditions defined by Station REF-03 with the background water quality conditions defined by the Bight'98 reference sites.

II. Cleanup to Attain Background Water Quality Conditions

The Regional Board designates cleanup levels for contaminated bay sediment sites in accordance with State Water Resources Control Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304.* Resolution No. 92-49 is a state policy that establishes policies and procedures for investigation and cleanup and abatement under Water Code Section 13304. The Resolution establishes the basis for determining cleanup levels of waters of the State and sediments that impact waters of the State.

Resolution No. 92-49 provides that dischargers are required to cleanup and abate the effects of discharges… "in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored...". Alternative cleanup levels less stringent than background must, among other things, not unreasonably affect present and anticipated beneficial uses of waters of the State. The Resolution also includes procedures to investigate the nature and horizontal and vertical extent of a discharge and procedures to determine appropriate cleanup and abatement measures.

Under the terms of Resolution 92-49 the Regional Board is required to have a presumptive cleanup goal to require cleanup to attain background water quality conditions. The Regional Board will establish a cleanup level above background water quality conditions, only if the Board determines that it is technologically or economically infeasible to achieve background water quality conditions. If the Regional Board makes such a determination, the Board will then select a cleanup level that is based on the lowest levels which are technologically or economically achievable and that will not unreasonably affect present and anticipated beneficial uses of waters of the Region. This approach provides for determining and establishing a level of water quality protection, which is reasonable without allowing or causing an unreasonable effect on water quality.

Under the terms of Resolution No. 92-49, the Regional Board is requiring NASSCO and Southwest Marine to evaluate the feasibility of various cleanup alternatives including complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge). The Regional Board has historically used sediment chemistry concentrations at off-site reference station(s) as a surrogate for characterizing background water quality conditions in sediment cleanup investigations. The focus on sediment chemistry for defining background water quality conditions is based on several factors:

- Pollution effects from contaminated sediment extend beyond those associated with sediment – derived pollutants in the water column or sediment pore water. Pollutants in the sediment itself, as measured by sediment chemistry, can lead to toxic and bioaccumulation effects from sediment ingestion and direct contact with contaminated sediment particles.
- Sediment chemistry concentrations are preferred over water quality concentrations because they are less variable spatially and temporally.
- The definition of background water quality conditions establishes the benchmark for complete removal of all of the waste discharged and sediment chemistry is an important consideration in determining this benchmark.

III. Criteria Used to Select Reference Station REF-03

The Regional Board considered the use of three reference stations (REF-01, REF-02, and REF-03) as the background reference station. These reference stations are designated as NPDES sampling locations for all shipyard and boatyard facilities located in San Diego Bay and are located in areas that would not be influenced by shipyard discharges. Reference station REF-01 is located on the west side of San Diego Bay off the Naval Ocean Systems Center pier, reference station REF-02 is located on the north side of San Diego Bay at the Cortez Marina in Harbor Island's west basin, and reference station REF-03 is located on the northeast side of San Diego Bay at the end on the Broadway pier.

The Regional Board conducted a statistical analysis using the Student's t-test to compare the sediment conditions from the three NPDES reference stations to the sediment conditions at NASSCO and Southwest Marine from urban runoff. Sediment conditions from urban runoff is evaluated on a yearly basis at NASSCO and Southwest Marine as required by the NPDES monitoring programs for the shipyards. Station NSS-STD-01 is sampled in the vicinity of stormdrain SW-9 and is located on the south side of the NASSCO facility near Chollas Creek. Station SWM-STD-01 is sampled in the vicinity of stormdrain SW-4 and is located near the bulkhead between Piers 3 and 4 at Southwest Marine.

The objective of the statistical analysis was to identify a reference station that most closely represents sediment conditions that would exist within the NASSCO and Southwest Marine leaseholds prior to waste discharges (per Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*). The sediments in the vicinity of NPDES stations NSS-STD-01 and SWM-STD-01 are assumed to be mostly affected by watershed runoff and have minimal influence by shipyard discharges. The contaminants that were used in the statistical analysis consist of five metals (copper, zinc, mercury, lead, and TBT) and five PAHs (pyrene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perlyene, and chrysene).

Based on the results of the statistical analysis, the sediment chemistry at reference station REF-03 had the least number of chemicals (3 of 10 chemicals) that were statistically different when compared to the sediment chemistry at NPDES stations NSS-STD-01 and SWM-STD-01. Consequently, REF-03 was selected as the background reference station. A summary of the statistical analysis is provided in Appendix E of the February 16, 2001 Regional Board report titled *Final Regional Board Report, Shipyard Sediment Cleanup Levels, NASSCO and Southwest Marine Shipyards, San Diego Bay.*

The sediment from reference station REF-03 is monitored on a semiannual basis as required by the NPDES permit for the shipyards. The results of 13 rounds of sediment sampling were used to calculate the weighted average background levels. Weighted averages were used to account for the historical data collected from the NPDES monitoring programs. Sediment data collected within 2 years were given twice the weight of data collected greater than 2 years. The background sediment levels are shown below.

Contaminant	REF-03 Background Sediment Concentrations Dry Weight (mg/kg)
Copper	87.5
Zinc	139
Lead	41
PCBs	0.12
Mercury	0.57

IV. Criteria Used to Select Bight'98 Reference Stations

Recently, sediment quality triad data from the 1998 Southern California Bight Regional Monitoring Project (Bight'98) became available to the Regional Board. Bight'98 is part of an effort to provide an integrated assessment to determine the spatial extent and magnitude of ecological disturbances on the mainland shelf of the Southern California Bight and is an expansion of the 1994 Southern California Bight Pilot Project (Bight '94). The triad of data from the Bight'98 study includes synoptic measurements of sediment chemistry, toxicity, and benthic infauna. The Regional Board, with the assistance of the Southern California Coastal Water Research Project (SCCWRP), identified a subset of reference sites in San Diego Bay from the Bight'98 study and consequently developed alternate sediment background concentrations for NASSCO and Southwest Marine. The screening criterion used to select the subset of Bight'98 reference stations is detailed below.

Candidate reference sites were selected using the results of the Bight'98 monitoring survey. Forty-six randomly selected stations in San Diego Bay were sampled during Bight'98 and analyzed for sediment characteristics, chemistry, toxicity, and benthic infauna (Figure 1). A stepwise screening method was conducted in three phases in order to obtain a pool of candidate sites representing a range of habitat characteristics and locations. An overview of the Bight'98 reference station selection process is shown on Figure 2.

In phase I, all 46 Bight'98 stations were evaluated on the basis of desired habitat characteristics, lack of acute toxicity, low overall contamination (mean Effects Range Median [ERM] quotient), and diverse benthic infauna. The phase I selection process identified five of the cleanest stations (level 1) among the Bight'98 data set; however, the grain size (10-49% fines) of these stations were relatively restricted (Table 1). The phase I screening steps were:

1. Select stations with grain size (% silt + clay) characteristics that were within the range present at the study sites (NASSCO fines 4%-85% and Southwest Marine fines 2%-87%).
2. Of the remaining stations, select only stations with no toxicity to amphipods.
3. Of the remaining stations, select one third of the stations with the lowest overall contamination level (mean ERM quotient <0.13). The ERM quotient value of 0.13 was selected because it represented the boundary for the cleanest 1/3 of the stations. In comparison to the mean ERM quotient classifications published by Long and MacDonald (*1998. Predicting the toxicity in marine sediments with numerical sediment quality guidelines. Environmental Toxicology and Chemistry 17, 4.*), the quotient value of 0.13 falls into the "medium-low" priority classification (0.11 – 0.50). The "medium-low" classification indicates that there is a 30% probability that the sediment is toxic based on amphipod survival tests. The "low" priority classification is <0.10, which indicates that there is a 12% probability that the sediment is toxic based on amphipod survival tests.
4. Of the remaining stations, select the five that contain the greatest diversity of infauna (>50 species per sample). These five stations were identified as phase I stations. Analysis of the benthic community data for Bight'98 has not been completed, so the relationship between specific indicators of benthos condition in the bay (e.g., diversity and abundance) and contaminant impact is not known. For the purposes of this analysis, it was assumed that the least impacted stations in the bay would contain the greatest number of species.

The phase II selection procedure was applied in an effort to identify potential reference stations containing finer grain size characteristics. This process differs from phase I in that only stations containing relatively high % fines were included and the criteria for contamination level and species diversity were modified in order to retain a sufficient number of stations (5) for further evaluation. The phase II screening steps were:

1. Select stations with grain size in the upper range of that present at the study site (51-87%).
2. Of the remaining stations, select only stations with no toxicity to amphipods.
3. Of the remaining stations, select one third of the stations with the lowest overall contamination level (mean ERM quotient <0.20). The ERM quotient value of 0.20 was selected because it represented the boundary for the cleanest 1/3 of the stations. In comparison to the mean ERM quotient classifications published by Long and MacDonald (1998), the quotient value of 0.20 falls into the "medium-low" priority classification (0.11 – 0.50).
4. Of the remaining stations, select the five that contain the greatest diversity of infauna (>40 species per sample). These five stations were identified as phase II stations.

None of the stations selected in phases I or II were located in the central portion of San Diego Bay. A third selection round was then conducted in order to identify candidate reference sites in the central portion of San Diego Bay. The 16 Bight' 98 stations in this region were screened using the following steps:

1. Select stations with grain sizes that were within the range present at the study sites.
2. Of the remaining stations, select only stations with no toxicity to amphipods.
3. Of the remaining stations, select the stations with the lowest overall contamination level (mean ERM quotient <0.20). The ERM quotient value of 0.20 was selected because it represented the boundary for the cleanest 1/3 of the stations. In comparison to the mean ERM quotient classifications published by Long and MacDonald (1998), the quotient value of 0.20 falls into the "medium-low" priority classification (0.11 – 0.50).
4. Of the remaining stations, select the five that contain the greatest diversity of infauna (>39 species per sample). These five stations were identified as phase III stations.

The locations of the phase I, II, and III stations are shown in Figure 3. The characteristics of these stations are summarized in Table 1.

A subset of 12 stations from Table 1 is recommended for use in determining the background sediment chemistry concentrations for the NASSCO and Southwest Marine sites. The recommended stations were selected to best satisfy the objectives of varied characteristics, multiple locations within the bay, low contaminant concentrations, low toxicity, and healthy benthos.

Three of 15 candidate stations that are not recommended for use had characteristics that were deemed somewhat undesirable. Station 2225 was located in a marina (potential impacts from boating activities), station 2442 had a relatively high PAH concentration (4,950 micrograms per kilogram), and station 2238 was located in an area that may be influenced by the South Bay Power Plant.

The background sediment chemistry concentrations for NASSCO and Southwest Marine were calculated using the upper 95% confidence interval of the mean values of the 12 reference sites. The background concentrations for the chemicals of concern are shown below (mean and upper 95% confidence interval).

Contaminant[(a)]	Mean (Bight'98 Data) Dry Weight (mg/kg)	Upper 95% Confidence Interval (Bight' 98 Data) Dry Weight (mg/kg)
Copper	46	84
Zinc	87	142
Lead	19	31
PCBs	--	<0.20[(b)]
Mercury	0.20	0.39
Arsenic	5.2	11
Cadmium	0.08	0.21
Chromium	25	46
Nickel	7.9	17
Silver	0.30	0.72
PAHs	0.24	1.2

(a) Contaminants listed are associated with shipbuilding and repair activities believed to be present in bay sediment. It should be noted that butyltin species, polychlorinated triphenyls, and total petroleum hydrocarbons (also associated with shipbuilding and repair activities) are not listed because Bight'98 did not analyze for these contaminants.

(b) The laboratory is currently reevaluating the analytical data for PCBs due to detection limit issues. The sediment background concentration for PCBs is considered an interim value until these issues are resolved.

V. Rationale for Replacing Original Background Concentrations

The Regional Board has determined based on the reasons described below that the background sediment chemistry concentrations defined by the Bight'98 reference sites should replace the original background sediment chemistry concentrations defined by REF-03.

- *Toxicity and Benthic Infauna Data.* REF-03 was one of three NPDES reference locations considered by the Regional Board during reference station selection (detailed in the February 16, 2001 Regional Board report titled *Final Regional Board Report, Shipyard Sediment Cleanup Levels, NASSCO and Southwest Marine Shipyards, San Diego Bay*). REF-03 was selected based solely on chemistry data. The NPDES monitoring program for all shipyard and boatyard facilities does not require collection of toxicity and the benthic infauna data at the three NPDES reference locations. Accordingly, this information was not available for use in the reference station selection. Collection of synoptic measurements of sediment chemistry, toxicity, and benthic infauna (triad approach) is essential to assess the relative quality of sediments and to determine whether impacts are related to chemical contamination. Each component of the triad complements the other two and together all three components provides an integrated assessment of the quality of the sediment. Without the triad of data it is difficult to draw conclusions on the presence or absence of toxicity and on the condition of benthic communities at REF-03, and whether these biological effects, if present, are due to pollutant concentrations or confounding effects (e.g., elevated ammonia concentrations, propeller wash, etc.). Consequently, NASSCO and Southwest Marine should use the Bight'98 data to represent background water quality conditions because: (1) The triad approach was incorporated into the study, (2) Supporting data indicates low toxicity and healthy benthic communities at the recommended background stations, and (3) The triad of data would allow the Regional Board to define background water quality conditions in terms of sediment chemistry, toxicity, and benthic community structure. Cleanup to the Bight'98 sediment concentrations would likely result in sediment conditions having a mean amphipod survival rate between 89%-96% (using a 95% confidence interval) in 10-day amphipod tests (representative of low toxicity).

The background condition for the benthic community cannot be defined at this time because analysis of the Bight'98 benthic data has not been completed. It is anticipated that the analysis will be completed in February 2002. Additionally, the Bight'98 program is currently developing a Benthic Response Index (BRI) for bays and harbors, which will likely be used to define the benthos background conditions in San Diego Bay. This document will be modified to include this information when the benthic data becomes available.

- *Grain Size Distribution.* The grain size distributions at NASSCO (sampled on 10/15/98) and Southwest Marine (sampled on 6/10/99) range from 2%-87% for fine-grained sediments and 13%-98% for coarse-grained sediments. In order to account for this spatial variability multiple reference locations with similar grain size distributions must be identified and potentially used to represent background conditions for the two shipyards. The current background sediment chemistry concentrations established for NASSCO and Southwest Marine are based on a single sampling location (REF-03) that has a specific grain size characteristic (65% fine-grained and 35% coarse-grained, as sampled on 10/15/98). Consequently, NASSCO and Southwest Marine should use the Bight'98 data to represent background conditions because the 12 recommended reference stations more closely represent the shipyard's sediment grain size distribution.

VI. Background Conditions to be used in NASSCO and Southwest Marine Sediment Study

Based on the foregoing, the Bight'98 reference sites should serve as the "Background Reference Stations" representing background water quality conditions at NASSCO and Southwest Marine. Furthermore, NASSCO and Southwest Marine should direct their site-specific studies in accordance with the newly defined background conditions. The final background conditions for NASSCO and Southwest Marine as defined by sediment chemistry, toxicity, and benthic community structure are as follows:

Contaminant[a]	Background Sediment Concentrations Dry Weight (mg/kg)	Expected Background Toxicity Conditions[b]	Expected Background Benthic Community Conditions
Copper	84	Amphipod Survival Rate Between 89%-96%	Data Not Yet Available[c]
Zinc	142		
Lead	31		
PCBs	<0.20[d]		
Mercury	0.39		
Arsenic	11		
Cadmium	0.21		
Chromium	46		
Nickel	17		
Silver	0.72		
PAHs	1.2		

(a) Contaminants listed are associated with shipbuilding and repair activities believed to be present in bay sediment. It should be noted that butyltin species, polychlorinated triphenyls, and total petroleum hydrocarbons (also associated with shipbuilding and repair activities) are not listed because Bight'98 did not analyze for these contaminants.

(b) Based on cleanup to the background sediment concentrations determined by the Bight'98 reference sites.

(c) It is anticipated that analysis of the Bight'98 benthic data will be completed in February 2002.

(d) The laboratory is currently reevaluating the analytical data for PCBs due to detection limit issues. The sediment background concentration for PCBs is considered an interim value until these issues are resolved.

Table 1. Characteristics of candidate reference sites for San Diego Bay[(1)]. The characteristics of the NASSCO and Southwest Marine study sites are also shown.

Station/ Area	Level	% Fines	Cu mg/kg	Zn mg/kg	Pb mg/kg	PCBs ug/kg	Hg mg/kg	ERMq[(2)]	# Species
NASSCO		2-87							
Southwest Marine		4-85							
2435	1	49	28.4	64.4	7.10	<20	0.123	0.07	59
2229	1	43	58.9	99.3	24.5	<20	0.315	0.12	62
2440	1	38	41.8	81.1	20.6	<20	0.235	0.09	58
2230	1	10	16.1	38.3	10.8	<20	0.379	0.06	71
2231	1	31	58.1	92.5	21.6	<20	0.224	0.10	70
2441	2	79	71.8	123	21.9	<20	0.190	0.13	84
2225*	2	57	127	130	22.1	<20	0.691	0.19	69
2442*	2	79	77.7	139	21.1	<20	0.176	0.14	52
2238*	2	57	55.1	143	18.1	<20	0.169	0.12	41
2433	2	71	71.6	126	21.0	<20	0.263	0.14	58
2241	3	18	59.2	103.7	26.3	<20	0.213	0.16	44
2244	3	20	41.8	82.4	15.4	<20	0.177	0.12	48
2265	3	13	18.0	43.2	12.0	<20	0.065	0.06	48
2243	3	35	38.8	81.2	19.9	<20	0.239	0.09	47
2240	3	44	47.4	103	22.5	<20	0.263	0.11	40

* Stations 2225, 2442, and 2238 were not used to calculate the background concentrations (mean and upper 95% confidence interval).

(1) The Bight'98 data (% fines, chemistry, and # species) presented in this table are not final values until they are made public by the Bight'98 Steering Committee. As such, these values are subject to change.

(2) ERM quotient values were calculated using chemicals that have published ERM values (Long et. al., 1995).

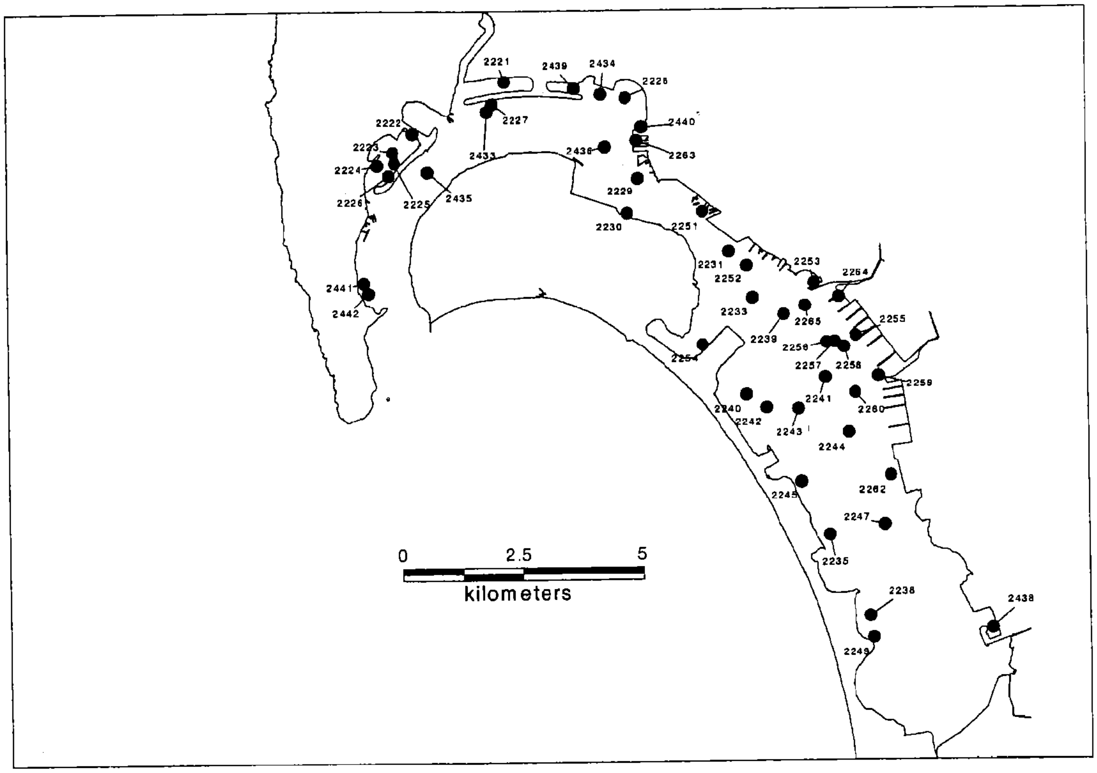

Figure 1 - Location of San Diego Bay stations analyzed as part of the Bight'98 regional survey.

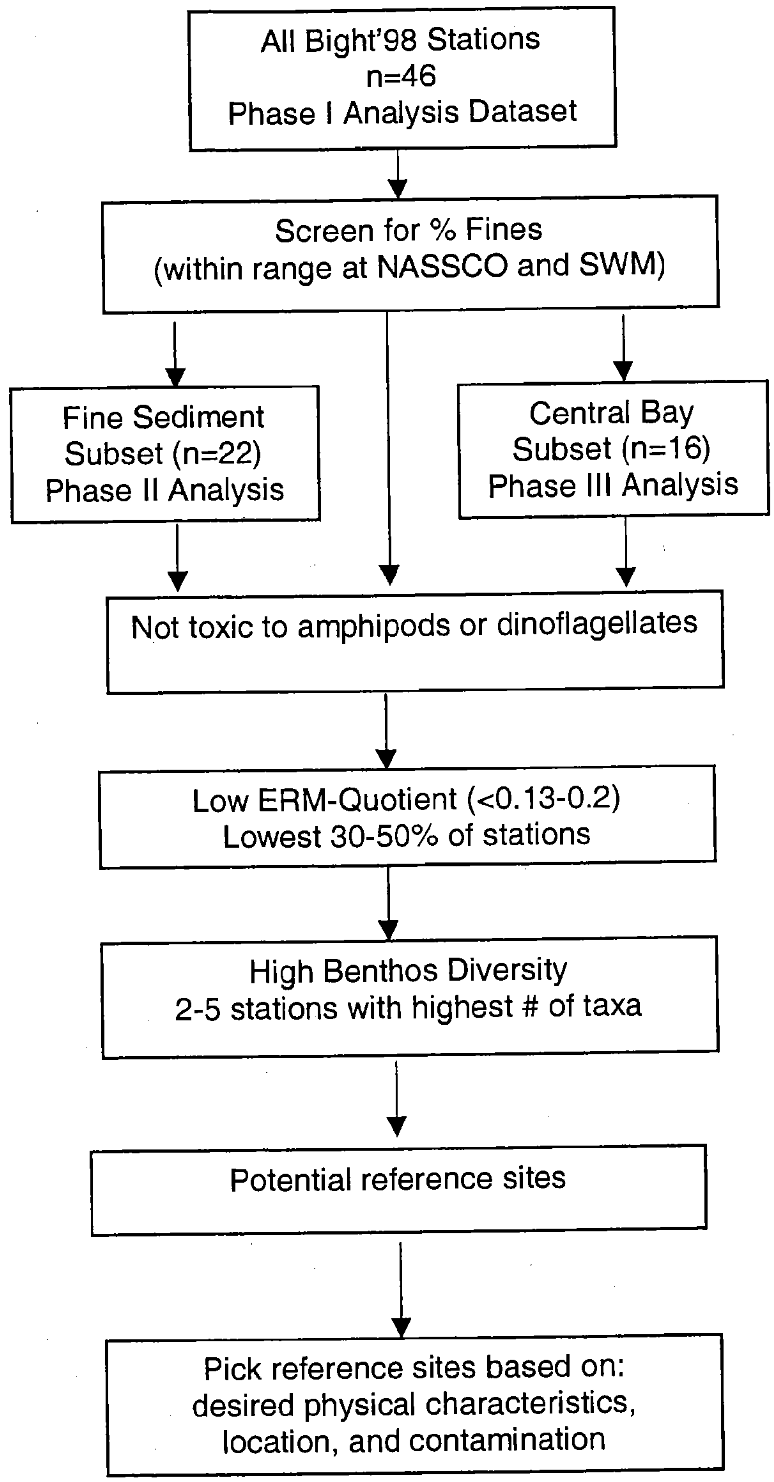

Figure 2 - Overview of reference site selection process. The selection process was applied to three groups of Bight'98 stations from San Diego Bay.

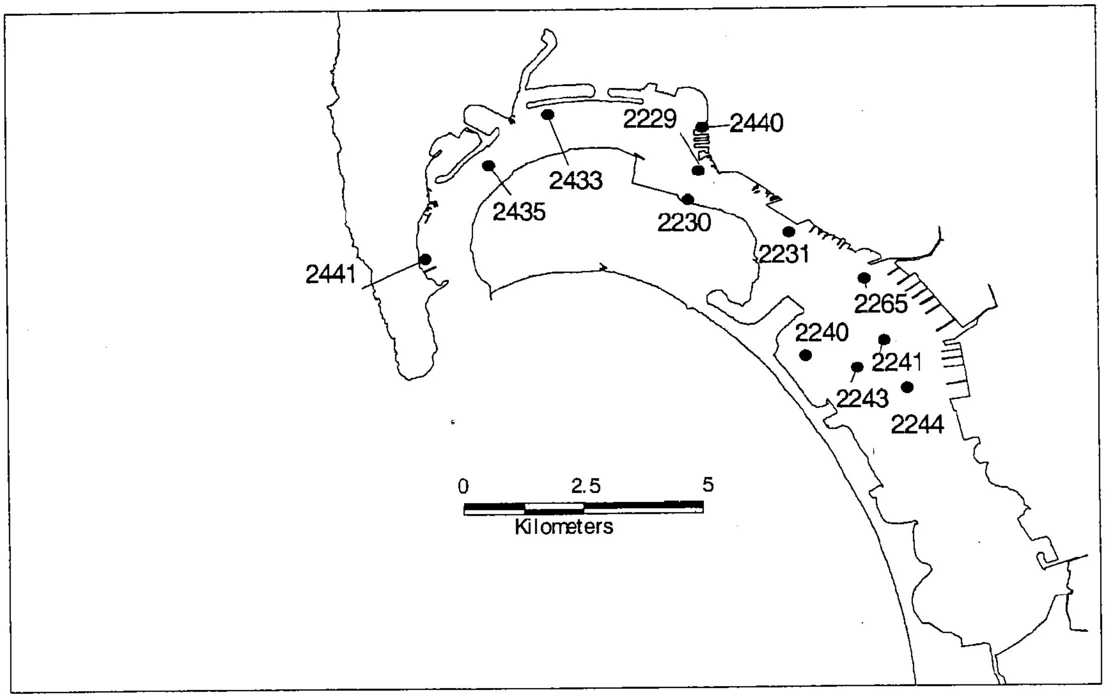

Figure 3 - Location of 12 recommended Bight'98 stations for use in defining background conditions for the NASSCO and Southwest Marine sediment study.

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Table 9. Fish and invertebrate species by study[a]

		Fish Tissue		
Tissue Study	Receptor	Primary target species	Alternate target species	Invertebrates
Fish histopathology[b]	NA	White croaker, black croaker	Goby, barred sand bass, spotted sand bass	
Ecological risk assessment[c]	Large piscivorous birds (California brown pelican, western grebe), cormorant	Goby, croaker[d]	Sand bass[d], Pacific sardine, small perch, herring, Northern anchovy, topsmelt	
	Small piscivorous birds	Goby, Pacific sardine	Small perch, herring, northern anchovy, topsmelt	
	Benthivorous birds (surf scoter)			Benthic mussel soft tissue
	Marine mammals (California sea lion)	Goby, white croaker, black croaker	Barred sand bass, spotted sand bass	
Human health risk assessment[e]	Humans	White croaker, black croaker	Barred sand bass, spotted sand bass, black and barred surfperch, halibut, corbina, Scorpaenidae (scorpionfish, rockfish, and bocaccio), turbot	Crab (or lobster) edible tissue and whole body

Note: NA - not applicable

[a] In addition to the animal tissue shown in this table, eelgrass will be collected to evaluate exposure to sea turtles.

[b] Histopathological analyses will consist of examination of fish gill, liver, kidney, and gonad. External lesions will also be noted and bile analyzed for fluorescent aromatic compounds.

[c] Data from whole body analyses will be used for the ecological risk assessment.

[d] Within the appropriate prey size range for the receptor.

[e] Data from both whole body and fillet analyses will be used for the human health risk assessment.

December 20, 2002

Chairman John Minan and Regional Water Quality Control Board Members

BY FAX (858) 571-6972

RE: Issues related to sediment cleanup at the San Diego Bay Commercial Shipyard sites.

Dear Chairman Minan and Boardmembers:

We am writing to draw your attention to three pressing issues meriting your immediate action. First, one of the most critically important decisions to be made in the entire process of cleaning up San Diego Bay - the decision on what background conditions are in the Bay - is being made behind closed doors without the input of the Bay Council, our scientific consultants, or any other public members except the dischargers. Second, the data underlying this decision is unavailable to the public, but being made available to many other parties, including the shipyards and their consultant, and the Navy. Third, sampling for the fish species that provide the most direct link between contaminated sediments and upper trophic levels failed, apparently because the most appropriate methods for collection were not used, and completely inappropriate species are being used as a replacement.

On Friday, December 12, a meeting on the determination of background conditions was convened by your staff. Invited participants included the Navy, NASSCO and Southwest Marine, and the Shipyard's consultant, Exponent. Given that the dischargers were in attendance, this was clearly not an internal meeting. The determination of background will set the bar for how clean the Bay will ever become. This is the import of these deliberations.

The data being used to make this determination is the Bight 98 data on sediment chemistry, toxicity, and benthic community health. Only the toxicity data has been released to the public. The Bay Council's scientific consultant has asked repeatedly over the last several months when this data will be available, as it is critical to our informed participation. The latest response is that the data will probably be available around the first of the year.

As you know, we have been full and active participants in the NASSCO and SWM shipyard cleanup investigations, from the beginning. We have consistently devoted significant time, resources and cooperative effort. To be excluded from the discussion, and even the data, at this critical juncture is inexplicable and untenable.

We understand that another, concluding meeting on setting background will be convened in January. We request notice and approval to participate in this meeting, and to have immediate access to the Bight 98 data in order to continue to contribute to the overall cleanup process, and to prepare for this meeting.

In August 2002, Bay council members provided comments on the "Draft Field Sampling Plan for the NASSCO and Southwest Marine Detailed Sediment Investigation," including our concern that the uptake of contaminants by gobies be included in the ecological risk assessment. Your staff, in their November 2002 response to those comments, indicate that the Regional Board reached agreement with the Natural Resource Trustee Agencies that gobies should be included in the assessment if they could be found in sufficient numbers. The letter goes on to describe an attempt to collect gobies using "various techniques such as otter trawls, beach seines, and fish traps," and to report that only one goby was found. The letter continues "Spotted sand bass, anchovies, and topsmelt were found to be the most abundant species present at the shipyard sites. Accordingly, these species are being used for the ecological risk assessment."

An air lift device with a fine-mesh filter bag to retain the gobies should be used. This apparatus allows a large amount of sediment to pass through the filter bag and should work well for catching gobies. At a minimum the arrow goby should be present, even under contaminated conditions. The mesh size of otter trawls and many beach seines are too large to catch gobies - very fine "minnow seines" are the only seines that seem to work. Fish traps are not at all effective for collecting gobies.

Topsmelt and anchovies are entirely unsuitable to replace gobies, because they lack the essential criterion: site fidelity. These species move around in the Bay far too much. While spotted sand bass are better than anchovies and topsmelt for site fidelity reasons, they are not nearly as useful as gobies.

Because gobies provide the most direct link between contaminated sediments and the higher trophic levels, another attempt needs to be made to catch gobies, using appropriate methods. Topsmelt and anchovies do not meet the essential criterion of site fidelity and should not be allowed to be used as alternative species in this assessment.

Thank you for your attention to this important matter.

Sincerely,

Laura Hunter
Environmental Health Coalition

Bruce Reznik
San Diego Baykeeper Surfrider Foundation, San Diego Chapter

Marco Gonzalez
Surfrider Foundation,
San Diego Chapter

Jim Peugh
San Diego Audubon Society

FISH SMART! EAT SAFE!

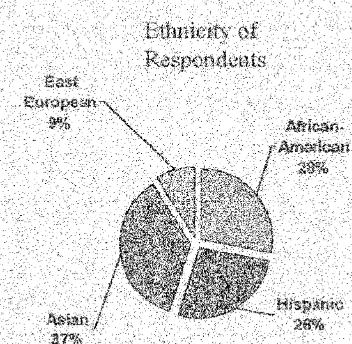
Project Components – 2002 - 2003

Outreach letters and phone calls
Meetings with health advocates from community groups
Surveys at fishing piers
Community events
Outreach hand-outs
Chicago Department of Public Health
Newspaper Articles to Chicagoland African-American and Non-English Press

FISH SMART! EAT SAFE!

Survey - 2002

- 2 Locations on Chicago Lake Michigan lakefront
- Non-Random selection of ethnic respondents
- Screened: All eat or share the fish caught
- Surveys in English, Spanish and Vietnamese
- 57 Completed Surveys



FISH SMART! EAT SAFE!

Survey - 2003

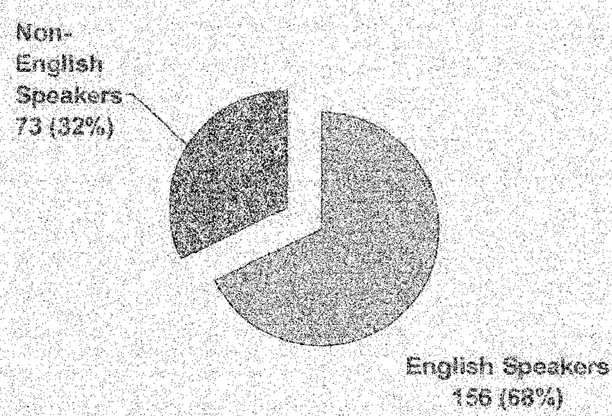
- 2 Locations on Chicago Lake Michigan lakefront
- All willing fishermen interviewed
- Screened: All eat or share the fish caught
- Surveys in English and Spanish
- 160 Completed surveys

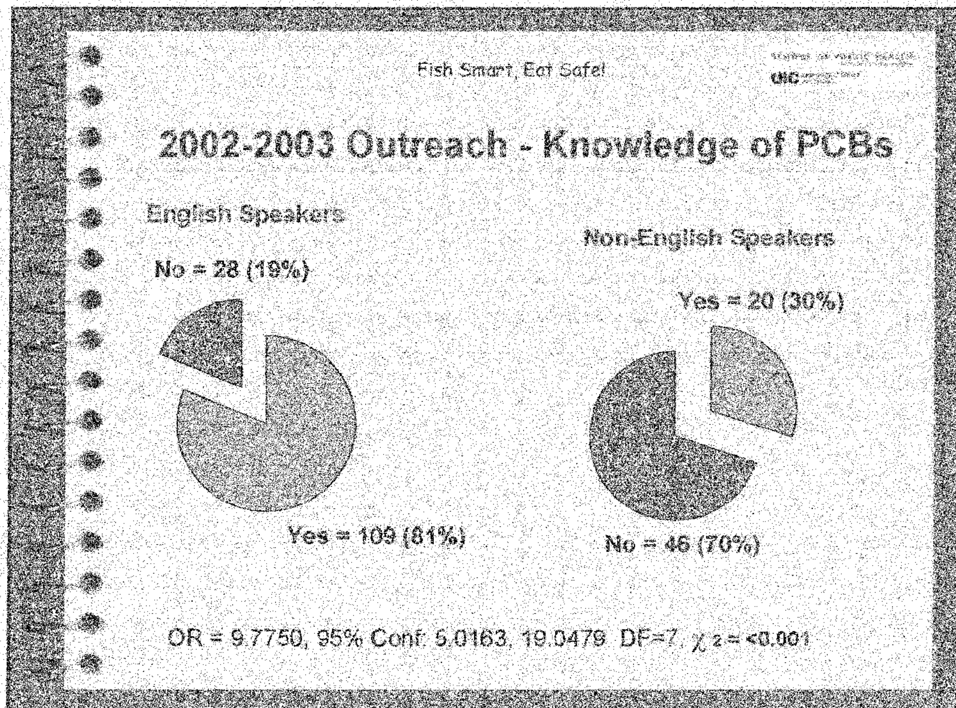
Native Language of Respondents

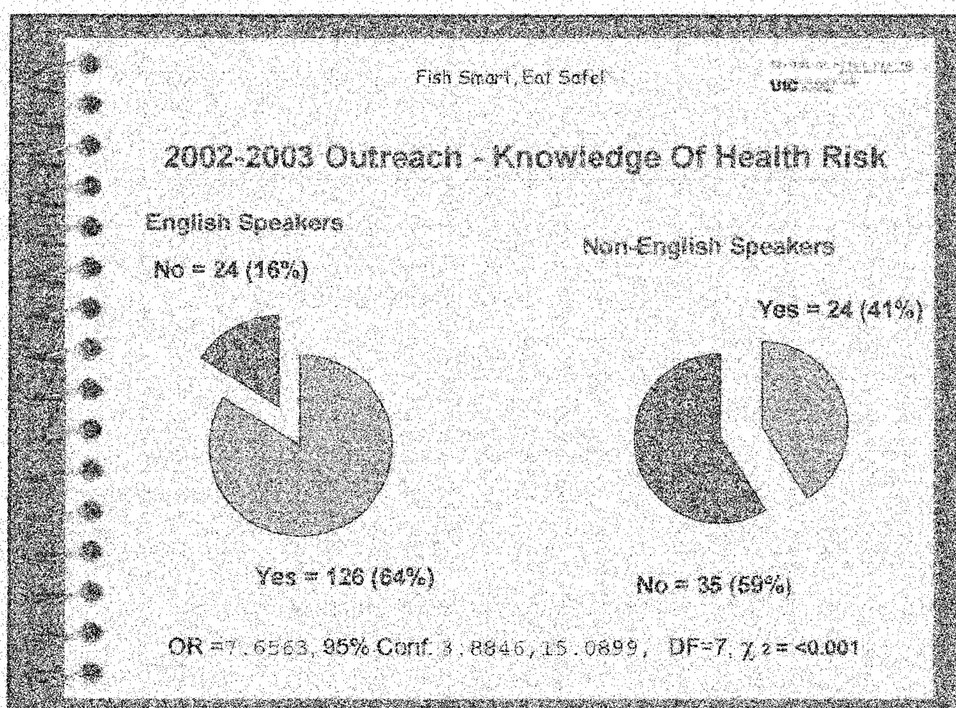
English
Spanish
Korean
Chinese
Vietnamese
Polish
Romanian
Bulgarian
Czech
Italian
Tagalog

FISH SMART! EAT SAFE!

English and Non-English Speakers 2002-2003

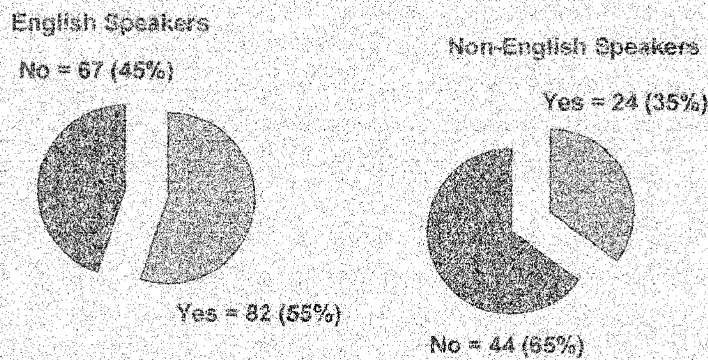



Fish Smart, Eat Safe!
UIC
2002-2003 Outreach - Knowledge of PCBs
English Speakers
No = 28 (19%)
Yes = 109 (81%)
Non-English Speakers
Yes = 20 (30%)
No = 46 (70%)
OR = 9.7750, 95% Conf. 5.0163, 19.0479 DF=7, χ 2 = <0.001


Fish Smart, Eat Safe!
UIC
2002-2003 Outreach - Knowledge Of Health Risk
English Speakers
No = 24 (16%)
Yes = 126 (84%)
Non-English Speakers
Yes = 24 (41%)
No = 35 (59%)
OR =7.6563, 95% Conf. 3.8846, 15.0899, DF=7, χ 2 = <0.001

Fish Smart, Eat Safe!

2002-2003 Outreach - Knowledge of Fish Advisories



OR =2.2438, 95% Confidence:2.402, 4.0596, DF=7, χ_2 = <0.007

Fish Smart, Eat Safe!

Additional Findings . . .

- Median age of fishermen was 40-49 years
- 86% were men
- 82% of fishermen share their catch with family and friends
- 14% of non-Native English speakers and 8% of English speakers identifed carp or catfish as one of the two fish eaten most frequently
- The mode value for consumption of catch frequency was "more than one time per week"
- Almost all fishers [2002] obtained fishing licenses (91%)
- Family physician identified as most trustworthy source of information about fish contamination; the media (tv, newspaper, radio) the most common source of information about contaminants in fish
- Fishermen came to Lake Michigan from multiple neighborhoods and communities in the Chicagoland area

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UIC University of Illinois at Chicago

Conclusions . . .

- *In urban communities struggling with multiple social challenges, fish consumption issues are frequently underestimated or unrecognized as relevant. Subsistence fishing often occurs "below the radar."*
- *In poulations which are heterogeneous, culturally and language-diverse, risk communication requires additional resources and new strategies for reaching target fishermen.*
- *Access to information about the risks of PCB contamination in Lake Michigan fish and risk of mercury contamination in other waterways remains a significant environmental justice issue; knowledge is not accessible uniformly, and significant disparities remain in non-English speaking communities about these risks.*

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Conclusions *(continued)* . . .

- *Fish advisory information is not easily accessible to key populations such as pregnant women, and many health providers at the community level do not have the information or tools to address the issue even if they are interested.*
- *Existing fish advisories are difficult to find, difficult to follow, and pay inadequate attention to cultural preferences and practices*
- *Fish consumption advice is conflicting and inconsistent*

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Recommendations:

- Develop ongoing media campaigns and risk communication materials which:
  - recognize the heterogeneity of targeted communities in urban settings,
  - are designed in consultation with community representatives,
  - are culturally sensitive and appropriate,
  - are widely translated into multiple languages to assure accessibility to the broad diversity of target communities; e.g., regular dissemination of information to foreign-language radio stations and print media
- Consistency between agency guidelines

Fish Smart, Eat Safe!

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UIC University of Illinois at Chicago

Recommendations *(continued)*:

- Focus on primary health care providers, obstetricians, and pediatricians as key messengers of fish consumption information in target communities
- Develop an outreach program for EPA regions, where needed, which includes:
  - 1) an outreach campaign to community groups and health care personnel,
  - 2) dedication of at least one individual trained to do outreach presentations and act as a local resource person,
  - 3) a widely-disseminated toll-free phone number which connects to a live person who can answer questions about advisories specific to relevant areas in the region, and is available for outreach presentations to interested groups and organizations.

PCB Risk Communication and Outreach Project
2002-2003
"Fish Smart, Eat Safe!"

The University of Illinois at Chicago School of Public Health
Great Lakes Centers for Occupational and Environmental Safety and Health
U. S. Environmental Protection Agency Program on Persistent Bioaccumulative Toxics

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From: Jeff Brown [jeffb@sccwrp.org]
Sent: Wednesday, January 08, 2003 2:56 PM
To: steveb
Subject: San Diego Bay PAH data

PAH San Diego Bay_ForSAS.xls   PAHs_ND=MDL.xls

Steve,

Attached are two Excel files with Bight'98 PAH data. The file called "PAH San Diego Bay_ForSAS" contains all the individual data for each compound, including replicate data. The other file titled "PAHs_ND=MDL" contains the mean data of all replicates, for each compound.

Data from the "PAHs_ND=MDL" file were used in the distance-from-shore approach. All replicate data were used to calculate the mean for each compound at each station. Replicates that had non-detects values (result = -99 in the "PAH San Diego Bay_ForSAS" file) were substituted with the method detection limit prior to calculating the mean. The mean value for each compound was then summed up for each station. The summed value for each station is presented in the distance-from-shore summary.

Jeff

EHC 001311

STATION	ParameterCode	COMMON NAME	PAHs (ng/g)
2221	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2221	1-METHNAP	1-Methylnapthalene	39
2221	1-MPHENAH	1-Methylphenanthrene	29
2221	26-2MNAP	2,6-Dimethylnaphthalene	43
2221	2BANTH	Dibenz[a,h]anthracene	25
2221	2-METHNAP	2-Methylnapthalene	39
2221	ACENAPE	Acenaphthene	42
2221	ACENAPTYLE	Acenaphthylene	25
2221	ANTHRACENE	Anthracene	35
2221	BAA	Benz[a]anthracene	28
2221	BAP	Benzo[a]pyrene	43.7
2221	BBF	Benzo[b]fluoranthene	45
2221	BEP	Benzo[e]pyrene	37
2221	BGHIP	Benzo[g,h,i]perylene	38
2221	BIPHENYL	Biphenyl	42
2221	BKF	Benzo[k]fluoranthene	43.1
2221	CHRYSENE	Chrysene	28.6
2221	FLUORANTHN	Fluoranthene	39
2221	FLUORENE	Fluorene	46
2221	ICDP	Indeno(1,2,3-c,d)pyrene	29.1
2221	NAPTHALENE	Naphthalene	36
2221	PERYLENE	Perylene	18
2221	PHENANTHRN	Phenanthrene	37
2221	PYRENE	Pyrene	50.3
2222	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2222	1-METHNAP	1-Methylnapthalene	39
2222	1-MPHENAH	1-Methylphenanthrene	29
2222	26-2MNAP	2,6-Dimethylnaphthalene	43
2222	2BANTH	Dibenz[a,h]anthracene	25
2222	2-METHNAP	2-Methylnapthalene	39
2222	ACENAPE	Acenaphthene	42
2222	ACENAPTYLE	Acenaphthylene	25
2222	ANTHRACENE	Anthracene	35
2222	BAA	Benz[a]anthracene	33.3
2222	BAP	Benzo[a]pyrene	71.4
2222	BBF	Benzo[b]fluoranthene	120
2222	BEP	Benzo[e]pyrene	60.5
2222	BGHIP	Benzo[g,h,i]perylene	50.4
2222	BIPHENYL	Biphenyl	42
2222	BKF	Benzo[k]fluoranthene	73.6
2222	CHRYSENE	Chrysene	40.4
2222	FLUORANTHN	Fluoranthene	46.5
2222	FLUORENE	Fluorene	46
2222	ICDP	Indeno(1,2,3-c,d)pyrene	47.6
2222	NAPTHALENE	Naphthalene	36
2222	PERYLENE	Perylene	21.9
2222	PHENANTHRN	Phenanthrene	37
2222	PYRENE	Pyrene	50.9
2223	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2223	1-METHNAP	1-Methylnapthalene	39
2223	1-MPHENAH	1-Methylphenanthrene	29

2223	26-2MNAP	2,6-Dimethylnaphthalene	43
2223	2BANTH	Dibenz[a,h]anthracene	25
2223	2-METHNAP	2-Methylnapthalene	39
2223	ACENAPE	Acenaphthene	42
2223	ACENAPTYLE	Acenaphthylene	25
2223	ANTHRACENE	Anthracene	35
2223	BAA	Benz[a]anthracene	23.6
2223	BAP	Benzo[a]pyrene	44.3
2223	BBF	Benzo[b]fluoranthene	66
2223	BEP	Benzo[e]pyrene	40.4
2223	BGHIP	Benzo[g,h,i]perylene	26.9
2223	BIPHENYL	Biphenyl	42
2223	BKF	Benzo[k]fluoranthene	43.2
2223	CHRYSENE	Chrysene	33.1
2223	FLUORANTHN	Fluoranthene	39
2223	FLUORENE	Fluorene	46
2223	ICDP	Indeno(1,2,3-c,d)pyrene	27
2223	NAPTHALENE	Naphthalene	36
2223	PERYLENE	Perylene	18
2223	PHENANTHRN	Phenanthrene	37
2223	PYRENE	Pyrene	39.3
2224	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2224	1-METHNAP	1-Methylnapthalene	39
2224	1-MPHENAH	1-Methylphenanthrene	29
2224	26-2MNAP	2,6-Dimethylnaphthalene	43
2224	2BANTH	Dibenz[a,h]anthracene	25
2224	2-METHNAP	2-Methylnapthalene	39
2224	ACENAPE	Acenaphthene	42
2224	ACENAPTYLE	Acenaphthylene	25
2224	ANTHRACENE	Anthracene	35
2224	BAA	Benz[a]anthracene	23
2224	BAP	Benzo[a]pyrene	18
2224	BBF	Benzo[b]fluoranthene	27
2224	BEP	Benzo[e]pyrene	18
2224	BGHIP	Benzo[g,h,i]perylene	25
2224	BIPHENYL	Biphenyl	42
2224	BKF	Benzo[k]fluoranthene	20
2224	CHRYSENE	Chrysene	21
2224	FLUORANTHN	Fluoranthene	39
2224	FLUORENE	Fluorene	46
2224	ICDP	Indeno(1,2,3-c,d)pyrene	22
2224	NAPTHALENE	Naphthalene	36
2224	PERYLENE	Perylene	18
2224	PHENANTHRN	Phenanthrene	37
2224	PYRENE	Pyrene	27
2225	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2225	1-METHNAP	1-Methylnapthalene	39
2225	1-MPHENAH	1-Methylphenanthrene	29
2225	26-2MNAP	2,6-Dimethylnaphthalene	43
2225	2BANTH	Dibenz[a,h]anthracene	25
2225	2-METHNAP	2-Methylnapthalene	39
2225	ACENAPE	Acenaphthene	42

2225	ACENAPTYLE	Acenaphthylene	25
2225	ANTHRACENE	Anthracene	35
2225	BAA	Benz[a]anthracene	35.1
2225	BAP	Benzo[a]pyrene	37.9
2225	BBF	Benzo[b]fluoranthene	55
2225	BEP	Benzo[e]pyrene	36.8
2225	BGHIP	Benzo[g,h,i]perylene	25
2225	BIPHENYL	Biphenyl	42
2225	BKF	Benzo[k]fluoranthene	42.8
2225	CHRYSENE	Chrysene	51
2225	FLUORANTHN	Fluoranthene	39
2225	FLUORENE	Fluorene	46
2225	ICDP	Indeno(1,2,3-c,d)pyrene	22.3
2225	NAPTHALENE	Naphthalene	36
2225	PERYLENE	Perylene	18
2225	PHENANTHRN	Phenanthrene	37
2225	PYRENE	Pyrene	38.8
2226	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2226	1-METHNAP	1-Methylnapthalene	39
2226	1-MPHENAH	1-Methylphenanthrene	29
2226	26-2MNAP	2,6-Dimethylnaphthalene	43
2226	2BANTH	Dibenz[a,h]anthracene	25
2226	2-METHNAP	2-Methylnapthalene	39
2226	ACENAPE	Acenaphthene	42
2226	ACENAPTYLE	Acenaphthylene	25
2226	ANTHRACENE	Anthracene	35
2226	BAA	Benz[a]anthracene	68.3
2226	BAP	Benzo[a]pyrene	107
2226	BBF	Benzo[b]fluoranthene	148
2226	BEP	Benzo[e]pyrene	91.7
2226	BGHIP	Benzo[g,h,i]perylene	50.1
2226	BIPHENYL	Biphenyl	42
2226	BKF	Benzo[k]fluoranthene	103
2226	CHRYSENE	Chrysene	93
2226	FLUORANTHN	Fluoranthene	59.3
2226	FLUORENE	Fluorene	46
2226	ICDP	Indeno(1,2,3-c,d)pyrene	50.5
2226	NAPTHALENE	Naphthalene	36
2226	PERYLENE	Perylene	29.1
2226	PHENANTHRN	Phenanthrene	37
2226	PYRENE	Pyrene	83.1
2227	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2227	1-METHNAP	1-Methylnapthalene	39
2227	1-MPHENAH	1-Methylphenanthrene	29
2227	26-2MNAP	2,6-Dimethylnaphthalene	43
2227	2BANTH	Dibenz[a,h]anthracene	25
2227	2-METHNAP	2-Methylnapthalene	39
2227	ACENAPE	Acenaphthene	42
2227	ACENAPTYLE	Acenaphthylene	25
2227	ANTHRACENE	Anthracene	35
2227	BAA	Benz[a]anthracene	53.3
2227	BAP	Benzo[a]pyrene	66.9

2227	BBF	Benzo[b]fluoranthene	87
2227	BEP	Benzo[e]pyrene	55.4
2227	BGHIP	Benzo[g,h,i]perylene	36.3
2227	BIPHENYL	Biphenyl	42
2227	BKF	Benzo[k]fluoranthene	56.3
2227	CHRYSENE	Chrysene	71.1
2227	FLUORANTHN	Fluoranthene	62.3
2227	FLUORENE	Fluorene	46
2227	ICDP	Indeno(1,2,3-c,d)pyrene	33.1
2227	NAPTHALENE	Naphthalene	36
2227	PERYLENE	Perylene	18.9
2227	PHENANTHRN	Phenanthrene	37
2227	PYRENE	Pyrene	70.1
2228	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2228	1-METHNAP	1-Methylnapthalene	39
2228	1-MPHENAH	1-Methylphenanthrene	29
2228	26-2MNAP	2,6-Dimethylnaphthalene	43
2228	2BANTH	Dibenz[a,h]anthracene	25
2228	2-METHNAP	2-Methylnapthalene	39
2228	ACENAPE	Acenaphthene	42
2228	ACENAPTYLE	Acenaphthylene	25
2228	ANTHRACENE	Anthracene	35
2228	BAA	Benz[a]anthracene	63.5
2228	BAP	Benzo[a]pyrene	100
2228	BBF	Benzo[b]fluoranthene	131
2228	BEP	Benzo[e]pyrene	84.4
2228	BGHIP	Benzo[g,h,i]perylene	63.6
2228	BIPHENYL	Biphenyl	42
2228	BKF	Benzo[k]fluoranthene	77.4
2228	CHRYSENE	Chrysene	79.4
2228	FLUORANTHN	Fluoranthene	72.3
2228	FLUORENE	Fluorene	46
2228	ICDP	Indeno(1,2,3-c,d)pyrene	54.8
2228	NAPTHALENE	Naphthalene	36
2228	PERYLENE	Perylene	27.6
2228	PHENANTHRN	Phenanthrene	37
2228	PYRENE	Pyrene	92.9
2229	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2229	1-METHNAP	1-Methylnapthalene	39
2229	1-MPHENAH	1-Methylphenanthrene	29
2229	26-2MNAP	2,6-Dimethylnaphthalene	43
2229	2BANTH	Dibenz[a,h]anthracene	25
2229	2-METHNAP	2-Methylnapthalene	39
2229	ACENAPE	Acenaphthene	42
2229	ACENAPTYLE	Acenaphthylene	39.5
2229	ANTHRACENE	Anthracene	60.8
2229	BAA	Benz[a]anthracene	99.5
2229	BAP	Benzo[a]pyrene	106
2229	BBF	Benzo[b]fluoranthene	88
2229	BEP	Benzo[e]pyrene	80.4
2229	BGHIP	Benzo[g,h,i]perylene	54.7
2229	BIPHENYL	Biphenyl	42

2229	BKF	Benzo[k]fluoranthene	104
2229	CHRYSENE	Chrysene	121
2229	FLUORANTHN	Fluoranthene	142
2229	FLUORENE	Fluorene	46
2229	ICDP	Indeno(1,2,3-c,d)pyrene	48.3
2229	NAPTHALENE	Naphthalene	36
2229	PERYLENE	Perylene	27.9
2229	PHENANTHRN	Phenanthrene	211
2229	PYRENE	Pyrene	190
2230	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2230	1-METHNAP	1-Methylnapthalene	39
2230	1-MPHENAH	1-Methylphenanthrene	29
2230	26-2MNAP	2,6-Dimethylnaphthalene	43
2230	2BANTH	Dibenz[a,h]anthracene	25
2230	2-METHNAP	2-Methylnapthalene	39
2230	ACENAPE	Acenaphthene	42
2230	ACENAPTYLE	Acenaphthylene	25
2230	ANTHRACENE	Anthracene	35
2230	BAA	Benz[a]anthracene	23
2230	BAP	Benzo[a]pyrene	18
2230	BBF	Benzo[b]fluoranthene	27
2230	BEP	Benzo[e]pyrene	18
2230	BGHIP	Benzo[g,h,i]perylene	25
2230	BIPHENYL	Biphenyl	42
2230	BKF	Benzo[k]fluoranthene	20
2230	CHRYSENE	Chrysene	21
2230	FLUORANTHN	Fluoranthene	39
2230	FLUORENE	Fluorene	46
2230	ICDP	Indeno(1,2,3-c,d)pyrene	22
2230	NAPTHALENE	Naphthalene	36
2230	PERYLENE	Perylene	18
2230	PHENANTHRN	Phenanthrene	37
2230	PYRENE	Pyrene	27
2231	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2231	1-METHNAP	1-Methylnapthalene	39
2231	1-MPHENAH	1-Methylphenanthrene	29
2231	26-2MNAP	2,6-Dimethylnaphthalene	43
2231	2BANTH	Dibenz[a,h]anthracene	25
2231	2-METHNAP	2-Methylnapthalene	39
2231	ACENAPE	Acenaphthene	42
2231	ACENAPTYLE	Acenaphthylene	25
2231	ANTHRACENE	Anthracene	35
2231	BAA	Benz[a]anthracene	33.9
2231	BAP	Benzo[a]pyrene	65.9
2231	BBF	Benzo[b]fluoranthene	67
2231	BEP	Benzo[e]pyrene	60.1
2231	BGHIP	Benzo[g,h,i]perylene	49
2231	BIPHENYL	Biphenyl	42
2231	BKF	Benzo[k]fluoranthene	66.9
2231	CHRYSENE	Chrysene	50.9
2231	FLUORANTHN	Fluoranthene	41.9
2231	FLUORENE	Fluorene	46

2231	ICDP	Indeno(1,2,3-c,d)pyrene	39.6
2231	NAPTHALENE	Naphthalene	36
2231	PERYLENE	Perylene	19.6
2231	PHENANTHRN	Phenanthrene	37
2231	PYRENE	Pyrene	65.5
2233	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2233	1-METHNAP	1-Methylnapthalene	39
2233	1-MPHENAH	1-Methylphenanthrene	29
2233	26-2MNAP	2,6-Dimethylnaphthalene	43
2233	2BANTH	Dibenz[a,h]anthracene	25
2233	2-METHNAP	2-Methylnapthalene	39
2233	ACENAPE	Acenaphthene	42
2233	ACENAPTYLE	Acenaphthylene	25
2233	ANTHRACENE	Anthracene	35
2233	BAA	Benz[a]anthracene	23
2233	BAP	Benzo[a]pyrene	18
2233	BBF	Benzo[b]fluoranthene	27
2233	BEP	Benzo[e]pyrene	18
2233	BGHIP	Benzo[g,h,i]perylene	25
2233	BIPHENYL	Biphenyl	42
2233	BKF	Benzo[k]fluoranthene	20
2233	CHRYSENE	Chrysene	21
2233	FLUORANTHN	Fluoranthene	39
2233	FLUORENE	Fluorene	46
2233	ICDP	Indeno(1,2,3-c,d)pyrene	22
2233	NAPTHALENE	Naphthalene	36
2233	PERYLENE	Perylene	18
2233	PHENANTHRN	Phenanthrene	37
2233	PYRENE	Pyrene	30.05
2235	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2235	1-METHNAP	1-Methylnapthalene	39
2235	1-MPHENAH	1-Methylphenanthrene	29
2235	26-2MNAP	2,6-Dimethylnaphthalene	43
2235	2BANTH	Dibenz[a,h]anthracene	25
2235	2-METHNAP	2-Methylnapthalene	39
2235	ACENAPE	Acenaphthene	42
2235	ACENAPTYLE	Acenaphthylene	25
2235	ANTHRACENE	Anthracene	35
2235	BAA	Benz[a]anthracene	23
2235	BAP	Benzo[a]pyrene	18
2235	BBF	Benzo[b]fluoranthene	27
2235	BEP	Benzo[e]pyrene	18
2235	BGHIP	Benzo[g,h,i]perylene	25
2235	BIPHENYL	Biphenyl	42
2235	BKF	Benzo[k]fluoranthene	20
2235	CHRYSENE	Chrysene	21
2235	FLUORANTHN	Fluoranthene	39
2235	FLUORENE	Fluorene	46
2235	ICDP	Indeno(1,2,3-c,d)pyrene	22
2235	NAPTHALENE	Naphthalene	36
2235	PERYLENE	Perylene	18
2235	PHENANTHRN	Phenanthrene	37

2235	PYRENE	Pyrene	27
2238	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2238	1-METHNAP	1-Methylnapthalene	39
2238	1-MPHENAH	1-Methylphenanthrene	29
2238	26-2MNAP	2,6-Dimethylnaphthalene	43
2238	2BANTH	Dibenz[a,h]anthracene	25
2238	2-METHNAP	2-Methylnapthalene	39
2238	ACENAPE	Acenaphthene	42
2238	ACENAPTYLE	Acenaphthylene	25
2238	ANTHRACENE	Anthracene	35
2238	BAA	Benz[a]anthracene	23
2238	BAP	Benzo[a]pyrene	18
2238	BBF	Benzo[b]fluoranthene	27
2238	BEP	Benzo[e]pyrene	18
2238	BGHIP	Benzo[g,h,i]perylene	25
2238	BIPHENYL	Biphenyl	42
2238	BKF	Benzo[k]fluoranthene	20
2238	CHRYSENE	Chrysene	21
2238	FLUORANTHN	Fluoranthene	39
2238	FLUORENE	Fluorene	46
2238	ICDP	Indeno(1,2,3-c,d)pyrene	22
2238	NAPTHALENE	Naphthalene	36
2238	PERYLENE	Perylene	18
2238	PHENANTHRN	Phenanthrene	37
2238	PYRENE	Pyrene	27
2239	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2239	1-METHNAP	1-Methylnapthalene	39
2239	1-MPHENAH	1-Methylphenanthrene	29
2239	26-2MNAP	2,6-Dimethylnaphthalene	43
2239	2BANTH	Dibenz[a,h]anthracene	25
2239	2-METHNAP	2-Methylnapthalene	39
2239	ACENAPE	Acenaphthene	42
2239	ACENAPTYLE	Acenaphthylene	25
2239	ANTHRACENE	Anthracene	35
2239	BAA	Benz[a]anthracene	47.6
2239	BAP	Benzo[a]pyrene	82
2239	BBF	Benzo[b]fluoranthene	96
2239	BEP	Benzo[e]pyrene	74.6
2239	BGHIP	Benzo[g,h,i]perylene	49.7
2239	BIPHENYL	Biphenyl	42
2239	BKF	Benzo[k]fluoranthene	80.5
2239	CHRYSENE	Chrysene	70.1
2239	FLUORANTHN	Fluoranthene	55.9
2239	FLUORENE	Fluorene	46
2239	ICDP	Indeno(1,2,3-c,d)pyrene	45.4
2239	NAPTHALENE	Naphthalene	36
2239	PERYLENE	Perylene	28.9
2239	PHENANTHRN	Phenanthrene	37
2239	PYRENE	Pyrene	70.2
2240	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2240	1-METHNAP	1-Methylnapthalene	39
2240	1-MPHENAH	1-Methylphenanthrene	29

2240	26-2MNAP	2,6-Dimethylnaphthalene	43
2240	2BANTH	Dibenz[a,h]anthracene	25
2240	2-METHNAP	2-Methylnapthalene	39
2240	ACENAPE	Acenaphthene	42
2240	ACENAPTYLE	Acenaphthylene	25
2240	ANTHRACENE	Anthracene	35
2240	BAA	Benz[a]anthracene	23.7
2240	BAP	Benzo[a]pyrene	28.8
2240	BBF	Benzo[b]fluoranthene	41
2240	BEP	Benzo[e]pyrene	27.5
2240	BGHIP	Benzo[g,h,i]perylene	26.1
2240	BIPHENYL	Biphenyl	42
2240	BKF	Benzo[k]fluoranthene	20.35
2240	CHRYSENE	Chrysene	21
2240	FLUORANTHN	Fluoranthene	39
2240	FLUORENE	Fluorene	46
2240	ICDP	Indeno(1,2,3-c,d)pyrene	22
2240	NAPTHALENE	Naphthalene	36
2240	PERYLENE	Perylene	18
2240	PHENANTHRN	Phenanthrene	37
2240	PYRENE	Pyrene	32.2
2241	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2241	1-METHNAP	1-Methylnapthalene	39
2241	1-MPHENAH	1-Methylphenanthrene	29
2241	26-2MNAP	2,6-Dimethylnaphthalene	43
2241	2BANTH	Dibenz[a,h]anthracene	25
2241	2-METHNAP	2-Methylnapthalene	39
2241	ACENAPE	Acenaphthene	42
2241	ACENAPTYLE	Acenaphthylene	25
2241	ANTHRACENE	Anthracene	35
2241	BAA	Benz[a]anthracene	23
2241	BAP	Benzo[a]pyrene	18
2241	BBF	Benzo[b]fluoranthene	27
2241	BEP	Benzo[e]pyrene	18
2241	BGHIP	Benzo[g,h,i]perylene	25
2241	BIPHENYL	Biphenyl	42
2241	BKF	Benzo[k]fluoranthene	20
2241	CHRYSENE	Chrysene	21
2241	FLUORANTHN	Fluoranthene	39
2241	FLUORENE	Fluorene	46
2241	ICDP	Indeno(1,2,3-c,d)pyrene	22
2241	NAPTHALENE	Naphthalene	36
2241	PERYLENE	Perylene	18
2241	PHENANTHRN	Phenanthrene	37
2241	PYRENE	Pyrene	27
2242	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2242	1-METHNAP	1-Methylnapthalene	39
2242	1-MPHENAH	1-Methylphenanthrene	29
2242	26-2MNAP	2,6-Dimethylnaphthalene	43
2242	2BANTH	Dibenz[a,h]anthracene	25
2242	2-METHNAP	2-Methylnapthalene	39
2242	ACENAPE	Acenaphthene	42

2242	ACENAPTYLE	Acenaphthylene	25
2242	ANTHRACENE	Anthracene	35
2242	BAA	Benz[a]anthracene	23
2242	BAP	Benzo[a]pyrene	33
2242	BBF	Benzo[b]fluoranthene	37
2242	BEP	Benzo[e]pyrene	29
2242	BGHIP	Benzo[g,h,i]perylene	29.9
2242	BIPHENYL	Biphenyl	42
2242	BKF	Benzo[k]fluoranthene	30.6
2242	CHRYSENE	Chrysene	21.3
2242	FLUORANTHN	Fluoranthene	39
2242	FLUORENE	Fluorene	46
2242	ICDP	Indeno(1,2,3-c,d)pyrene	23.9
2242	NAPTHALENE	Naphthalene	36
2242	PERYLENE	Perylene	18
2242	PHENANTHRN	Phenanthrene	37
2242	PYRENE	Pyrene	29
2243	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2243	1-METHNAP	1-Methylnapthalene	39
2243	1-MPHENAH	1-Methylphenanthrene	29
2243	26-2MNAP	2,6-Dimethylnaphthalene	43
2243	2BANTH	Dibenz[a,h]anthracene	25
2243	2-METHNAP	2-Methylnapthalene	39
2243	ACENAPE	Acenaphthene	42
2243	ACENAPTYLE	Acenaphthylene	25
2243	ANTHRACENE	Anthracene	35
2243	BAA	Benz[a]anthracene	23
2243	BAP	Benzo[a]pyrene	18
2243	BBF	Benzo[b]fluoranthene	27
2243	BEP	Benzo[e]pyrene	18
2243	BGHIP	Benzo[g,h,i]perylene	25
2243	BIPHENYL	Biphenyl	42
2243	BKF	Benzo[k]fluoranthene	20
2243	CHRYSENE	Chrysene	21
2243	FLUORANTHN	Fluoranthene	39
2243	FLUORENE	Fluorene	46
2243	ICDP	Indeno(1,2,3-c,d)pyrene	22
2243	NAPTHALENE	Naphthalene	36
2243	PERYLENE	Perylene	18
2243	PHENANTHRN	Phenanthrene	37
2243	PYRENE	Pyrene	27
2244	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2244	1-METHNAP	1-Methylnapthalene	39
2244	1-MPHENAH	1-Methylphenanthrene	29
2244	26-2MNAP	2,6-Dimethylnaphthalene	43
2244	2BANTH	Dibenz[a,h]anthracene	25
2244	2-METHNAP	2-Methylnapthalene	39
2244	ACENAPE	Acenaphthene	42
2244	ACENAPTYLE	Acenaphthylene	25
2244	ANTHRACENE	Anthracene	35
2244	BAA	Benz[a]anthracene	23
2244	BAP	Benzo[a]pyrene	18

2244	BBF	Benzo[b]fluoranthene	27
2244	BEP	Benzo[e]pyrene	18
2244	BGHIP	Benzo[g,h,i]perylene	25
2244	BIPHENYL	Biphenyl	42
2244	BKF	Benzo[k]fluoranthene	20
2244	CHRYSENE	Chrysene	21
2244	FLUORANTHN	Fluoranthene	39
2244	FLUORENE	Fluorene	46
2244	ICDP	Indeno(1,2,3-c,d)pyrene	22
2244	NAPTHALENE	Naphthalene	36
2244	PERYLENE	Perylene	18
2244	PHENANTHRN	Phenanthrene	37
2244	PYRENE	Pyrene	27
2245	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2245	1-METHNAP	1-Methylnapthalene	39
2245	1-MPHENAH	1-Methylphenanthrene	29
2245	26-2MNAP	2,6-Dimethylnaphthalene	43
2245	2BANTH	Dibenz[a,h]anthracene	25
2245	2-METHNAP	2-Methylnapthalene	39
2245	ACENAPE	Acenaphthene	42
2245	ACENAPTYLE	Acenaphthylene	25
2245	ANTHRACENE	Anthracene	35
2245	BAA	Benz[a]anthracene	23
2245	BAP	Benzo[a]pyrene	20.8
2245	BBF	Benzo[b]fluoranthene	30
2245	BEP	Benzo[e]pyrene	21.6
2245	BGHIP	Benzo[g,h,i]perylene	25
2245	BIPHENYL	Biphenyl	42
2245	BKF	Benzo[k]fluoranthene	20
2245	CHRYSENE	Chrysene	21
2245	FLUORANTHN	Fluoranthene	39
2245	FLUORENE	Fluorene	46
2245	ICDP	Indeno(1,2,3-c,d)pyrene	22
2245	NAPTHALENE	Naphthalene	36
2245	PERYLENE	Perylene	18
2245	PHENANTHRN	Phenanthrene	37
2245	PYRENE	Pyrene	27.2
2247	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2247	1-METHNAP	1-Methylnapthalene	39
2247	1-MPHENAH	1-Methylphenanthrene	29
2247	26-2MNAP	2,6-Dimethylnaphthalene	43
2247	2BANTH	Dibenz[a,h]anthracene	25
2247	2-METHNAP	2-Methylnapthalene	39
2247	ACENAPE	Acenaphthene	42
2247	ACENAPTYLE	Acenaphthylene	25
2247	ANTHRACENE	Anthracene	35
2247	BAA	Benz[a]anthracene	23
2247	BAP	Benzo[a]pyrene	18.9
2247	BBF	Benzo[b]fluoranthene	28
2247	BEP	Benzo[e]pyrene	18.8
2247	BGHIP	Benzo[g,h,i]perylene	25
2247	BIPHENYL	Biphenyl	42

2247	BKF	Benzo[k]fluoranthene	20
2247	CHRYSENE	Chrysene	21
2247	FLUORANTHN	Fluoranthene	39
2247	FLUORENE	Fluorene	46
2247	ICDP	Indeno(1,2,3-c,d)pyrene	22
2247	NAPTHALENE	Naphthalene	36
2247	PERYLENE	Perylene	18
2247	PHENANTHRN	Phenanthrene	37
2247	PYRENE	Pyrene	27
2249	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2249	1-METHNAP	1-Methylnapthalene	39
2249	1-MPHENAH	1-Methylphenanthrene	29
2249	26-2MNAP	2,6-Dimethylnaphthalene	43
2249	2BANTH	Dibenz[a,h]anthracene	25
2249	2-METHNAP	2-Methylnapthalene	39
2249	ACENAPE	Acenaphthene	42
2249	ACENAPTYLE	Acenaphthylene	25
2249	ANTHRACENE	Anthracene	35
2249	BAA	Benz[a]anthracene	25.8
2249	BAP	Benzo[a]pyrene	24.4
2249	BBF	Benzo[b]fluoranthene	27
2249	BEP	Benzo[e]pyrene	21.8
2249	BGHIP	Benzo[g,h,i]perylene	25
2249	BIPHENYL	Biphenyl	42
2249	BKF	Benzo[k]fluoranthene	22.6
2249	CHRYSENE	Chrysene	25.4
2249	FLUORANTHN	Fluoranthene	43.9
2249	FLUORENE	Fluorene	46
2249	ICDP	Indeno(1,2,3-c,d)pyrene	22
2249	NAPTHALENE	Naphthalene	36
2249	PERYLENE	Perylene	18
2249	PHENANTHRN	Phenanthrene	37
2249	PYRENE	Pyrene	45
2251	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2251	1-METHNAP	1-Methylnapthalene	39
2251	1-MPHENAH	1-Methylphenanthrene	29
2251	26-2MNAP	2,6-Dimethylnaphthalene	43
2251	2BANTH	Dibenz[a,h]anthracene	97.6
2251	2-METHNAP	2-Methylnapthalene	39
2251	ACENAPE	Acenaphthene	42
2251	ACENAPTYLE	Acenaphthylene	98.3
2251	ANTHRACENE	Anthracene	164
2251	BAA	Benz[a]anthracene	366
2251	BAP	Benzo[a]pyrene	567
2251	BBF	Benzo[b]fluoranthene	760
2251	BEP	Benzo[e]pyrene	499
2251	BGHIP	Benzo[g,h,i]perylene	282
2251	BIPHENYL	Biphenyl	42
2251	BKF	Benzo[k]fluoranthene	329
2251	CHRYSENE	Chrysene	536
2251	FLUORANTHN	Fluoranthene	503
2251	FLUORENE	Fluorene	46

2251	ICDP	Indeno(1,2,3-c,d)pyrene	254
2251	NAPTHALENE	Naphthalene	36
2251	PERYLENE	Perylene	131
2251	PHENANTHRN	Phenanthrene	218
2251	PYRENE	Pyrene	665
2252	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2252	1-METHNAP	1-Methylnapthalene	39
2252	1-MPHENAH	1-Methylphenanthrene	29
2252	26-2MNAP	2,6-Dimethylnaphthalene	43
2252	2BANTH	Dibenz[a,h]anthracene	25
2252	2-METHNAP	2-Methylnapthalene	39
2252	ACENAPE	Acenaphthene	42
2252	ACENAPTYLE	Acenaphthylene	25
2252	ANTHRACENE	Anthracene	35
2252	BAA	Benz[a]anthracene	23
2252	BAP	Benzo[a]pyrene	18
2252	BBF	Benzo[b]fluoranthene	27
2252	BEP	Benzo[e]pyrene	18
2252	BGHIP	Benzo[g,h,i]perylene	25
2252	BIPHENYL	Biphenyl	42
2252	BKF	Benzo[k]fluoranthene	20
2252	CHRYSENE	Chrysene	21
2252	FLUORANTHN	Fluoranthene	39
2252	FLUORENE	Fluorene	46
2252	ICDP	Indeno(1,2,3-c,d)pyrene	22
2252	NAPTHALENE	Naphthalene	36
2252	PERYLENE	Perylene	18
2252	PHENANTHRN	Phenanthrene	37
2252	PYRENE	Pyrene	29.45
2253	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2253	1-METHNAP	1-Methylnapthalene	39
2253	1-MPHENAH	1-Methylphenanthrene	29
2253	26-2MNAP	2,6-Dimethylnaphthalene	43
2253	2BANTH	Dibenz[a,h]anthracene	43.25
2253	2-METHNAP	2-Methylnapthalene	39
2253	ACENAPE	Acenaphthene	42
2253	ACENAPTYLE	Acenaphthylene	36.8
2253	ANTHRACENE	Anthracene	50.35
2253	BAA	Benz[a]anthracene	125
2253	BAP	Benzo[a]pyrene	222.5
2253	BBF	Benzo[b]fluoranthene	305.5
2253	BEP	Benzo[e]pyrene	200
2253	BGHIP	Benzo[g,h,i]perylene	86.95
2253	BIPHENYL	Biphenyl	42
2253	BKF	Benzo[k]fluoranthene	188
2253	CHRYSENE	Chrysene	134.4
2253	FLUORANTHN	Fluoranthene	143
2253	FLUORENE	Fluorene	46
2253	ICDP	Indeno(1,2,3-c,d)pyrene	94.2
2253	NAPTHALENE	Naphthalene	36
2253	PERYLENE	Perylene	58.3
2253	PHENANTHRN	Phenanthrene	60.05

2253	PYRENE	Pyrene	176
2254	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2254	1-METHNAP	1-Methylnapthalene	39
2254	1-MPHENAH	1-Methylphenanthrene	29
2254	26-2MNAP	2,6-Dimethylnaphthalene	43
2254	2BANTH	Dibenz[a,h]anthracene	193
2254	2-METHNAP	2-Methylnapthalene	39
2254	ACENAPE	Acenaphthene	42
2254	ACENAPTYLE	Acenaphthylene	241
2254	ANTHRACENE	Anthracene	368
2254	BAA	Benz[a]anthracene	1000
2254	BAP	Benzo[a]pyrene	1150
2254	BBF	Benzo[b]fluoranthene	2010
2254	BEP	Benzo[e]pyrene	1180
2254	BGHIP	Benzo[g,h,i]perylene	289
2254	BIPHENYL	Biphenyl	42
2254	BKF	Benzo[k]fluoranthene	1160
2254	CHRYSENE	Chrysene	1330
2254	FLUORANTHN	Fluoranthene	1500
2254	FLUORENE	Fluorene	54
2254	ICDP	Indeno(1,2,3-c,d)pyrene	361
2254	NAPTHALENE	Naphthalene	36
2254	PERYLENE	Perylene	291
2254	PHENANTHRN	Phenanthrene	311
2254	PYRENE	Pyrene	1340
2255	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2255	1-METHNAP	1-Methylnapthalene	39
2255	1-MPHENAH	1-Methylphenanthrene	29
2255	26-2MNAP	2,6-Dimethylnaphthalene	43
2255	2BANTH	Dibenz[a,h]anthracene	61.35
2255	2-METHNAP	2-Methylnapthalene	39
2255	ACENAPE	Acenaphthene	42
2255	ACENAPTYLE	Acenaphthylene	36.35
2255	ANTHRACENE	Anthracene	55.95
2255	BAA	Benz[a]anthracene	204
2255	BAP	Benzo[a]pyrene	281
2255	BBF	Benzo[b]fluoranthene	397.5
2255	BEP	Benzo[e]pyrene	214
2255	BGHIP	Benzo[g,h,i]perylene	103.5
2255	BIPHENYL	Biphenyl	42
2255	BKF	Benzo[k]fluoranthene	205
2255	CHRYSENE	Chrysene	237
2255	FLUORANTHN	Fluoranthene	239.5
2255	FLUORENE	Fluorene	46
2255	ICDP	Indeno(1,2,3-c,d)pyrene	110
2255	NAPTHALENE	Naphthalene	36
2255	PERYLENE	Perylene	77.5
2255	PHENANTHRN	Phenanthrene	59.7
2255	PYRENE	Pyrene	234
2256	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2256	1-METHNAP	1-Methylnapthalene	39
2256	1-MPHENAH	1-Methylphenanthrene	29

2256	26-2MNAP	2,6-Dimethylnaphthalene	43
2256	2BANTH	Dibenz[a,h]anthracene	25
2256	2-METHNAP	2-Methylnapthalene	39
2256	ACENAPE	Acenaphthene	42
2256	ACENAPTYLE	Acenaphthylene	25
2256	ANTHRACENE	Anthracene	35
2256	BAA	Benz[a]anthracene	31.4
2256	BAP	Benzo[a]pyrene	43.8
2256	BBF	Benzo[b]fluoranthene	56
2256	BEP	Benzo[e]pyrene	41.1
2256	BGHIP	Benzo[g,h,i]perylene	35.2
2256	BIPHENYL	Biphenyl	42
2256	BKF	Benzo[k]fluoranthene	40.9
2256	CHRYSENE	Chrysene	36.5
2256	FLUORANTHN	Fluoranthene	39.7
2256	FLUORENE	Fluorene	46
2256	ICDP	Indeno(1,2,3-c,d)pyrene	30.65
2256	NAPTHALENE	Naphthalene	36
2256	PERYLENE	Perylene	20.4
2256	PHENANTHRN	Phenanthrene	37
2256	PYRENE	Pyrene	42.5
2257	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2257	1-METHNAP	1-Methylnapthalene	39
2257	1-MPHENAH	1-Methylphenanthrene	29
2257	26-2MNAP	2,6-Dimethylnaphthalene	43
2257	2BANTH	Dibenz[a,h]anthracene	25
2257	2-METHNAP	2-Methylnapthalene	39
2257	ACENAPE	Acenaphthene	42
2257	ACENAPTYLE	Acenaphthylene	25
2257	ANTHRACENE	Anthracene	35
2257	BAA	Benz[a]anthracene	38.85
2257	BAP	Benzo[a]pyrene	55.9
2257	BBF	Benzo[b]fluoranthene	69.5
2257	BEP	Benzo[e]pyrene	52.85
2257	BGHIP	Benzo[g,h,i]perylene	39.7
2257	BIPHENYL	Biphenyl	42
2257	BKF	Benzo[k]fluoranthene	56.65
2257	CHRYSENE	Chrysene	48.6
2257	FLUORANTHN	Fluoranthene	45.2
2257	FLUORENE	Fluorene	46
2257	ICDP	Indeno(1,2,3-c,d)pyrene	35.95
2257	NAPTHALENE	Naphthalene	36
2257	PERYLENE	Perylene	20.45
2257	PHENANTHRN	Phenanthrene	37
2257	PYRENE	Pyrene	46.8
2258	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2258	1-METHNAP	1-Methylnapthalene	39
2258	1-MPHENAH	1-Methylphenanthrene	29
2258	26-2MNAP	2,6-Dimethylnaphthalene	43
2258	2BANTH	Dibenz[a,h]anthracene	25
2258	2-METHNAP	2-Methylnapthalene	39
2258	ACENAPE	Acenaphthene	42

2258	ACENAPTYLE	Acenaphthylene	25
2258	ANTHRACENE	Anthracene	35
2258	BAA	Benz[a]anthracene	31.7
2258	BAP	Benzo[a]pyrene	51.3
2258	BBF	Benzo[b]fluoranthene	62.5
2258	BEP	Benzo[e]pyrene	47.75
2258	BGHIP	Benzo[g,h,i]perylene	33.8
2258	BIPHENYL	Biphenyl	42
2258	BKF	Benzo[k]fluoranthene	49.95
2258	CHRYSENE	Chrysene	37.55
2258	FLUORANTHN	Fluoranthene	39.2
2258	FLUORENE	Fluorene	46
2258	ICDP	Indeno(1,2,3-c,d)pyrene	31.75
2258	NAPTHALENE	Naphthalene	36
2258	PERYLENE	Perylene	21.55
2258	PHENANTHRN	Phenanthrene	37
2258	PYRENE	Pyrene	41.1
2259	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2259	1-METHNAP	1-Methylnapthalene	39
2259	1-MPHENAH	1-Methylphenanthrene	29
2259	26-2MNAP	2,6-Dimethylnaphthalene	43
2259	2BANTH	Dibenz[a,h]anthracene	65.6
2259	2-METHNAP	2-Methylnapthalene	39
2259	ACENAPE	Acenaphthene	42
2259	ACENAPTYLE	Acenaphthylene	69.7
2259	ANTHRACENE	Anthracene	104
2259	BAA	Benz[a]anthracene	165
2259	BAP	Benzo[a]pyrene	372
2259	BBF	Benzo[b]fluoranthene	480
2259	BEP	Benzo[e]pyrene	304
2259	BGHIP	Benzo[g,h,i]perylene	123
2259	BIPHENYL	Biphenyl	42
2259	BKF	Benzo[k]fluoranthene	277
2259	CHRYSENE	Chrysene	279
2259	FLUORANTHN	Fluoranthene	94.6
2259	FLUORENE	Fluorene	46
2259	ICDP	Indeno(1,2,3-c,d)pyrene	138
2259	NAPTHALENE	Naphthalene	36
2259	PERYLENE	Perylene	111
2259	PHENANTHRN	Phenanthrene	49.2
2259	PYRENE	Pyrene	195
2260	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2260	1-METHNAP	1-Methylnapthalene	39
2260	1-MPHENAH	1-Methylphenanthrene	29
2260	26-2MNAP	2,6-Dimethylnaphthalene	43
2260	2BANTH	Dibenz[a,h]anthracene	25
2260	2-METHNAP	2-Methylnapthalene	39
2260	ACENAPE	Acenaphthene	42
2260	ACENAPTYLE	Acenaphthylene	25
2260	ANTHRACENE	Anthracene	35
2260	BAA	Benz[a]anthracene	23
2260	BAP	Benzo[a]pyrene	18

2260	BBF	Benzo[b]fluoranthene	27
2260	BEP	Benzo[e]pyrene	18
2260	BGHIP	Benzo[g,h,i]perylene	25
2260	BIPHENYL	Biphenyl	42
2260	BKF	Benzo[k]fluoranthene	20
2260	CHRYSENE	Chrysene	21
2260	FLUORANTHN	Fluoranthene	39
2260	FLUORENE	Fluorene	46
2260	ICDP	Indeno(1,2,3-c,d)pyrene	22
2260	NAPTHALENE	Naphthalene	36
2260	PERYLENE	Perylene	18
2260	PHENANTHRN	Phenanthrene	37
2260	PYRENE	Pyrene	27
2262	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2262	1-METHNAP	1-Methylnapthalene	39
2262	1-MPHENAH	1-Methylphenanthrene	29
2262	26-2MNAP	2,6-Dimethylnaphthalene	43
2262	2BANTH	Dibenz[a,h]anthracene	25
2262	2-METHNAP	2-Methylnapthalene	39
2262	ACENAPE	Acenaphthene	42
2262	ACENAPTYLE	Acenaphthylene	25
2262	ANTHRACENE	Anthracene	35
2262	BAA	Benz[a]anthracene	43.4
2262	BAP	Benzo[a]pyrene	64
2262	BBF	Benzo[b]fluoranthene	84
2262	BEP	Benzo[e]pyrene	60.9
2262	BGHIP	Benzo[g,h,i]perylene	35.4
2262	BIPHENYL	Biphenyl	42
2262	BKF	Benzo[k]fluoranthene	65.1
2262	CHRYSENE	Chrysene	58.2
2262	FLUORANTHN	Fluoranthene	39.3
2262	FLUORENE	Fluorene	46
2262	ICDP	Indeno(1,2,3-c,d)pyrene	35.9
2262	NAPTHALENE	Naphthalene	36
2262	PERYLENE	Perylene	18
2262	PHENANTHRN	Phenanthrene	37
2262	PYRENE	Pyrene	54.5
2263	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2263	1-METHNAP	1-Methylnapthalene	39
2263	1-MPHENAH	1-Methylphenanthrene	29
2263	26-2MNAP	2,6-Dimethylnaphthalene	43
2263	2BANTH	Dibenz[a,h]anthracene	59.4
2263	2-METHNAP	2-Methylnapthalene	39
2263	ACENAPE	Acenaphthene	42
2263	ACENAPTYLE	Acenaphthylene	52.05
2263	ANTHRACENE	Anthracene	206.85
2263	BAA	Benz[a]anthracene	178.4
2263	BAP	Benzo[a]pyrene	334
2263	BBF	Benzo[b]fluoranthene	424
2263	BEP	Benzo[e]pyrene	263
2263	BGHIP	Benzo[g,h,i]perylene	121.9
2263	BIPHENYL	Biphenyl	42

2263	BKF	Benzo[k]fluoranthene	305
2263	CHRYSENE	Chrysene	357
2263	FLUORANTHN	Fluoranthene	146.1
2263	FLUORENE	Fluorene	50.55
2263	ICDP	Indeno(1,2,3-c,d)pyrene	123.8
2263	NAPTHALENE	Naphthalene	36
2263	PERYLENE	Perylene	96.5
2263	PHENANTHRN	Phenanthrene	93.5
2263	PYRENE	Pyrene	268
2264	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2264	1-METHNAP	1-Methylnapthalene	39
2264	1-MPHENAH	1-Methylphenanthrene	29
2264	26-2MNAP	2,6-Dimethylnaphthalene	46.6
2264	2BANTH	Dibenz[a,h]anthracene	49.8
2264	2-METHNAP	2-Methylnapthalene	39
2264	ACENAPE	Acenaphthene	42
2264	ACENAPTYLE	Acenaphthylene	72
2264	ANTHRACENE	Anthracene	119.5
2264	BAA	Benz[a]anthracene	251.5
2264	BAP	Benzo[a]pyrene	380
2264	BBF	Benzo[b]fluoranthene	528.5
2264	BEP	Benzo[e]pyrene	315
2264	BGHIP	Benzo[g,h,i]perylene	66.5
2264	BIPHENYL	Biphenyl	42
2264	BKF	Benzo[k]fluoranthene	349.5
2264	CHRYSENE	Chrysene	435.65
2264	FLUORANTHN	Fluoranthene	270
2264	FLUORENE	Fluorene	46
2264	ICDP	Indeno(1,2,3-c,d)pyrene	87.5
2264	NAPTHALENE	Naphthalene	36
2264	PERYLENE	Perylene	104
2264	PHENANTHRN	Phenanthrene	78.5
2264	PYRENE	Pyrene	553.5
2265	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2265	1-METHNAP	1-Methylnapthalene	39
2265	1-MPHENAH	1-Methylphenanthrene	29
2265	26-2MNAP	2,6-Dimethylnaphthalene	43
2265	2BANTH	Dibenz[a,h]anthracene	25
2265	2-METHNAP	2-Methylnapthalene	39
2265	ACENAPE	Acenaphthene	42
2265	ACENAPTYLE	Acenaphthylene	25
2265	ANTHRACENE	Anthracene	35
2265	BAA	Benz[a]anthracene	23
2265	BAP	Benzo[a]pyrene	18
2265	BBF	Benzo[b]fluoranthene	27
2265	BEP	Benzo[e]pyrene	18
2265	BGHIP	Benzo[g,h,i]perylene	25
2265	BIPHENYL	Biphenyl	42
2265	BKF	Benzo[k]fluoranthene	20
2265	CHRYSENE	Chrysene	21
2265	FLUORANTHN	Fluoranthene	39
2265	FLUORENE	Fluorene	46

2265	ICDP	Indeno(1,2,3-c,d)pyrene	22
2265	NAPTHALENE	Naphthalene	36
2265	PERYLENE	Perylene	18
2265	PHENANTHRN	Phenanthrene	37
2265	PYRENE	Pyrene	27
2433	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2433	1-METHNAP	1-Methylnapthalene	39
2433	1-MPHENAH	1-Methylphenanthrene	29
2433	26-2MNAP	2,6-Dimethylnaphthalene	43
2433	2BANTH	Dibenz[a,h]anthracene	25
2433	2-METHNAP	2-Methylnapthalene	39
2433	ACENAPE	Acenaphthene	42
2433	ACENAPTYLE	Acenaphthylene	25
2433	ANTHRACENE	Anthracene	35
2433	BAA	Benz[a]anthracene	51.1
2433	BAP	Benzo[a]pyrene	53.1
2433	BBF	Benzo[b]fluoranthene	73.5
2433	BEP	Benzo[e]pyrene	47.95
2433	BGHIP	Benzo[g,h,i]perylene	30.4
2433	BIPHENYL	Biphenyl	42
2433	BKF	Benzo[k]fluoranthene	49.35
2433	CHRYSENE	Chrysene	63.65
2433	FLUORANTHN	Fluoranthene	46.25
2433	FLUORENE	Fluorene	46
2433	ICDP	Indeno(1,2,3-c,d)pyrene	27.25
2433	NAPTHALENE	Naphthalene	36
2433	PERYLENE	Perylene	18
2433	PHENANTHRN	Phenanthrene	37
2433	PYRENE	Pyrene	56.35
2434	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2434	1-METHNAP	1-Methylnapthalene	39
2434	1-MPHENAH	1-Methylphenanthrene	29
2434	26-2MNAP	2,6-Dimethylnaphthalene	43
2434	2BANTH	Dibenz[a,h]anthracene	28.6
2434	2-METHNAP	2-Methylnapthalene	39
2434	ACENAPE	Acenaphthene	42
2434	ACENAPTYLE	Acenaphthylene	25
2434	ANTHRACENE	Anthracene	36.1
2434	BAA	Benz[a]anthracene	78.5
2434	BAP	Benzo[a]pyrene	128
2434	BBF	Benzo[b]fluoranthene	189
2434	BEP	Benzo[e]pyrene	122
2434	BGHIP	Benzo[g,h,i]perylene	73.7
2434	BIPHENYL	Biphenyl	42
2434	BKF	Benzo[k]fluoranthene	124
2434	CHRYSENE	Chrysene	100
2434	FLUORANTHN	Fluoranthene	98.6
2434	FLUORENE	Fluorene	46
2434	ICDP	Indeno(1,2,3-c,d)pyrene	72.8
2434	NAPTHALENE	Naphthalene	36
2434	PERYLENE	Perylene	35
2434	PHENANTHRN	Phenanthrene	37

2434	PYRENE	Pyrene	111
2435	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2435	1-METHNAP	1-Methylnapthalene	39
2435	1-MPHENAH	1-Methylphenanthrene	29
2435	26-2MNAP	2,6-Dimethylnaphthalene	43
2435	2BANTH	Dibenz[a,h]anthracene	25
2435	2-METHNAP	2-Methylnapthalene	39
2435	ACENAPE	Acenaphthene	42
2435	ACENAPTYLE	Acenaphthylene	25
2435	ANTHRACENE	Anthracene	35
2435	BAA	Benz[a]anthracene	23
2435	BAP	Benzo[a]pyrene	18
2435	BBF	Benzo[b]fluoranthene	27
2435	BEP	Benzo[e]pyrene	18
2435	BGHIP	Benzo[g,h,i]perylene	25
2435	BIPHENYL	Biphenyl	42
2435	BKF	Benzo[k]fluoranthene	20
2435	CHRYSENE	Chrysene	21
2435	FLUORANTHN	Fluoranthene	39
2435	FLUORENE	Fluorene	46
2435	ICDP	Indeno(1,2,3-c,d)pyrene	22
2435	NAPTHALENE	Naphthalene	36
2435	PERYLENE	Perylene	18
2435	PHENANTHRN	Phenanthrene	37
2435	PYRENE	Pyrene	27
2436	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2436	1-METHNAP	1-Methylnapthalene	39
2436	1-MPHENAH	1-Methylphenanthrene	29
2436	26-2MNAP	2,6-Dimethylnaphthalene	43
2436	2BANTH	Dibenz[a,h]anthracene	25
2436	2-METHNAP	2-Methylnapthalene	39
2436	ACENAPE	Acenaphthene	42
2436	ACENAPTYLE	Acenaphthylene	25
2436	ANTHRACENE	Anthracene	35
2436	BAA	Benz[a]anthracene	40.13333333
2436	BAP	Benzo[a]pyrene	57.06666667
2436	BBF	Benzo[b]fluoranthene	59.33333333
2436	BEP	Benzo[e]pyrene	46.33333333
2436	BGHIP	Benzo[g,h,i]perylene	32.63333333
2436	BIPHENYL	Biphenyl	42
2436	BKF	Benzo[k]fluoranthene	58.63333333
2436	CHRYSENE	Chrysene	51.53333333
2436	FLUORANTHN	Fluoranthene	49.93333333
2436	FLUORENE	Fluorene	46
2436	ICDP	Indeno(1,2,3-c,d)pyrene	29.7
2436	NAPTHALENE	Naphthalene	36
2436	PERYLENE	Perylene	18.13333333
2436	PHENANTHRN	Phenanthrene	37
2436	PYRENE	Pyrene	57
2438	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2438	1-METHNAP	1-Methylnapthalene	39
2438	1-MPHENAH	1-Methylphenanthrene	29

2438	26-2MNAP	2,6-Dimethylnaphthalene	43
2438	2BANTH	Dibenz[a,h]anthracene	25
2438	2-METHNAP	2-Methylnapthalene	39
2438	ACENAPE	Acenaphthene	42
2438	ACENAPTYLE	Acenaphthylene	25
2438	ANTHRACENE	Anthracene	35
2438	BAA	Benz[a]anthracene	23
2438	BAP	Benzo[a]pyrene	18
2438	BBF	Benzo[b]fluoranthene	27
2438	BEP	Benzo[e]pyrene	18
2438	BGHIP	Benzo[g,h,i]perylene	25
2438	BIPHENYL	Biphenyl	42
2438	BKF	Benzo[k]fluoranthene	20
2438	CHRYSENE	Chrysene	21
2438	FLUORANTHN	Fluoranthene	39
2438	FLUORENE	Fluorene	46
2438	ICDP	Indeno(1,2,3-c,d)pyrene	22
2438	NAPTHALENE	Naphthalene	36
2438	PERYLENE	Perylene	18
2438	PHENANTHRN	Phenanthrene	37
2438	PYRENE	Pyrene	27
2439	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2439	1-METHNAP	1-Methylnapthalene	39
2439	1-MPHENAH	1-Methylphenanthrene	29
2439	26-2MNAP	2,6-Dimethylnaphthalene	43
2439	2BANTH	Dibenz[a,h]anthracene	25
2439	2-METHNAP	2-Methylnapthalene	39
2439	ACENAPE	Acenaphthene	42
2439	ACENAPTYLE	Acenaphthylene	25
2439	ANTHRACENE	Anthracene	35
2439	BAA	Benz[a]anthracene	40.7
2439	BAP	Benzo[a]pyrene	66.4
2439	BBF	Benzo[b]fluoranthene	100
2439	BEP	Benzo[e]pyrene	72
2439	BGHIP	Benzo[g,h,i]perylene	42.9
2439	BIPHENYL	Biphenyl	42
2439	BKF	Benzo[k]fluoranthene	73.6
2439	CHRYSENE	Chrysene	73.4
2439	FLUORANTHN	Fluoranthene	48.3
2439	FLUORENE	Fluorene	46
2439	ICDP	Indeno(1,2,3-c,d)pyrene	39.3
2439	NAPTHALENE	Naphthalene	36
2439	PERYLENE	Perylene	19.2
2439	PHENANTHRN	Phenanthrene	37
2439	PYRENE	Pyrene	66
2440	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2440	1-METHNAP	1-Methylnapthalene	39
2440	1-MPHENAH	1-Methylphenanthrene	29
2440	26-2MNAP	2,6-Dimethylnaphthalene	43
2440	2BANTH	Dibenz[a,h]anthracene	25
2440	2-METHNAP	2-Methylnapthalene	39
2440	ACENAPE	Acenaphthene	42

2440	ACENAPTYLE	Acenaphthylene	25
2440	ANTHRACENE	Anthracene	35
2440	BAA	Benz[a]anthracene	23
2440	BAP	Benzo[a]pyrene	18
2440	BBF	Benzo[b]fluoranthene	27
2440	BEP	Benzo[e]pyrene	18
2440	BGHIP	Benzo[g,h,i]perylene	25
2440	BIPHENYL	Biphenyl	42
2440	BKF	Benzo[k]fluoranthene	20
2440	CHRYSENE	Chrysene	21
2440	FLUORANTHN	Fluoranthene	39
2440	FLUORENE	Fluorene	46
2440	ICDP	Indeno(1,2,3-c,d)pyrene	22
2440	NAPTHALENE	Naphthalene	36
2440	PERYLENE	Perylene	18
2440	PHENANTHRN	Phenanthrene	37
2440	PYRENE	Pyrene	27
2441	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2441	1-METHNAP	1-Methylnapthalene	39
2441	1-MPHENAH	1-Methylphenanthrene	29
2441	26-2MNAP	2,6-Dimethylnaphthalene	46.05
2441	2BANTH	Dibenz[a,h]anthracene	25
2441	2-METHNAP	2-Methylnapthalene	39
2441	ACENAPE	Acenaphthene	42
2441	ACENAPTYLE	Acenaphthylene	25.25
2441	ANTHRACENE	Anthracene	75.65
2441	BAA	Benz[a]anthracene	129
2441	BAP	Benzo[a]pyrene	109.9
2441	BBF	Benzo[b]fluoranthene	152
2441	BEP	Benzo[e]pyrene	86.65
2441	BGHIP	Benzo[g,h,i]perylene	28.95
2441	BIPHENYL	Biphenyl	42
2441	BKF	Benzo[k]fluoranthene	106.7
2441	CHRYSENE	Chrysene	192
2441	FLUORANTHN	Fluoranthene	220
2441	FLUORENE	Fluorene	46
2441	ICDP	Indeno(1,2,3-c,d)pyrene	34.05
2441	NAPTHALENE	Naphthalene	36
2441	PERYLENE	Perylene	37.35
2441	PHENANTHRN	Phenanthrene	86.05
2441	PYRENE	Pyrene	223
2442	167-3MNAP	1,6,7-Trimethylnaphthalene	39
2442	1-METHNAP	1-Methylnapthalene	39
2442	1-MPHENAH	1-Methylphenanthrene	29
2442	26-2MNAP	2,6-Dimethylnaphthalene	50.35
2442	2BANTH	Dibenz[a,h]anthracene	49.1
2442	2-METHNAP	2-Methylnapthalene	39
2442	ACENAPE	Acenaphthene	42
2442	ACENAPTYLE	Acenaphthylene	58.8
2442	ANTHRACENE	Anthracene	512
2442	BAA	Benz[a]anthracene	575
2442	BAP	Benzo[a]pyrene	398

2442	BBF	Benzo[b]fluoranthene	510
2442	BEP	Benzo[e]pyrene	283.5
2442	BGHIP	Benzo[g,h,i]perylene	73.15
2442	BIPHENYL	Biphenyl	42
2442	BKF	Benzo[k]fluoranthene	388
2442	CHRYSENE	Chrysene	808
2442	FLUORANTHN	Fluoranthene	1342
2442	FLUORENE	Fluorene	46
2442	ICDP	Indeno(1,2,3-c,d)pyrene	88.95
2442	NAPTHALENE	Naphthalene	36
2442	PERYLENE	Perylene	114.15
2442	PHENANTHRN	Phenanthrene	206.5
2442	PYRENE	Pyrene	1001

STATION	STRATA	TestMateri	ParameterCode	QAType	COMMON NAME	Result
2221	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2221	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2221	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2221	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2221	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2221	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2221	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2221	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2221	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2221	sdmari	Sediment	BAA	Result	Benz[a]anthracene	28
2221	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	43.7
2221	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	45
2221	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	37
2221	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	38
2221	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2221	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	43.1
2221	sdmari	Sediment	CHRYSENE	Result	Chrysene	28.6
2221	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2221	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2221	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	29.1
2221	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2221	sdmari	Sediment	PERYLENE	Result	Perylene	-99
2221	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2221	sdmari	Sediment	PYRENE	Result	Pyrene	50.3
2222	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2222	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2222	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2222	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2222	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2222	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2222	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2222	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2222	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2222	sdmari	Sediment	BAA	Result	Benz[a]anthracene	33.3
2222	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	71.4
2222	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	120
2222	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	60.5
2222	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	50.4
2222	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2222	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	73.6
2222	sdmari	Sediment	CHRYSENE	Result	Chrysene	40.4
2222	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	46.5
2222	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2222	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	47.6
2222	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2222	sdmari	Sediment	PERYLENE	Result	Perylene	21.9
2222	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2222	sdmari	Sediment	PYRENE	Result	Pyrene	50.9
2223	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2223	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2223	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99

2223	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2223	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2223	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2223	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2223	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2223	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2223	sdmari	Sediment	BAA	Result	Benz[a]anthracene	23.6
2223	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	44.3
2223	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	66
2223	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	40.4
2223	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	26.9
2223	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2223	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	43.2
2223	sdmari	Sediment	CHRYSENE	Result	Chrysene	33.1
2223	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2223	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2223	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	27
2223	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2223	sdmari	Sediment	PERYLENE	Result	Perylene	-99
2223	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2223	sdmari	Sediment	PYRENE	Result	Pyrene	39.3
2224	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2224	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2224	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2224	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2224	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2224	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2224	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2224	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2224	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2224	sdmari	Sediment	BAA	Result	Benz[a]anthracene	-99
2224	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	-99
2224	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2224	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	-99
2224	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2224	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2224	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2224	sdmari	Sediment	CHRYSENE	Result	Chrysene	-99
2224	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2224	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2224	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2224	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2224	sdmari	Sediment	PERYLENE	Result	Perylene	-99
2224	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2224	sdmari	Sediment	PYRENE	Result	Pyrene	-99
2225	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2225	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2225	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2225	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2225	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2225	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2225	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99

2225	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2225	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2225	sdmari	Sediment	BAA	Result	Benz[a]anthracene	35.1
2225	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	37.9
2225	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	55
2225	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	36.8
2225	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2225	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2225	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	42.8
2225	sdmari	Sediment	CHRYSENE	Result	Chrysene	51
2225	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2225	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2225	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	22.3
2225	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2225	sdmari	Sediment	PERYLENE	Result	Perylene	-99
2225	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2225	sdmari	Sediment	PYRENE	Result	Pyrene	38.8
2226	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2226	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2226	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2226	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2226	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2226	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2226	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2226	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2226	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2226	sdmari	Sediment	BAA	Result	Benz[a]anthracene	68.3
2226	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	107
2226	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	148
2226	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	91.7
2226	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	50.1
2226	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2226	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	103
2226	sdmari	Sediment	CHRYSENE	Result	Chrysene	93
2226	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	59.3
2226	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2226	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	50.5
2226	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2226	sdmari	Sediment	PERYLENE	Result	Perylene	29.1
2226	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2226	sdmari	Sediment	PYRENE	Result	Pyrene	83.1
2227	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2227	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2227	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2227	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2227	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2227	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2227	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2227	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2227	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2227	sdmari	Sediment	BAA	Result	Benz[a]anthracene	53.3
2227	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	66.9

2227	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	87
2227	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	55.4
2227	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	36.3
2227	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2227	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	56.3
2227	sdmari	Sediment	CHRYSENE	Result	Chrysene	71.1
2227	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	62.3
2227	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2227	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	33.1
2227	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2227	sdmari	Sediment	PERYLENE	Result	Perylene	18.9
2227	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2227	sdmari	Sediment	PYRENE	Result	Pyrene	70.1
2228	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2228	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2228	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2228	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2228	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2228	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2228	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2228	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2228	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2228	sdmari	Sediment	BAA	Result	Benz[a]anthracene	63.5
2228	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	100
2228	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	131
2228	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	84.4
2228	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	63.6
2228	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2228	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	77.4
2228	sdmari	Sediment	CHRYSENE	Result	Chrysene	79.4
2228	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	72.3
2228	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2228	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	54.8
2228	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2228	sdmari	Sediment	PERYLENE	Result	Perylene	27.6
2228	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2228	sdmari	Sediment	PYRENE	Result	Pyrene	92.9
2229	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2229	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2229	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2229	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2229	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2229	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2229	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2229	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	39.5
2229	sdother	Sediment	ANTHRACENE	Result	Anthracene	60.8
2229	sdother	Sediment	BAA	Result	Benz[a]anthracene	99.5
2229	sdother	Sediment	BAP	Result	Benzo[a]pyrene	106
2229	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	88
2229	sdother	Sediment	BEP	Result	Benzo[e]pyrene	80.4
2229	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	54.7
2229	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99

2229	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	104
2229	sdother	Sediment	CHRYSENE	Result	Chrysene	121
2229	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	142
2229	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2229	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	48.3
2229	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2229	sdother	Sediment	PERYLENE	Result	Perylene	27.9
2229	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	211
2229	sdother	Sediment	PYRENE	Result	Pyrene	190
2230	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2230	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2230	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2230	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2230	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2230	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2230	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2230	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2230	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2230	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2230	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2230	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2230	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2230	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2230	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2230	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2230	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2230	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2230	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2230	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2230	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2230	sdother	Sediment	PERYLENE	Result	Perylene	-99
2230	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2230	sdother	Sediment	PYRENE	Result	Pyrene	-99
2231	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2231	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2231	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2231	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2231	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2231	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2231	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2231	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2231	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2231	sdother	Sediment	BAA	Result	Benz[a]anthracene	33.9
2231	sdother	Sediment	BAP	Result	Benzo[a]pyrene	65.9
2231	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	67
2231	sdother	Sediment	BEP	Result	Benzo[e]pyrene	60.1
2231	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	49
2231	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2231	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	66.9
2231	sdother	Sediment	CHRYSENE	Result	Chrysene	50.9
2231	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	41.9
2231	sdother	Sediment	FLUORENE	Result	Fluorene	-99

2231	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	39.6
2231	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2231	sdother	Sediment	PERYLENE	Result	Perylene	19.6
2231	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2231	sdother	Sediment	PYRENE	Result	Pyrene	65.5
2233	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2233	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2233	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2233	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2233	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2233	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2233	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2233	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2233	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2233	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2233	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2233	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2233	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2233	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2233	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2233	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2233	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2233	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2233	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2233	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2233	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2233	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2233	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2233	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2233	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2233	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2233	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2233	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2233	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2233	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2233	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2233	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2233	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2233	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2233	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2233	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2233	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2233	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2233	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2233	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2233	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2233	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2233	sdother	Sediment	PERYLENE	Result	Perylene	-99
2233	sdother	Sediment	PERYLENE	Result	Perylene	-99
2233	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2233	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2233	sdother	Sediment	PYRENE	Result	Pyrene	-99

2233	sdother	Sediment	PYRENE	Result	Pyrene	33.1
2235	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2235	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2235	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2235	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2235	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2235	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2235	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2235	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2235	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2235	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2235	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2235	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2235	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2235	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2235	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2235	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2235	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2235	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2235	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2235	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2235	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2235	sdother	Sediment	PERYLENE	Result	Perylene	-99
2235	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2235	sdother	Sediment	PYRENE	Result	Pyrene	-99
2238	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2238	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2238	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2238	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2238	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2238	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2238	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2238	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2238	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2238	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2238	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2238	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2238	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2238	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2238	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2238	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2238	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2238	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2238	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2238	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2238	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2238	sdother	Sediment	PERYLENE	Result	Perylene	-99
2238	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2238	sdother	Sediment	PYRENE	Result	Pyrene	-99
2239	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2239	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2239	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99

2239	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2239	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2239	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2239	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2239	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2239	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2239	sdother	Sediment	BAA	Result	Benz[a]anthracene	47.6
2239	sdother	Sediment	BAP	Result	Benzo[a]pyrene	82
2239	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	96
2239	sdother	Sediment	BEP	Result	Benzo[e]pyrene	74.6
2239	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	49.7
2239	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2239	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	80.5
2239	sdother	Sediment	CHRYSENE	Result	Chrysene	70.1
2239	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	55.9
2239	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2239	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	45.4
2239	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2239	sdother	Sediment	PERYLENE	Result	Perylene	28.9
2239	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2239	sdother	Sediment	PYRENE	Result	Pyrene	70.2
2240	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2240	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2240	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2240	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2240	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2240	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2240	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2240	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2240	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2240	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2240	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2240	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2240	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2240	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2240	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2240	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2240	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2240	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2240	sdother	Sediment	BAA	Result	Benz[a]anthracene	24.4
2240	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2240	sdother	Sediment	BAP	Result	Benzo[a]pyrene	30.9
2240	sdother	Sediment	BAP	Result	Benzo[a]pyrene	26.7
2240	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	44
2240	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	38
2240	sdother	Sediment	BEP	Result	Benzo[e]pyrene	29
2240	sdother	Sediment	BEP	Result	Benzo[e]pyrene	26
2240	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	27.1
2240	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	25.1
2240	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2240	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2240	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99

2240	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	20.7
2240	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2240	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2240	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2240	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2240	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2240	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2240	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2240	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2240	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2240	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2240	sdother	Sediment	PERYLENE	Result	Perylene	-99
2240	sdother	Sediment	PERYLENE	Result	Perylene	-99
2240	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2240	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2240	sdother	Sediment	PYRENE	Result	Pyrene	35.4
2240	sdother	Sediment	PYRENE	Result	Pyrene	29
2241	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2241	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2241	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2241	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2241	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2241	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2241	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2241	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2241	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2241	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2241	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2241	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2241	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2241	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2241	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2241	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2241	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2241	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2241	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2241	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2241	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2241	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2241	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2241	sdother	Sediment	PERYLENE	Result	Perylene	-99
2241	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2241	sdother	Sediment	PYRENE	Result	Pyrene	-99
2242	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2242	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2242	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2242	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2242	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2242	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2242	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2242	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2242	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99

2242	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2242	sdother	Sediment	BAP	Result	Benzo[a]pyrene	33
2242	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	37
2242	sdother	Sediment	BEP	Result	Benzo[e]pyrene	29
2242	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	29.9
2242	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2242	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	30.6
2242	sdother	Sediment	CHRYSENE	Result	Chrysene	21.3
2242	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2242	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2242	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	23.9
2242	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2242	sdother	Sediment	PERYLENE	Result	Perylene	-99
2242	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2242	sdother	Sediment	PYRENE	Result	Pyrene	29
2243	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2243	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2243	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2243	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2243	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2243	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2243	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2243	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2243	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2243	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2243	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2243	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2243	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2243	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2243	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2243	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2243	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2243	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2243	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2243	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2243	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2243	sdother	Sediment	PERYLENE	Result	Perylene	-99
2243	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2243	sdother	Sediment	PYRENE	Result	Pyrene	-99
2244	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2244	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2244	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2244	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2244	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2244	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2244	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2244	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2244	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2244	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2244	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2244	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2244	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99

2244	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2244	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2244	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2244	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2244	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2244	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2244	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2244	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2244	sdother	Sediment	PERYLENE	Result	Perylene	-99
2244	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2244	sdother	Sediment	PYRENE	Result	Pyrene	-99
2245	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2245	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2245	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2245	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2245	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2245	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2245	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2245	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2245	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2245	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2245	sdother	Sediment	BAP	Result	Benzo[a]pyrene	20.8
2245	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	30
2245	sdother	Sediment	BEP	Result	Benzo[e]pyrene	21.6
2245	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2245	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2245	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2245	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2245	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2245	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2245	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2245	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2245	sdother	Sediment	PERYLENE	Result	Perylene	-99
2245	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2245	sdother	Sediment	PYRENE	Result	Pyrene	27.2
2247	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2247	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2247	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2247	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2247	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2247	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2247	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2247	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2247	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2247	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2247	sdother	Sediment	BAP	Result	Benzo[a]pyrene	18.9
2247	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	28
2247	sdother	Sediment	BEP	Result	Benzo[e]pyrene	18.8
2247	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2247	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2247	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2247	sdother	Sediment	CHRYSENE	Result	Chrysene	-99

2247	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2247	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2247	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2247	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2247	sdother	Sediment	PERYLENE	Result	Perylene	-99
2247	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2247	sdother	Sediment	PYRENE	Result	Pyrene	-99
2249	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2249	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2249	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2249	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2249	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2249	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2249	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2249	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2249	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2249	sdother	Sediment	BAA	Result	Benz[a]anthracene	25.8
2249	sdother	Sediment	BAP	Result	Benzo[a]pyrene	24.4
2249	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2249	sdother	Sediment	BEP	Result	Benzo[e]pyrene	21.8
2249	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2249	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2249	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	22.6
2249	sdother	Sediment	CHRYSENE	Result	Chrysene	25.4
2249	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	43.9
2249	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2249	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2249	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2249	sdother	Sediment	PERYLENE	Result	Perylene	-99
2249	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2249	sdother	Sediment	PYRENE	Result	Pyrene	45
2251	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2251	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2251	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2251	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2251	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	97.6
2251	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2251	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2251	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	98.3
2251	sdport	Sediment	ANTHRACENE	Result	Anthracene	164
2251	sdport	Sediment	BAA	Result	Benz[a]anthracene	366
2251	sdport	Sediment	BAP	Result	Benzo[a]pyrene	567
2251	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	760
2251	sdport	Sediment	BEP	Result	Benzo[e]pyrene	499
2251	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	282
2251	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2251	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	329
2251	sdport	Sediment	CHRYSENE	Result	Chrysene	536
2251	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	503
2251	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2251	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	254
2251	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99

2251	sdport	Sediment	PERYLENE	Result	Perylene	131
2251	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	218
2251	sdport	Sediment	PYRENE	Result	Pyrene	665
2252	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2252	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2252	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2252	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2252	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2252	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2252	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2252	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2252	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2252	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2252	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2252	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2252	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2252	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2252	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2252	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2252	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2252	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2252	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2252	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2252	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2252	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2252	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2252	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2252	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2252	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2252	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2252	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2252	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2252	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2252	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2252	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2252	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2252	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2252	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2252	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2252	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2252	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2252	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2252	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2252	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2252	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2252	sdport	Sediment	PERYLENE	Result	Perylene	-99
2252	sdport	Sediment	PERYLENE	Result	Perylene	-99
2252	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2252	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2252	sdport	Sediment	PYRENE	Result	Pyrene	-99
2252	sdport	Sediment	PYRENE	Result	Pyrene	31.9
2253	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99

2253	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2253	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2253	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2253	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	32.8
2253	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	53.7
2253	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2253	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2253	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2253	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	48.6
2253	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2253	sdport	Sediment	ANTHRACENE	Result	Anthracene	65.7
2253	sdport	Sediment	BAA	Result	Benz[a]anthracene	99
2253	sdport	Sediment	BAA	Result	Benz[a]anthracene	151
2253	sdport	Sediment	BAP	Result	Benzo[a]pyrene	158
2253	sdport	Sediment	BAP	Result	Benzo[a]pyrene	287
2253	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	225
2253	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	386
2253	sdport	Sediment	BEP	Result	Benzo[e]pyrene	150
2253	sdport	Sediment	BEP	Result	Benzo[e]pyrene	250
2253	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	75.4
2253	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	98.5
2253	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2253	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	131
2253	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	245
2253	sdport	Sediment	CHRYSENE	Result	Chrysene	99.8
2253	sdport	Sediment	CHRYSENE	Result	Chrysene	169
2253	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	104
2253	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	182
2253	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2253	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	74.4
2253	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	114
2253	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2253	sdport	Sediment	PERYLENE	Result	Perylene	39.5
2253	sdport	Sediment	PERYLENE	Result	Perylene	77.1
2253	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2253	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	83.1
2253	sdport	Sediment	PYRENE	Result	Pyrene	122
2253	sdport	Sediment	PYRENE	Result	Pyrene	230
2254	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2254	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2254	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2254	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2254	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	193
2254	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2254	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2254	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	241
2254	sdport	Sediment	ANTHRACENE	Result	Anthracene	368
2254	sdport	Sediment	BAA	Result	Benz[a]anthracene	1000
2254	sdport	Sediment	BAP	Result	Benzo[a]pyrene	1150
2254	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	2010
2254	sdport	Sediment	BEP	Result	Benzo[e]pyrene	1180
2254	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	289

2254	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2254	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	1160
2254	sdport	Sediment	CHRYSENE	Result	Chrysene	1330
2254	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	1500
2254	sdport	Sediment	FLUORENE	Result	Fluorene	54
2254	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	361
2254	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2254	sdport	Sediment	PERYLENE	Result	Perylene	291
2254	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	311
2254	sdport	Sediment	PYRENE	Result	Pyrene	1340
2255	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2255	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2255	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2255	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2255	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2255	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	97.7
2255	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2255	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2255	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2255	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	47.7
2255	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2255	sdport	Sediment	ANTHRACENE	Result	Anthracene	76.9
2255	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2255	sdport	Sediment	BAA	Result	Benz[a]anthracene	385
2255	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2255	sdport	Sediment	BAP	Result	Benzo[a]pyrene	544
2255	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2255	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	768
2255	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2255	sdport	Sediment	BEP	Result	Benzo[e]pyrene	410
2255	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2255	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	182
2255	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2255	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2255	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	390
2255	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2255	sdport	Sediment	CHRYSENE	Result	Chrysene	453
2255	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2255	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	440
2255	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2255	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2255	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	198
2255	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2255	sdport	Sediment	PERYLENE	Result	Perylene	-99
2255	sdport	Sediment	PERYLENE	Result	Perylene	137
2255	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2255	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	82.4
2255	sdport	Sediment	PYRENE	Result	Pyrene	-99
2255	sdport	Sediment	PYRENE	Result	Pyrene	441
2256	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2256	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2256	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99

2256	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2256	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2256	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2256	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2256	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2256	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2256	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2256	sdport	Sediment	BAA	Result	Benz[a]anthracene	39.8
2256	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2256	sdport	Sediment	BAP	Result	Benzo[a]pyrene	69.6
2256	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2256	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	85
2256	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2256	sdport	Sediment	BEP	Result	Benzo[e]pyrene	64.2
2256	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2256	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	45.4
2256	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2256	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2256	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	61.8
2256	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2256	sdport	Sediment	CHRYSENE	Result	Chrysene	52
2256	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2256	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	40.4
2256	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2256	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2256	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	39.3
2256	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2256	sdport	Sediment	PERYLENE	Result	Perylene	-99
2256	sdport	Sediment	PERYLENE	Result	Perylene	22.8
2256	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2256	sdport	Sediment	PYRENE	Result	Pyrene	-99
2256	sdport	Sediment	PYRENE	Result	Pyrene	58
2257	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2257	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2257	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2257	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2257	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2257	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2257	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2257	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2257	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2257	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2257	sdport	Sediment	BAA	Result	Benz[a]anthracene	54.7
2257	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2257	sdport	Sediment	BAP	Result	Benzo[a]pyrene	93.8
2257	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2257	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	112
2257	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2257	sdport	Sediment	BEP	Result	Benzo[e]pyrene	87.7
2257	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2257	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	54.4
2257	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99

2257	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2257	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	93.3
2257	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2257	sdport	Sediment	CHRYSENE	Result	Chrysene	76.2
2257	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2257	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	51.4
2257	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2257	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2257	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	49.9
2257	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2257	sdport	Sediment	PERYLENE	Result	Perylene	-99
2257	sdport	Sediment	PERYLENE	Result	Perylene	22.9
2257	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2257	sdport	Sediment	PYRENE	Result	Pyrene	-99
2257	sdport	Sediment	PYRENE	Result	Pyrene	66.6
2258	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2258	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2258	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2258	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2258	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2258	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2258	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2258	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2258	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2258	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2258	sdport	Sediment	BAA	Result	Benz[a]anthracene	40.4
2258	sdport	Sediment	BAP	Result	Benzo[a]pyrene	22
2258	sdport	Sediment	BAP	Result	Benzo[a]pyrene	80.6
2258	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2258	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	98
2258	sdport	Sediment	BEP	Result	Benzo[e]pyrene	20.2
2258	sdport	Sediment	BEP	Result	Benzo[e]pyrene	75.3
2258	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2258	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	42.6
2258	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2258	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2258	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	79.9
2258	sdport	Sediment	CHRYSENE	Result	Chrysene	21.6
2258	sdport	Sediment	CHRYSENE	Result	Chrysene	53.5
2258	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2258	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	39.4
2258	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2258	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2258	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	41.5
2258	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2258	sdport	Sediment	PERYLENE	Result	Perylene	-99
2258	sdport	Sediment	PERYLENE	Result	Perylene	25.1
2258	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2258	sdport	Sediment	PYRENE	Result	Pyrene	30.1
2258	sdport	Sediment	PYRENE	Result	Pyrene	52.1
2259	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2259	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99

2259	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2259	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2259	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	65.6
2259	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2259	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2259	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	69.7
2259	sdport	Sediment	ANTHRACENE	Result	Anthracene	104
2259	sdport	Sediment	BAA	Result	Benz[a]anthracene	165
2259	sdport	Sediment	BAP	Result	Benzo[a]pyrene	372
2259	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	480
2259	sdport	Sediment	BEP	Result	Benzo[e]pyrene	304
2259	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	123
2259	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2259	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	277
2259	sdport	Sediment	CHRYSENE	Result	Chrysene	279
2259	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	94.6
2259	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2259	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	138
2259	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2259	sdport	Sediment	PERYLENE	Result	Perylene	111
2259	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	49.2
2259	sdport	Sediment	PYRENE	Result	Pyrene	195
2260	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2260	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2260	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2260	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2260	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2260	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2260	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2260	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2260	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2260	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2260	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2260	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2260	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2260	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2260	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2260	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2260	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2260	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2260	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2260	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2260	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2260	sdport	Sediment	PERYLENE	Result	Perylene	-99
2260	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2260	sdport	Sediment	PYRENE	Result	Pyrene	-99
2262	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2262	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2262	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2262	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2262	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2262	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99

2262	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2262	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2262	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2262	sdport	Sediment	BAA	Result	Benz[a]anthracene	43.4
2262	sdport	Sediment	BAP	Result	Benzo[a]pyrene	64
2262	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	84
2262	sdport	Sediment	BEP	Result	Benzo[e]pyrene	60.9
2262	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	35.4
2262	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2262	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	65.1
2262	sdport	Sediment	CHRYSENE	Result	Chrysene	58.2
2262	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	39.3
2262	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2262	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	35.9
2262	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2262	sdport	Sediment	PERYLENE	Result	Perylene	-99
2262	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2262	sdport	Sediment	PYRENE	Result	Pyrene	54.5
2263	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2263	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2263	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2263	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2263	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	32.1
2263	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	86.7
2263	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2263	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2263	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	26.5
2263	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	77.6
2263	sdport	Sediment	ANTHRACENE	Result	Anthracene	40.7
2263	sdport	Sediment	ANTHRACENE	Result	Anthracene	373
2263	sdport	Sediment	BAA	Result	Benz[a]anthracene	93.8
2263	sdport	Sediment	BAA	Result	Benz[a]anthracene	263
2263	sdport	Sediment	BAP	Result	Benzo[a]pyrene	143
2263	sdport	Sediment	BAP	Result	Benzo[a]pyrene	525
2263	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	185
2263	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	663
2263	sdport	Sediment	BEP	Result	Benzo[e]pyrene	131
2263	sdport	Sediment	BEP	Result	Benzo[e]pyrene	395
2263	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	73.8
2263	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	170
2263	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2263	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	173
2263	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	437
2263	sdport	Sediment	CHRYSENE	Result	Chrysene	184
2263	sdport	Sediment	CHRYSENE	Result	Chrysene	530
2263	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	95.2
2263	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	197
2263	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2263	sdport	Sediment	FLUORENE	Result	Fluorene	55.1
2263	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	64.6
2263	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	183
2263	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99

2263	sdport	Sediment	PERYLENE	Result	Perylene	48
2263	sdport	Sediment	PERYLENE	Result	Perylene	145
2263	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2263	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	150
2263	sdport	Sediment	PYRENE	Result	Pyrene	182
2263	sdport	Sediment	PYRENE	Result	Pyrene	354
2264	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2264	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2264	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2264	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2264	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	50.2
2264	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2264	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	74.6
2264	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2264	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2264	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2264	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	119
2264	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2264	sdport	Sediment	ANTHRACENE	Result	Anthracene	204
2264	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2264	sdport	Sediment	BAA	Result	Benz[a]anthracene	480
2264	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2264	sdport	Sediment	BAP	Result	Benzo[a]pyrene	742
2264	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2264	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	1030
2264	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2264	sdport	Sediment	BEP	Result	Benzo[e]pyrene	612
2264	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2264	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	108
2264	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2264	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	20
2264	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	679
2264	sdport	Sediment	CHRYSENE	Result	Chrysene	22.3
2264	sdport	Sediment	CHRYSENE	Result	Chrysene	849
2264	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2264	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	501
2264	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2264	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2264	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	153
2264	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2264	sdport	Sediment	PERYLENE	Result	Perylene	-99
2264	sdport	Sediment	PERYLENE	Result	Perylene	190
2264	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2264	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	120
2264	sdport	Sediment	PYRENE	Result	Pyrene	-99
2264	sdport	Sediment	PYRENE	Result	Pyrene	1080
2265	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2265	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2265	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2265	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2265	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2265	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99

2265	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2265	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2265	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2265	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2265	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2265	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2265	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2265	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2265	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2265	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2265	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2265	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2265	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2265	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2265	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2265	sdport	Sediment	PERYLENE	Result	Perylene	-99
2265	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2265	sdport	Sediment	PYRENE	Result	Pyrene	-99
2433	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2433	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2433	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2433	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2433	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2433	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2433	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2433	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2433	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2433	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2433	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2433	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2433	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2433	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2433	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2433	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2433	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2433	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2433	sdother	Sediment	BAA	Result	Benz[a]anthracene	47.7
2433	sdother	Sediment	BAA	Result	Benz[a]anthracene	54.5
2433	sdother	Sediment	BAP	Result	Benzo[a]pyrene	48.5
2433	sdother	Sediment	BAP	Result	Benzo[a]pyrene	57.7
2433	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	68
2433	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	79
2433	sdother	Sediment	BEP	Result	Benzo[e]pyrene	45.1
2433	sdother	Sediment	BEP	Result	Benzo[e]pyrene	50.8
2433	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	30
2433	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	30.8
2433	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2433	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2433	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	45.2
2433	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	53.5
2433	sdother	Sediment	CHRYSENE	Result	Chrysene	57.9
2433	sdother	Sediment	CHRYSENE	Result	Chrysene	69.4

2433	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	44.1
2433	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	48.4
2433	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2433	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2433	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	26.2
2433	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	28.3
2433	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2433	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2433	sdother	Sediment	PERYLENE	Result	Perylene	-99
2433	sdother	Sediment	PERYLENE	Result	Perylene	-99
2433	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2433	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2433	sdother	Sediment	PYRENE	Result	Pyrene	55.3
2433	sdother	Sediment	PYRENE	Result	Pyrene	57.4
2434	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2434	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2434	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2434	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2434	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	28.6
2434	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2434	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2434	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2434	sdother	Sediment	ANTHRACENE	Result	Anthracene	36.1
2434	sdother	Sediment	BAA	Result	Benz[a]anthracene	78.5
2434	sdother	Sediment	BAP	Result	Benzo[a]pyrene	128
2434	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	189
2434	sdother	Sediment	BEP	Result	Benzo[e]pyrene	122
2434	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	73.7
2434	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2434	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	124
2434	sdother	Sediment	CHRYSENE	Result	Chrysene	100
2434	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	98.6
2434	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2434	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	72.8
2434	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2434	sdother	Sediment	PERYLENE	Result	Perylene	35
2434	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2434	sdother	Sediment	PYRENE	Result	Pyrene	111
2435	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2435	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2435	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2435	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2435	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2435	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2435	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2435	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2435	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2435	sdother	Sediment	BAA	Result	Benz[a]anthracene	-99
2435	sdother	Sediment	BAP	Result	Benzo[a]pyrene	-99
2435	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2435	sdother	Sediment	BEP	Result	Benzo[e]pyrene	-99
2435	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99

2435	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2435	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2435	sdother	Sediment	CHRYSENE	Result	Chrysene	-99
2435	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2435	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2435	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2435	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2435	sdother	Sediment	PERYLENE	Result	Perylene	-99
2435	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2435	sdother	Sediment	PYRENE	Result	Pyrene	-99
2436	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2436	sdother	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2436	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2436	sdother	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2436	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2436	sdother	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2436	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2436	sdother	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2436	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2436	sdother	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2436	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2436	sdother	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2436	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2436	sdother	Sediment	ACENAPE	Result	Acenaphthene	-99
2436	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2436	sdother	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2436	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2436	sdother	Sediment	ANTHRACENE	Result	Anthracene	-99
2436	sdother	Sediment	BAA	Result	Benz[a]anthracene	37.3
2436	sdother	Sediment	BAA	Result	Benz[a]anthracene	46.4
2436	sdother	Sediment	BAA	Result	Benz[a]anthracene	36.7
2436	sdother	Sediment	BAP	Result	Benzo[a]pyrene	50.3
2436	sdother	Sediment	BAP	Result	Benzo[a]pyrene	67.5
2436	sdother	Sediment	BAP	Result	Benzo[a]pyrene	53.4
2436	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	57
2436	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	56
2436	sdother	Sediment	BBF	Result	Benzo[b]fluoranthene	65
2436	sdother	Sediment	BEP	Result	Benzo[e]pyrene	39.7
2436	sdother	Sediment	BEP	Result	Benzo[e]pyrene	54.8
2436	sdother	Sediment	BEP	Result	Benzo[e]pyrene	44.5
2436	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	30.6
2436	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	33.3
2436	sdother	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	34
2436	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2436	sdother	Sediment	BIPHENYL	Result	Biphenyl	-99
2436	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	48.9
2436	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	73.6
2436	sdother	Sediment	BKF	Result	Benzo[k]fluoranthene	53.4
2436	sdother	Sediment	CHRYSENE	Result	Chrysene	45.4
2436	sdother	Sediment	CHRYSENE	Result	Chrysene	56.8
2436	sdother	Sediment	CHRYSENE	Result	Chrysene	52.4
2436	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	40.6

2436	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	53.1
2436	sdother	Sediment	FLUORANTHN	Result	Fluoranthene	56.1
2436	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2436	sdother	Sediment	FLUORENE	Result	Fluorene	-99
2436	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	29.4
2436	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	29.5
2436	sdother	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	30.2
2436	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2436	sdother	Sediment	NAPTHALENE	Result	Naphthalene	-99
2436	sdother	Sediment	PERYLENE	Result	Perylene	-99
2436	sdother	Sediment	PERYLENE	Result	Perylene	18.4
2436	sdother	Sediment	PERYLENE	Result	Perylene	-99
2436	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2436	sdother	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2436	sdother	Sediment	PYRENE	Result	Pyrene	46.8
2436	sdother	Sediment	PYRENE	Result	Pyrene	61.9
2436	sdother	Sediment	PYRENE	Result	Pyrene	62.3
2438	sdmari	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2438	sdmari	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2438	sdmari	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2438	sdmari	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2438	sdmari	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2438	sdmari	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2438	sdmari	Sediment	ACENAPE	Result	Acenaphthene	-99
2438	sdmari	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2438	sdmari	Sediment	ANTHRACENE	Result	Anthracene	-99
2438	sdmari	Sediment	BAA	Result	Benz[a]anthracene	-99
2438	sdmari	Sediment	BAP	Result	Benzo[a]pyrene	-99
2438	sdmari	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2438	sdmari	Sediment	BEP	Result	Benzo[e]pyrene	-99
2438	sdmari	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2438	sdmari	Sediment	BIPHENYL	Result	Biphenyl	-99
2438	sdmari	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2438	sdmari	Sediment	CHRYSENE	Result	Chrysene	-99
2438	sdmari	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2438	sdmari	Sediment	FLUORENE	Result	Fluorene	-99
2438	sdmari	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2438	sdmari	Sediment	NAPTHALENE	Result	Naphthalene	-99
2438	sdmari	Sediment	PERYLENE	Result	Perylene	-99
2438	sdmari	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2438	sdmari	Sediment	PYRENE	Result	Pyrene	-99
2439	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2439	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2439	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2439	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2439	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2439	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2439	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2439	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2439	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2439	sdport	Sediment	BAA	Result	Benz[a]anthracene	40.7
2439	sdport	Sediment	BAP	Result	Benzo[a]pyrene	66.4

2439	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	100
2439	sdport	Sediment	BEP	Result	Benzo[e]pyrene	72
2439	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	42.9
2439	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2439	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	73.6
2439	sdport	Sediment	CHRYSENE	Result	Chrysene	73.4
2439	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	48.3
2439	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2439	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	39.3
2439	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2439	sdport	Sediment	PERYLENE	Result	Perylene	19.2
2439	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2439	sdport	Sediment	PYRENE	Result	Pyrene	66
2440	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2440	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2440	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2440	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2440	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2440	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2440	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2440	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2440	sdport	Sediment	ANTHRACENE	Result	Anthracene	-99
2440	sdport	Sediment	BAA	Result	Benz[a]anthracene	-99
2440	sdport	Sediment	BAP	Result	Benzo[a]pyrene	-99
2440	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	-99
2440	sdport	Sediment	BEP	Result	Benzo[e]pyrene	-99
2440	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	-99
2440	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2440	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	-99
2440	sdport	Sediment	CHRYSENE	Result	Chrysene	-99
2440	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	-99
2440	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2440	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	-99
2440	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2440	sdport	Sediment	PERYLENE	Result	Perylene	-99
2440	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	-99
2440	sdport	Sediment	PYRENE	Result	Pyrene	-99
2441	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2441	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2441	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2441	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2441	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	49.1
2441	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	-99
2441	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2441	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2441	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	-99
2441	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	25.5
2441	sdport	Sediment	ANTHRACENE	Result	Anthracene	54.5
2441	sdport	Sediment	ANTHRACENE	Result	Anthracene	96.8
2441	sdport	Sediment	BAA	Result	Benz[a]anthracene	102
2441	sdport	Sediment	BAA	Result	Benz[a]anthracene	156
2441	sdport	Sediment	BAP	Result	Benzo[a]pyrene	86.8

2441	sdport	Sediment	BAP	Result	Benzo[a]pyrene	133
2441	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	123
2441	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	181
2441	sdport	Sediment	BEP	Result	Benzo[e]pyrene	70.3
2441	sdport	Sediment	BEP	Result	Benzo[e]pyrene	103
2441	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	28.1
2441	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	29.8
2441	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2441	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	78.4
2441	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	135
2441	sdport	Sediment	CHRYSENE	Result	Chrysene	144
2441	sdport	Sediment	CHRYSENE	Result	Chrysene	240
2441	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	162
2441	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	278
2441	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2441	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	30.2
2441	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	37.9
2441	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2441	sdport	Sediment	PERYLENE	Result	Perylene	26.5
2441	sdport	Sediment	PERYLENE	Result	Perylene	48.2
2441	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	61.1
2441	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	111
2441	sdport	Sediment	PYRENE	Result	Pyrene	173
2441	sdport	Sediment	PYRENE	Result	Pyrene	273
2442	sdport	Sediment	167-3MNAP	Result	1,6,7-Trimethylnaphthalene	-99
2442	sdport	Sediment	1-METHNAP	Result	1-Methylnapthalene	-99
2442	sdport	Sediment	1-MPHENAH	Result	1-Methylphenanthrene	-99
2442	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	-99
2442	sdport	Sediment	26-2MNAP	Result	2,6-Dimethylnaphthalene	57.7
2442	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	42.8
2442	sdport	Sediment	2BANTH	Result	Dibenz[a,h]anthracene	55.4
2442	sdport	Sediment	2-METHNAP	Result	2-Methylnapthalene	-99
2442	sdport	Sediment	ACENAPE	Result	Acenaphthene	-99
2442	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	38.2
2442	sdport	Sediment	ACENAPTYLE	Result	Acenaphthylene	79.4
2442	sdport	Sediment	ANTHRACENE	Result	Anthracene	261
2442	sdport	Sediment	ANTHRACENE	Result	Anthracene	763
2442	sdport	Sediment	BAA	Result	Benz[a]anthracene	520
2442	sdport	Sediment	BAA	Result	Benz[a]anthracene	630
2442	sdport	Sediment	BAP	Result	Benzo[a]pyrene	312
2442	sdport	Sediment	BAP	Result	Benzo[a]pyrene	484
2442	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	442
2442	sdport	Sediment	BBF	Result	Benzo[b]fluoranthene	578
2442	sdport	Sediment	BEP	Result	Benzo[e]pyrene	224
2442	sdport	Sediment	BEP	Result	Benzo[e]pyrene	343
2442	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	67.4
2442	sdport	Sediment	BGHIP	Result	Benzo[g,h,i]perylene	78.9
2442	sdport	Sediment	BIPHENYL	Result	Biphenyl	-99
2442	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	241
2442	sdport	Sediment	BKF	Result	Benzo[k]fluoranthene	535
2442	sdport	Sediment	CHRYSENE	Result	Chrysene	798
2442	sdport	Sediment	CHRYSENE	Result	Chrysene	818

2442	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	964
2442	sdport	Sediment	FLUORANTHN	Result	Fluoranthene	1720
2442	sdport	Sediment	FLUORENE	Result	Fluorene	-99
2442	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	79.8
2442	sdport	Sediment	ICDP	Result	Indeno(1,2,3-c,d)pyrene	98.1
2442	sdport	Sediment	NAPTHALENE	Result	Naphthalene	-99
2442	sdport	Sediment	PERYLENE	Result	Perylene	92.3
2442	sdport	Sediment	PERYLENE	Result	Perylene	136
2442	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	191
2442	sdport	Sediment	PHENANTHRN	Result	Phenanthrene	222
2442	sdport	Sediment	PYRENE	Result	Pyrene	982
2442	sdport	Sediment	PYRENE	Result	Pyrene	1020

Units	Qualifier	MDL	ResltSubMDL
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	28
ng/g dry wt	R	18	43.7
ng/g dry wt		27	45
ng/g dry wt	R	18	37
ng/g dry wt	R	25	38
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	43.1
ng/g dry wt	R	21	28.6
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	29.1
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	50.3
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	33.3
ng/g dry wt	R	18	71.4
ng/g dry wt		27	120
ng/g dry wt	R	18	60.5
ng/g dry wt	R	25	50.4
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	73.6
ng/g dry wt	R	21	40.4
ng/g dry wt	R	39	46.5
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	47.6
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	21.9
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	50.9
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29

ng/g dry wt ND	43	43
ng/g dry wt ND	25	25
ng/g dry wt ND	39	39
ng/g dry wt ND	42	42
ng/g dry wt ND	25	25
ng/g dry wt ND	35	35
ng/g dry wt R	23	23.6
ng/g dry wt R	18	44.3
ng/g dry wt	27	66
ng/g dry wt R	18	40.4
ng/g dry wt R	25	26.9
ng/g dry wt ND	42	42
ng/g dry wt R	20	43.2
ng/g dry wt R	21	33.1
ng/g dry wt ND	39	39
ng/g dry wt ND	46	46
ng/g dry wt R	22	27
ng/g dry wt ND	36	36
ng/g dry wt ND	18	18
ng/g dry wt ND	37	37
ng/g dry wt R	27	39.3
ng/g dry wt ND	39	39
ng/g dry wt ND	39	39
ng/g dry wt ND	29	29
ng/g dry wt ND	43	43
ng/g dry wt ND	25	25
ng/g dry wt ND	39	39
ng/g dry wt ND	42	42
ng/g dry wt ND	25	25
ng/g dry wt ND	35	35
ng/g dry wt ND	23	23
ng/g dry wt ND	18	18
ng/g dry wt ND	27	27
ng/g dry wt ND	18	18
ng/g dry wt ND	25	25
ng/g dry wt ND	42	42
ng/g dry wt ND	20	20
ng/g dry wt ND	21	21
ng/g dry wt ND	39	39
ng/g dry wt ND	46	46
ng/g dry wt ND	22	22
ng/g dry wt ND	36	36
ng/g dry wt ND	18	18
ng/g dry wt ND	37	37
ng/g dry wt ND	27	27
ng/g dry wt ND	39	39
ng/g dry wt ND	39	39
ng/g dry wt ND	29	29
ng/g dry wt ND	43	43
ng/g dry wt ND	25	25
ng/g dry wt ND	39	39
ng/g dry wt ND	42	42

ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	35.1
ng/g dry wt	R	18	37.9
ng/g dry wt		27	55
ng/g dry wt	R	18	36.8
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	42.8
ng/g dry wt	R	21	51
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	22.3
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	38.8
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	68.3
ng/g dry wt	R	18	107
ng/g dry wt		27	148
ng/g dry wt	R	18	91.7
ng/g dry wt	R	25	50.1
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	103
ng/g dry wt	R	21	93
ng/g dry wt	R	39	59.3
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	50.5
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	29.1
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	83.1
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	53.3
ng/g dry wt	R	18	66.9

ng/g dry wt	27	87
ng/g dry wt R	18	55.4
ng/g dry wt R	25	36.3
ng/g dry wt ND	42	42
ng/g dry wt R	20	56.3
ng/g dry wt R	21	71.1
ng/g dry wt R	39	62.3
ng/g dry wt ND	46	46
ng/g dry wt R	22	33.1
ng/g dry wt ND	36	36
ng/g dry wt R	18	18.9
ng/g dry wt ND	37	37
ng/g dry wt R	27	70.1
ng/g dry wt ND	39	39
ng/g dry wt ND	39	39
ng/g dry wt ND	29	29
ng/g dry wt ND	43	43
ng/g dry wt ND	25	25
ng/g dry wt ND	39	39
ng/g dry wt ND	42	42
ng/g dry wt ND	25	25
ng/g dry wt ND	35	35
ng/g dry wt R	23	63.5
ng/g dry wt R	18	100
ng/g dry wt	27	131
ng/g dry wt R	18	84.4
ng/g dry wt R	25	63.6
ng/g dry wt ND	42	42
ng/g dry wt R	20	77.4
ng/g dry wt R	21	79.4
ng/g dry wt R	39	72.3
ng/g dry wt ND	46	46
ng/g dry wt R	22	54.8
ng/g dry wt ND	36	36
ng/g dry wt R	18	27.6
ng/g dry wt ND	37	37
ng/g dry wt R	27	92.9
ng/g dry wt ND	39	39
ng/g dry wt ND	39	39
ng/g dry wt ND	29	29
ng/g dry wt ND	43	43
ng/g dry wt ND	25	25
ng/g dry wt ND	39	39
ng/g dry wt ND	42	42
ng/g dry wt R	25	39.5
ng/g dry wt R	35	60.8
ng/g dry wt R	23	99.5
ng/g dry wt R	18	106
ng/g dry wt	27	88
ng/g dry wt R	18	80.4
ng/g dry wt R	25	54.7
ng/g dry wt ND	42	42

ng/g dry wt	R	20	104
ng/g dry wt	R	21	121
ng/g dry wt	R	39	142
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	48.3
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	27.9
ng/g dry wt	R	37	211
ng/g dry wt	R	27	190
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	33.9
ng/g dry wt	R	18	65.9
ng/g dry wt		27	67
ng/g dry wt	R	18	60.1
ng/g dry wt	R	25	49
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	66.9
ng/g dry wt	R	21	50.9
ng/g dry wt	R	39	41.9
ng/g dry wt	ND	46	46

ng/g dry wt	R	22	39.6
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	19.6
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	65.5
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27

ng/g dry wt	R	27	33.1
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29

ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	47.6
ng/g dry wt	R	18	82
ng/g dry wt		27	96
ng/g dry wt	R	18	74.6
ng/g dry wt	R	25	49.7
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	80.5
ng/g dry wt	R	21	70.1
ng/g dry wt	R	39	55.9
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	45.4
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	28.9
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	70.2
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	24.4
ng/g dry wt	ND	23	23
ng/g dry wt	R	18	30.9
ng/g dry wt	R	18	26.7
ng/g dry wt		27	44
ng/g dry wt		27	38
ng/g dry wt	R	18	29
ng/g dry wt	R	18	26
ng/g dry wt	R	25	27.1
ng/g dry wt	R	25	25.1
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20

ng/g dry wt	R	20	20.7
ng/g dry wt	ND	21	21
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	35.4
ng/g dry wt	R	27	29
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35

ng/g dry wt	ND	23	23
ng/g dry wt	R	18	33
ng/g dry wt		27	37
ng/g dry wt	R	18	29
ng/g dry wt	R	25	29.9
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	30.6
ng/g dry wt	R	21	21.3
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	23.9
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	29
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18

ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	R	18	20.8
ng/g dry wt		27	30
ng/g dry wt	R	18	21.6
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	27.2
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	R	18	18.9
ng/g dry wt		27	28
ng/g dry wt	R	18	18.8
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21

ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	25.8
ng/g dry wt	R	18	24.4
ng/g dry wt	ND	27	27
ng/g dry wt	R	18	21.8
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	22.6
ng/g dry wt	R	21	25.4
ng/g dry wt	R	39	43.9
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	45
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	25	97.6
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	R	25	98.3
ng/g dry wt	R	35	164
ng/g dry wt	R	23	366
ng/g dry wt	R	18	567
ng/g dry wt		27	760
ng/g dry wt	R	18	499
ng/g dry wt	R	25	282
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	329
ng/g dry wt	R	21	536
ng/g dry wt	R	39	503
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	254
ng/g dry wt	ND	36	36

ng/g dry wt	R	18	131
ng/g dry wt	R	37	218
ng/g dry wt	R	27	665
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	R	27	31.9
ng/g dry wt	ND	39	39

ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	25	32.8
ng/g dry wt	R	25	53.7
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	48.6
ng/g dry wt	ND	35	35
ng/g dry wt	R	35	65.7
ng/g dry wt	R	23	99
ng/g dry wt	R	23	151
ng/g dry wt	R	18	158
ng/g dry wt	R	18	287
ng/g dry wt		27	225
ng/g dry wt		27	386
ng/g dry wt	R	18	150
ng/g dry wt	R	18	250
ng/g dry wt	R	25	75.4
ng/g dry wt	R	25	98.5
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	131
ng/g dry wt	R	20	245
ng/g dry wt	R	21	99.8
ng/g dry wt	R	21	169
ng/g dry wt	R	39	104
ng/g dry wt	R	39	182
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	74.4
ng/g dry wt	R	22	114
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	39.5
ng/g dry wt	R	18	77.1
ng/g dry wt	ND	37	37
ng/g dry wt	R	37	83.1
ng/g dry wt	R	27	122
ng/g dry wt	R	27	230
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	25	193
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	R	25	241
ng/g dry wt	R	35	368
ng/g dry wt	R	23	1000
ng/g dry wt	R	18	1150
ng/g dry wt		27	2010
ng/g dry wt	R	18	1180
ng/g dry wt	R	25	289

ng/g dry wt	ND	42	42
ng/g dry wt	R	20	1160
ng/g dry wt	R	21	1330
ng/g dry wt	R	39	1500
ng/g dry wt	R	46	54
ng/g dry wt	R	22	361
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	291
ng/g dry wt	R	37	311
ng/g dry wt	R	27	1340
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	97.7
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	47.7
ng/g dry wt	ND	35	35
ng/g dry wt	R	35	76.9
ng/g dry wt	ND	23	23
ng/g dry wt	R	23	385
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	544
ng/g dry wt	ND	27	27
ng/g dry wt		27	768
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	410
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	182
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	R	20	390
ng/g dry wt	ND	21	21
ng/g dry wt	R	21	453
ng/g dry wt	ND	39	39
ng/g dry wt	R	39	440
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	R	22	198
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	137
ng/g dry wt	ND	37	37
ng/g dry wt	R	37	82.4
ng/g dry wt	ND	27	27
ng/g dry wt	R	27	441
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29

ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	R	23	39.8
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	69.6
ng/g dry wt	ND	27	27
ng/g dry wt		27	85
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	64.2
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	45.4
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	R	20	61.8
ng/g dry wt	ND	21	21
ng/g dry wt	R	21	52
ng/g dry wt	ND	39	39
ng/g dry wt	R	39	40.4
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	R	22	39.3
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	22.8
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	R	27	58
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	R	23	54.7
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	93.8
ng/g dry wt	ND	27	27
ng/g dry wt		27	112
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	87.7
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	54.4
ng/g dry wt	ND	42	42

ng/g dry wt	ND	20	20
ng/g dry wt	R	20	93.3
ng/g dry wt	ND	21	21
ng/g dry wt	R	21	76.2
ng/g dry wt	ND	39	39
ng/g dry wt	R	39	51.4
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	R	22	49.9
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	22.9
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	R	27	66.6
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	R	23	40.4
ng/g dry wt	R	18	22
ng/g dry wt	R	18	80.6
ng/g dry wt	ND	27	27
ng/g dry wt		27	98
ng/g dry wt	R	18	20.2
ng/g dry wt	R	18	75.3
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	42.6
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	R	20	79.9
ng/g dry wt	R	21	21.6
ng/g dry wt	R	21	53.5
ng/g dry wt	ND	39	39
ng/g dry wt	R	39	39.4
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	R	22	41.5
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	25.1
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	30.1
ng/g dry wt	R	27	52.1
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39

ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	25	65.6
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	R	25	69.7
ng/g dry wt	R	35	104
ng/g dry wt	R	23	165
ng/g dry wt	R	18	372
ng/g dry wt		27	480
ng/g dry wt	R	18	304
ng/g dry wt	R	25	123
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	277
ng/g dry wt	R	21	279
ng/g dry wt	R	39	94.6
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	138
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	111
ng/g dry wt	R	37	49.2
ng/g dry wt	R	27	195
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39

ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	43.4
ng/g dry wt	R	18	64
ng/g dry wt		27	84
ng/g dry wt	R	18	60.9
ng/g dry wt	R	25	35.4
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	65.1
ng/g dry wt	R	21	58.2
ng/g dry wt	R	39	39.3
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	35.9
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	54.5
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	25	32.1
ng/g dry wt	R	25	86.7
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	R	25	26.5
ng/g dry wt	R	25	77.6
ng/g dry wt	R	35	40.7
ng/g dry wt	R	35	373
ng/g dry wt	R	23	93.8
ng/g dry wt	R	23	263
ng/g dry wt	R	18	143
ng/g dry wt	R	18	525
ng/g dry wt		27	185
ng/g dry wt		27	663
ng/g dry wt	R	18	131
ng/g dry wt	R	18	395
ng/g dry wt	R	25	73.8
ng/g dry wt	R	25	170
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	173
ng/g dry wt	R	20	437
ng/g dry wt	R	21	184
ng/g dry wt	R	21	530
ng/g dry wt	R	39	95.2
ng/g dry wt	R	39	197
ng/g dry wt	ND	46	46
ng/g dry wt	R	46	55.1
ng/g dry wt	R	22	64.6
ng/g dry wt	R	22	183
ng/g dry wt	ND	36	36

ng/g dry wt	R	18	48
ng/g dry wt	R	18	145
ng/g dry wt	ND	37	37
ng/g dry wt	R	37	150
ng/g dry wt	R	27	182
ng/g dry wt	R	27	354
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	43	50.2
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	74.6
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	119
ng/g dry wt	ND	35	35
ng/g dry wt	R	35	204
ng/g dry wt	ND	23	23
ng/g dry wt	R	23	480
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	742
ng/g dry wt	ND	27	27
ng/g dry wt		27	1030
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	612
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	108
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	20
ng/g dry wt	R	20	679
ng/g dry wt	R	21	22.3
ng/g dry wt	R	21	849
ng/g dry wt	ND	39	39
ng/g dry wt	R	39	501
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	R	22	153
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	190
ng/g dry wt	ND	37	37
ng/g dry wt	R	37	120
ng/g dry wt	ND	27	27
ng/g dry wt	R	27	1080
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39

ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	47.7
ng/g dry wt	R	23	54.5
ng/g dry wt	R	18	48.5
ng/g dry wt	R	18	57.7
ng/g dry wt		27	68
ng/g dry wt		27	79
ng/g dry wt	R	18	45.1
ng/g dry wt	R	18	50.8
ng/g dry wt	R	25	30
ng/g dry wt	R	25	30.8
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	45.2
ng/g dry wt	R	20	53.5
ng/g dry wt	R	21	57.9
ng/g dry wt	R	21	69.4

ng/g dry wt	R	39	44.1
ng/g dry wt	R	39	48.4
ng/g dry wt	ND	46	46
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	26.2
ng/g dry wt	R	22	28.3
ng/g dry wt	ND	36	36
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	55.3
ng/g dry wt	R	27	57.4
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	25	28.6
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	R	35	36.1
ng/g dry wt	R	23	78.5
ng/g dry wt	R	18	128
ng/g dry wt		27	189
ng/g dry wt	R	18	122
ng/g dry wt	R	25	73.7
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	124
ng/g dry wt	R	21	100
ng/g dry wt	R	39	98.6
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	72.8
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	35
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	111
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25

ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	37.3
ng/g dry wt	R	23	46.4
ng/g dry wt	R	23	36.7
ng/g dry wt	R	18	50.3
ng/g dry wt	R	18	67.5
ng/g dry wt	R	18	53.4
ng/g dry wt		27	57
ng/g dry wt		27	56
ng/g dry wt		27	65
ng/g dry wt	R	18	39.7
ng/g dry wt	R	18	54.8
ng/g dry wt	R	18	44.5
ng/g dry wt	R	25	30.6
ng/g dry wt	R	25	33.3
ng/g dry wt	R	25	34
ng/g dry wt	ND	42	42
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	48.9
ng/g dry wt	R	20	73.6
ng/g dry wt	R	20	53.4
ng/g dry wt	R	21	45.4
ng/g dry wt	R	21	56.8
ng/g dry wt	R	21	52.4
ng/g dry wt	R	39	40.6

ng/g dry wt	R	39	53.1
ng/g dry wt	R	39	56.1
ng/g dry wt	ND	46	46
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	29.4
ng/g dry wt	R	22	29.5
ng/g dry wt	R	22	30.2
ng/g dry wt	ND	36	36
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	R	18	18.4
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	46.8
ng/g dry wt	R	27	61.9
ng/g dry wt	R	27	62.3
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	R	23	40.7
ng/g dry wt	R	18	66.4

ng/g dry wt		27	100
ng/g dry wt	R	18	72
ng/g dry wt	R	25	42.9
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	73.6
ng/g dry wt	R	21	73.4
ng/g dry wt	R	39	48.3
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	39.3
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	19.2
ng/g dry wt	ND	37	37
ng/g dry wt	R	27	66
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	ND	35	35
ng/g dry wt	ND	23	23
ng/g dry wt	ND	18	18
ng/g dry wt	ND	27	27
ng/g dry wt	ND	18	18
ng/g dry wt	ND	25	25
ng/g dry wt	ND	42	42
ng/g dry wt	ND	20	20
ng/g dry wt	ND	21	21
ng/g dry wt	ND	39	39
ng/g dry wt	ND	46	46
ng/g dry wt	ND	22	22
ng/g dry wt	ND	36	36
ng/g dry wt	ND	18	18
ng/g dry wt	ND	37	37
ng/g dry wt	ND	27	27
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	43	49.1
ng/g dry wt	ND	25	25
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	ND	25	25
ng/g dry wt	R	25	25.5
ng/g dry wt	R	35	54.5
ng/g dry wt	R	35	96.8
ng/g dry wt	R	23	102
ng/g dry wt	R	23	156
ng/g dry wt	R	18	86.8

ng/g dry wt	R	18	133
ng/g dry wt		27	123
ng/g dry wt		27	181
ng/g dry wt	R	18	70.3
ng/g dry wt	R	18	103
ng/g dry wt	R	25	28.1
ng/g dry wt	R	25	29.8
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	78.4
ng/g dry wt	R	20	135
ng/g dry wt	R	21	144
ng/g dry wt	R	21	240
ng/g dry wt	R	39	162
ng/g dry wt	R	39	278
ng/g dry wt	ND	46	46
ng/g dry wt	R	22	30.2
ng/g dry wt	R	22	37.9
ng/g dry wt	ND	36	36
ng/g dry wt	R	18	26.5
ng/g dry wt	R	18	48.2
ng/g dry wt	R	37	61.1
ng/g dry wt	R	37	111
ng/g dry wt	R	27	173
ng/g dry wt	R	27	273
ng/g dry wt	ND	39	39
ng/g dry wt	ND	39	39
ng/g dry wt	ND	29	29
ng/g dry wt	ND	43	43
ng/g dry wt	R	43	57.7
ng/g dry wt	R	25	42.8
ng/g dry wt	R	25	55.4
ng/g dry wt	ND	39	39
ng/g dry wt	ND	42	42
ng/g dry wt	R	25	38.2
ng/g dry wt	R	25	79.4
ng/g dry wt	R	35	261
ng/g dry wt	R	35	763
ng/g dry wt	R	23	520
ng/g dry wt	R	23	630
ng/g dry wt	R	18	312
ng/g dry wt	R	18	484
ng/g dry wt		27	442
ng/g dry wt		27	578
ng/g dry wt	R	18	224
ng/g dry wt	R	18	343
ng/g dry wt	R	25	67.4
ng/g dry wt	R	25	78.9
ng/g dry wt	ND	42	42
ng/g dry wt	R	20	241
ng/g dry wt	R	20	535
ng/g dry wt	R	21	798
ng/g dry wt	R	21	818

ng/g dry wt R	39	964
ng/g dry wt R	39	1720
ng/g dry wt ND	46	46
ng/g dry wt R	22	79.8
ng/g dry wt R	22	98.1
ng/g dry wt ND	36	36
ng/g dry wt R	18	92.3
ng/g dry wt R	18	136
ng/g dry wt R	37	191
ng/g dry wt R	37	222
ng/g dry wt R	27	982
ng/g dry wt R	27	1020

Laura Hunter

From:	Steve Bay [steveb@sccwrp.org]
ent:	Thursday, January 23, 2003 7:02 AM
To:	Laura Hunter
Subject:	bight98 data

B98SDBData.xls BRI_CP2001.XLS

Laura,

Attached are the chemistry, summary tox, and summary benthic data for bight'98 stations in San Diego Bay. Please note that there are variations in the way the nondetect data and ERM quotients are presented in these files, relative to the way it addressed by NOAA, shipyards, or the Navy.

I will forward you another message that contains more detailed data for the PAHs

Also attached is the benthic index data for the Chollas/Paleta study.

Steve

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Southern California Coastal Water Research Project
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StationID	Stratum	Depth	Date	Latitude	Longitude	Toxic_Amp	Toxic_Dinc	SurvivalAd	LuminAdj_
2221	San Diego	3.8	7/27/1998	32.72785	-117.205	N	N	82.29167	100
2222	San Diego	4.8	7/27/1998	32.71878	-117.226	N	N	82.29167	100
2223	San Diego	3.6	7/27/1998	32.71542	-117.231	N	M	88.54167	80.53
2224	San Diego	4.5	7/27/1998	32.71308	-117.234	N	N	96.875	100
2225	San Diego	3.6	7/27/1998	32.7134	-117.23	N	M	88.54167	72.15
2226	San Diego	4.8	7/27/1998	32.71112	-117.232	N	N	86.45833	98.34
2227	San Diego	8.8	7/27/1998	32.72373	-117.208	N	M	97.91667	75.99
2228	San Diego	5.2	7/28/1998	32.72407	-117.178	N	N	101.0417	100
2229	San Diego	11.5	7/28/1998	32.70895	-117.176	N	H	97.91667	1.26
2230	San Diego	3.5	8/5/1998	32.70253	-117.179	N		65.65657	
2231	San Diego	13.1	7/28/1998	32.69465	-117.157	N	M	93.75	82.09
2233	San Diego	8.8	7/29/1998	32.68582	-117.152	N	N	98.97959	93.99
2235	San Diego	3.6	7/30/1998	32.6408	-117.137	M	N	71.42857	100
2238	San Diego	3.3	7/30/1998	32.62542	-117.129	N	M	86.73469	52.51
2239	San Diego	11.2	7/29/1998	32.6824	-117.145	N	M	100	66.85
2240	San Diego	3.3	8/4/1998	32.66753	-117.154	N	N	88.77551	86.2
2241	San Diego	3.9	7/29/1998	32.67027	-117.136	N	M	97.91667	69.05
2242	San Diego	3.7	8/4/1998	32.66497	-117.15	N	N	91.83673	92.21
2243	San Diego	3.9	8/4/1998	32.6645	-117.143	N	N	95.91837	96.03
2244	San Diego	3.3	7/30/1998	32.65972	-117.132	N	M	100	51.86
2245	San Diego	3.9	8/4/1998	32.65083	-117.143	M	N	65.65657	100
2247	San Diego	3.3	7/30/1998	32.64233	-117.125	N	H	89.79592	32.83
2249	San Diego	3	7/30/1998	32.62133	-117.128	M	N	75.5102	100
2251	San Diego	8.5	7/28/1998	32.7023	-117.162	N	N	76.04167	100
2252	San Diego	10.9	7/29/1998	32.69187	-117.153	N	N	104.1667	100
2253	San Diego	7.5	8/5/1998	32.68813	-117.138	N	N	88.88889	96.08
2254	San Diego	4.5	8/5/1998	32.67725	-117.163	N	N	97.9798	100
2255	San Diego	10.6	7/29/1998	32.67797	-117.129	N	N	96.875	100
2256	San Diego	8.2	7/29/1998	32.67685	-117.136	N	N	100	100
2257	San Diego	8.5	7/29/1998	32.67683	-117.134	N	N	90.81633	100
2258	San Diego	11.2	7/29/1998	32.67592	-117.132	N	N	91.83673	100
2259	San Diego	10.9	7/30/1998	32.67022	-117.125	N	N	96.93878	97.63
2260	San Diego	3.6	7/30/1998	32.66718	-117.13	M	M	73.46939	83.07
2262	San Diego	10.3	7/30/1998	32.6515	-117.123	M	N	78.49462	86.21
2263	San Diego	13.1	7/28/1998	32.71605	-117.176	N	N	88.17204	100
2264	San Diego	10.1	8/5/1998	32.68538	-117.133	N		89.79592	
2265	San Diego	11.2	7/29/1998	32.68388	-117.14	N	N	84.94624	100
2433	San Diego	9.1	7/27/1998	32.72235	-117.209	N	M	96.875	61.3
2434	San Diego	3.3	7/28/1998	32.7249	-117.184	N	N	101.0417	92.27
2435	San Diego	12.1	7/27/1998	32.71153	-117.223	N	M	102.0833	68.37
2436	San Diego	11	7/28/1998	32.71503	-117.183	N	H	100	27.78
2438	San Diego	3.4	7/30/1998	32.6223	-117.102	N	N	79.59184	84.51
2439	San Diego	3	7/28/1998	32.7261	-117.19	N	M	84.375	78.6
2440	San Diego	10	7/28/1998	32.71848	-117.175	N		103.125	
2441	San Diego	15.6	8/5/1998	32.69115	-117.238	N	N	87.87879	84.6
2442	San Diego	13.3	8/5/1998	32.6892	-117.237	N	M	80.80808	79.3

Fines%	Total_Orga	Abundance	NumberOf	Shannon	Evenness	ITI	Abund_Artl	Abund_Ecl	Pct_Arthro
69	0.859	824	35	3.776217	0.709558	63.4694	168	1	20.38835
72	0.985	693	35	2.575374	0.483917	67.41613	115	0	16.59452
77	1.113	816	37	3.835437	0.720686	74.49494	238	0	29.16667
40	0.645	383	41	4.178525	0.765377	88.03786	88	0	22.9765
57	1.029	3147	69	3.314988	0.527411	68.38268	837	1	26.59676
91	1.727	1012	57	3.742839	0.623806	69.80218	477	0	47.13439
50	0.932	933	52	4.110368	0.710969	86.09954	231	0	24.75884
45	0.73	251	41	4.522056	0.828302	77.61345	26	0	10.35857
43	0.9245	704	62	4.518359	0.734723	70.91186	181	1	25.71023
10	0.201	1371	71	3.890607	0.624614	69.23289	352	1	25.67469
31	0.639	1502	70	3.982182	0.631713	92.39289	307	2	20.43941
36	0.45	395	39	3.943819	0.718122	54.68454	29	0	7.341772
45	0.64	551	29	2.992857	0.60993	66.17559	16	0	2.903811
57	0.9575	760	41	3.561303	0.66044	66.60852	30	1	3.947368
34	0.715	1030	25	2.399816	0.499197	91.76284	71	0	6.893204
44	0.547	1201	40	3.153565	0.581167	76.36491	10	0	0.832639
18	0.517	1526	44	3.325945	0.589304	76.91822	91	2	5.963303
31	0.742	1117	28	2.589434	0.527714	80.85774	27	2	2.417189
35	0.487	966	47	3.954191	0.700619	70.05235	77	5	7.971014
20	0.297	1376	48	3.874009	0.679598	81.30644	152	7	11.04651
60	0.784	487	25	3.11788	0.648565	79.1875	3	0	0.616016
44	0.582	900	33	3.011432	0.578071	71.07855	54	1	6
72	1.349	600	37	3.267121	0.613898	68.16481	5	3	0.833333
72	1.994	1194	34	2.671937	0.509141	94.06583	21	0	1.758794
16	0.593	324	35	4.045363	0.776543	71.60737	87	3	26.85185
66	1.567	465	33	3.270462	0.632594	70.15974	29	0	6.236559
35	0.662	684	33	3.133784	0.606157	68.0843	18	0	2.631579
59	1.176	391	30	3.067649	0.619202	71.88804	34	0	8.695652
67	1.261	237	28	3.835258	0.774143	82.82969	41	0	17.29958
77	1.632	503	37	3.332312	0.634977	86.38618	30	0	5.964215
71	1.443	826	36	3.30637	0.613163	88.11673	28	0	3.389831
68	1.242	102	22	3.774798	0.812858	86.81875	6	1	5.882353
27	0.513	2262	48	2.632824	0.459647	78.52313	20	0	0.884173
74	1.644	542	29	3.03169	0.617843	68.99655	7	0	1.291513
73	1.2485	343	44	4.678932	0.833335	77.65677	45	0	13.11953
73	2.0065	237	28	3.923268	0.799542	69.32205	26	0	10.97046
13	0.354	1543	48	3.448456	0.607933	90.40234	241	0	15.61892
71	1.168	708	58	4.438454	0.739742	89.79009	146	0	20.62147
45	0.714	575	49	4.757928	0.830655	78.63774	40	0	6.956522
49	0.548	441	59	4.877695	0.812949	79.94839	51	2	11.56463
55	1.361	599	48	4.41976	0.768001	74.74564	144	0	24.04007
68	0.921	384	34	3.807265	0.72548	60.27079	2	0	0.520833
53	1.026	536	33	3.41624	0.666027	69.77815	83	0	15.48507
38	0.496	648	58	4.534785	0.755798	85.2	71	0	10.95679
79	1.974	1668	84	4.650212	0.709459	66.13189	18	16	1.079137
79	1.987	387	52	4.144128	0.707433	60.59258	9	5	2.325581

Pct_Ophiui	BRI_E2	Status	Description
0.121359	38.84706	2	Marginal
0	45.2218	3	Disturbed
0	42.59657	3	Disturbed
0	28.75902	1	Reference
0.031776	38.2283	2	Marginal
0	38.34715	2	Marginal
0	24.8939	1	Reference
0	32.59319	2	Marginal
0.142045	15.68984	1	Reference
0.072939	18.37301	1	Reference
0.133156	15.96508	1	Reference
0	28.80551	1	Reference
0	42.09619	3	Disturbed
0.131579	38.47665	2	Marginal
0	37.96509	2	Marginal
0	28.83227	1	Reference
0.131062	34.74322	2	Marginal
0.179051	36.61125	2	Marginal
0.517598	36.36324	2	Marginal
0.508721	31.22577	2	Marginal
0	42.56588	3	Disturbed
0.111111	34.11363	2	Marginal
0.5	44.64773	3	Disturbed
0	43.16382	3	Disturbed
0.925926	4.261723	1	Reference
0	44.5194	3	Disturbed
0	46.74704	3	Disturbed
0	37.24864	2	Marginal
0	37.90377	2	Marginal
0	38.09773	2	Marginal
0	43.1986	3	Disturbed
0.980392	38.39021	2	Marginal
0	39.06429	2	Marginal
0	40.61988	2	Marginal
0	26.27643	1	Reference
0	43.82766	3	Disturbed
0	26.67602	1	Reference
0	20.99423	1	Reference
0	23.96415	1	Reference
0.453515	-1.112	1	Reference
0	19.37823	1	Reference
0	47.59851	3	Disturbed
0	38.21638	2	Marginal
0	31.65557	2	Marginal
0.959233	17.24158	1	Reference
1.29199	21.0674	1	Reference

Station	BRI_E2
2243	55.05176
2433	22.84713
2440	30.38204
2441	30.03789
2238	60.28676
C01	50.33771
C02	48.13862
C03	54.42774
C04	54.84726
C05	56.07885
C06	49.77997
C07	44.81224
C08	65.43748
C09	52.5313
C10	52.73066
C11	30.11505
C12	54.65536
C13	71.78715
C14	82.5445
P01	32.28686
P02	41.41903
P03	54.31025
P04	49.65459
P05	51.18804
P06	56.46611
P07	52.98549
P08	44.35523
P09	48.32926
P10	53.5059
P11	55.15565
P12	42.62345
P13	50.7837
P14	57.34299
P15	59.38091
P16	68.87387
P17	65.23921

Laura Hunter

From: Tom Alo [alot@rb9.swrcb.ca.gov]
Sent: Monday, January 13, 2003 9:47 AM
To: elainecarlin@att.net; peugh@cox.net; Emkimr@cts.com; Laura Hunter; Breznik@sdbaykeeper.org; marco@surfridersd.org
Cc: David Barker; Craig Carlisle; Alan Monji; Brennan Ott
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EHC 001298

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From: Tom Alo [alot@rb9.swrcb.ca.gov]
ent: Tuesday, January 14, 2003 2:33 PM
ro: elainecarlin@att.net; peugh@cox.net; emkimr@cts.com; Laura Hunter; nielsend@exponent.com; fairey@mlml.calstate.edu; mchee@nassco.com; Denise.Klimas@noaa.gov; donald.macdonald@noaa.gov; mmartin@ospr.dfg.ca.gov; Scott_Sobiech@r1.fws.gov; jeffb@sccwrp.org; steveb@sccwrp.org; breznik@sdbaykeeper.org; chadwick@spawar.navy.mil; ckatz@spawar.navy.mil; marco@surfridersd.org; halvaxs@swmarine.com; anderson@ucdavis.edu; jwhunt@ucdavis.edu
Cc: David Barker; Charles Cheng; Craig Carlisle; Alan Monji; Brennan Ott; Peter Peuron
Subject: Final Agenda for January 22-23 Technical Meetings

January 22-23 Meeting.PDF

All,

Attached is the final agenda for the January 22-23 technical meeting. This meeting is a continuation of the technical meeting we had on December 12, 2002. As you'll notice on the agenda some of the topics have strikeouts. The strikeouts indicate that these topics will not be discussed as they were already covered at the December 12 meeting.

Please keep in mind that the reference station meetings are not intended to address the establishment of bay-wide background conditions for all sites in San Diego Bay. Rather the goal of these meetings is to focus our discussions on developing a reference pool for the NASSCO, 'outhwest Marine, Chollas Creek, and 7th Street Channel sediment .nvestigations. Ultimately, statistical comparisons will be made between the reference pool and the stations at these four sites to determine whether the site sediments are exceeding background sediment quality conditions. The indicators that will be used for this determination are sediment chemistry, toxicity, and benthic community composition.

I'd like to get a head count so that I could reserve an appropriate sized conference room for the January 22-23 meeting. Please let me know ASAP if you will be attending the meeting or will be joining us via conference call. For those of you planning to phone in please use this # for both days: (916) 255-4069.

If you have any questions or comments please contact me.

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230/460V, 3 phase, 60 Hz

Adhesive Work (Wood/Plastics)

- Type of adhesive used and VOC content

?, ?

- Estimated usage

?

On-Board Ship

Spray Painting

- Type of paint used, quantity and VOC content

Various, see touch up painting - shipboard, <340 g/l

- Material Painted (Wood, plastic, etc...)

Primarily metals

- Paint application equipment

spray painting

Touch-up painting (over 20 gallons)

- Type of paint used, quantity and VOC content

Various, <3000 gal, <340 g/l

- Material painted (wood, plastic, etc...)

Primarily metals, mastics

Abrasive Blasting

- Emission control devices

Temporary booth with ventilation/filters

- Abrasive used

Aluminum oxide

085149

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****
****

56 - Isopropyl alcohol, ? g/l

- Bath dimensions

38 - 36"x24"x17" - 30 gal tank
56 - 24"x16"x18" - 10-15 gal tank

- Lid or cover type

Lid

- Estimated usage

38 - change out tank once per month
56 - change out tank once per month

Cold solvent cleaning - Handwiping

- Type of solvent used and VOC content

Primarily isopropyl alcohol, ? g/l

- Estimated usage

350 - 500 gallons/yr

Fiberglass/Woodworking/Formica dust control services

- Emission control devices

Bag house or filters?

- Enclosure type

?

Electric Oven (paint drying)

- Parts dried and coating on parts

Primarily powder coat baking, no VOC
Some metal paint drying, <20 gal/yr, <340 g/l

- Dimensions

114"x126"x96"

- Emission controls

?

- Rating on oven

085148

Laura Hunter

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Sent: Tuesday, January 14, 2003 2:33 PM
To: elainecarlin@att.net; peugh@cox.net; emkimr@cts.com; Laura Hunter; nielsend@exponent.com; fairey@mlml.calstate.edu; mchee@nassco.com; Denise.Klimas@noaa.gov; donald.macdonald@noaa.gov; mmartin@ospr.dfg.ca.gov; Scott_Sobiech@r1.fws.gov; jeffb@sccwrp.org; steveb@sccwrp.org; breznik@sdbaykeeper.org; chadwick@spawar.navy.mil; ckatz@spawar.navy.mil; marco@surfridersd.org; halvaxs@swmarine.com; anderson@ucdavis.edu; jwhunt@ucdavis.edu
Cc: David Barker; Charles Cheng; Craig Carlisle; Alan Monji; Brennan Ott; Peter Peuron
Subject: Final Agenda for January 22-23 Technical Meetings

January 22-23 Meeting.PDF

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If you have any questions or comments please contact me.

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San Diego, CA 92123
Main: (858) 467-2952
Direct: (858) 636-3154
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California Regional Water Quality Control Board
San Diego Region

Internet Address: http://www.swrcb.ca.gov/rwqcb9
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Phone (858) 467-2952 FAX (858) 571-6972

Vinston H. Hickox
Secretary for Environmental Protection

Gray Davis
Governor

AGENDA

TECHNICAL WORKGROUP MEETING:
APPROACH TO DEVELOP A REFERENCE POOL FOR THE NASSCO AND SOUTHWEST MARINE SHIPYARDS & CHOLLAS/PALETA INVESTIGATIONS

January 22 & 23, 2003
SDRWQCB, Mildred Dilucia Library
8:00 am – 5:00 pm

I. Introductions

II. Overview of Proposed Approaches & Differences (Tom Alo)

III. Summary of December 12 Meeting (Tom Alo)

IV. Present and Discuss SCCWRP/SPAWAR/Exponent Approach on Reference Pool

STEP 1: Evaluate reference station data from Shipyard and Chollas/Paleta investigations.

- ~~Evaluation approach (Steve Bay)~~
- ~~Chollas/Paleta results (Steve Bay)~~
- NASSCO/SWM results (Dreas Nielsen)
- Comparison between Chollas/Paleta results and Shipyard results

STEP 2: Evaluate data from Bight'98 stations and select reference sites.

- ~~Evaluation approaches (Steve Bay)~~
- ~~Distance evaluation (Steve Bay)~~
- ~~Multivariate evaluation (Steve Bay)~~
- ~~Comparison of Bight'98 and 2001 data (Dreas Nielsen)~~
- Comments on Distance-From-Shore Approach
- Comments on Principal Components Analysis

STEP 3: Development and usage of a reference pool for the Shipyard and Chollas/Paleta projects (Steve Bay).

- Selection of datasets
- Data use
- Application for future projects

V. Present and Discuss NOAA's Approach on Reference Pool (Denise Klimas & Don MacDonald)

- Evaluation Approach
- Results
- Conclusions and Recommendations

VI. Discussion on Preferred Approach to Develop a Reference Pool for NASSCO and Southwest Marine Shipyards & Chollas/Paleta Investigations

VII. Closing/Action Items

Laura Hunter

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230/460V, 3 phase, 60 Hz

Adhesive Work (Wood/Plastics)

- Type of adhesive used and VOC content

?, ?

- Estimated usage

?

On-Board Ship

Spray Painting

- Type of paint used, quantity and VOC content

Various, see touch up painting - shipboard, <340 g/l

- Material Painted (Wood, plastic, etc...)

Primarily metals

- Paint application equipment

spray painting

Touch-up painting (over 20 gallons)

- Type of paint used, quantity and VOC content

Various, <3000 gal, <340 g/l

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Abrasive Blasting

- Emission control devices

Temporary booth with ventilation/filters

- Abrasive used

Aluminum oxide

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56 - Isopropyl alcohol, ? g/l

- Bath dimensions

38 - 36"x24"x17" - 30 gal tank
56 - 24"x16"x18" - 10-15 gal tank

- Lid or cover type

Lid

- Estimated usage

38 - change out tank once per month
56 - change out tank once per month

Cold solvent cleaning - Handwiping

- Type of solvent used and VOC content

Primarily isopropyl alcohol, ? g/l

- Estimated usage

350 - 500 gallons/yr

Fiberglass/Woodworking/Formica dust control services

- Emission control devices

Bag house or filters?

- Enclosure type

?

Electric Oven (paint drying)

- Parts dried and coating on parts

Primarily powder coat baking, no VOC
Some metal paint drying, <20 gal/yr, <340 g/l

- Dimensions

114"x126"x96"

- Emission controls

?

- Rating on oven

085148

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EHC 001251

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Juliana C. Hernandez
Natural Resources,
Secretary

Natural Resources Office
Staff Civil Engineer (18N)
NAS North Island (Bldg 3)
BOX 357040
San Diego, CA 92135-7040

Telephone: (619) 545-2725
DSN 735-2725

FAX: (619) 545-1101
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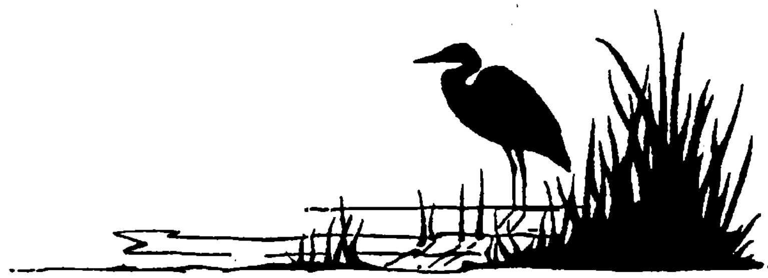

Date: 02 OCT 95 To: John Coon

Telephone: 2-1647 Fax Number: 2-3789

Number of Pages transmitted, including cover sheet: 1

Remarks: Clark is out sick. Can meeting be rescheduled for either Wednesday Afternoon or Thursday morning. Please call me so I can schedule it with him.

Thanks.

Julie

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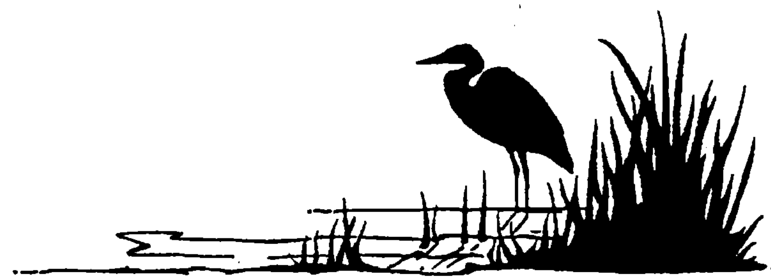

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Sediment Chemistry	ERM	ERL	BPTCP	N.I.	SY[2]	NOAA[1]	Dist[1]	PCA[1]	CP
Arsenic (mg/Kg)	70	8.20	23.65	11.70	9.34	8.09	9.02	9.76	10.40
Copper (mg/Kg)	270	34.0	139	152	93	86.5	127.9	107.7	97
Lead (mg/Kg)	218	46.7	38.2	92.8	95.0	39.1	50.5	39.0	44.9
Mercury (mg/Kg)	0.71	0.15	0.77	0.91	0.50	0.54	0.56	0.50	0.42
Zinc (mg/Kg)	410	150	292	278	146	149	210	188	239
PPPAH (ug/Kg)	44792	4022	3840	3297	3720				2729
TPCB (ug/Kg)	180	23	171	121	168				55
TCHLOR (ug/Kg)	6.0	0.5	3.7	5.6					1.3
TDDT (ug/Kg)	46	1.6	8.3	15					13
ERMQ			0.46	0.54	0.40	0.32	0.42	0.33	0.25
N metals			**11**	**10**	**5**	**14**	**22**	**21**	**5**
N organics			**11**	**10**	**5**	**0**	**0**	**0**	**5**

[1]Predictions excluding B98 organics due to number of nondetect valu
[2]Chlordane & DDT values not reported in SY data

CP+SY[2]	CP+SY[2]+ Dist[1]	CP+SY[2]+ PCA[1]	CP+SY[2]+ NOAA[1]
9.63	9.03	9.53	7.81
90	116	101	81
66.7	54.3	48.4	50.3
0.43	0.52	0.47	0.48
195	202	186	167
2746	2746	2746	2898
110	110	110	119
1.3	1.3	1.3	1.05
13	13	13	3.03
0.31	0.38	0.32	0.31
10	**32**	**31**	**21**
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REFERENCE SITE POOL EVALUATION

Bart Chadwick and Chuck Katz
SPAWAR Systems Center San Diego

Introduction

The following evaluation was performed to see how using different reference site data pools affects the determination of chemical and toxicological thresholds, and how this might affect the ability to distinguish contaminated sites when the thresholds are applied to Hot Spot data. The analysis was performed with a common set of parameters, assumptions, calculations, and statistics. Nine chemical parameters (As, Cu, Pb, Hg, Zn, PPPAH, TPCB, TCHLOR, and TDDT), ERMQ and Amphipod toxicity were evaluated. The chemical parameters were chosen on the basis that they represented chemicals of concern at the Chollas and Paleta hotspots during the original data screening presented to the RWQCB board in June 2002. The following rules and assumptions were applied:

- Calculations were made using non-detect data converted to ½ method detection limits.
- The 95% prediction interval was used for all reference pools as the statistic of choice when evaluating whether or not an individual hot spot data value (or station) exceeded reference.
- Data sets containing more than 50% non-detect data for a given parameter (i.e., PCBs in Bight 98) were not included in statistical evaluations on the basis that a high number of non-detects would bias the variability of the pool.

Reference Pools

Seven reference data envelopes were calculated in this evaluation. Toxicity data were analyzed in a separate file but for the same reference pools. The Excel files attached with this document containing the data are: RefEnvEval.xls, Chollas-PaletaSedChemTables.xls, and Tox refeval data.xls. The file and sheet label for each data set are listed below.

1) **CP** This data set is based on only the 2001 Chollas-Paleta reference data set after acceptance criteria were applied. The data set consists of only 5 stations using the acceptance criteria established by SCCWRP/Navy. Station 2440 chemistry data were excluded because of substantial deviation in multiple chemical parameters. **File:** RefEnvEval.xls **Tab:** CP
2) **CP+SY** This data set is a combination of the CP and Shipyard 2001 reference data set again applying the acceptance criteria to both set. No data or stations

were excluded by Exponent in the SY data set. **File:** RefEnvEval.xls **Tab:** CP+SY

3) **CP+SY+Dist** This reference data pool was developed by combining the above two data sets with Bight'98 data from the 22 stations meeting the distance criteria outlined by SCCWRP. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98Dist. **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 dist

4) **CP+SY+PCA** This reference data pool was developed by combining the CP and SY data set with Bight'98 data from the 21 stations meeting the PCA grouping outlined by Exponent. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98 PCA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 PCA

5) **CP+SY+NOAA** This reference data pool was developed by combining NOAA's reference pool that includes a subset of the CP and SY data sets and 14 Bight 98 stations. It should be noted that the organics data here exceeded the 50% rule for non-detects for the Bight98 data. **File:** RefEnvEval.xls **Tab:** CP+SY+NOAA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** NOAA

6) **BPTCP** This reference data pool was developed using data from the 11 reference sites identified in the original BPTCP study. These data are shown for comparison purposes only and were not used for comparing to hot spot data. Non-detects were replaced with ½ detection limit.

7) **NI** This reference data pool was developed using data from 10 reference sites used in the North Island Remedial Investigation (1996). These data are shown for comparison purposes only and were not used for comparing to hot spot data. Non-detects were replaced with ½ detection limit.

Results

Grain size and TOC were compared for the different reference pools (Figure 1) with the exception of the NOAA data pool. The comparison indicates that incorporation of additional sites either by the distance or PCA method would help to broaden the range of the TOC and grain size pool to be more comparable to the CP site data. Areas that are still not well represented would include inner Paleta and outer Chollas which appear to be enriched in TOC for the same grain size range as the reference areas. This is reflected in the regression slopes shown on the plot.

A summary of the 95% prediction intervals in each of the reference pools identified above is shown in the Table 1 (chemistry) and Table 2 (toxicity). The results are also shown graphically in Figures 2 and 3. For chemistry, the comparison indicates that for most parameters, the reference pools for chemistry do not vary significantly. There is no pool that is always lower or higher than the rest. For toxicity, there is a large change for

the different data pools. The upper 95% PI increases from 16% survival for the original CP data set, to 62% survival for the CP+SY+Dist pool.

The implication that these changes have for identification of stations at the CP site was also evaluated (see Figures 4-6 for chemistry, Figure 7 for toxicity). Figure 4 shows that, for copper, using the CP+SY+Dist pool would result in the identification of 17 stations as exceeding reference for the CP sites. This would increase to 25 sites using the CP+SY+NOAA pool. For PAHs, these would be no change in the number of sites identified. Overall (see Figure 6), the number of sites that would be identified as exceeding reference for any contaminant would be virtually the same for all the pools with 28 sites for CP+SY+Dist and CP+SY+PCA, 29 for CP and CP+SY, and 30 for CP+SY+NOAA.

For toxicity (Figure 7) no stations would be identified as exceeding reference based on the original CP reference data. This increases to an identification of 7 stations for the CP+SY+Dist pool. The NOAA pool was not evaluated for toxicity because the reference stations were filtered to only select stations with survival > 90%, resulting in a strong biasing of the mean.

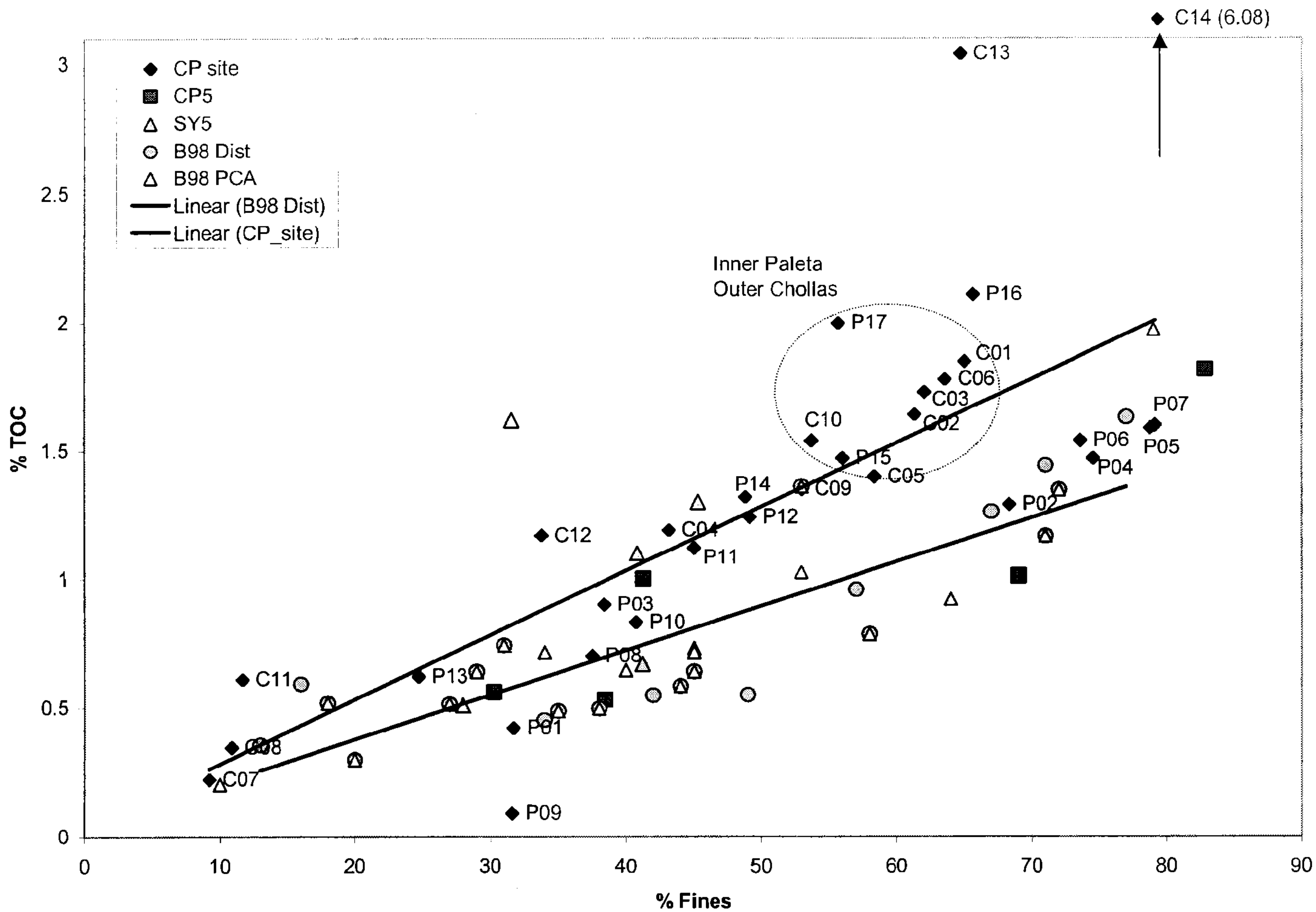

Figure 1. TOC vs. fines for the different reference sets.

Table 1. A summary of the 95% prediction intervals for chemistry in each of the reference pools.

Sediment Chemistry	ERM	ERL	BPTCP	N.I.	SY[2]	NOAA[1]	Dist[1]	PCA[1]	CP	CP+SY[2]	CP+SY[2]+ Dist[1]	CP+SY[2]+ PCA[1]	CP+SY[2]+ NOAA[1]
Arsenic (mg/Kg)	70	8.20	23.65	11.70	9.34	8.09	9.02	9.76	10.40	9.63	9.03	9.53	7.81
Copper (mg/Kg)	270	34.0	139	152	93	86.5	127.9	107.7	97	90	116	101	81
Lead (mg/Kg)	218	46.7	38.2	92.8	95.0	39.1	50.5	39.0	44.9	66.7	54.3	48.4	50.3
Mercury (mg/Kg)	0.71	0.15	0.77	0.91	0.50	0.54	0.56	0.50	0.42	0.43	0.52	0.47	0.48
Zinc (mg/Kg)	410	150	292	278	146	149	210	188	239	195	202	186	167
PPPAH (ug/Kg)	44792	4022	3840	3297	3720				2729	2746	2746	2746	2898
TPCB (ug/Kg)	180	23	171	121	168				55	110	110	110	119
TCHLOR (ug/Kg)	6.0	0.5	3.7	5.6					1.3	1.3	1.3	1.3	1.05
TDDT (ug/Kg)	46	1.6	8.3	15					13	13	13	13	3.03
ERMQ			0.46	0.54	0.40	0.32	0.42	0.33	0.25	0.31	0.38	0.32	0.31
N metals			**11**	**10**	**5**	**14**	**22**	**21**	**5**	**10**	**32**	**31**	**21**
N organics			**11**	**10**	**5**	**0**	**0**	**0**	**5**	**10**	**10**	**10**	**7**

[1]Predictions excluding B98 organics due to number of nondetect valu
[2]Chlordane & DDT values not reported in SY data

Table 2. A summary of the 95% prediction intervals for amphipod toxicity in each of the reference pools. Note the NOAA pool was not used because the toxicity data was filtered.

Pool	AVG	STD DEV	95% PI
CP	70	23	16
CP+SY	81	19	44
CP+SY+Dist	86	14	62
CP+SY+PCA	85	14	60

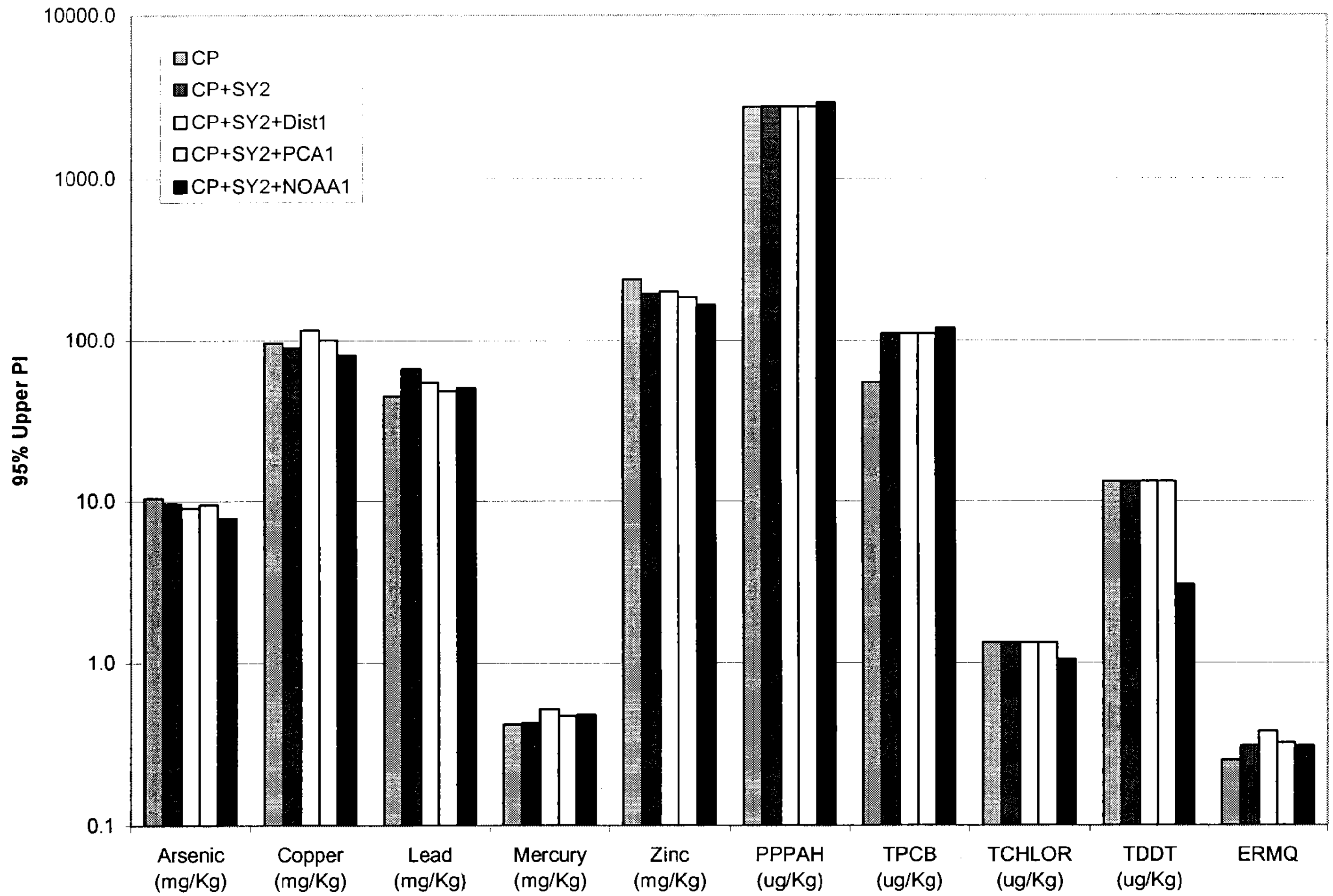

Figure 2. Comparison of Upper 95% PI for chemistry in the different reference pools.

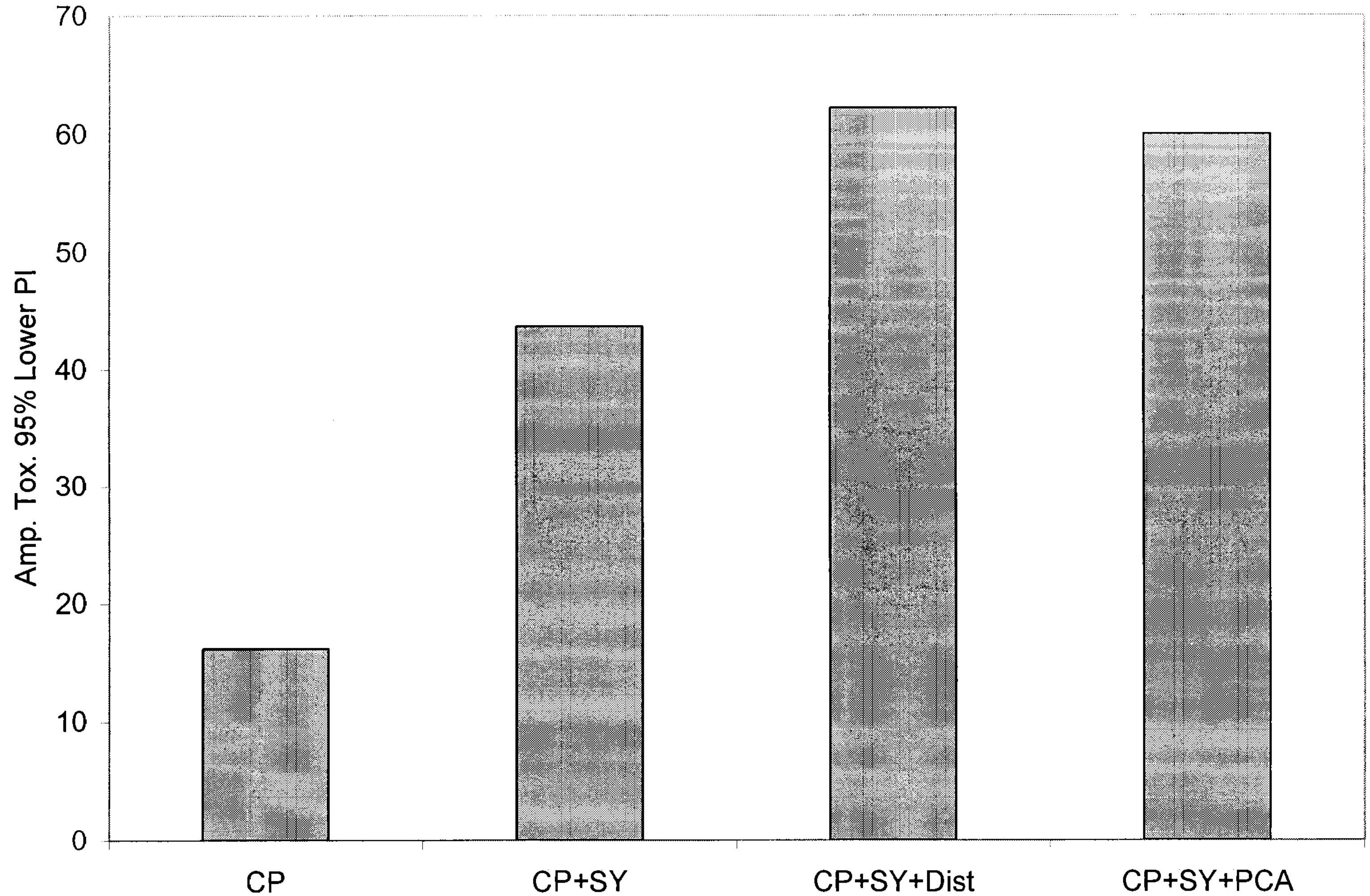

Figure 3. Comparison of lower 95% PI for toxicity in the different reference pools.

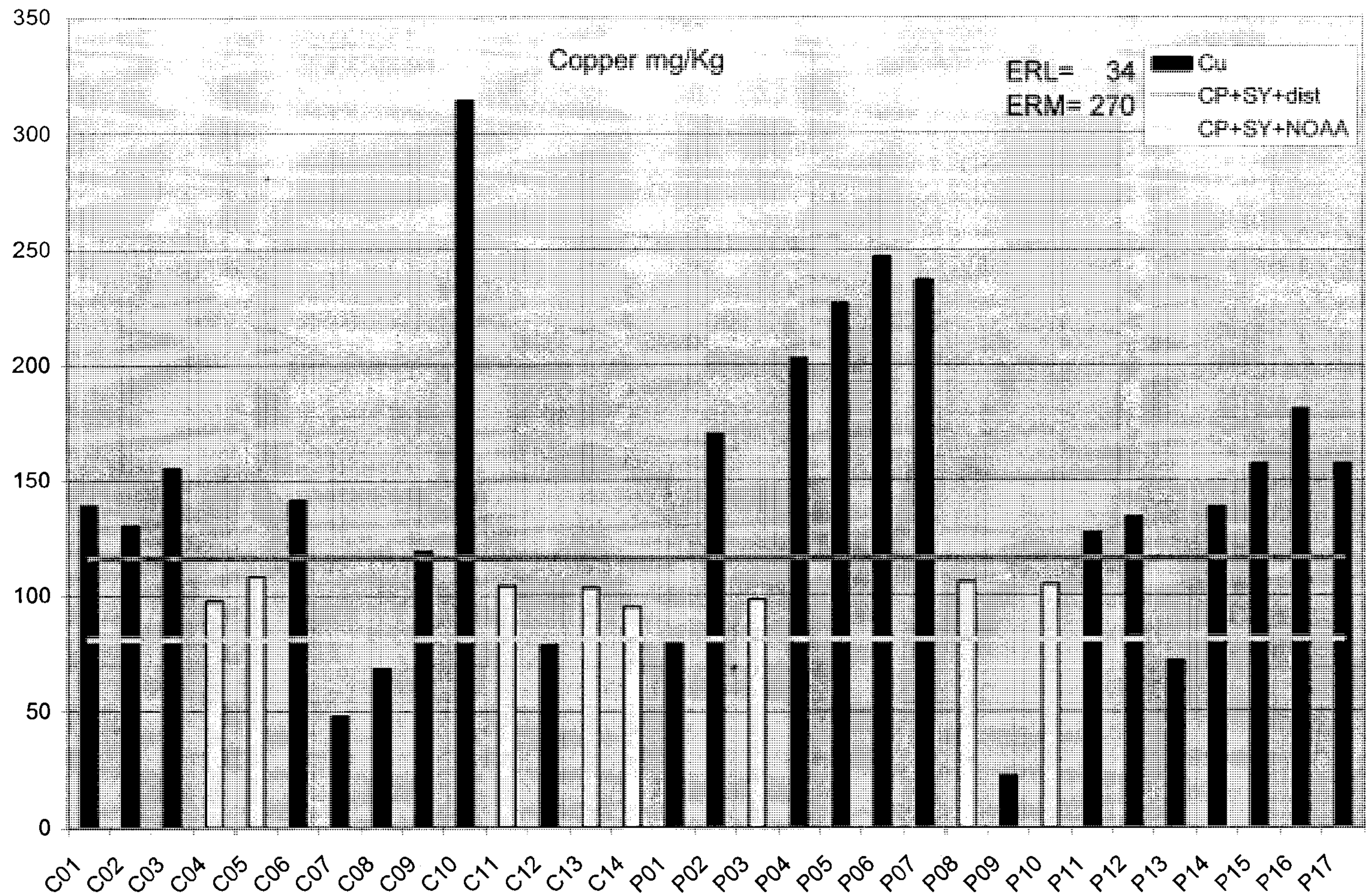

Figure 4. CP site data with minimum and maximum reference pool values (95% prediction interval) for Cu. Columns in orange show stations that would change with choice of reference pool.

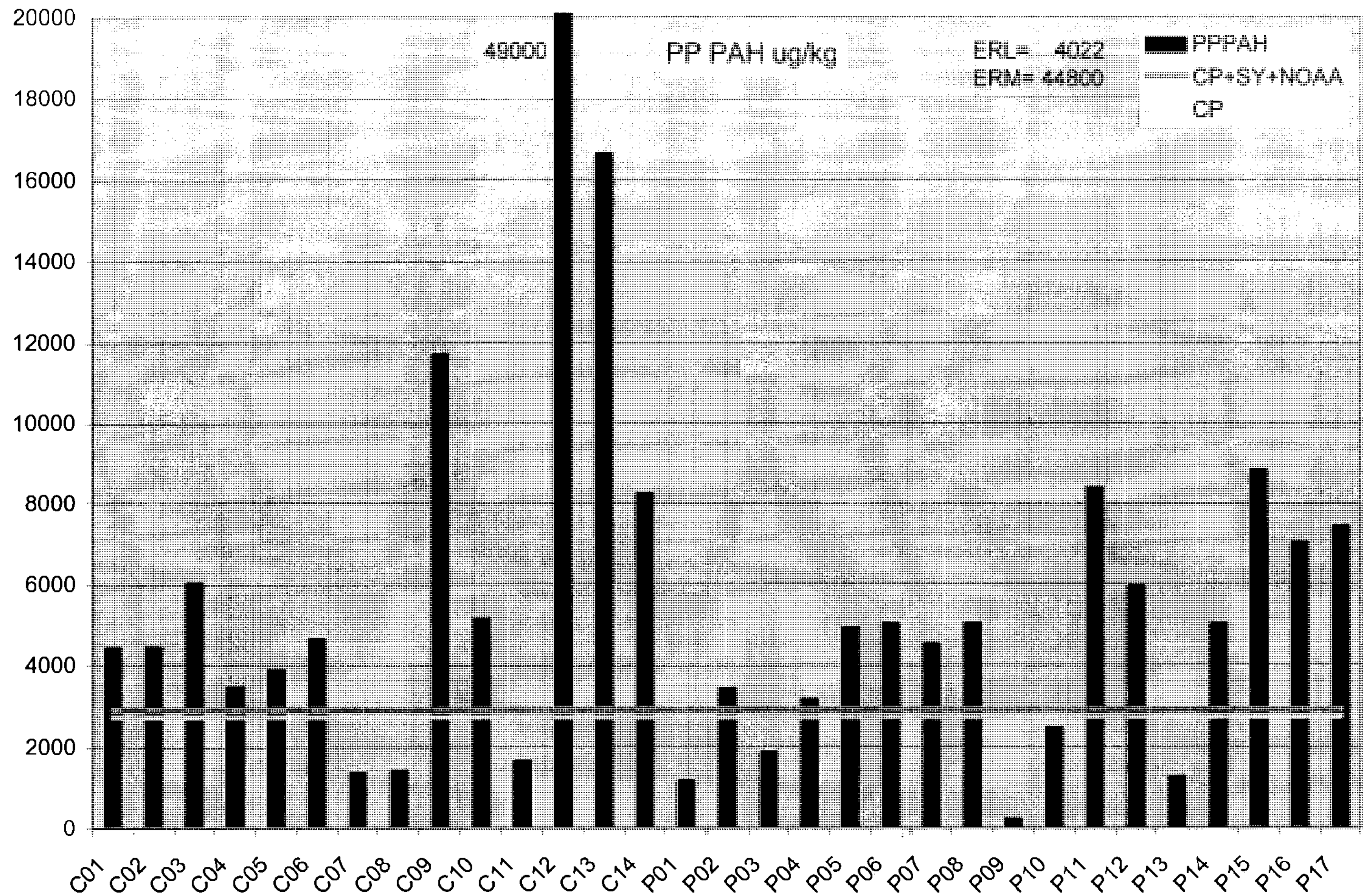

Figure 5. CP site data with minimum and maximum reference pool values (95% prediction interval) for PAH. No stations would change with choice of reference pool.

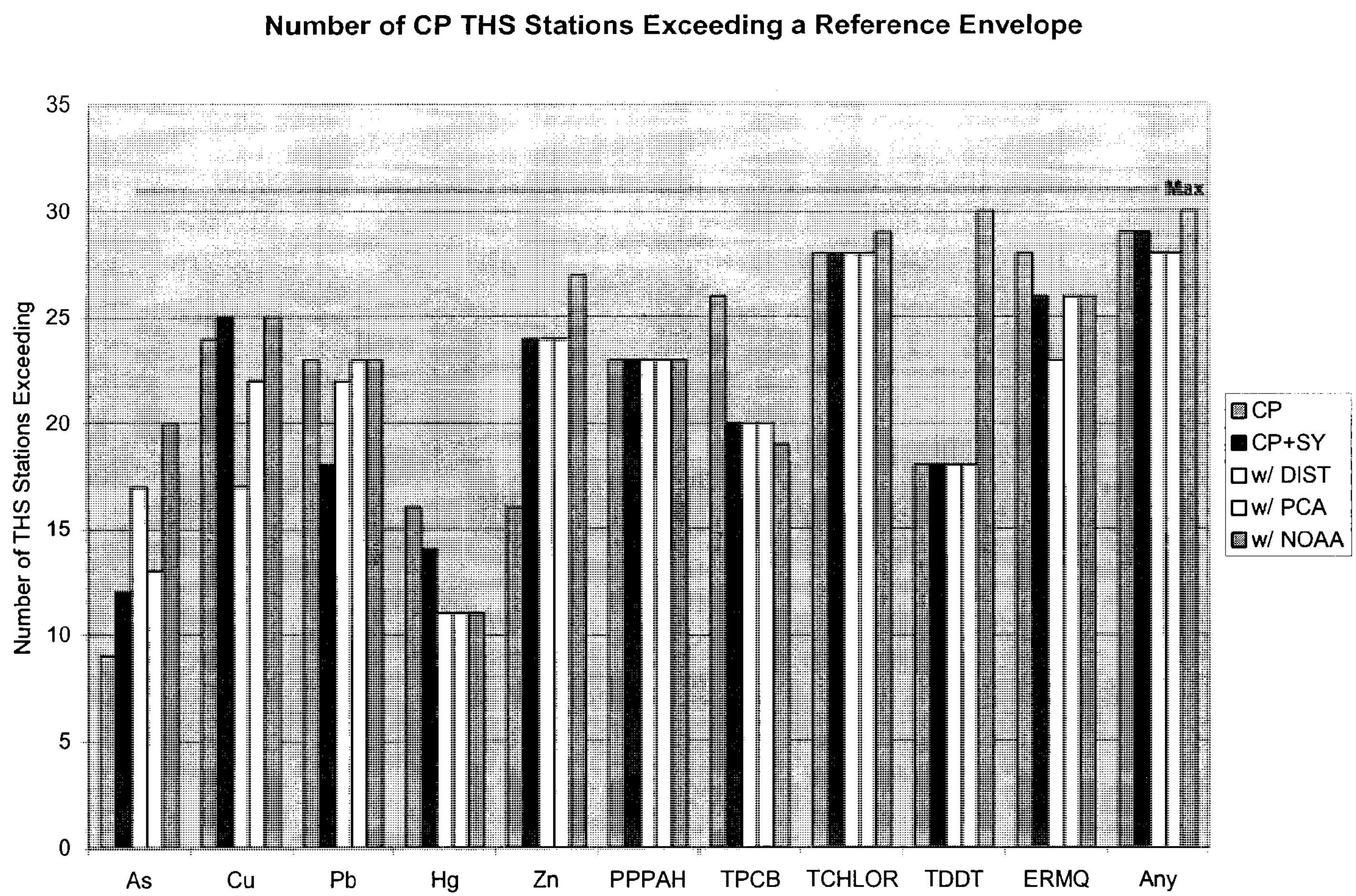

Figure 6. Number of CP sites exceeding 95% Upper PI for the different reference pools and contaminants.

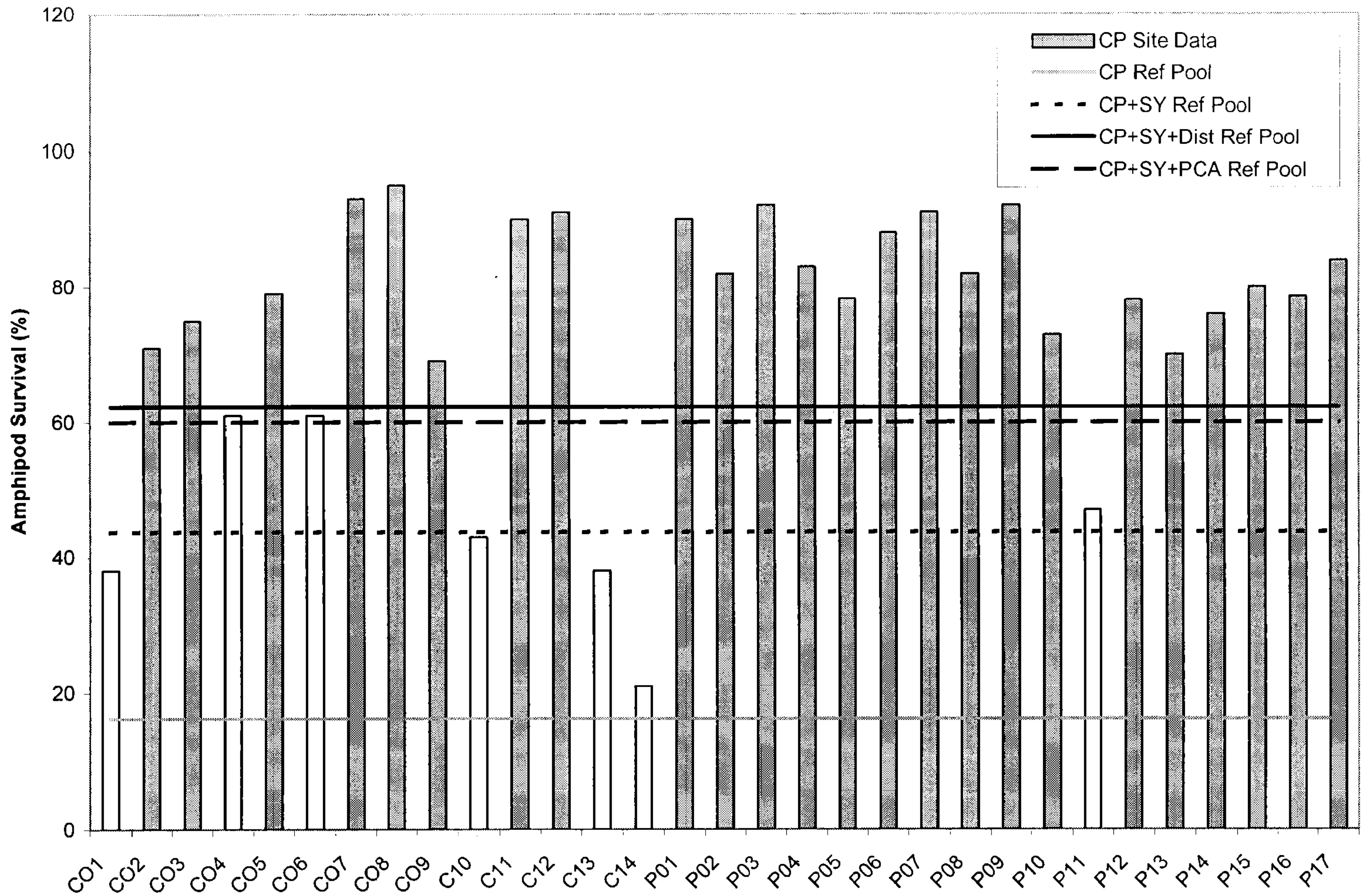

Figure 7. CP site toxicity data with reference pool thresholds. Light blue bars indicate stations that would change with choice of reference pool.

REFERENCE SITE POOL EVALUATION

Bart Chadwick and Chuck Katz
SPAWAR Systems Center San Diego

Introduction

The following evaluation was performed to see how using different reference site data pools affects the determination of chemical and toxicological thresholds, and how this might affect the ability to distinguish contaminated sites when the thresholds are applied to Hot Spot data. The analysis was performed with a common set of parameters, assumptions, calculations, and statistics. Nine chemical parameters (As, Cu, Pb, Hg, Zn, PPPAH, TPCB, TCHLOR, and TDDT), ERMQ and Amphipod toxicity were evaluated. The chemical parameters were chosen on the basis that they represented chemicals of concern at the Chollas and Paleta hotspots during the original data screening presented to the RWQCB board in June 2002. The following rules and assumptions were applied:

- Calculations were made using non-detect data converted to ½ method detection limits.
- The 95% prediction interval was used for all reference pools as the statistic of choice when evaluating whether or not an individual hot spot data value (or station) exceeded reference.
- Data sets containing more than 50% non-detect data for a given parameter (i.e., PCBs in Bight 98) were not included in statistical evaluations on the basis that a high number of non-detects would bias the variability of the pool.

Reference Pools

Seven reference data envelopes were calculated in this evaluation. Toxicity data were analyzed in a separate file but for the same reference pools. The Excel files attached with this document containing the data are: RefEnvEval.xls, Chollas-PaletaSedChemTables.xls, and Tox refeval data.xls. The file and sheet label for each data set are listed below.

1) **CP** This data set is based on only the 2001 Chollas-Paleta reference data set after acceptance criteria were applied. The data set consists of only 5 stations using the acceptance criteria established by SCCWRP/Navy. Station 2440 chemistry data were excluded because of substantial deviation in multiple chemical parameters. **File:** RefEnvEval.xls **Tab:** CP
2) **CP+SY** This data set is a combination of the CP and Shipyard 2001 reference data set again applying the acceptance criteria to both set. No data or stations

were excluded by Exponent in the SY data set. **File:** RefEnvEval.xls **Tab:** CP+SY

3) **CP+SY+Dist** This reference data pool was developed by combining the above two data sets with Bight'98 data from the 22 stations meeting the distance criteria outlined by SCCWRP. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98Dist. **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 dist

4) **CP+SY+PCA** This reference data pool was developed by combining the CP and SY data set with Bight'98 data from the 21 stations meeting the PCA grouping outlined by Exponent. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98 PCA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 PCA

5) **CP+SY+NOAA** This reference data pool was developed by combining NOAA's reference pool that includes a subset of the CP and SY data sets and 14 Bight 98 stations. It should be noted that the organics data here exceeded the 50% rule for non-detects for the Bight98 data. **File:** RefEnvEval.xls **Tab:** CP+SY+NOAA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** NOAA

6) **BPTCP** This reference data pool was developed using data from the 11 reference sites identified in the original BPTCP study. These data are shown for comparison purposes only and were not used for comparing to hot spot data. Non-detects were replaced with ½ detection limit.

7) **NI** This reference data pool was developed using data from 10 reference sites used in the North Island Remedial Investigation (1996). These data are shown for comparison purposes only and were not used for comparing to hot spot data. Non-detects were replaced with ½ detection limit.

Results

Grain size and TOC were compared for the different reference pools (Figure 1) with the exception of the NOAA data pool. The comparison indicates that incorporation of additional sites either by the distance or PCA method would help to broaden the range of the TOC and grain size pool to be more comparable to the CP site data. Areas that are still not well represented would include inner Paleta and outer Chollas which appear to be enriched in TOC for the same grain size range as the reference areas. This is reflected in the regression slopes shown on the plot.

A summary of the 95% prediction intervals in each of the reference pools identified above is shown in the Table 1 (chemistry) and Table 2 (toxicity). The results are also shown graphically in Figures 2 and 3. For chemistry, the comparison indicates that for most parameters, the reference pools for chemistry do not vary significantly. There is no pool that is always lower or higher than the rest. For toxicity, there is a large change for

the different data pools. The upper 95% PI increases from 16% survival for the original CP data set, to 62% survival for the CP+SY+Dist pool.

The implication that these changes have for identification of stations at the CP site was also evaluated (see Figures 4-6 for chemistry, Figure 7 for toxicity). Figure 4 shows that, for copper, using the CP+SY+Dist pool would result in the identification of 17 stations as exceeding reference for the CP sites. This would increase to 25 sites using the CP+SY+NOAA pool. For PAHs, these would be no change in the number of sites identified. Overall (see Figure 6), the number of sites that would be identified as exceeding reference for any contaminant would be virtually the same for all the pools with 28 sites for CP+SY+Dist and CP+SY+PCA, 29 for CP and CP+SY, and 30 for CP+SY+NOAA.

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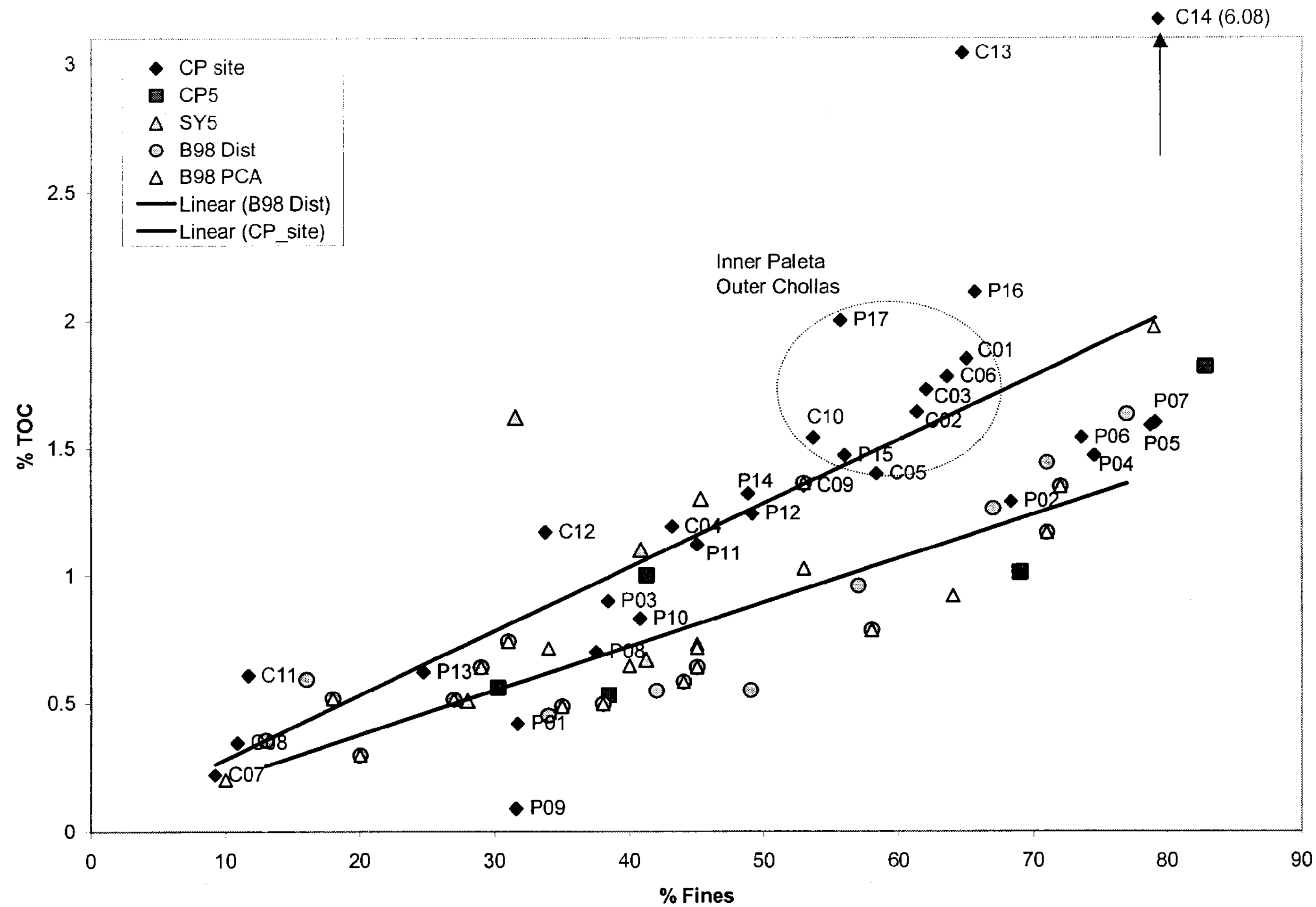

Figure 1. TOC vs. fines for the different reference sets.

Table 1. A summary of the 95% prediction intervals for chemistry in each of the reference pools.

Sediment Chemistry	ERM	ERL	BPTCP	N.I.	SY[2]	NOAA[1]	Dist[1]	PCA[1]	CP	CP+SY[2]	CP+SY[2]+ Dist[1]	CP+SY[2]+ PCA[1]	CP+SY[2]+ NOAA[1]
Arsenic (mg/Kg)	70	8.20	23.65	11.70	9.34	8.09	9.02	9.76	10.40	9.63	9.03	9.53	7.81
Copper (mg/Kg)	270	34.0	139	152	93	86.5	127.9	107.7	97	90	116	101	81
Lead (mg/Kg)	218	46.7	38.2	92.8	95.0	39.1	50.5	39.0	44.9	66.7	54.3	48.4	50.3
Mercury (mg/Kg)	0.71	0.15	0.77	0.91	0.50	0.54	0.56	0.50	0.42	0.43	0.52	0.47	0.48
Zinc (mg/Kg)	410	150	292	278	146	149	210	188	239	195	202	186	167
PPPAH (ug/Kg)	44792	4022	3840	3297	3720				2729	2746	2746	2746	2898
TPCB (ug/Kg)	180	23	171	121	168				55	110	110	110	119
TCHLOR (ug/Kg)	6.0	0.5	3.7	5.6					1.3	1.3	1.3	1.3	1.05
TDDT (ug/Kg)	46	1.6	8.3	15					13	13	13	13	3.03
ERMQ			0.46	0.54	0.40	0.32	0.42	0.33	0.25	0.31	0.38	0.32	0.31
N metals			**11**	**10**	**5**	**14**	**22**	**21**	**5**	**10**	**32**	**31**	**21**
N organics			**11**	**10**	**5**	**0**	**0**	**0**	**5**	**10**	**10**	**10**	**7**

[1]Predictions excluding B98 organics due to number of nondetect valu
[2]Chlordane & DDT values not reported in SY data

Table 2. A summary of the 95% prediction intervals for amphipod toxicity in each of the reference pools. Note the NOAA pool was not used because the toxicity data was filtered.

Pool	AVG	STD DEV	95% PI
CP	70	23	16
CP+SY	81	19	44
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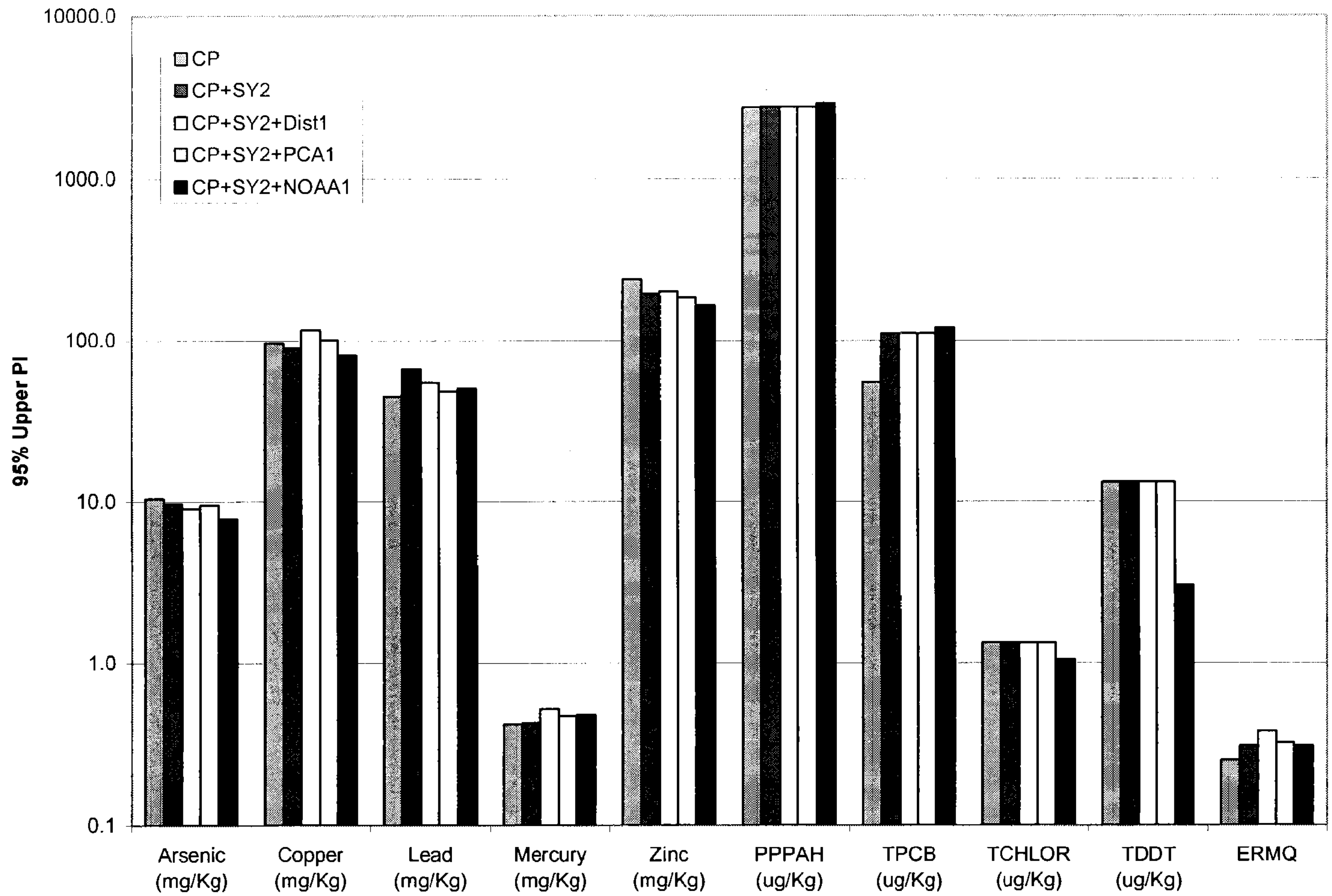


Figure 2. Comparison of Upper 95% PI for chemistry in the different reference pools.

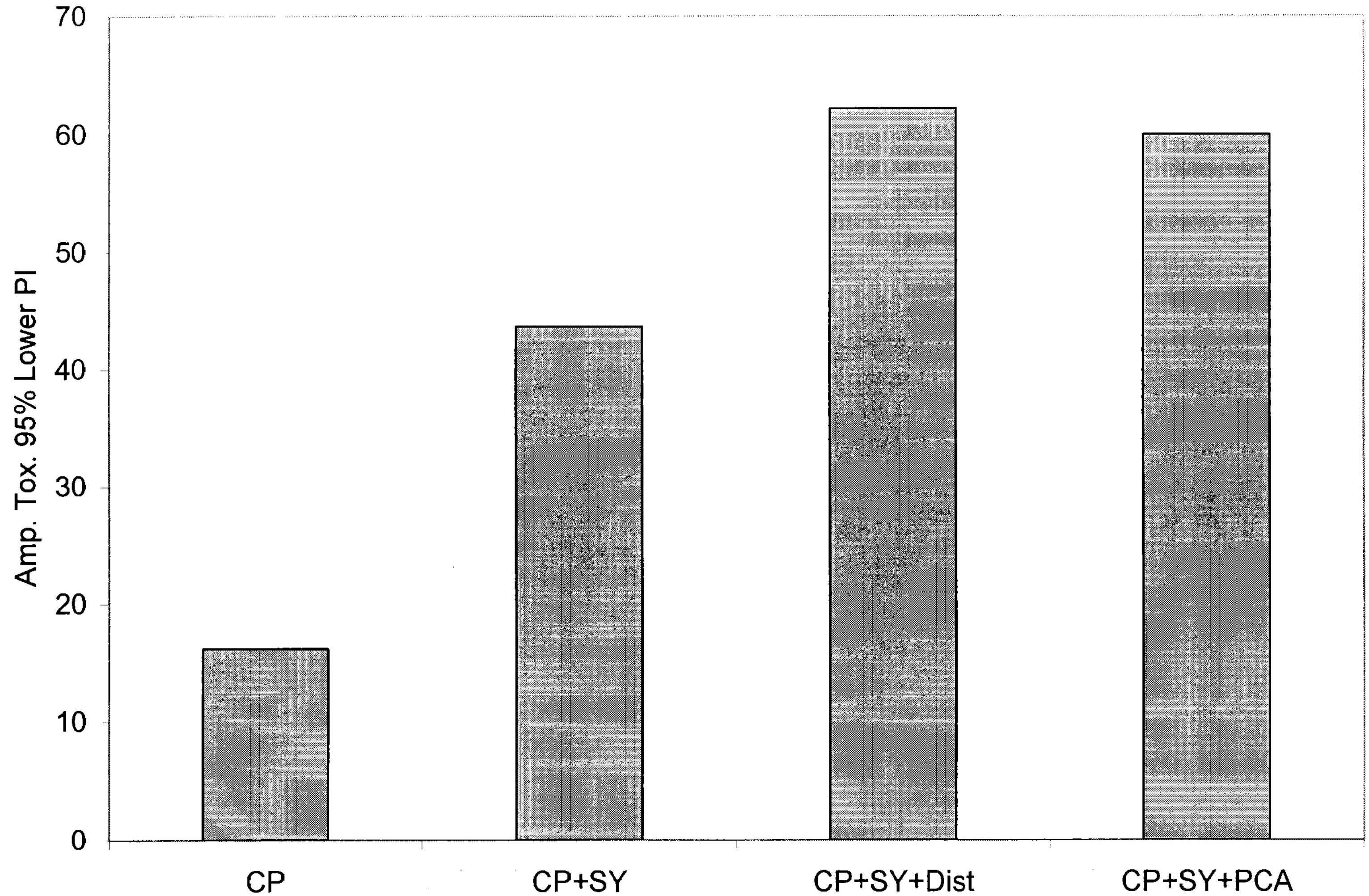


Figure 3. Comparison of lower 95% PI for toxicity in the different reference pools.

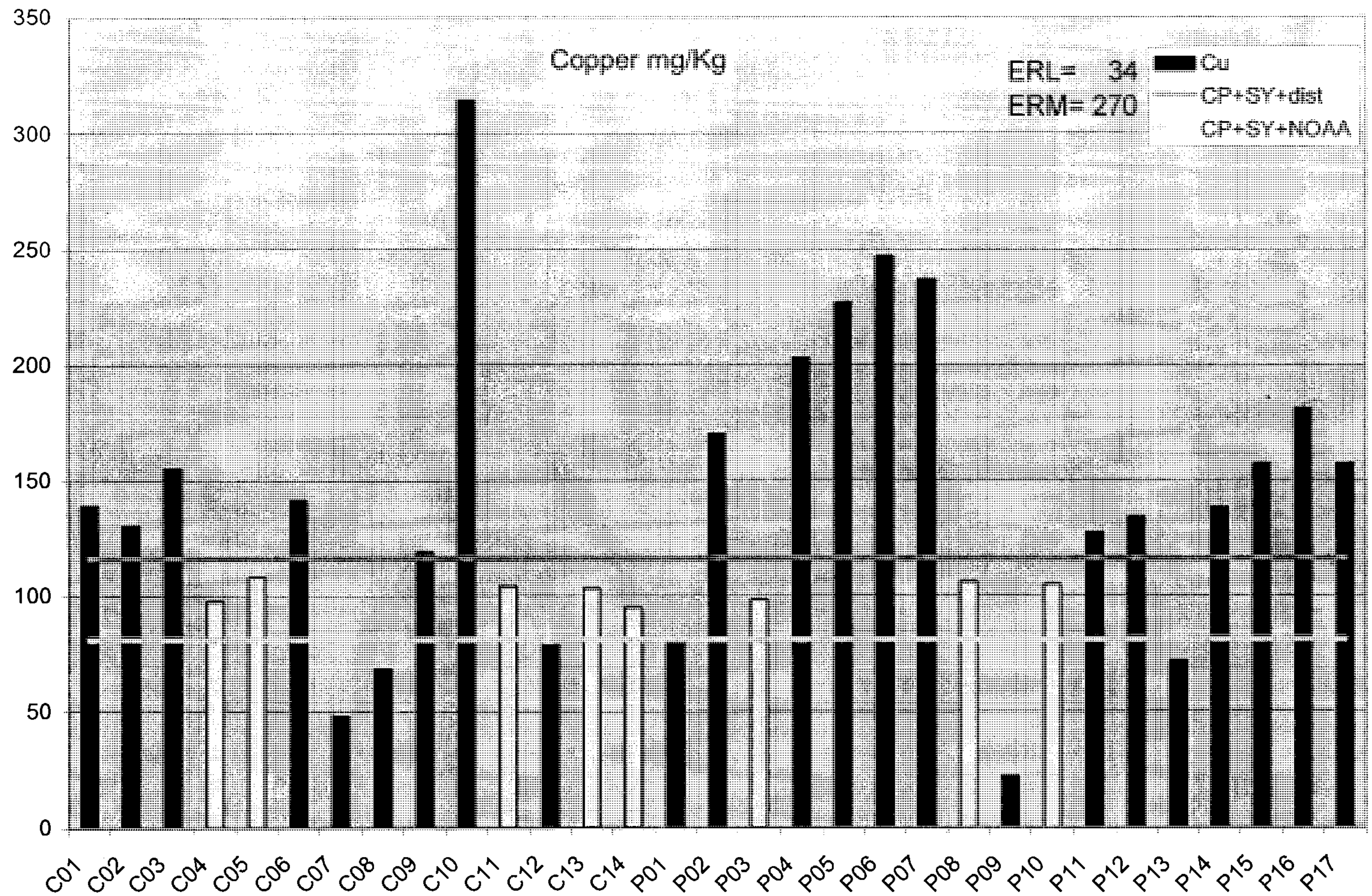


Figure 4. CP site data with minimum and maximum reference pool values (95% prediction interval) for Cu. Columns in orange show stations that would change with choice of reference pool.

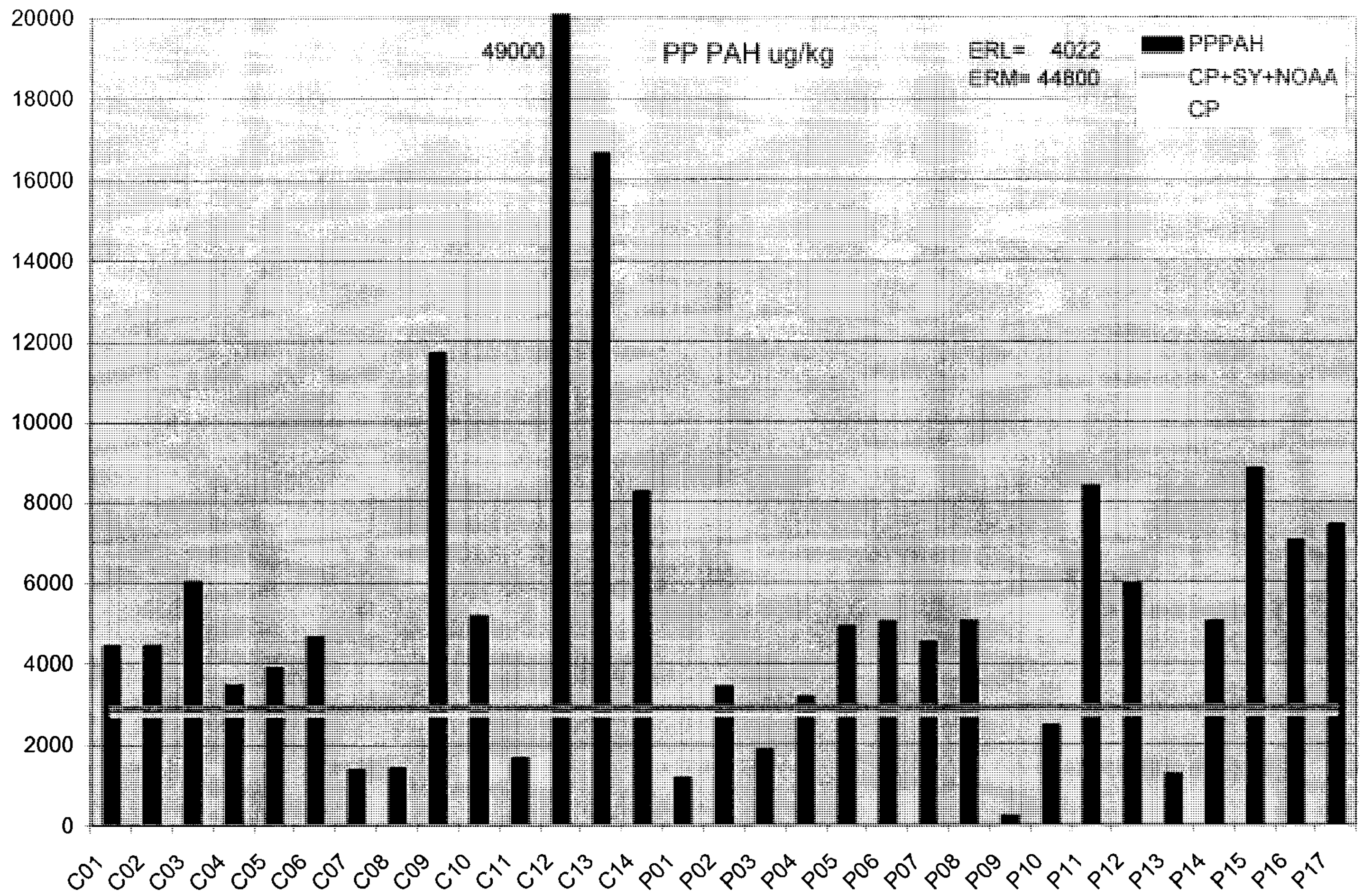


Figure 5. CP site data with minimum and maximum reference pool values (95% prediction interval) for PAH. No stations would change with choice of reference pool.

Number of CP THS Stations Exceeding a Reference Envelope

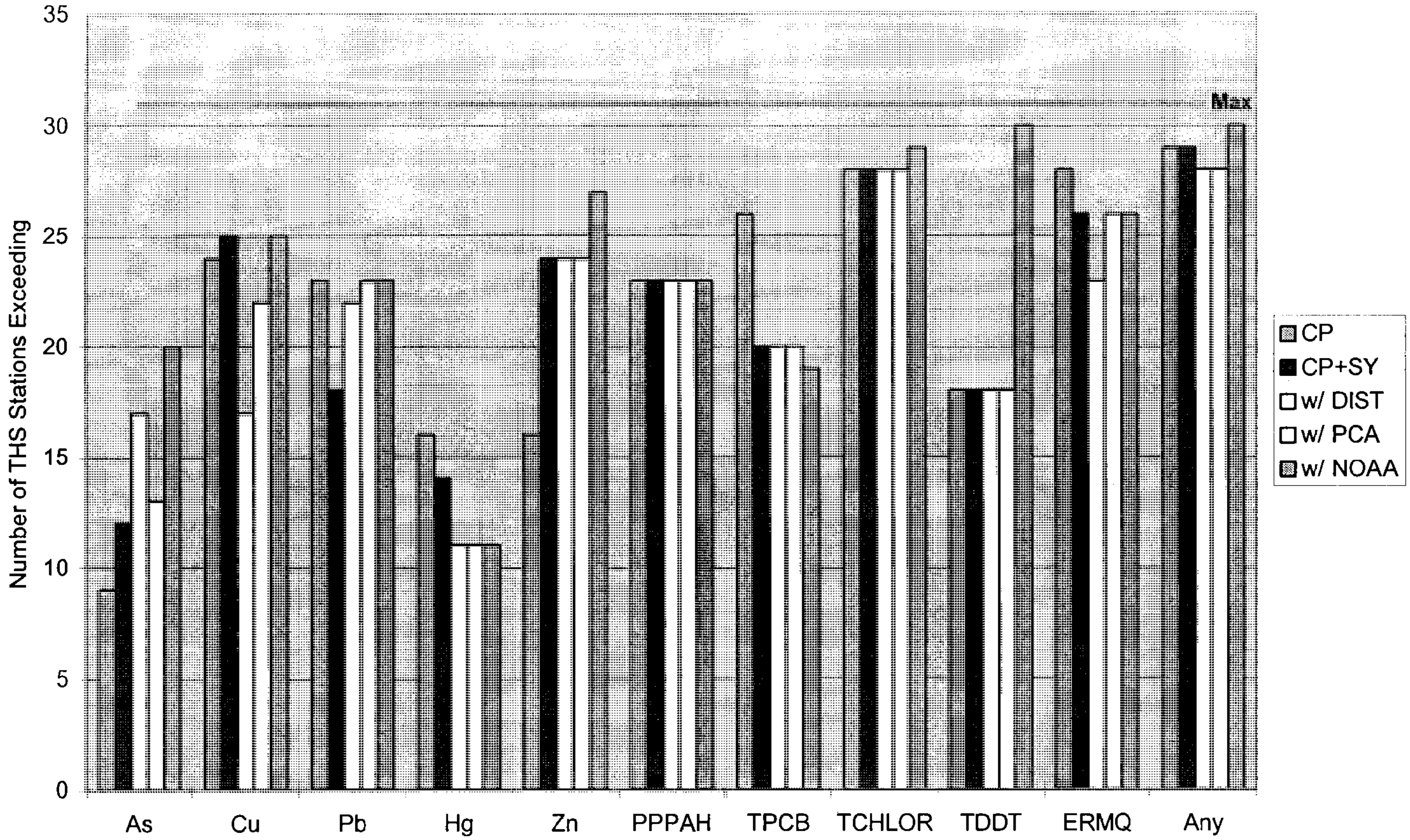


Figure 6. Number of CP sites exceeding 95% Upper PI for the different reference pools and contaminants.

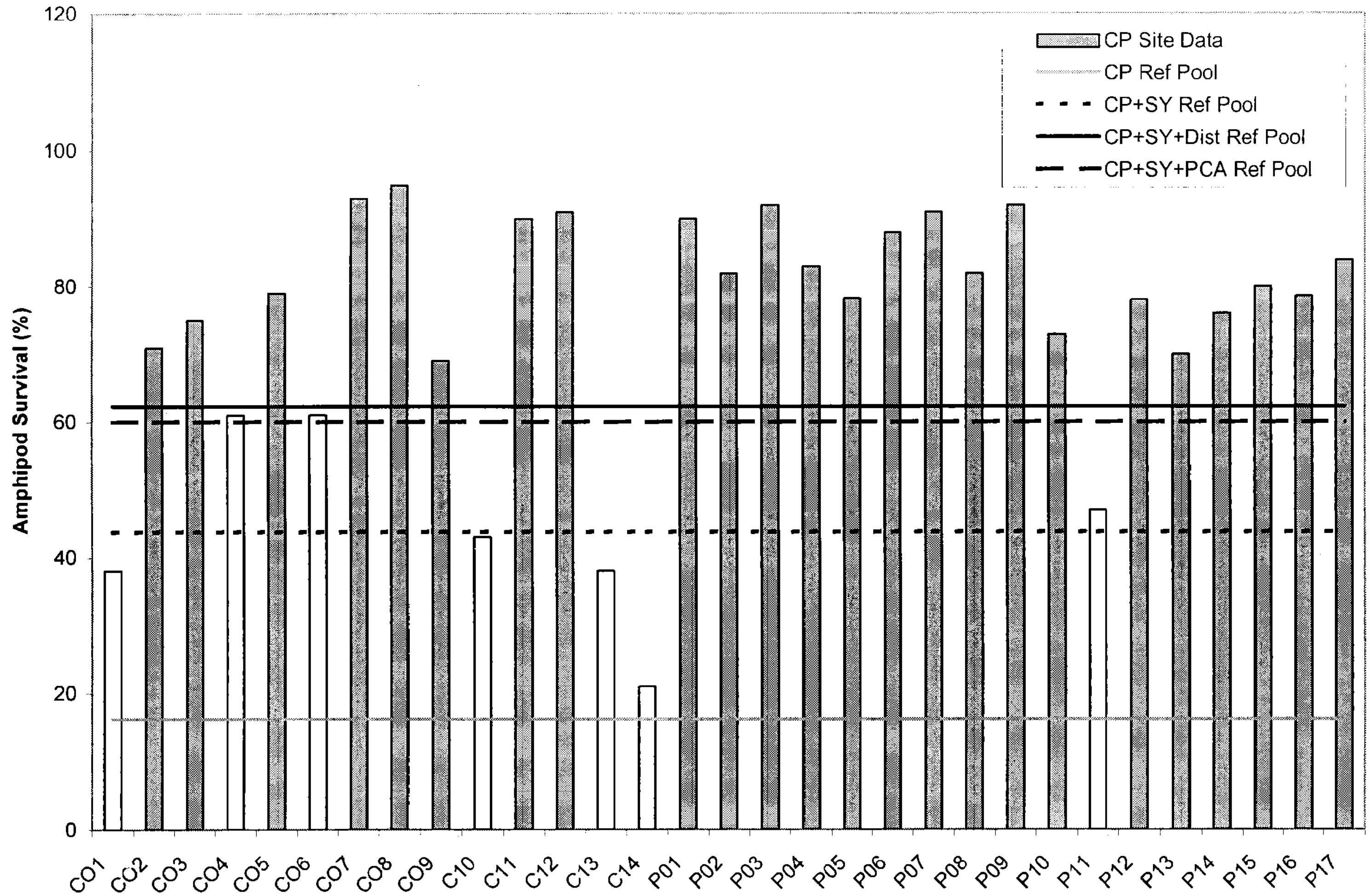


Figure 7. CP site toxicity data with reference pool thresholds. Light blue bars indicate stations that would change with choice of reference pool.

Laura Hunter

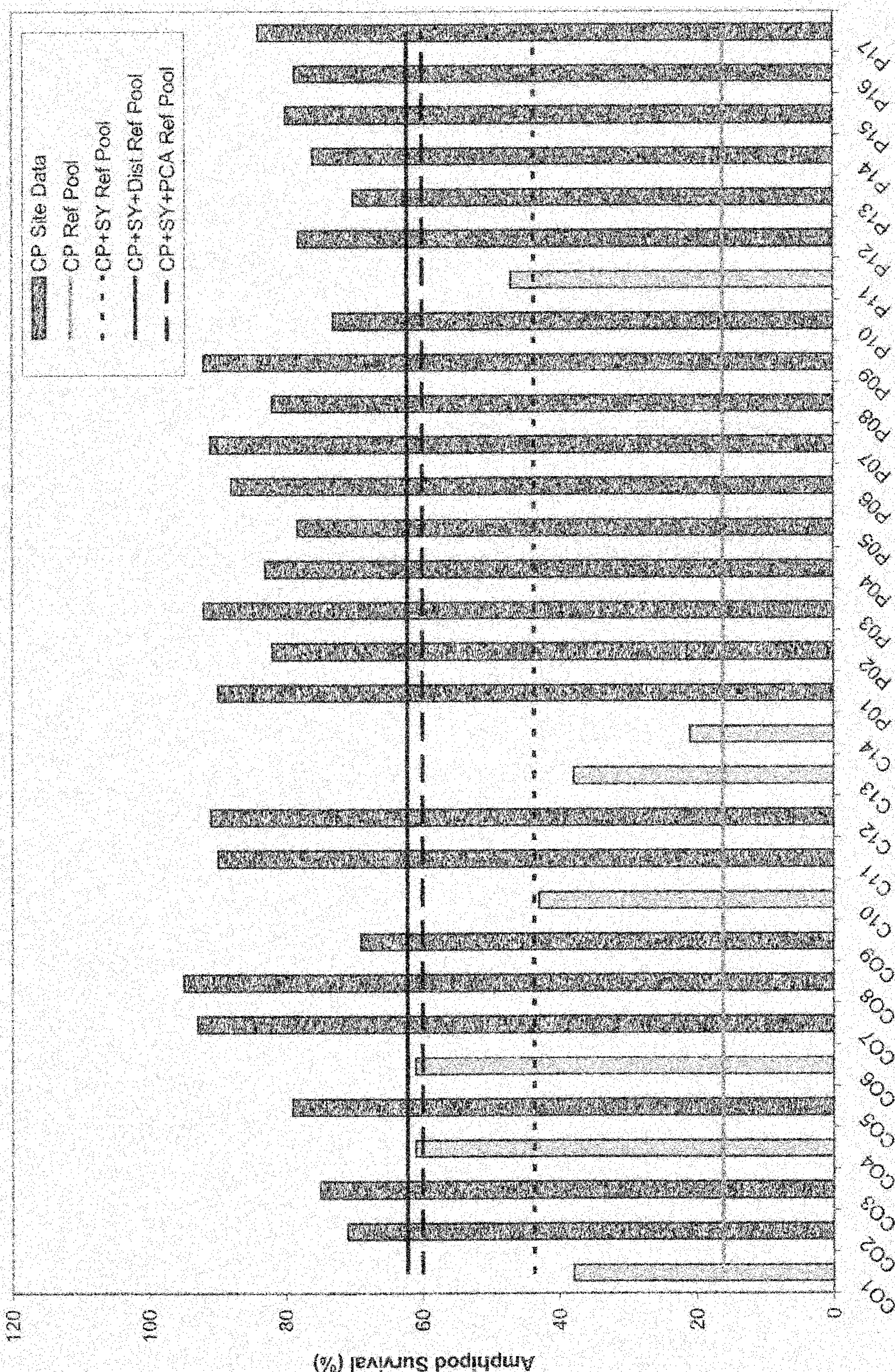
From: Tom Alo [alot@rb9.swrcb.ca.gov]
Sent: Tuesday, January 21, 2003 9:40 AM
To: elainecarlin@att.net; peugh@cox.net; emkimr@cts.com; Laura Hunter; nielsend@exponent.com; fairey@mlml.calstate.edu; mchee@nassco.com; Denise.Klimas@noaa.gov; donald.macdonald@noaa.gov; MMARTIN@OSPR.DFG.CA.GOV; Scott_Sobiech@r1.fws.gov; jeffb@sccwrp.org; steveb@sccwrp.org; breznik@sdbaykeeper.org; marco@surfridersd.org; halvaxs@swmarine.com; anderson@ucdavis.edu; jwhunt@ucdavis.edu
Cc: chadwick@spawar.navy.mil; ckatz@spawar.navy.mil
Subject: Re: Fwd: NOAA Approach

Re: Fwd: NOAA Approach

Good morning everyone. I am forwarding you a write-up and data evaluation from Bart Chadwick of SPAWAR. The information will be presented and discussed in Topic IV, Step 3 of the agenda.

If you have any questions or comments please contact me. See (or hear) you tomorrow.

--Tom


CP Site Data
CP Ref Pool
CP+SY Ref Pool
CP+SY+Dist Ref Pool
CP+SY+PCA Ref Pool
Amphipod Survival (%)
0
20
40
60
80
100
120
C01
C02
C03
C04
C05
C06
C07
C08
C09
C10
C11
C12
C13
C14
P01
P02
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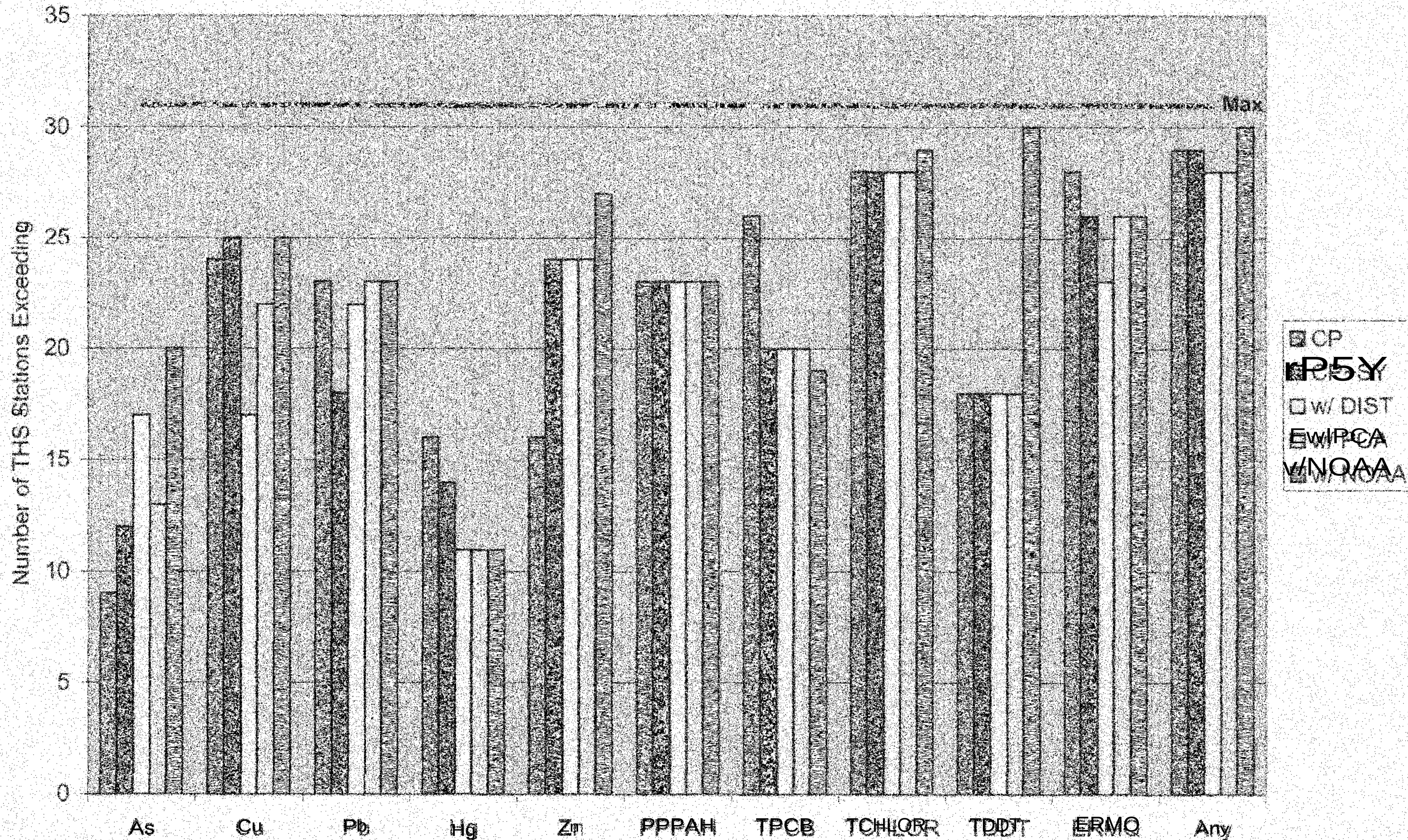
Number of CP THS Stations Exceeding a Reference Envelope



Sediment Chemistry	ERM	ERL	BPTCP	N.I.	SY[2]	NOAA[1]	Dist[1]	PCA[1]	CP
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[1]Predictions excluding B98 organics due to number of nondetect valu

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REFERENCE SITE POOL EVALUATION

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SPAWAR Systems Center San Diego

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Reference Pools

Seven reference data envelopes were calculated in this evaluation. Toxicity data were analyzed in a separate file but for the same reference pools. The Excel files attached with this document containing the data are: RefEnvEval.xls, Chollas-PaletaSedChemTables.xls, and Tox refeval data.xls. The file and sheet label for each data set are listed below.

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were excluded by Exponent in the SY data set. **File:** RefEnvEval.xls **Tab:** CP+SY

3) **CP+SY+Dist** This reference data pool was developed by combining the above two data sets with Bight'98 data from the 22 stations meeting the distance criteria outlined by SCCWRP. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98Dist. **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 dist

4) **CP+SY+PCA** This reference data pool was developed by combining the CP and SY data set with Bight'98 data from the 21 stations meeting the PCA grouping outlined by Exponent. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98 PCA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 PCA

5) **CP+SY+NOAA** This reference data pool was developed by combining NOAA's reference pool that includes a subset of the CP and SY data sets and 14 Bight 98 stations. It should be noted that the organics data here exceeded the 50% rule for non-detects for the Bight98 data. **File:** RefEnvEval.xls **Tab:** CP+SY+NOAA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** NOAA

6) **BPTCP** This reference data pool was developed using data from the 11 reference sites identified in the original BPTCP study. These data are shown for comparison purposes only and were not used for comparing to hot spot data. Non-detects were replaced with ½ detection limit.

7) **NI** This reference data pool was developed using data from 10 reference sites used in the North Island Remedial Investigation (1996). These data are shown for comparison purposes only and were not used for comparing to hot spot data. Non-detects were replaced with ½ detection limit.

Results

Grain size and TOC were compared for the different reference pools (Figure 1) with the exception of the NOAA data pool. The comparison indicates that incorporation of additional sites either by the distance or PCA method would help to broaden the range of the TOC and grain size pool to be more comparable to the CP site data. Areas that are still not well represented would include inner Paleta and outer Chollas which appear to be enriched in TOC for the same grain size range as the reference areas. This is reflected in the regression slopes shown on the plot.

A summary of the 95% prediction intervals in each of the reference pools identified above is shown in the Table 1 (chemistry) and Table 2 (toxicity). The results are also shown graphically in Figures 2 and 3. For chemistry, the comparison indicates that for most parameters, the reference pools for chemistry do not vary significantly. There is no pool that is always lower or higher than the rest. For toxicity, there is a large change for

the different data pools. The upper 95% PI increases from 16% survival for the original CP data set, to 62% survival for the CP+SY+Dist pool.

The implication that these changes have for identification of stations at the CP site was also evaluated (see Figures 4-6 for chemistry, Figure 7 for toxicity). Figure 4 shows that, for copper, using the CP+SY+Dist pool would result in the identification of 17 stations as exceeding reference for the CP sites. This would increase to 25 sites using the CP+SY+NOAA pool. For PAHs, these would be no change in the number of sites identified. Overall (see Figure 6), the number of sites that would be identified as exceeding reference for any contaminant would be virtually the same for all the pools with 28 sites for CP+SY+Dist and CP+SY+PCA, 29 for CP and CP+SY, and 30 for CP+SY+NOAA.

For toxicity (Figure 7) no stations would be identified as exceeding reference based on the original CP reference data. This increases to an identification of 7 stations for the CP+SY+Dist pool. The NOAA pool was not evaluated for toxicity because the reference stations were filtered to only select stations with survival > 90%, resulting in a strong biasing of the mean.

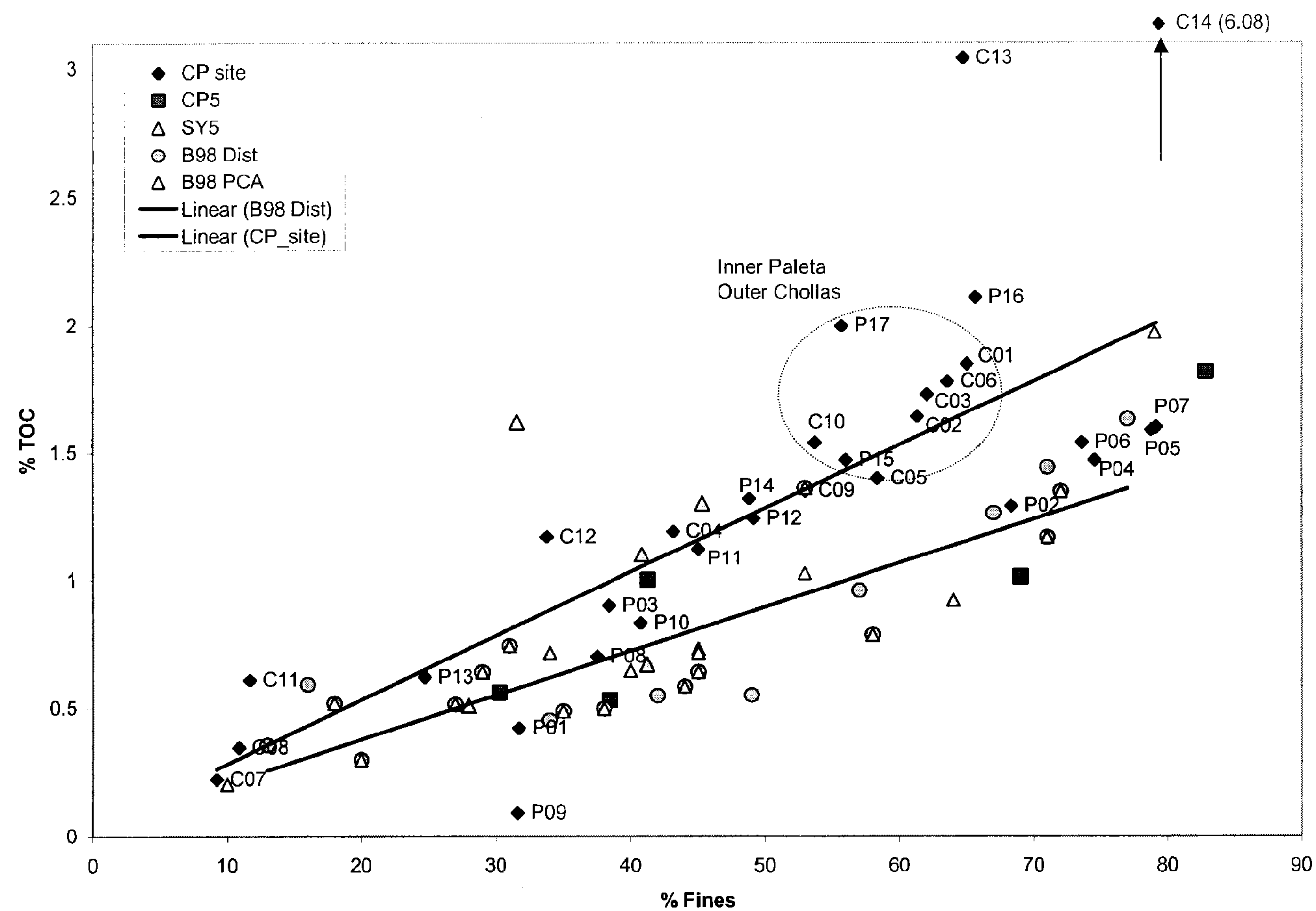

Figure 1. TOC vs. fines for the different reference sets.

Table 1. A summary of the 95% prediction intervals for chemistry in each of the reference pools.

Sediment Chemistry	ERM	ERL	BPTCP	N.I.	SY[2]	NOAA[1]	Dist[1]	PCA[1]	CP	CP+SY[2]	CP+SY[2]+ Dist[1]	CP+SY[2]+ PCA[1]	CP+SY[2]+ NOAA[1]
Arsenic (mg/Kg)	70	8.20	23.65	11.70	9.34	8.09	9.02	9.76	10.40	9.63	9.03	9.53	7.81
Copper (mg/Kg)	270	34.0	139	152	93	86.5	127.9	107.7	97	90	116	101	81
Lead (mg/Kg)	218	46.7	38.2	92.8	95.0	39.1	50.5	39.0	44.9	66.7	54.3	48.4	50.3
Mercury (mg/Kg)	0.71	0.15	0.77	0.91	0.50	0.54	0.56	0.50	0.42	0.43	0.52	0.47	0.48
Zinc (mg/Kg)	410	150	292	278	146	149	210	188	239	195	202	186	167
PPPAH (ug/Kg)	44792	4022	3840	3297	3720				2729	2746	2746	2746	2898
TPCB (ug/Kg)	180	23	171	121	168				55	110	110	110	119
TCHLOR (ug/Kg)	6.0	0.5	3.7	5.6					1.3	1.3	1.3	1.3	1.05
TDDT (ug/Kg)	46	1.6	8.3	15					13	13	13	13	3.03
ERMQ			0.46	0.54	0.40	0.32	0.42	0.33	0.25	0.31	0.38	0.32	0.31
N metals			**11**	**10**	**5**	**14**	**22**	**21**	**5**	**10**	**32**	**31**	**21**
N organics			**11**	**10**	**5**	**0**	**0**	**0**	**5**	**10**	**10**	**10**	**7**

[1]Predictions excluding B98 organics due to number of nondetect valu
[2]Chlordane & DDT values not reported in SY data

Table 2. A summary of the 95% prediction intervals for amphipod toxicity in each of the reference pools. Note the NOAA pool was not used because the toxicity data was filtered.

Pool	AVG	STD DEV	95% PI
CP	70	23	16
CP+SY	81	19	44
CP+SY+Dist	86	14	62
CP+SY+PCA	85	14	60

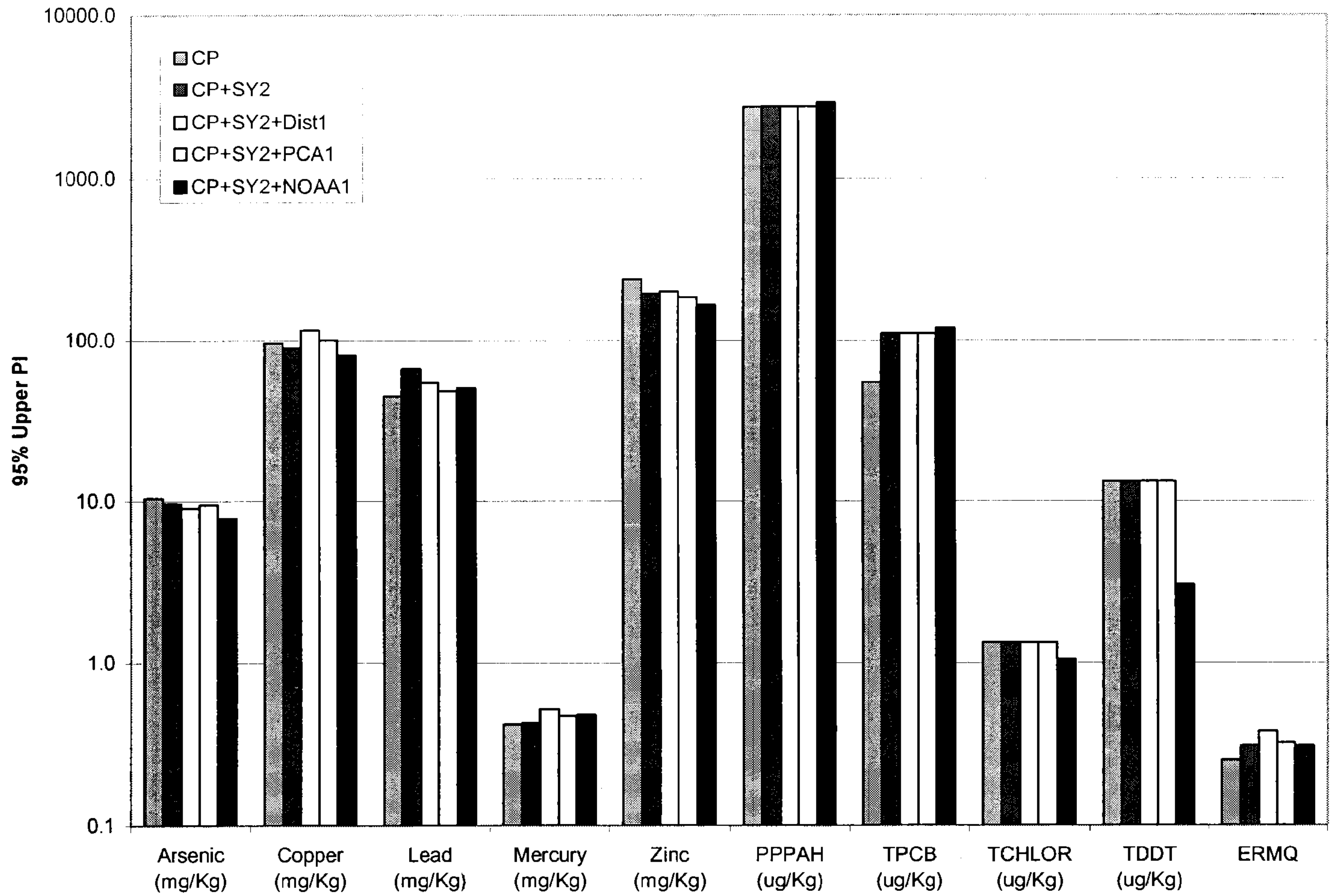

Figure 2. Comparison of Upper 95% PI for chemistry in the different reference pools.

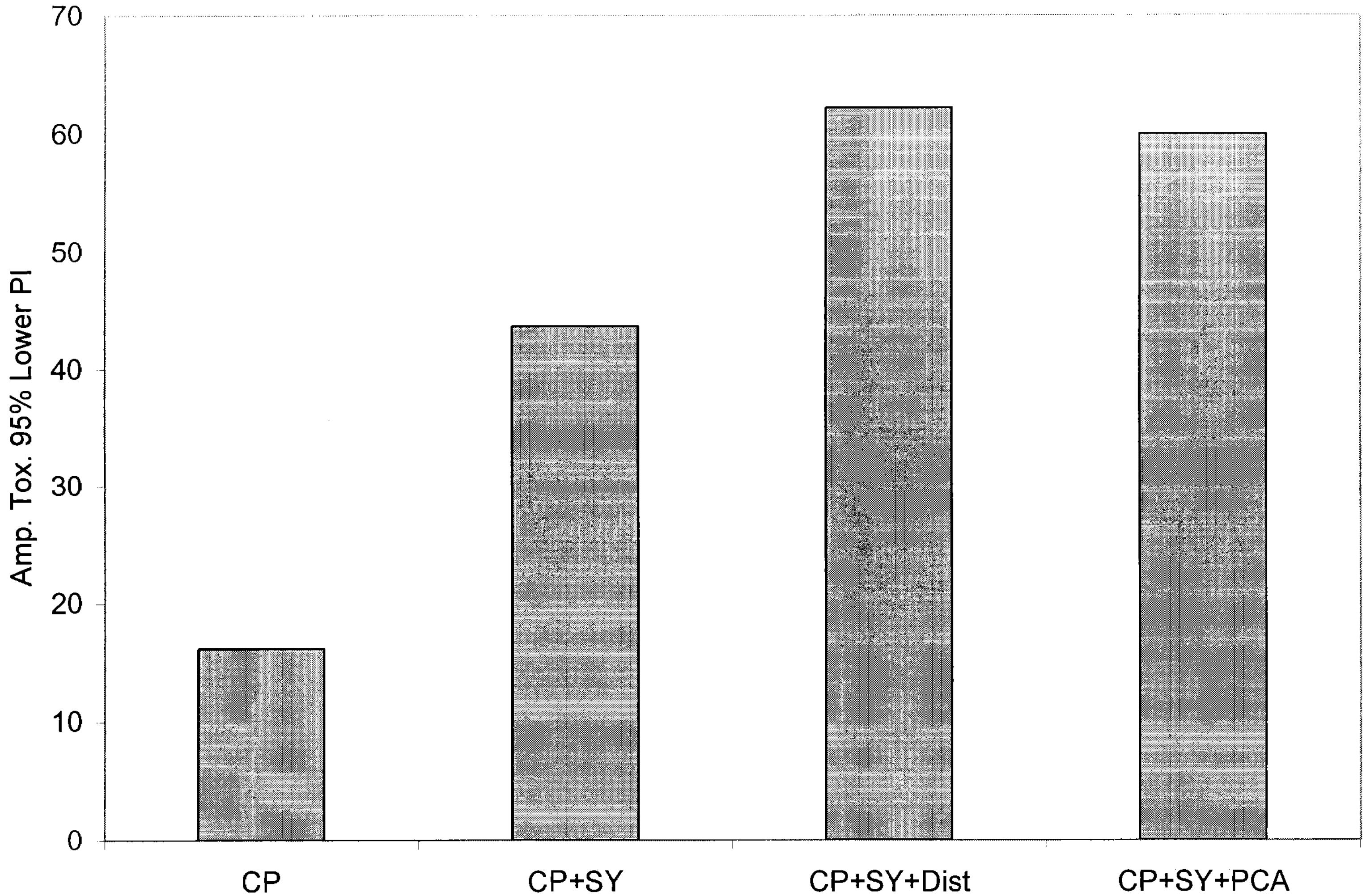

Figure 3. Comparison of lower 95% PI for toxicity in the different reference pools.

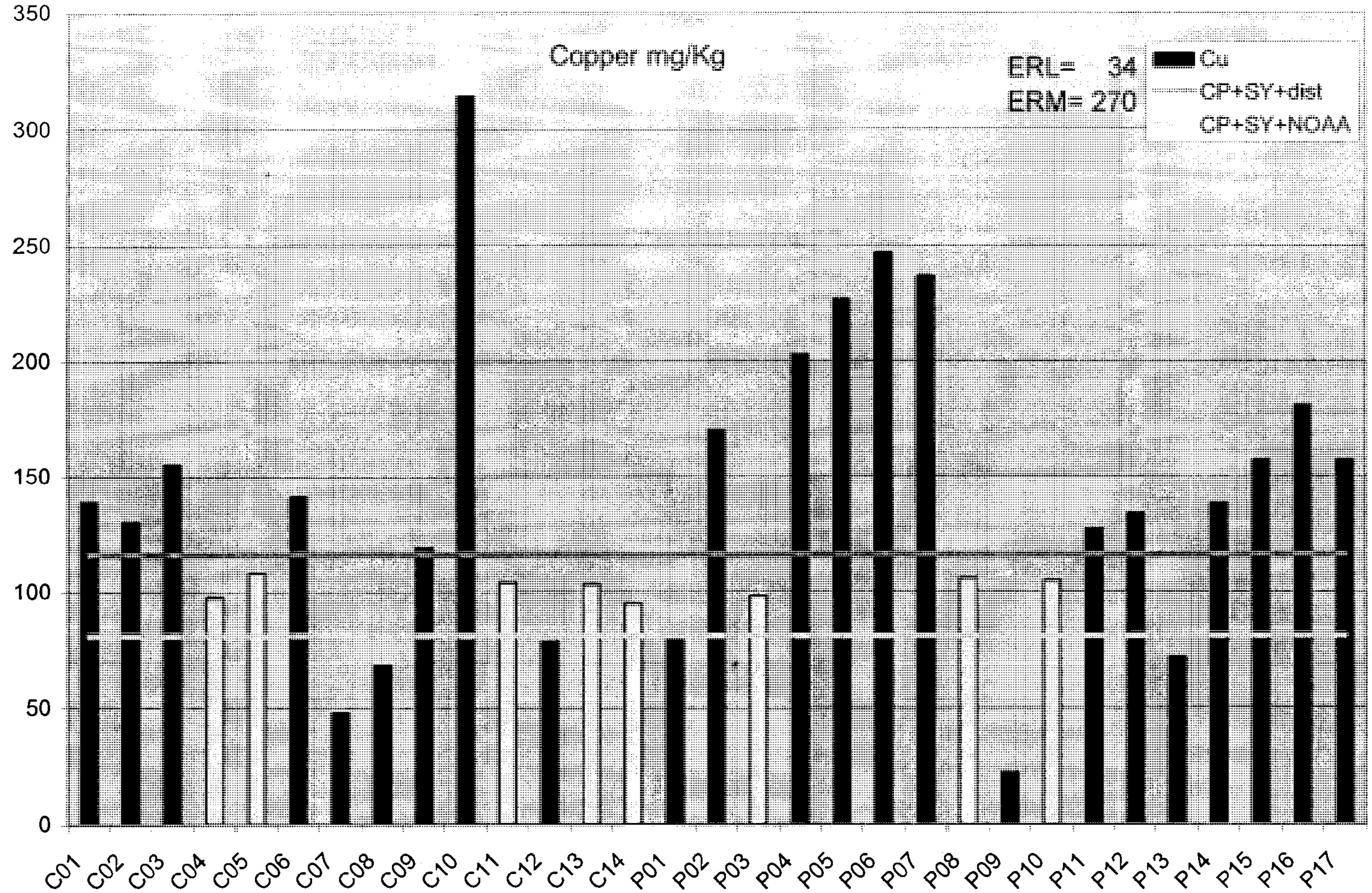

Figure 4. CP site data with minimum and maximum reference pool values (95% prediction interval) for Cu. Columns in orange show stations that would change with choice of reference pool.

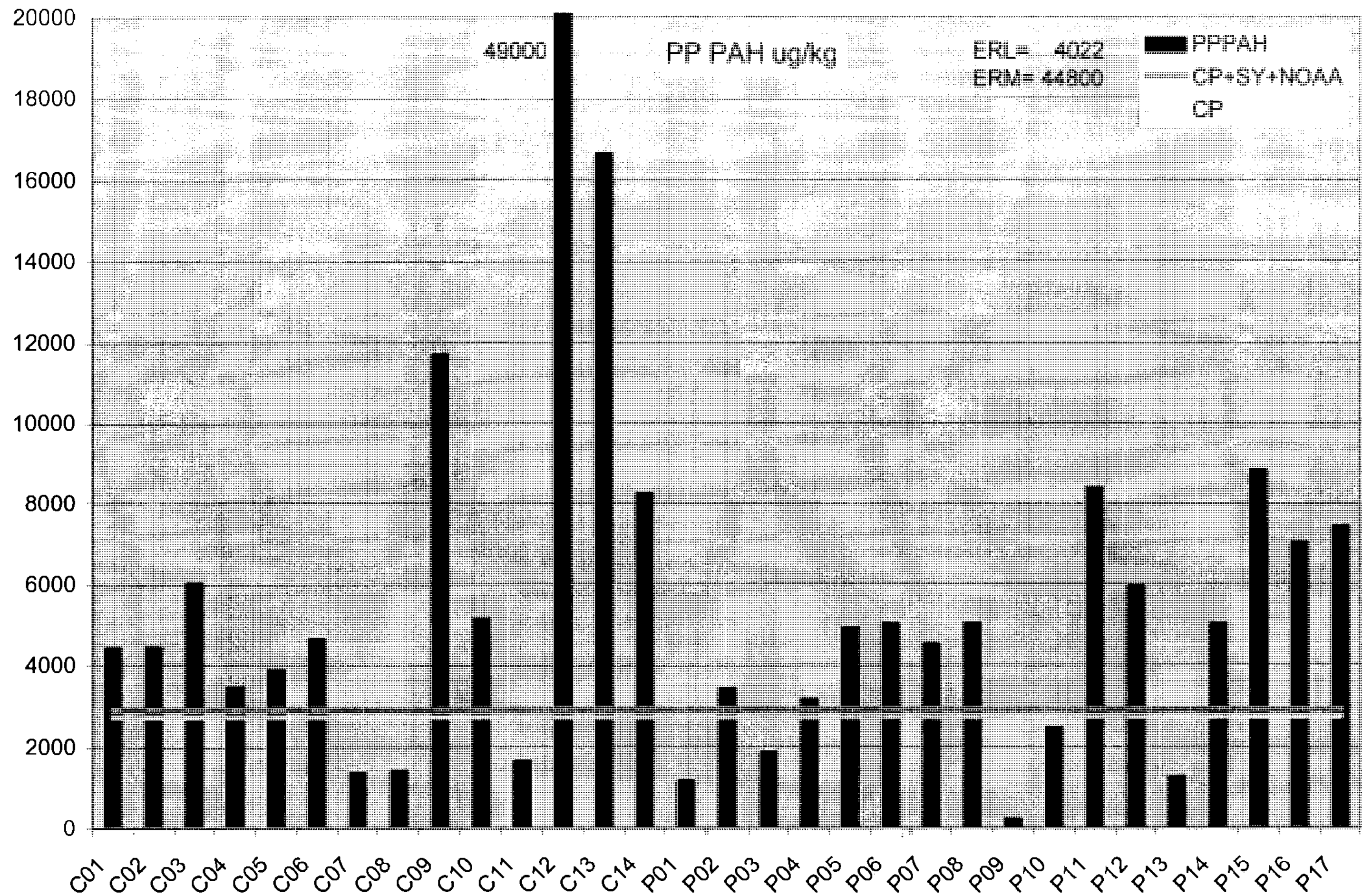

Figure 5. CP site data with minimum and maximum reference pool values (95% prediction interval) for PAH. No stations would change with choice of reference pool.

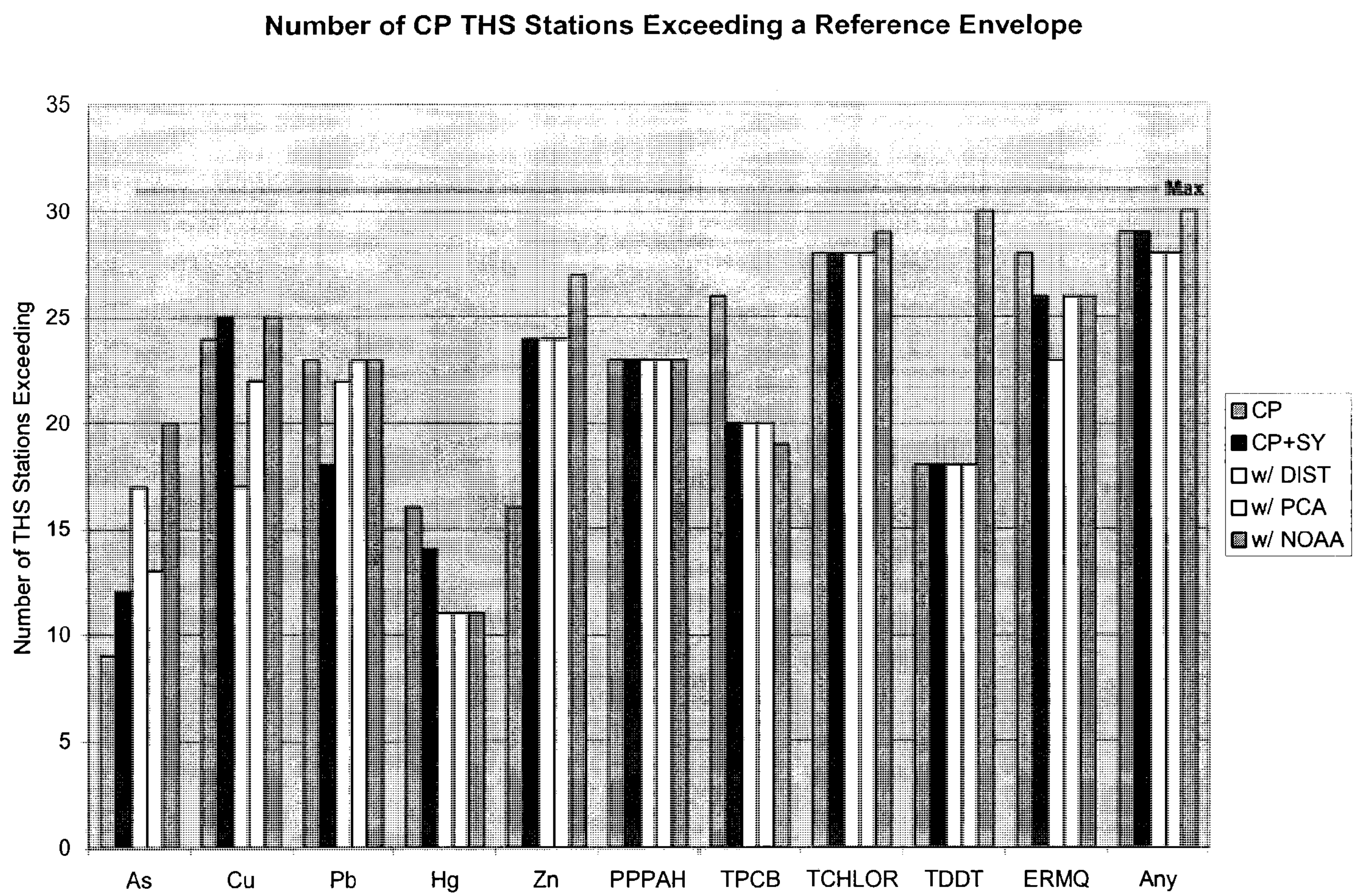

Figure 6. Number of CP sites exceeding 95% Upper PI for the different reference pools and contaminants.

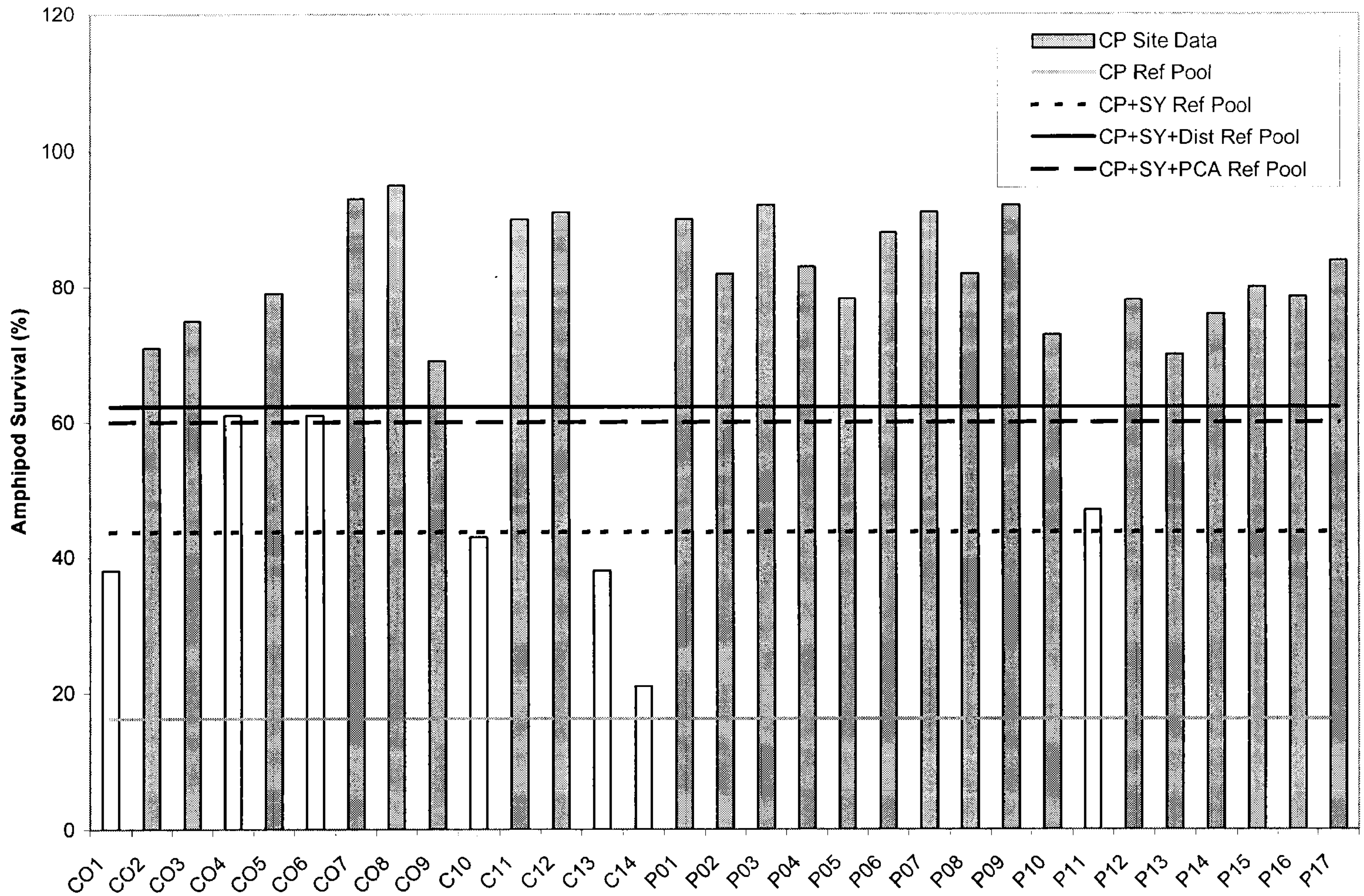

Figure 7. CP site toxicity data with reference pool thresholds. Light blue bars indicate stations that would change with choice of reference pool.

REFERENCE SITE POOL EVALUATION

Bart Chadwick and Chuck Katz
SPAWAR Systems Center San Diego

Introduction

The following evaluation was performed to see how using different reference site data pools affects the determination of chemical and toxicological thresholds, and how this might affect the ability to distinguish contaminated sites when the thresholds are applied to Hot Spot data. The analysis was performed with a common set of parameters, assumptions, calculations, and statistics. Nine chemical parameters (As, Cu, Pb, Hg, Zn, PPPAH, TPCB, TCHLOR, and TDDT), ERMQ and Amphipod toxicity were evaluated. The chemical parameters were chosen on the basis that they represented chemicals of concern at the Chollas and Paleta hotspots during the original data screening presented to the RWQCB board in June 2002. The following rules and assumptions were applied:

- Calculations were made using non-detect data converted to ½ method detection limits.
- The 95% prediction interval was used for all reference pools as the statistic of choice when evaluating whether or not an individual hot spot data value (or station) exceeded reference.
- Data sets containing more than 50% non-detect data for a given parameter (i.e., PCBs in Bight 98) were not included in statistical evaluations on the basis that a high number of non-detects would bias the variability of the pool.

Reference Pools

Seven reference data envelopes were calculated in this evaluation. Toxicity data were analyzed in a separate file but for the same reference pools. The Excel files attached with this document containing the data are: RefEnvEval.xls, Chollas-PaletaSedChemTables.xls, and Tox refeval data.xls. The file and sheet label for each data set are listed below.

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were excluded by Exponent in the SY data set. **File:** RefEnvEval.xls **Tab:** CP+SY

3) **CP+SY+Dist** This reference data pool was developed by combining the above two data sets with Bight'98 data from the 22 stations meeting the distance criteria outlined by SCCWRP. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98Dist. **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 dist

4) **CP+SY+PCA** This reference data pool was developed by combining the CP and SY data set with Bight'98 data from the 21 stations meeting the PCA grouping outlined by Exponent. It should be noted that the organics data here exceeded the 50% rule for non-detects and thus the 95% prediction interval calculated here is the same as for CP+SY. **File:** RefEnvEval.xls **Tab:** CP+SY+B98 PCA **NOTE:** The prediction interval calculated using non-detect values can be found in **File:** RefEnvEval.xls **Tab:** B98 PCA

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Results

Grain size and TOC were compared for the different reference pools (Figure 1) with the exception of the NOAA data pool. The comparison indicates that incorporation of additional sites either by the distance or PCA method would help to broaden the range of the TOC and grain size pool to be more comparable to the CP site data. Areas that are still not well represented would include inner Paleta and outer Chollas which appear to be enriched in TOC for the same grain size range as the reference areas. This is reflected in the regression slopes shown on the plot.

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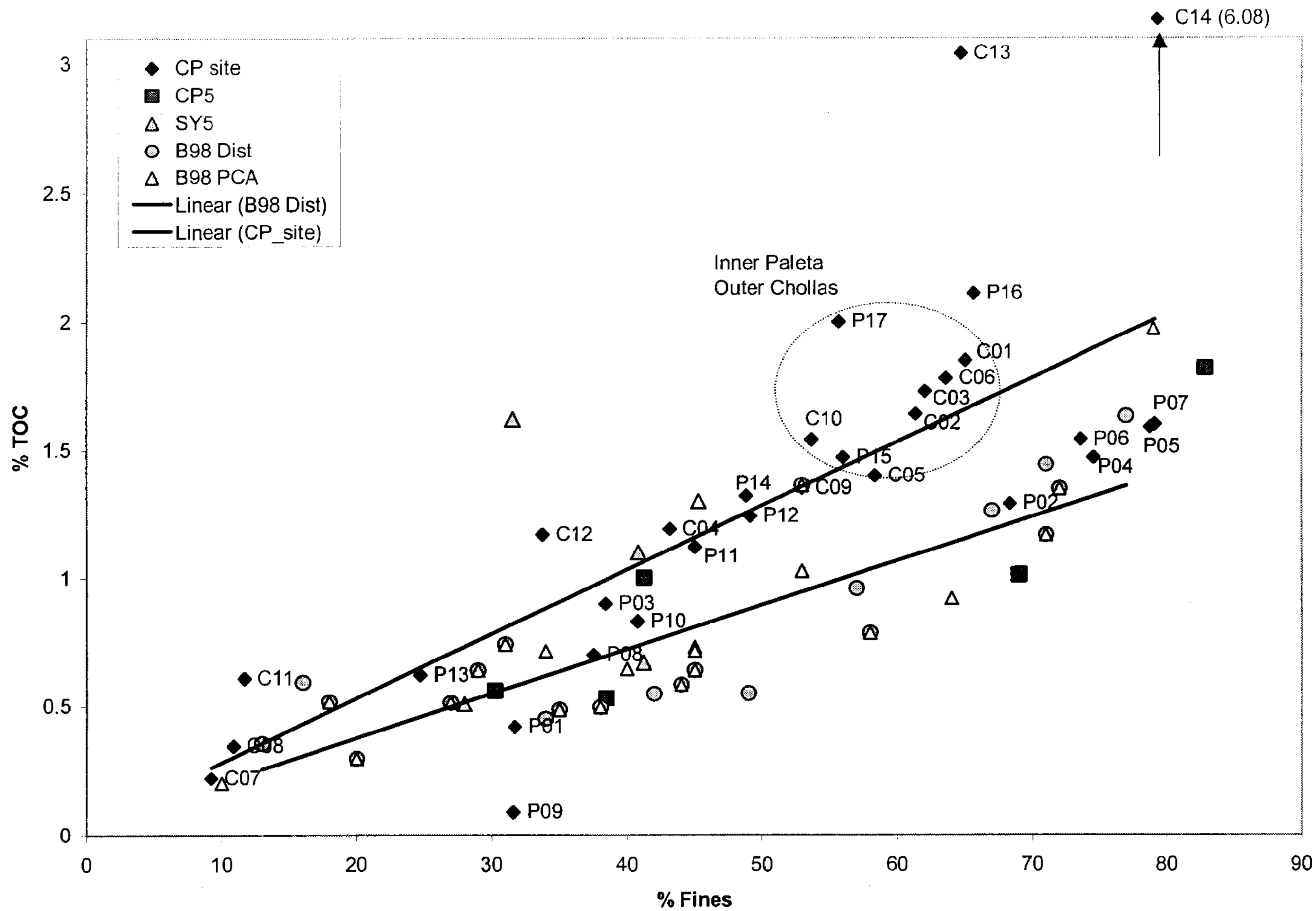

Figure 1. TOC vs. fines for the different reference sets.

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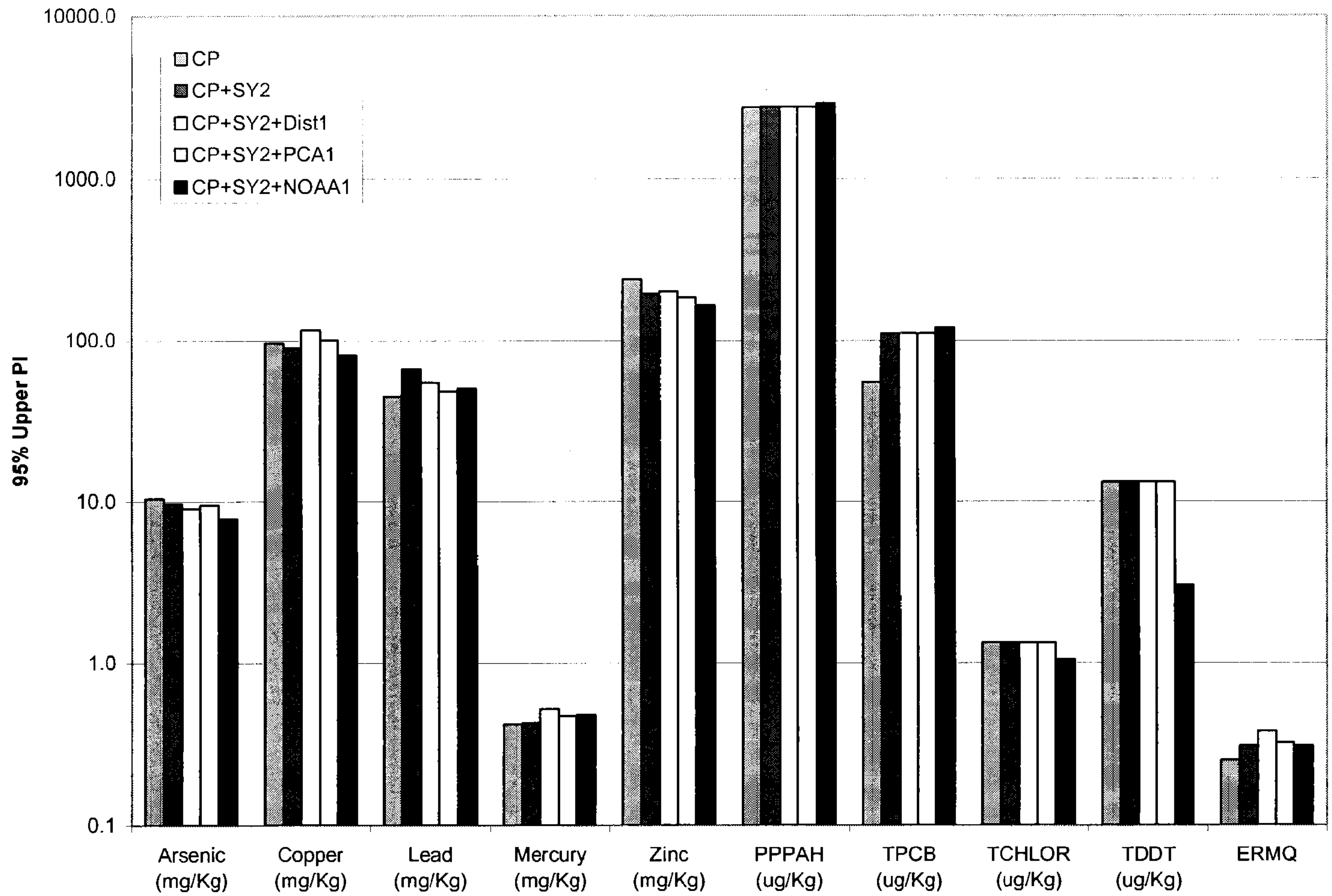


Figure 2. Comparison of Upper 95% PI for chemistry in the different reference pools.

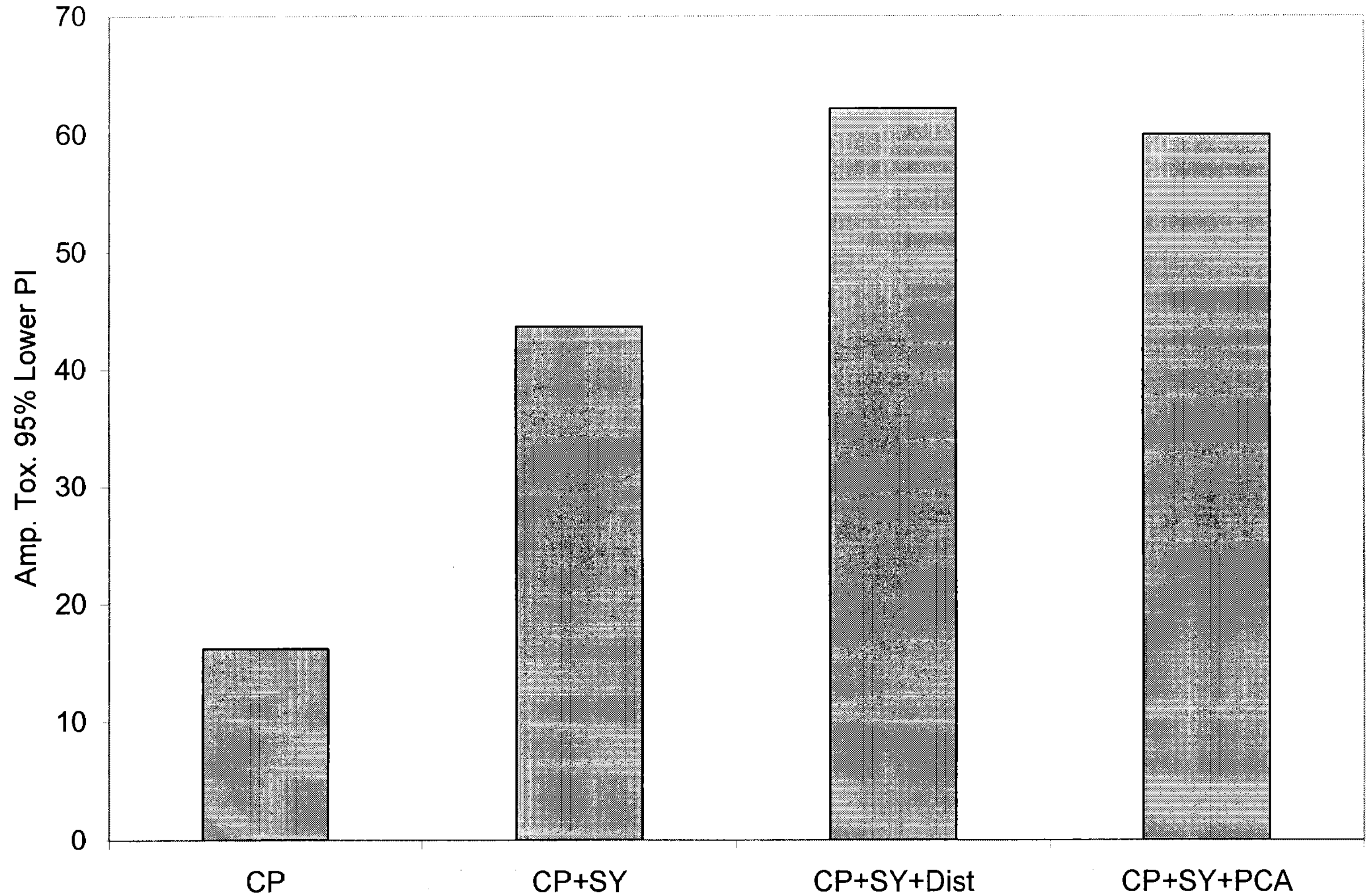


Figure 3. Comparison of lower 95% PI for toxicity in the different reference pools.

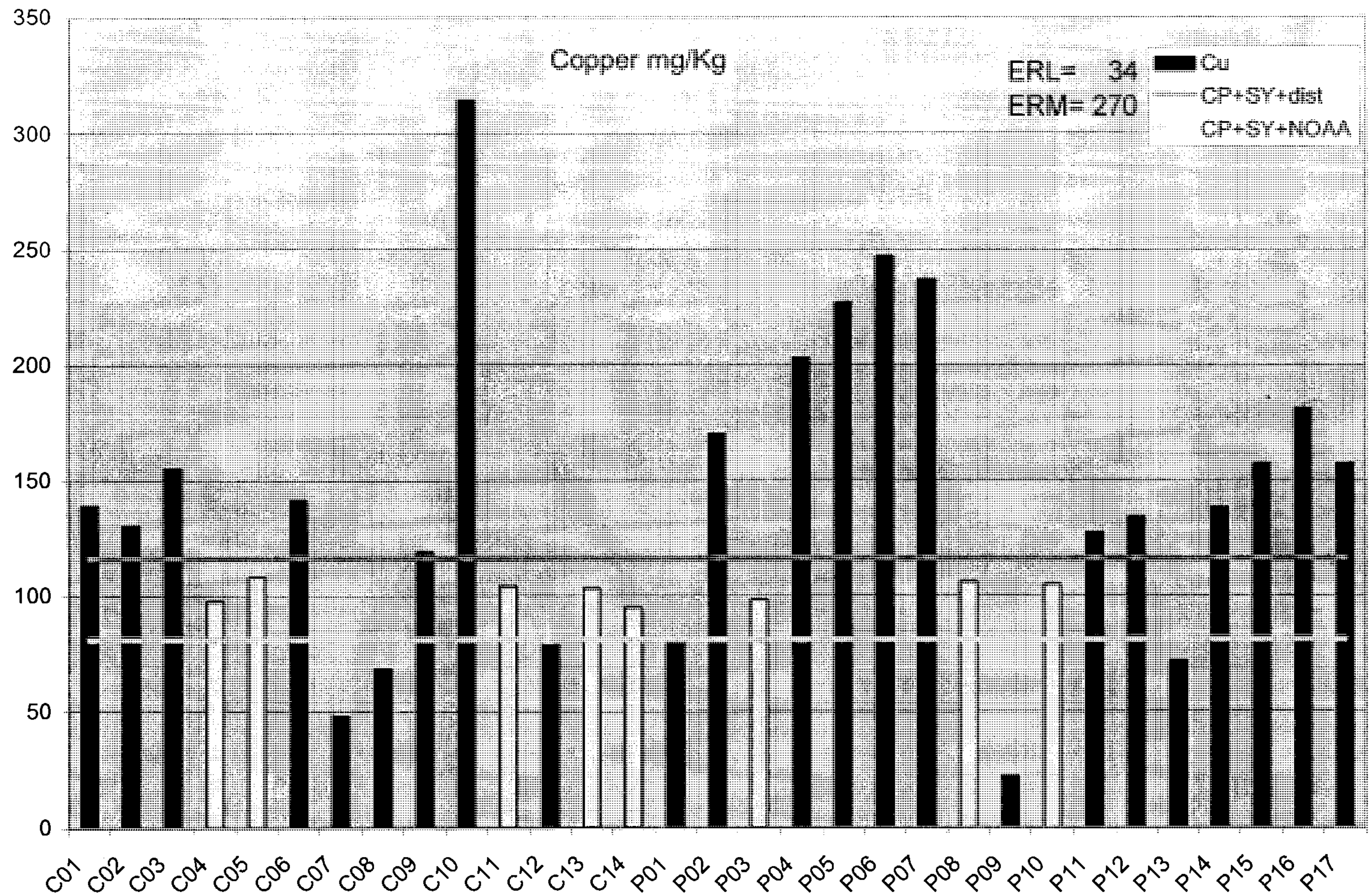


Figure 4. CP site data with minimum and maximum reference pool values (95% prediction interval) for Cu. Columns in orange show stations that would change with choice of reference pool.

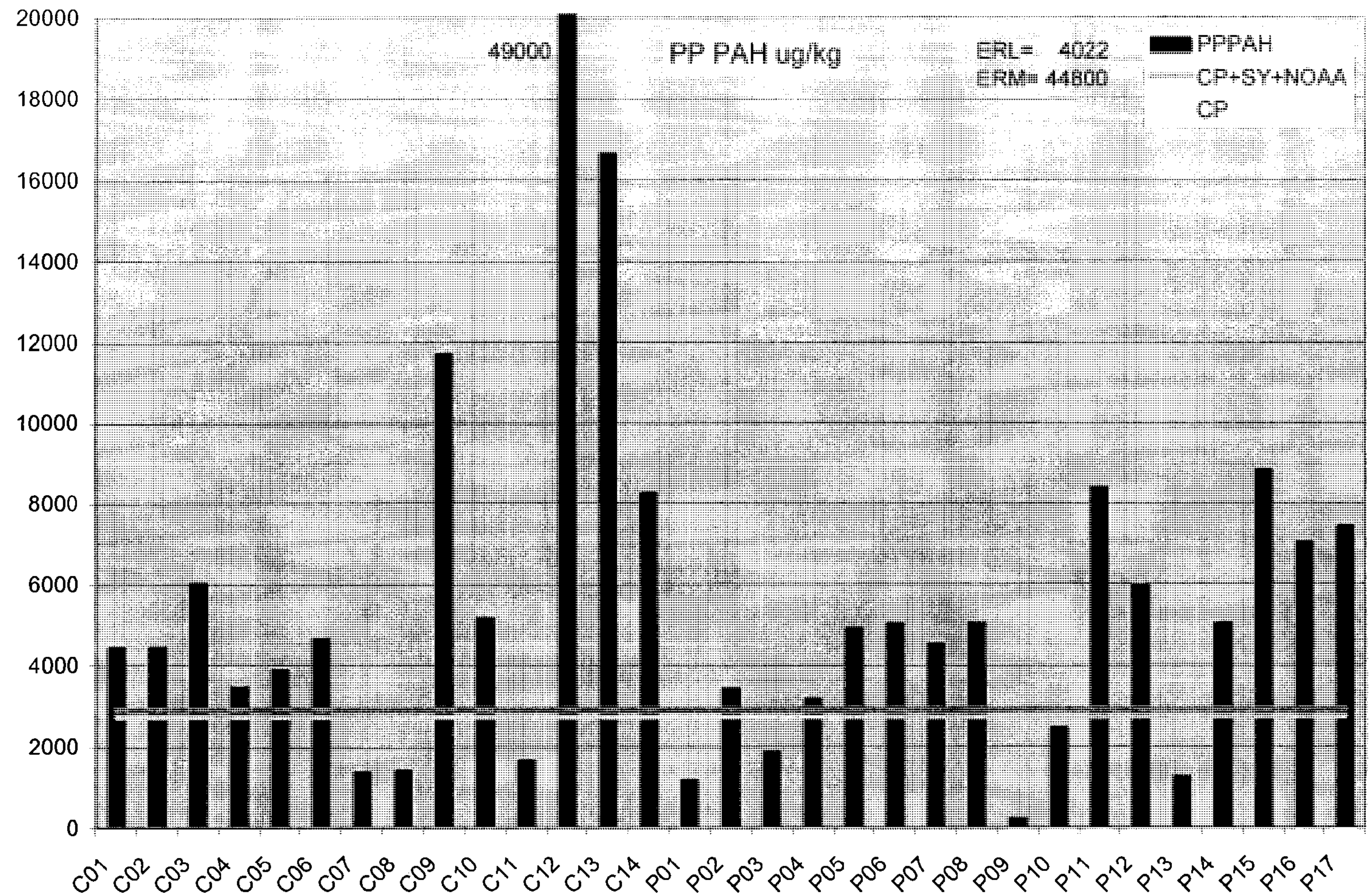


Figure 5. CP site data with minimum and maximum reference pool values (95% prediction interval) for PAH. No stations would change with choice of reference pool.

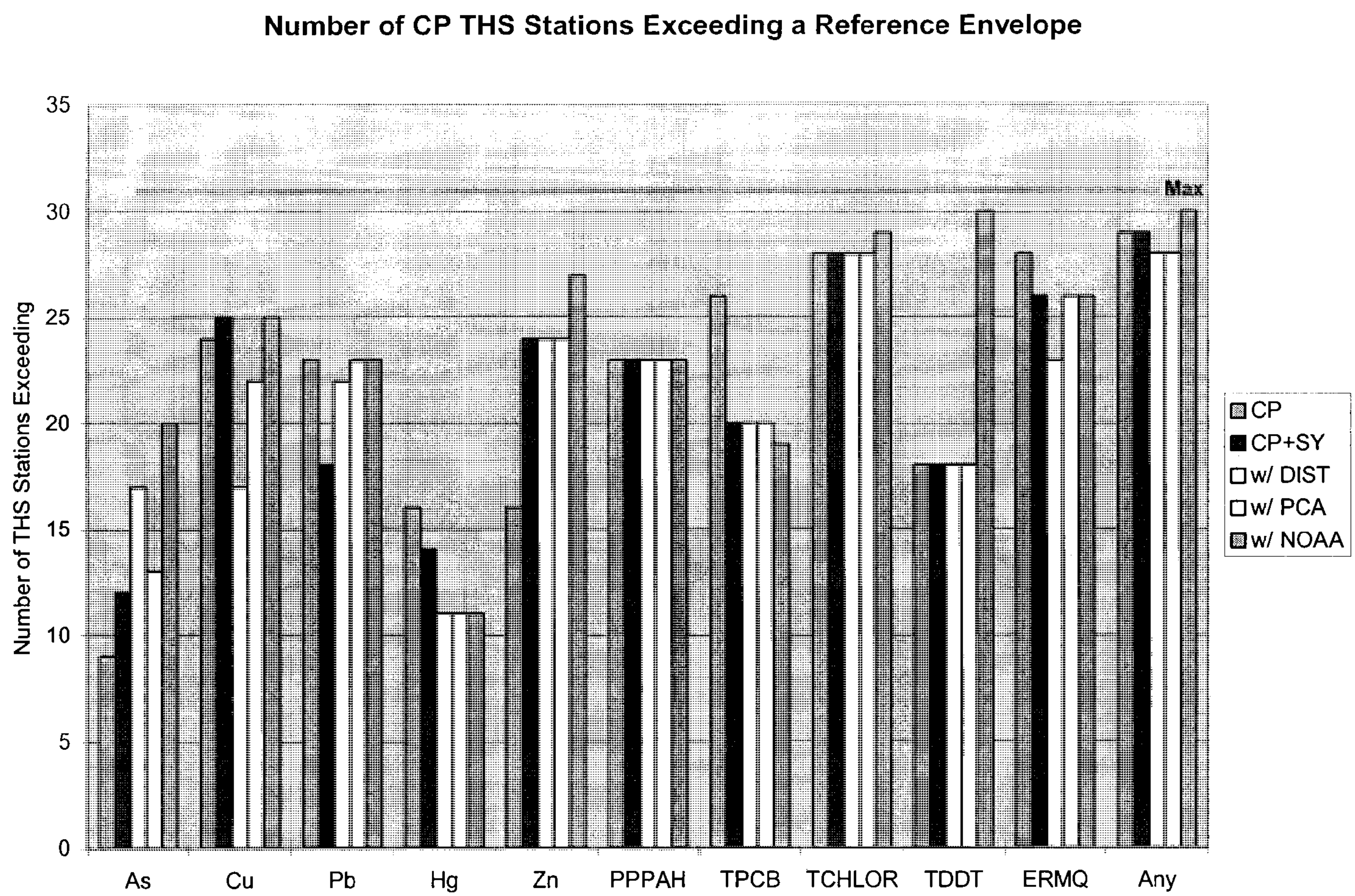


Figure 6. Number of CP sites exceeding 95% Upper PI for the different reference pools and contaminants.

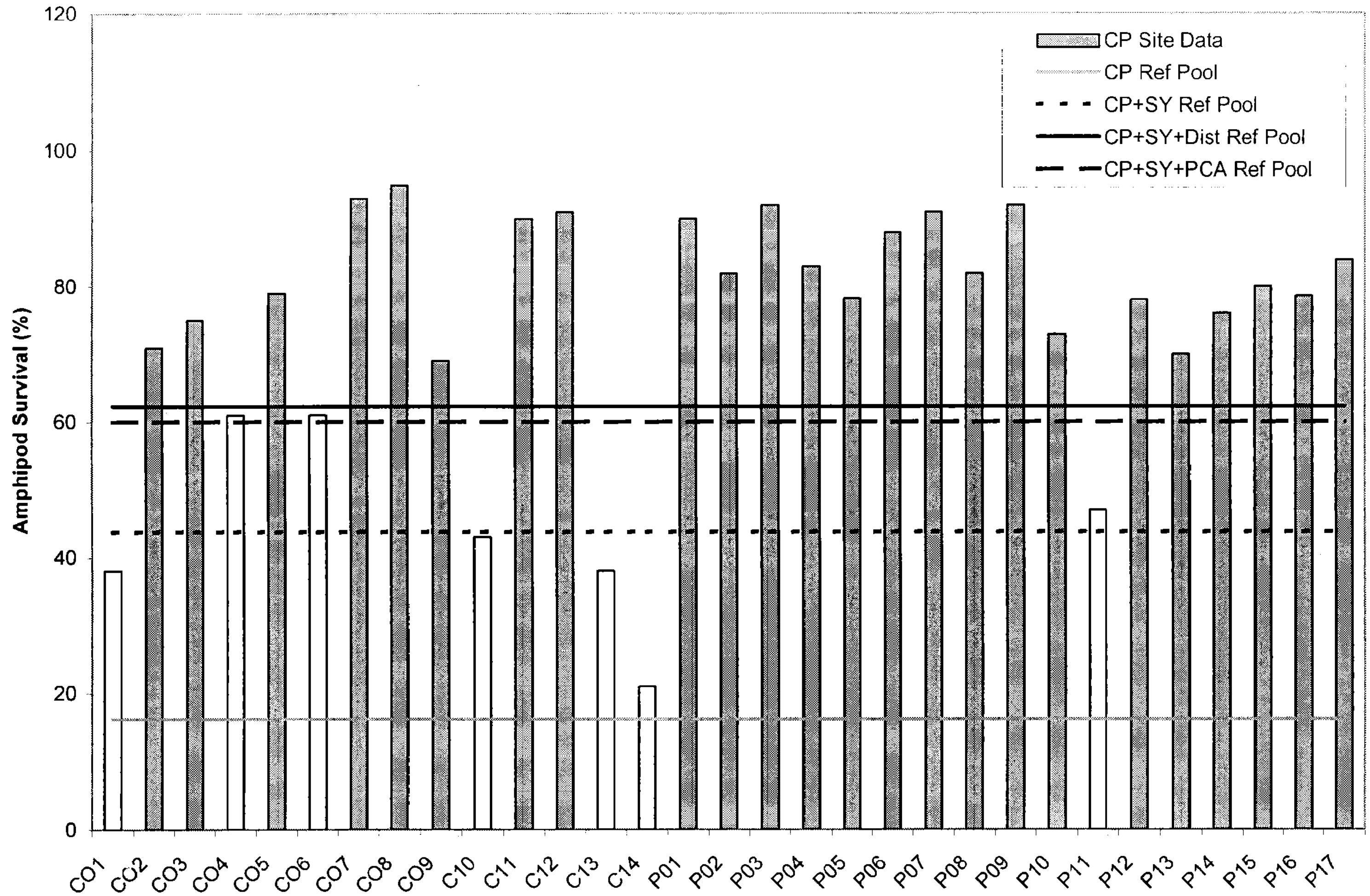


Figure 7. CP site toxicity data with reference pool thresholds. Light blue bars indicate stations that would change with choice of reference pool.

Laura Hunter

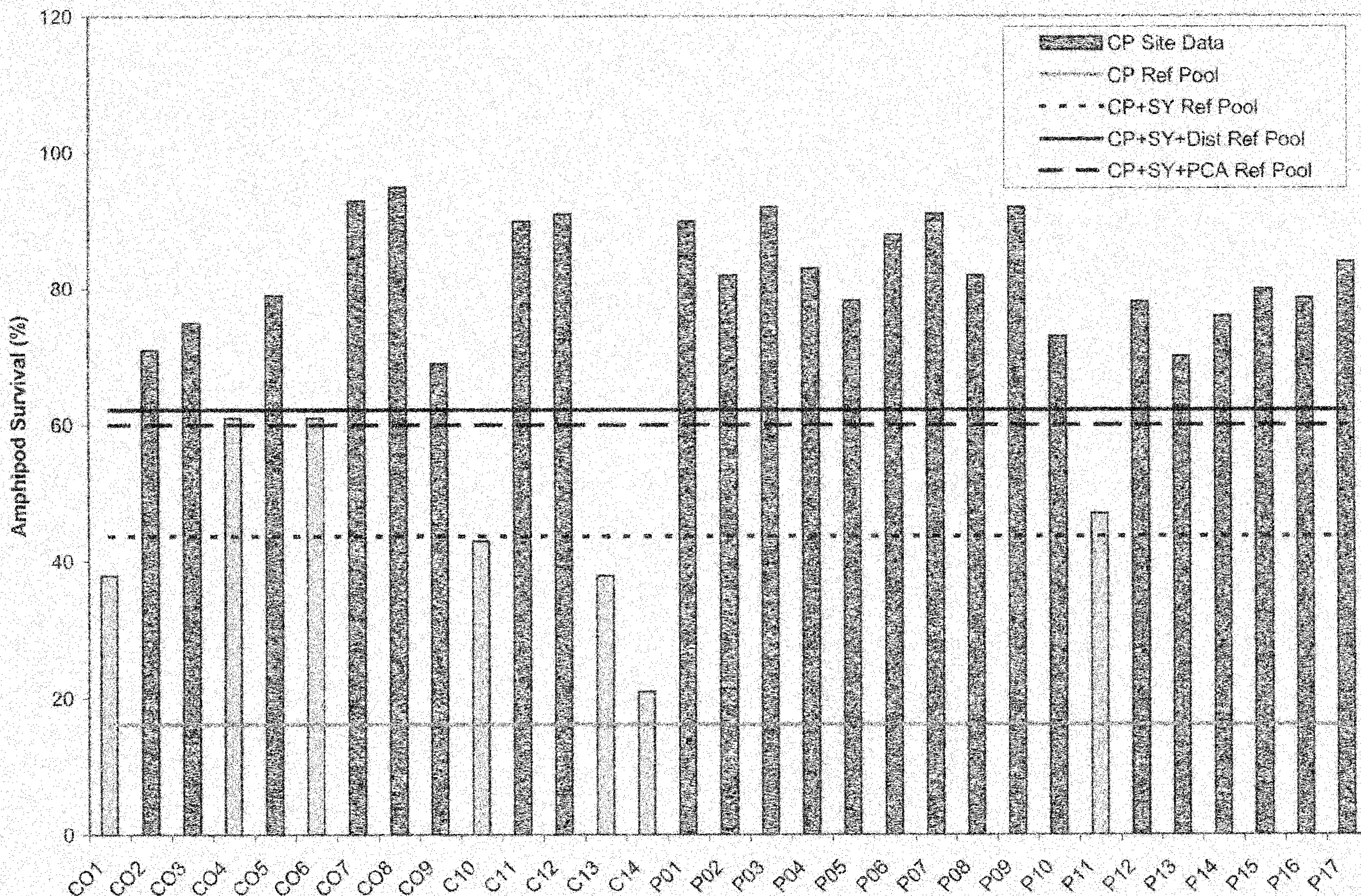
From: Tom Alo [alot@rb9.swrcb.ca.gov]
Sent: Tuesday, January 21, 2003 9:40 AM
To: elainecarlin@att.net; peugh@cox.net; emkimr@cts.com; Laura Hunter; nielsend@exponent.com; fairey@mlml.calstate.edu; mchee@nassco.com; Denise.Klimas@noaa.gov; donald.macdonald@noaa.gov; MMARTIN@OSPR.DFG.CA.GOV; Scott_Sobiech@r1.fws.gov; jeffb@sccwrp.org; steveb@sccwrp.org; breznik@sdbaykeeper.org; marco@surfridersd.org; halvaxs@swmarine.com; anderson@ucdavis.edu; jwhunt@ucdavis.edu
Cc: chadwick@spawar.navy.mil; ckatz@spawar.navy.mil
Subject: Re: Fwd: NOAA Approach

Re: Fwd: NOAA Approach

Good morning everyone. I am forwarding you a write-up and data evaluation from Bart Chadwick of SPAWAR. The information will be presented and discussed in Topic IV, Step 3 of the agenda.

If you have any questions or comments please contact me. See (or hear) you tomorrow.

--Tom



CP Site Data
CP Ref Pool
CP+SY Ref Pool
CP+SY+Dist Ref Pool
CP+SY+PCA Ref Pool
Amphipod Survival (%)
120
100
80
60
40
20
0
CO1
CO2
CO3
CO4
CO5
CO6
CO7
CO8
CO9
C10
C11
C12
C13
C14
P01
P02
P03
P04
P05
P06
P07
P08
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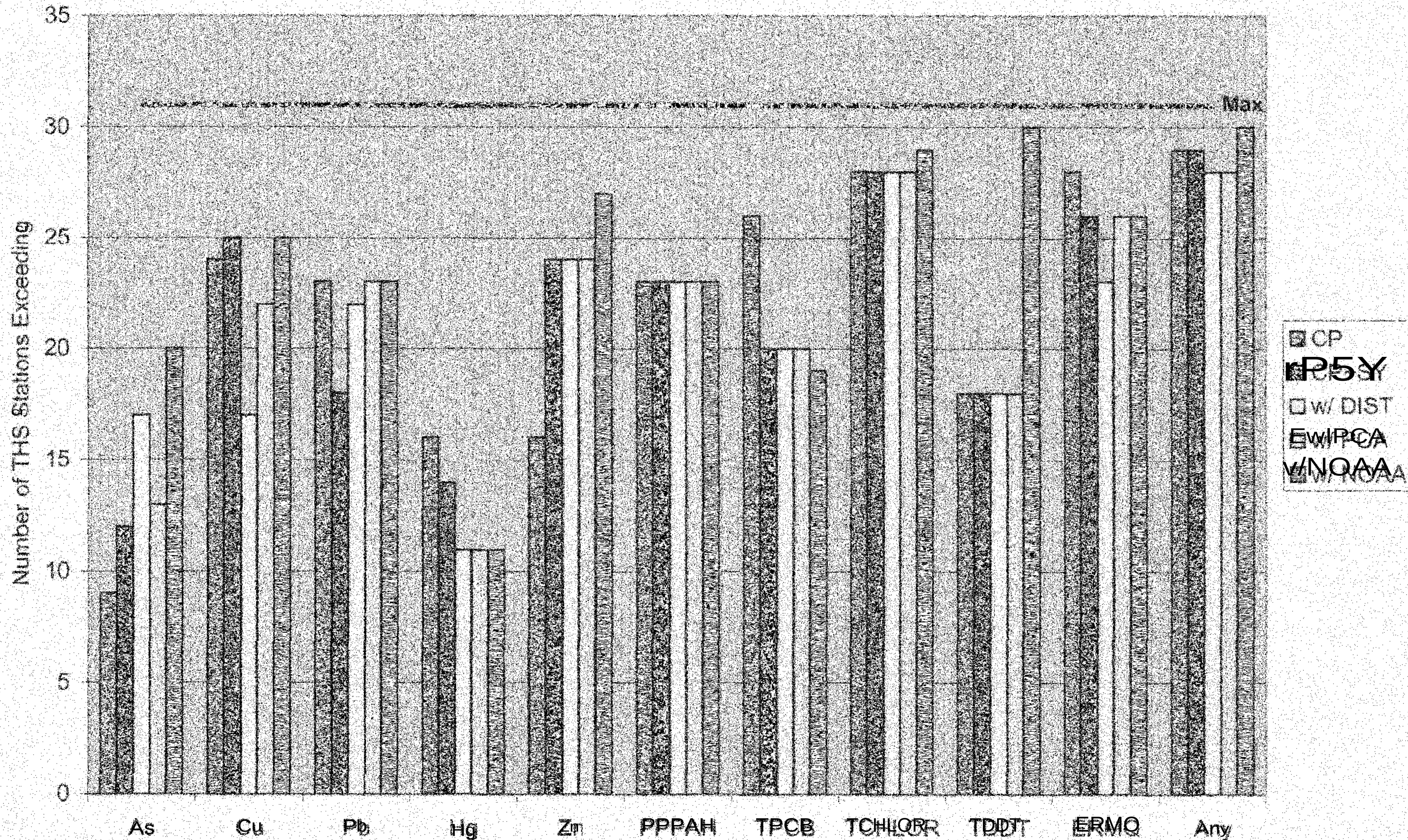
P14
P15
P16
P17

Number of CP THS Stations Exceeding a Reference Envelope



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From: Tom Alo [alot@rb9.swrcb.ca.gov]
Sent: Thursday, January 23, 2003 3:02 PM
To: morley.theresa.l@asw.enrsw.navy.mil; elainecarlin@att.net; emkimr@cts.com; underwoodpm@efdsw.navfac.navy.mil; Laura Hunter; nielsend@exponent.com; mchee@nassco.com; Denise.Klimas@noaa.gov; donald.macdonald@noaa.gov; Scott_Sobiech@r1.fws.gov; David Barker; Charles Cheng; Craig Carlisle; Alan Monji; Brennan Ott; Peter Peuron; steveb@sccwrp.org; chadwick@spawar.navy.mil; ckatz@spawar.navy.mil; Jallen@spawar.navy.mil; halvaxs@swmarine.com; anderson@ucdavis.edu
Cc: MMARTIN@OSPR.DFG.CA.GOV
Subject: EPA Document

All,

Here's the link for the EPA document that Michael Martin discussed at the Jan 22-23 meeting.

http://www.epa.gov/superfund/programs/risk/background.pdf

--Tom

Laura Hunter

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Sent: Thursday, January 23, 2003 3:02 PM
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--Tom

Laura Hunter

From: Steve Bay [steveb@sccwrp.org]
nt: Thursday, January 23, 2003 6:55 AM
ıo: Tom Alo; Brian Anderson; Laura Hunter
Subject: additional comparisons

OtherBight98Results.ppt

Tom, Brian, Laura,

I have attached some additional figures to help address the questions that were raised regarding the Bight'98 Benthic data, the different comparison limits (Prediction interval or standard deviation) and the relative locations of the sets of 10 and 14 candidate reference sites.

Steve

--

Steven Bay
Southern California Coastal Water Research Project
7171 Fenwick Lane
Westminster, CA 92683
714-372-9204 (ph)/ 714-894-9699 (fax)
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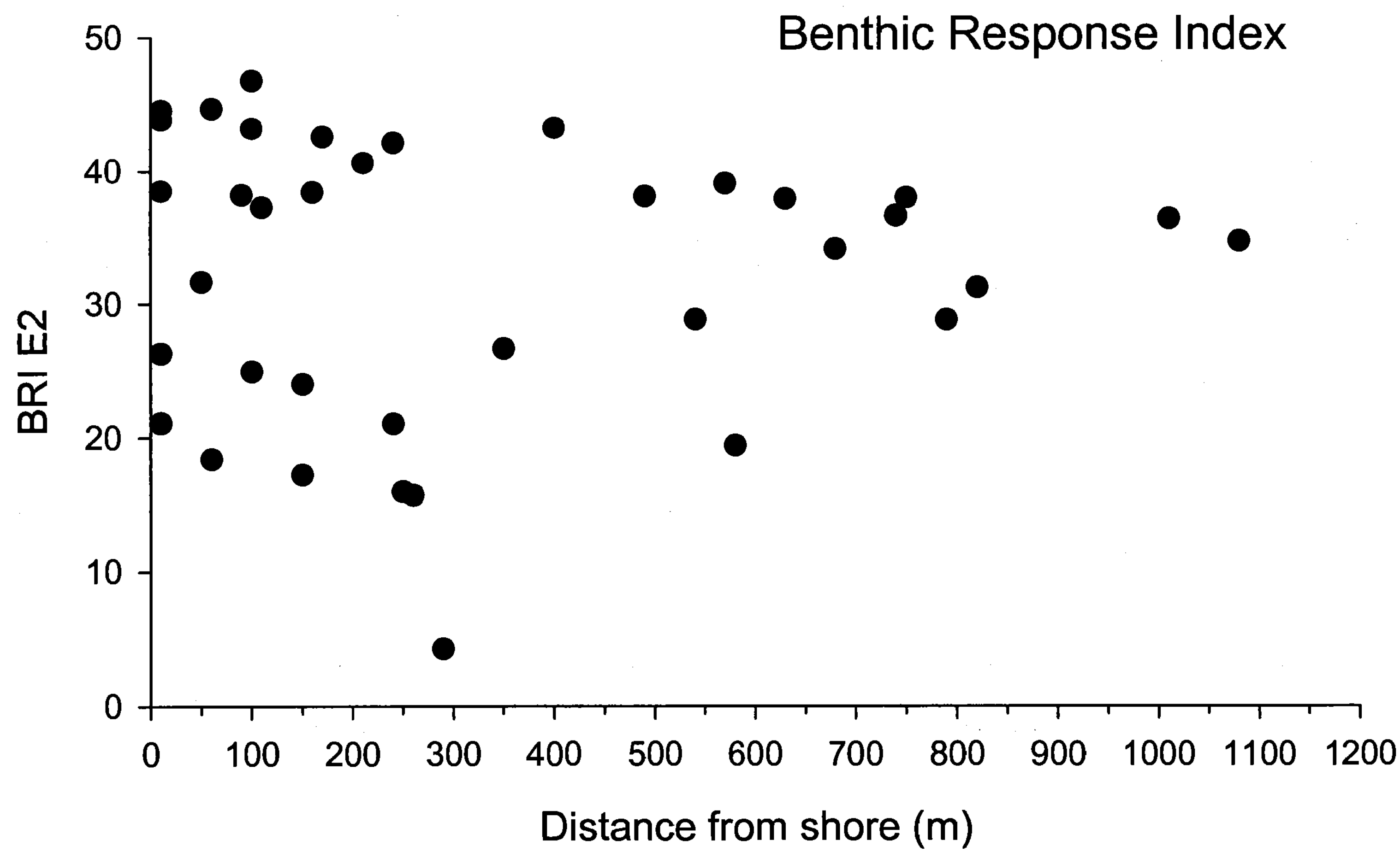
Bight'98 Data



Bight'98 Data