

STATE WATER QUALITY CONTROL BOARD, SAN DIEGO REGION  
**INFORMAL PEER REVIEW DOCUMENT**  
*A Review of Sediment Cleanup Levels for 3 Shipyards in San Diego Bay*

Submitted by: Russell Fairey

**Part A -- Background and Certifications**

Background.

Discharges of waste from shipyard operations at several shipyards in San Diego Bay have resulted in the presence of high concentrations of pollutants in the sediments at the shipyards. Pollutants associated with San Diego Bay shipyard activities include: copper and tributyltin from antifouling paints; and petroleum and PAHs from bilge waste. Other paint wastes may contain zinc, chromium and lead. Wastes which appear to be associated with general industrial activity around San Diego Bay include PCBs and PCTs (polychlorinated terphenyls such as Aroclor 5460); and antimony. The California Regional Water Quality Control Board, San Diego Region (SDRWQCB) has set a sediment cleanup level for Campbell Shipyard based on the Apparent Effects Threshold (AET) established by soil chemistry and toxicology studies undertaken at that shipyard.

The SDRWQCB has tentatively approved the applicability of the Campbell Shipyard AET sediment cleanup levels for use at two additional locations, which are the San Diego Bay sites occupied by NASSCO and Southwest Marine shipyards. These cleanup levels are presently considered by the Regional Board to be "interim cleanup levels". The application of the Campbell AET cleanup level to these other shipyards is based on an assumption that conditions at these two additional shipyards are sufficiently similar to the conditions at the Campbell Shipyard. It is also based on the assumption that such an extension is reasonable, even though the two additional shipyards have not undertaken the same level of site specific analysis that were done by Campbell. This determination is based upon the presumed similarity of the wastes in the sediments at all three shipyards, the similarity of the sediments themselves, and the similarity of the marine and benthic biota that would be anticipated to exist at all of the shipyards in the absence of pollution.

The peer review task is to consider the scientific validity of extension of sediment cleanup levels based on AET values derived from and for sediments at the Campbell shipyard at the other two shipyards. The Regional Board has given preliminary approval of this application, however it has requested a peer review to allow a reassessment of the application. If the peer review confirms the validity of the scientific basis of this action, the Regional Board will likely take action to remove the "interim" designation from the present designation of the NASSCO and Southwest Marine sediment cleanup levels. If the scientific basis for the Regional Board action was found to

be deficient, the Regional Board will require additional development of a more appropriate sediment cleanup level for NASSCO and Southwest Marine shipyards.

#### Personal Qualifications

Please summarize your professional qualifications by education and personal experience involving the analysis of bay sediments including studies of benthic communities, sediment chemistry and sediment toxicity.

Educational Qualifications:

(Undergraduate) Please see attached Curriculum Vitae

(Graduate Study)

Professional Qualifications:

Publications:

#### Certification of Objectivity & Disinterest

I certify that I have not been involved in the scientific studies used to establish the AETs for sediments at the Campbell shipyard in San Diego Bay; and that I have not been involved in any work associated with the cleanup of sediments at the NASSCO or Southwest Marine shipyards in San Diego Bay, nor will I accept such employment within 24 months. I do not have any economic or financial interest in the selection or determination of cleanup levels for sediments at any shipyard, boatyard, industrial facility, municipal storm drain, or Toxic Hot Spot in San Diego Bay.

Signed:

Date:

#### **Part B -- The Peer Review Charge**

The charge for this peer review is to write a response to the following question:

"Is it appropriate to apply the Campbell Shipyard Apparent Effects Threshold (AET) as the sediment cleanup level for the NASSCO and the Southwest Marine Shipyards?"

Reference materials for this review are to be provided exclusively by the Regional Board

Any deficiency in the scientific basis should be clearly specified to allow the Regional Board to appreciate the significance thereof.

### **Part C -- The Peer Review Response**

Statement of Russell Fairey

Date- February 23, 2000

The following documents were provided to me by the San Diego RWQCB in early Jan. 2000:

- 1a. State Water Resources Control Board- "Guidelines for Obtaining External Scientific Peer Review", August 1998.
- 2a. PTI Environmental Services- "Data Report, Campbell Shipyards Sediment Characterization- Phase 2, Volume 1", June 1991.
- 2b. PTI Environmental Services- "Appendices, Campbell Shipyards Sediment Characterization- Phase 2, Volume 2", June 1991.
- 2c. PTI Environmental Services- "Review Draft, Campbell Shipyards, Remedial Action Alternatives Analysis Report", October 1993.
- 2d. EcoSystems- "Campbell Shipyard, NPDES Permit, Marine Sediment Monitoring and Reporting Annual Report", August 1999.
- 3a. PTI Environmental Services- "Site Characterization and Remedial Action Plan, Prepared for National Steel and Shipbuilding Company (NASSCO), San Diego, California", November 1997.
- 3b. EcoSystems- "National Steel and Shipbuilding Company, NPDES Permit, Marine Sediment Monitoring and Reporting Twelfth Semi-Annual Reporting Period", June 1998.
- 3c. National Steel and Shipbuilding Company (NASSCO), "Amendment 1 to the NASSCO Sediment Study, Sampling and Analysis Plan", September 14, 1998
- 4a. Ogden Environmental and Energy Services Co., Inc.- "Final Report, Sediment Characterization and Remediation Plan, Southwest Marine Shipyard, San Diego, California", Pages 1-15, December 1998.
- 4b. Ogden Environmental and Energy Services Co., Inc. - "Final Report, Sediment Characterization and Remediation Plan, Southwest Marine Shipyard, San Diego, California", Appendix A, December 1998.
- 4c. EcoSystems- "Southwest Marine, NPDES Permit, Marine Sediment Monitoring and Reporting Twelfth Semi-Annual Reporting Period", June 1998.

- 4d. Ogden Environmental and Energy Services Co., Inc. - "Addendum to the Final Report, Sediment Characterization and Remediation Plan, Southwest Marine Shipyard, San Diego, California", March 1999.

In addition, I requested the following documents that I received mid February:

**CA RWQCB** San Diego Region, Staff Report on the establishment of shipyard sediment cleanup levels for National Steel and Shipbuilding Company and Southwest Marine, Inc.

**CA RWQCB** San Diego Region, Resolution No. 99-20, A resolution establishing interim shipyard cleanup levels for National Steel and Shipbuilding Company, San Diego County

**CA RWQCB** San Diego Region, Resolution No. 99-12, A resolution establishing interim shipyard cleanup levels for Southwest Marine, Inc., San Diego County

The charge of this review is to decide if sediment cleanup levels, that were developed using an AET approach with chemical and biological data from Campbell Shipyards, are appropriate sediment cleanup levels for other shipyards in San Diego Bay. This is a reasonable question to ask, considering the physical proximity and similar marine uses of the shipyards. The answer to this central question depends on the results of three separate determinations.

The first determination is whether data collected at Campbell Shipyards is sufficient and suitable for the application of an AET approach. This requires an assessment of the quality of data and an assessment of data suitability in meeting the requisites of the AET approach.

The second determination is whether physical, chemical and biological data are similar enough among shipyards to apply AETs developed in one area to other areas. This requires a direct comparison of data collected from each area.

The third determination is whether cleanup levels developed using an AET approach provide the level of environmental protection necessary to meet management objectives in the management area. The objective is stated as protection of beneficial use and abatement of the threat of pollution in San Diego Bay. This can be evaluated for data collected within the focus of the management area but benefits from review of additional data to provide context and perspective for meeting management objectives for the Bay.

Data Quality- Review of the above documents for Campbell Shipyards leads me to believe the sediment data quality is adequate for application of the AET approach. Some deficiencies in surrogate recoveries are noted and some analytes required re-analysis but in general the sediment

chemistry data is acceptable. Analytical variability is within acceptable limits, however because AETs values are generated from a small number of samples, it should be recognized that there is analytical variance around the AET values. Porewater data suffers from poor detection limits and is generally unusable. Tissue chemistry also suffers from poor detection limits, most notably for PCBs.

Data Sufficiency- Development and application of the AET approach has been demonstrated extensively in the state of Washington. Marine sediment management standards and minimum cleanup criteria have been established for over forty chemicals or chemical groups. The AET values that are currently promulgated (Chapter 173-204 WAC) were based on the evaluation of approximately 200 stations in 1996 (Barrick et al., 1988) and further revised based on the evaluation of approximately 400 stations in 1998 (Barnck et al., 1988, 1988 Update and Evaluation of Puget Sound AET -- Sediment Quality Values Refinement: Vol. 1 and Vol. 1 Data Appendices). Current AET refinements are often based on thousands of samples. As stated in the Campbell Shipyards Remedial Action Alternatives, the Puget Sound AET values have been shown to have a high degree of accuracy in predicting adverse effects in Puget Sound, but their accuracy has not been determined for other regions. The same general type of AET evaluation was used in development Campbell Shipyards however the evaluation data set was limited to only 15 stations. The Shelter Island Boatyard mercury AET was similarly developed using data for 11 stations. No subsequent evaluation of the degree of accuracy in predicting adverse biological effects has been performed for the shipyard or boatyard AET values. This is significant because the site specific AET values in San Diego Bay are recommended over AETs developed in Puget Sound for delineating the areal extent of sediment cleanup. The two chemicals that delineate the maximum extent of pollution using the Puget Sound AET values are copper (390 ppm) and zinc (410 ppm). The Campbell site-specific AET values are twice those of Puget Sound (810 and 820, respectively) and when applied as cleanup levels dramatically reduces the area of concern within the study area. The site-specific mercury AET value from the Shelter Island Boatyard is 10 times that of Puget Sound. If Campbell's site-specific AETs are assumed accurate at predicting adverse effects, based on these small data sets, then bioavailability of these metals must be quite different compared to shipyards and other water bodies in Puget Sound. Application of site-specific AETs to other shipyards in San Diego Bay assumes: 1) the small data set used to develop the sitespecific AETs accurately predict adverse biological effects and 2) bioavailability at other shipyards is likely similar to Campbell Shipyard or Harbor Island Boatyard study areas. No data is presented to support either assumption. It is actually easier to make the same assumptions regarding the Puget Sound AETs because of the extensive data used to confirm predictability. It seems prudent to either assess the accuracy of the Campbell and Harbor island AET values thoroughly or apply AET values based on larger proven data evaluations. This is compounded by the absence of biological data from the NASSCO and Southwest Marine site characterizations, thus making it impossible for an assessment of correlative associations or bioavailability to be made. It is my opinion that the current data is insufficient to make needed predictability or bioavailability evaluations of the site-specific AETs.

Site comparability- The RWQCB staff report dated 2/17/99 concludes that it is appropriate to apply Campbell Shipyard site specific AETs to NASSCO and Southwest Marine based on physical, chemical and biological similarities. The similarities mentioned, however, are in terms of site activities, hydro-geographic and bio-geographic zones and off-site pollutants. No effort has been made at the proposed cleanup areas to determine if the physical factors that influence sediment toxicity and bioavailability, such as sediment grain size, organic carbon content, sedimentation, scouring, etc... are similar among the areas. It is possible to address chemical similarities at NPDES discharge sites where a suite of chemicals are measured, but the characterization sites, which represent a much larger area, have a limited analyte list and subsequent comparison limitations. No porewater or resident tissue chemistry results are presented for NASSCO or Southwest Marine so no comparisons can be made. Biological data are absent from the NASSCO and Southwest Marine surveys, so no assessment of biological similarities can be made. Considering the limited data available for evaluation, there is no basis for the determination that the sites are similar or the implication that biological responses should be similar.

### Management Objectives

The third determination is whether cleanup levels developed using an AET approach provide the level of environmental protection necessary to meet management objectives. As described in the Campbell Shipyards Remedial Action Alternatives Analysis Report, "An AET is defined as the sediment concentration of a chemical above which a statistically significant adverse effect for a particular biological indicator is always observed". From a scientific perspective, is difficult to understand how cleanup levels based on chemical concentrations known to always have adverse effects can meet the RWQCBs management objective to be "protective of beneficial uses and abate the threat of pollution in San Diego Bay". It is solely a discretionary management decision as to what the term "protective" means and how to implement it, but additional data can be reviewed to help lend perspective to that decision. For example, the site specific AET developed for copper (810 ppm) can be applied to independent data for assessments of predictability. In the statewide Bay Protection and Toxic Cleanup Program, 603 sediment samples were analyzed for copper concentration and toxicity to amphipods. Only three samples in the state exceeded 810 ppm and all three were determined to be toxic to amphipods. Using the national SEDTOX database assembled by NOAA, that includes 2756 samples with synoptic chemistry and toxicity to amphipods, 20 of 22 samples were acutely toxic to amphipods when copper concentrations were >810 ppm. The site-specific AET value is proven highly predictive of adverse effects, but is not "protective" of amphipods considering acute mortality is observed 92% of the time throughout the nation. It also only identifies 23 of the combined 3359 samples (0.7 percent), so is applicable only the extreme tail of the copper concentration distribution. If the AET developed for Puget Sound is used (390 ppm) for the combined BPTCP and SEDTOX databases, 93 samples exceed 390 ppm, of which 77 samples (83%) were acutely toxic to amphipods. For these data, use of the Puget Sound AET allowed for the identification of an additional 54 samples that were associated with elevated copper, with only a small loss of predictive accuracy. If the management goal is to protect benthic crustacean species, use of the 390 ppm value for cleanup levels would likely be more "protective" because it would result in cleanups at 45 (83% of 54) additional stations where acute amphipod mortality is expected. The point to make is that selection of the most appropriate

cleanup level depends on what level of protection is considered adequate for pollution sensitive species. Again, that is a management decision, but use of Campbell's site-specific AETs concentrations, as cleanup levels for sediments in San Diego Bay, are predicted to provide less "protection" than lower, concentrations, such as the AET values developed for Puget Sound.

The Campbell Shipyard Remedial Action Alternatives Analysis Report examined marine benthic communities at fifteen stations and reports significant differences among abundance of species and individuals. Clustering using the Bray-Curtis Index indicates a significant group of nearshore stations, centered around ongoing shipbuilding activities, that are characterized by depressed number of species. Median chemical concentrations for copper, lead and PCBs at this group of stations (Table 3-11) are elevated and surprisingly similar to the site-specific AET values derived using acute amphipod toxicity. Although these results are not emphasized by the Campbell evaluation, measurable benthic community impacts are evident when chemical concentrations approach the Campbell site-specific AET values. The Campbell evaluation focused on individual and species abundance which are not considered particularly sensitive. Also no distinction is made regarding pollution adaptive species (eg-*Grandiderella japonica*) in major taxa groupings. Use of more sensitive community indices and statistical tools that are currently available would likely provide additional insight to adverse community response within the Campbell study area. Application of Campbell's site specific AETs to Southwest Marine and NASSCO will not address these concerns.

Little attention has been paid to potential human health hazards for mercury and PCBs identified by the survey at Campbell Shipyards. Although risk assessment models are shown to predict a significant level of concern associated with ingestion of fish and shellfish collected at the Campbell site, these levels are described as "well within ambient concentration ranges for seafood in San Diego Bay". It should be noted that PCB and mercury concentrations in tissues of fish collected at Campbell Shipyard exceed screening levels established by the USEPA (EPA823-R-95-007). Also, human health advisories are in place for San Francisco Bay for consumption of tissues with contaminant levels significantly lower than measured at the Campbell site. If Campbell and ambient tissue concentrations do present an unacceptable consumption health risk, as indicated, management of contaminant sources becomes vital to the protection of beneficial uses of San Diego Bay. Elevated levels of PCBs and mercury in shipyard sediments likely play a significant role. Acceptable levels of bioaccumulative substances such as PCBs and mercury should consider bioaccumulation models or human health protection rather than rely entirely on the acute toxicity endpoints used in the Campbell or Shelter Island AET evaluations. These issues are minimized in the Campbell evaluation and have been ignored by the Southwest Marine and NASSCO evaluations. Use of Campbell site specific AETs at other shipyards will not address these concerns.

## Summary

An extensive amount of material and data has been provided for my review. Although every piece of information provided could not be investigated within the time constraints of the review process, I have made considerable effort to make thorough use of all documents and supporting data during the review process. I have not discussed above all issues that I considered relevant to my review decisions regarding site-specific AETs, but instead have highlighted certain issues to clarify significant points. There are additional issues such as selection and use of reference sites, use of indicator chemicals, background determinations, and other interpretations of data that I have not discussed, but have contributed to my answering the central question regarding site-specific AET use at other shipyards.

Although I find no fault with the mechanics of development of site-specific AETs for Campbell Shipyards, I feel the minimal amount of data used in their development brings their reliability into question. I contacted the WA Dept. of Ecology group responsible for Puget Sound AET development and refinement, to ask them what they consider the minimum number of samples needed for AET development. The answer I received was around fifty samples, with synoptic chemical and biological measures, to provide what they consider adequate power and reliability. Larger data sets also allow for identification of data outliers that may bias results. Clearly site-specific AETs developed for Campbell evaluated far less data and in my opinion warrant extensive additional research before they can be considered reliable.

I find the Campbell site-specific AETs will likely not protect against adverse benthic community responses and that they do not adequately address reported human health hazards.

I find the argument that NASSCO and Southwest Marine Shipyards are similar to Campbell Shipyards unsupported by the minimal amount of data provided. Review of the available chemical data leads me to believe the sites are more likely dissimilar, but again minimal data makes this difficult to support.

In conclusion, I do not believe it is appropriate to apply the Campbell Shipyard or Shelter Island Boatyard Apparent Effects Threshold (AET) as sediment cleanup levels for the NASSCO and the Southwest Marine Shipyards.

If you wish to contact me regarding recommendations or clarification of any issues please feel free to do so.

Russell Fairey

## Russell Fairey- Curriculum Vitae

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### Education

1992 M. S., Marine Sciences, San Jose State University- Moss Landing Marine Laboratories, Moss Landing, CA

1984 B. S., Marine Biology, Texas A & M University, College Station, TX

Research Interest Marine geochemistry with emphasis on diagenesis and fate of chemicals of anthropogenic origin. Member- Science Advisory Group on Sediment Quality Assessment

### Publications

**Fairey, R.**, Long, E., Roberts, C., Anderson, B., Phillips, B., Hunt, J., Puckett, H., Wilson, C., Kapahi, G., Stephenson, M. A Recommended Method for Calculation of sediment Quality Guideline Quotients. (in review for *Environmental Toxicology and Chemistry*)

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**Fairey, R.**, Taberski, K., Lamerdin, S., Johnson E., Clark, R., Downing, J., Newman, J., Petreas, M. 1997. Organochlorines and other environmental contaminants in muscle tissue of sportfish collected from San Francisco Bay. *Mar. Poll. Bull.* 34 (12) 1058-1071

**Fairey, R.**, C. Bretz, S. Lamerdin, J. Hunt, B. Anderson, S. Tudor, C. Wilson, F. LeCaro, M. Stephenson, M. Puckett, and E. Long. 1996. Chemistry, Toxicity, and Benthic Community Conditions in Sediments of the San Diego Bay Region. California State Water Resources Control Board. Sacramento, CA. 162 pp.

San Francisco Regional Water Quality Control Board. 1995. Contaminant Levels in Fish Tissue from San Francisco Bay. California State Water Resources Control Board. **R. Fairey** and K. Taberski -eds. 149 pp.

**Fairey, W.R.**, K.S. Johnson, K.H. Coale, W.M. Berelson, T.L. Coley, V.A. Elrod, J.L. Nowicki, C. Chin, H.D. Iams. 1991. Trace metal analysis of sediment pore waters in a transect through the oxygen minimum of the California margin. 1991 Outstanding Student Paper, American Geophysical Union, San Francisco, CA. 042A-06

## Other Related Publications

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Jacobi, M., **R Fairey**, C. Roberts, E. Landrau, J. Hunt, B. Anderson, B. Phillips, C. Wilson, F. La Caro, B. Gwynne, M. Stephenson, and M. Puckett. 1998. Chemical and biological measures of sediment quality and tissue bioaccumulation in the North Coast Region. California State Water Resources Control Board. Sacramento, CA. 79 pp.

Phillips, B.M., B.S. Anderson, J.W. Hunt, J. Newman, R.S Tjeerdema, C.J. Wilson, E.R. Long, M. Stephenson, H.M. Puckett, **R Fairey**, J. Oakden, S. Dawson, and H. Smythe. 1998. Sediment Chemistry, Toxicity, and Benthic Community Conditions in Selected Water Bodies of the Santa Ana Region. California State Water Resources Control Board. Sacramento, CA. 105 pp.

Anderson, B.S., J.W. Hunt, B.M. Phillips, J. Newman, R.S Tjeerdema, C.J. Wilson, G. Kapahi, R.A. Sapudar, M. Stephenson, H.M. Puckett, **R Fairey**, J. Oakden, M. Lyons, and S. Birosik. 1998. Sediment Chemistry, Toxicity, and Benthic Community Conditions in Selected Water Bodies of the Los Angeles Region. California State Water Resources Control Board. Sacramento, CA 232 pp.

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