has been achieved. The request for biological monitoring and mitigation should be denied for the procedural reason that it was raised so late in the CAO proceedings. Substantively, there is no need for any biological monitoring because the testing conducted has shown no adverse biological impacts at copper concentrations over four times higher than the current cleanup level. For the same reason, there is no need for any on-site mitigation. To the extent the EHC contention contemplates off-site mitigation, it lacks legal authority.

II. FACTUAL BACKGROUND AND PROCEDURAL HISTORY

This CAO concerns the discharge of copper concentrate by Paco Terminals, Inc. from Paco's operation at the Port District's National City Marine Terminal (NCMT). Paco conducted a bulk copper concentrate unloading, storage and loading operation from early 1979 through late 1986. (Port District's Response in Opposition to the Request of Paco Terminals, Inc. to Add the Port District as a Responsible Party under Cleanup and Abatement Order 85-91, Ex. 6, ¶2; CAO Add. No. 4, Finding ¶ 5.) The Regional Board issued an NPDES permit to Paco in November, 1979. (CAO Finding, ¶1.) The Regional Board renewed Paco's NPDES permit in November, 1984. (Id.)

In December, 1985 the Regional Board issued Cleanup and Abatement Order No. 85-91 to Paco Terminals. The CAO charged Paco's operation with copper contamination of the sediments near the NCMT.

In November, 1987 the Regional Board issued Addendum No. 1 to the CAO which, among other things, established a cleanup level for copper within the sediment of 1,000 ppm. (CAO Add. No. 1, Directive ¶2.) The decision to set the cleanup level at 1,000 ppm was based on incomplete scientific data and inadequate analysis of the available data. (See Section III.B, infra.) It was also based on economic considerations which led Paco and the Regional Board Staff to believe that cleanup to the 1,000 ppm level would be economically and technically feasible. (See Section III.C, infra.)

In February, 1989 the Regional Board adopted Addendum No. 3 to the CAO, which added the Port District as a responsible party to the CAO. In August, 1989 the State Board, by a 3-2 vote, affirmed the Regional Board's decision in Addendum No. 3 for the reason that the Port District owned the land on which Paco operated. (San Diego Unified Port District, SWRCB No. WQ 89-12.)

After the State Board decision in 1989, the Port District concentrated its efforts on abating any risk of continuing discharge from the site. To date, the Port District has spent over $1.5 million on landside remediation.[3] Because the Port District had had no involvement in the development of the 1,000 ppm sediment cleanup level, or the economic or scientific feasibility studies supporting that cleanup level, it did not interfere with Paco's activities with respect to sediment cleanup.

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[3]The Port District's written testimony to the Regional Board dated November 22, 1991 estimated this figure as $1.3 million. (Port District Testimony 11/22/91 at 3.) However those figures were reviewed for depositions noticed by Paco in late December, 1991 for insurance litigation pending in Alabama, and were found to slightly exceed $1.5 million. (Hopkins Decl., ¶ 1. (Ex. 7))

In early 1990, the Port District was invited by Hon. Harry R. McCue, Magistrate of the United States District Court for the Southern District of California, to participate in settlement discussions of various federal court lawsuits concerning the cleanup problem. The settlement discussions had initially involved only a federal lawsuit filed by Paco against all of the mining companies that had shipped copper to Paco's facility and against the manufacturer hired by Paco to construct a custom-designed clamshell bucket Paco used to load the copper, which malfunctioned. The settlement discussions were expanded to include a later case Paco had filed against the Port District, in which the Port District counterclaimed against Paco. Also attending those settlement conferences were representatives of the regulatory agencies involved in the cleanup, including the Regional Board, EPA and DHS staff. (Port District January 31, 1990 Progress Report to Regional Board at 4.)

In late 1989 the primary focus of the discussions before Magistrate McCue was the feasibility of Paco's plan for ocean disposal of the sediment subject to the CAO. At that time, available ocean disposal sites had been temporarily closed and it was not clear when, or if, any would reopen to accept the sediment. After several inquiries from Magistrate McCue, EPA Staff eventually conceded that, even if the sites reopened, EPA would be extremely unlikely to authorize ocean disposal of sediment subject to a cleanup and abatement order, irrespective of the outcome of bioassay, toxicity and risk assessment studies on the sediment. Based on this information, the Port District and Paco were unable to continue to pursue ocean disposal as a viable remediation alternative. (Id.)

Magistrate McCue suggested that Paco discontinue such studies designed to obtain EPA clearance for ocean disposal, in favor of devising an alternative remediation plan that would be more likely to succeed. Magistrate McCue convened a "working group" as a subgroup of the settlement conferences, charged with devising an alternative remediation strategy. The members of the working group included representatives of Paco, the Port District, one of the mining companies, and the Regional Board Staff. (Port District April 30, 1990 Progress Report to Regional Board at 8.)

The working group meetings resulted in the development of the so-called "mining company option," which involves shipping the sediments back to one of the mining companies for recycling and reclaiming the valuable copper from the sediments. In 1990 and 1991 additional testing and feasibility studies were conducted which enabled the mining company to determine that the mining company option is technically feasible.

Having developed a technically feasible remediation alternative, Magistrate McCue's settlement discussions then turned to the issue of economic feasibility. Economic feasibility for the project was seriously threatened by Paco's having filed for bankruptcy protection in August, 1990. (Port District November 1, 1990 Progress Report to Regional Board at 3.) Although after several months Paco eventually withdrew its bankruptcy petition, its financial condition remains a concern.

Magistrate McCue suggested adding the parties' insurance carriers to the process. In August, 1991 the Port District moved for a stay of state court insurance litigation commenced by Paco in which the Port District had intervened, and successfully requested the state court judge presiding over that litigation to stay all proceedings and to refer all parties to Magistrate McCue for settlement conferences. (Port District November 22, 1991 Testimony to Regional Board at 25.)

In January, 1991 the Regional Board issued Addendum No. 6 to the CAO. Directive No. 5 of Addendum No. 6 required the parties to present and analyze new remedial action alternatives in light of the unavailability of ocean disposal. It also allowed the responsible parties to develop additional technical information to support a less stringent sediment copper cleanup objective that would protect the beneficial uses of San Diego Bay.

On August 1, 1991 the Port District and Paco submitted a report entitled Remedial Action Alternatives for National City Marine Terminal (the "Woodward-Clyde Report"). The Woodward-Clyde Report included several significant findings and conclusions in support of increasing the cleanup level for copper from 1,000 ppm (dry weight) to 4,000 ppm (dry weight). Those are listed in Addendum No. 7, Findings ¶10(a)-(l). The biological studies are set out in Section 2 of the Woodward-Clyde Report; the risk assessment studies are reported in Section 3.[4]

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[4]The report consists of two volumes: the Final Report and Appendices. The title of the report is Remedial Action Alternatives for National City Marine Terminal, Prepared for San Diego Unified Port District by Woodward-Clyde Consultants. The second volume is entitled Final Report Appendices. The Woodward-Clyde (footnote continued)

The Executive Summary of the Woodward-Clyde Report states:

> The risk assessment concludes the 1,000 mg Cu/kg remediation objective for the sediments in the vicinity of the NCMT established by the Water Quality Control Board, San Diego Region, is highly protective of aquatic life and other designated beneficial uses of San Diego Bay. Further, it is likely that a remediation objective considerably above that concentration would protect the designated beneficial uses of the Bay, and would be consistent with the intent of the San Diego Basin Plan and the California Ocean Plan. This is because the copper ore concentrate consists of a form of copper (cupric iron sulfide) that is highly insoluble in anoxic (oxygen-free) sediments such as those beneath the thin oxidized layer at the sediment surface in the vicinity of the NCMT. In addition, a variety of precipitation, complexation, and sorption reactions cause copper to be converted to non-toxic forms in both anoxic and oxic (oxygen-containing) waters, rendering the copper non-available and non-toxic to aquatic life in sediments and marine water.

(Woodward-Clyde Report at ES 2-3.)

The Regional Board set a hearing for December 9, 1991 on the issues of remediation plan deadlines and cleanup level. In written testimony submitted on November 22, 1991, the Port District requested that the cleanup level for copper be increased from 1,000 ppm to 4,000 ppm based on the findings and conclusion contained in the Woodward-Clyde Report.[5] The evidence submitted established that the copper in the sediment at the NCMT site is stable, highly insoluble and thus largely unavailable to aquatic life. It was also found to be non-toxic at the highest level

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(footnote continued from previous page)
Report is dated July 26, 1991 and was submitted to the Regional Board on August 1, 1991. The Woodward-Clyde Report is incorporated herein by reference.

[5]The Port District's November 22, 1991 written testimony, part of the Regional Board record, is incorporated herein by reference.

tested, up to 18,755 ppm. The evidence established that the existing 1,000 ppm cleanup level was overly protective of the aquatic life and the beneficial uses of San Diego Bay and that a significantly higher cleanup level would not adversely affect the aquatic life of the beneficial uses of San Diego Bay. As a result, at the hearing the Regional Board Staff stipulated that there would be no adverse biological impact to San Diego Bay at a 4,000 ppm cleanup level -- or higher. (Hearing Tr. at 57.)

In addition, the evidence submitted on December 9 established that a cleanup level more stringent than 4,000 ppm would jeopardize the mining company option. (Port District November 22, 1991 Testimony at 3-4, 12-17; Ex. 1, App. A.) The evidence also established that the mining company option, while not yet finalized, presented the only available and practicable alternative for complying with the CAO's current completion deadline of April, 1993. (Port District November 22, 1991 Testimony at 25-27.)

As a result of this evidence, the Regional Board on December 9, 1991 adopted Addendum No. 7 to the CAO which raised the cleanup level from 1,000 ppm to 4,000 ppm copper and which maintained the current April, 1993 deadline for completing the cleanup.

Since the adoption of Addendum No. 7, significant progress has been made in implementing the mining company option to accomplish the cleanup. In 1992 discussions between Port District and mining company technical personnel have resulted in the development of a specific plan to implement the mining company option.

(Hopkins Decl., ¶¶ 3-4. (Ex. 7)). However, it is the Port District's understanding that these plans are dependent upon maintaining the current 4,000 ppm cleanup level. (Id. at ¶ 5.) The mining company has notified the Port District that the mining company option will require the construction of certain capital improvements at the plant to handle the sediment. (Id. at ¶ 4.) It is the Port District's understanding that the specifications of these improvements, and other logistical and technical considerations for the project, depend upon the volume of the sediment to be shipped and processed and on the copper content of the sediment. Changing the cleanup level back to the former 1,000 ppm level would so greatly increase the overall quantity of sediment, and decrease the amount of recoverable copper, that it would require, at least, re-inventing the project, which would be fatal to compliance with the current April, 1993 completion deadline in the CAO. More significantly, those changes could render the entire project technically infeasible.

Also in 1992, the parties to Magistrate McCues's settlement conferences (Paco, the Port District, the mining companies, and the insurance companies) have circulated drafts of a settlement agreement that would resolve all litigation and would create a mechanism for accomplishing the mining company option and for funding the cleanup. However, all recent drafts of that settlement agreement (now almost in final form) are contingent upon maintaining the current 4,000 ppm cleanup level. It is the Port District's belief that the mining company option may only be accomplished as part of the overall settlement agreement. Thus, the mining company option, the only available cleanup methodology currently developed, is contingent on maintaining the 4,000 ppm cleanup level for economic and practical reasons, as well as for the technical reasons discussed above. (Hopkins Decl., ¶ 5. (Ex. 7))

III. ARGUMENT

A. Introduction

The arguments presented by the Petitioners in support of their various contentions overlap. This submission will refute the Petitioners' supporting arguments in the following format:

(1) The former 1,000 ppm cleanup level was not based on sound scientific data; it therefore does not establish the maximum level that will protect the beneficial uses of San Diego Bay and should not be reinstated;

(2) The Regional Board may consider economic and practical factors in determining the cleanup level;

(3) There is no factual basis for concluding that copper concentrations in the sediment of 4,000 ppm (or the difference between concentrations of 1,000 ppm and 4,000 ppm) will contribute to exceeding the water column objectives of the EBE Plan;

(4) The numerical water quality objectives of the EBE Plan do not apply to this CAO involving sediment cleanup; the 4,000 ppm cleanup level complies with EBE Plan requirements because that cleanup level has no adverse impacts on beneficial uses;

(5) The Regional Board decision setting the cleanup level properly and lawfully considered the practical consideration that the viability of the mining company option for cleaning up this site depended upon raising the cleanup level; and

(6) There is no factual or legal foundation for requiring a biological monitoring or mitigation program as part of this CAO.

B. The Former 1,000 ppm Cleanup Level was Based on Incomplete and Inadequate Scientific Evaluation, Which is Disproved by the Current Scientific Information.

Petitioners maintain that it was error for the Regional Board to change the 1,000 ppm remediation objective adopted in November, 1987, and contend that the former 1,000 ppm cleanup level is the legally established maximum allowable level to protect the beneficial uses of San Diego Bay. However, that remediation objective was based on incomplete or inadequate scientific data which is disproved by the current information.[6]

[6] The current data is contained in a number of sources which are part of the Regional Board record or have been otherwise submitted to this Board, all of which are incorporated herein by reference, including: Sections 2 and 3 of the Woodward-Clyde Report, which includes biological, toxicity and risk assessment studies conducted by Dr. G. Fred Lee and Dr. Anne Jones-Lee as a subcontractor to Woodward-Clyde (Lee and Jones 1991) and which were incorporated into the Woodward-Clyde Report; the Port District's written direct testimony for the December 9, 1991 hearing submitted on November 22, 1991, which includes discussions of scientific issues incorporating the work of Dr. Jean Nichols of Woodward-Clyde and Dr. Lee and Dr. Jones-Lee; the oral hearing testimony submitted on behalf of the Port District, in particular that of Dr. Nichols and that of Dr. Lee and Dr. Jones-Lee (contained in the December 9, 1991 hearing transcript and summarized in Appendix A to Exhibit 1 hereto, consisting of selected overheads prepared for use at the Regional Board December 9, 1991 hearing); supplemental written testimony prepared by Dr. Lee and (footnote continued)

Although the Port District was not a party to the CAO in November, 1987, the Port District had the opportunity to review the Regional Board Staff's technical decision making process regarding the establishment of the 1,000 ppm cleanup standard during depositions of Greg Peters, David Barker and Lance McMahan conducted by insurance company lawyers in the state court insurance litigation commenced by Paco in which the Port District intervened. Those depositions included questions concerning Regional Board Biologist Greg Peters' June 30, 1987 memorandum to the Paco Terminals file (and to Lance McMahan and David Barker, also of the Regional Board Staff) (Ex. 3) concerning the 1987 decision to set the cleanup level at 1,000 ppm. Based on those depositions, the four-page handwritten Peters memorandum summarizes the Regional Board Staff's complete biological analysis supporting the 1,000 ppm cleanup level.[7]

(footnote continued from previous page)
Dr. Jones-Lee for the December 9, 1991 hearing which addresses issues raised in written submissions following the filing of the Port District's written testimony on November 22, 1991 (Ex. 1, Appendix B); and the Comments of Dr. Lee and Dr. Jones-Lee to the EHC Petition (Ex. 1 hereto).

[7]Exhibit 3 hereto is the Peters Memorandum, in its entirety. Exhibits 4 - 6 hereto constitute portions of the deposition testimonies of Greg Peters, David Barker and Lance McMahan (respectively) of the Regional Board Staff related to the setting of the cleanup level in 1987. David Barker was unable to identify any other biological information supporting the cleanup level. Barker Tr., p. 225, line 14, through p. 226, line 16 (Ex. 5). Moreover, as of the date of Mr. Peters' deposition (July 24, 1991), Mr. Peters was not aware of any better or more reliable information on the biological effects of the copper concentrate on marine organisms of the type that might be found in San Diego Bay. Peters Tr., p. 57, lines 10-14 (Ex. 4). (The responsible parties submitted the results of the aquatic chemistry, bioassay, toxicity and risk assessment studies to the Regional Board Staff shortly thereafter, on August 1, 1991.)

The key reason the Regional Board Staff adopted the 1,000 ppm cleanup level in 1987 appeared to be that the Staff found (based upon work done by Paco's consultant, Westec) a positive correlation between copper content in the sediment and copper found in the interstitial water in the sediment. Peters Memorandum (Ex. 3, pp. 3-4). However, upon review of the information compiled by Paco's consultant, Drs. Lee and Jones-Lee found that the analytical procedure used did not distinguish between soluble and particulate forms of copper. (Ex. 1, App. B at 11-12.) Because the form of copper at the site is highly insoluble, this incorrect methodology resulted in an inaccurate exaggeration of the amount of soluble and potentially toxic copper in the interstitial water of this sediment. (Lee and Jones Comments at 6-7, 11-12 (Ex. 1); Lee and Jones Supplemental Testimony at 11-12. (Ex. 1, App. B))

The analytical error was then compounded by using improper statistical analyses that involved the arbitrary removal of data points, the utilization of which establishes that there is no statistically relevant correlation between interstitial water concentrations and sediment concentrations. Lee and Jones Supplemental Testimony at 14-16 (Ex. 1, App. B).

Further, even if the measurement had been correct, interstitial water concentrations of heavy metals in anoxic sediments should not be used as a basis for judging the availability of copper to oxygen-dependent benthic organisms. Various chemical reactions occur in sediments that tend to make the copper and other heavy metals in interstitial waters non-toxic to the aquatic life upon exposure to dissolved oxygen. (Port District November 22, 1991 Testimony at 17; Woodward-Clyde Report at ES 2-3, quoted above.)

The Peters Memorandum also shows that the 1,000 ppm cleanup level was recommended to guard against potential but unknown problems that might be caused by the copper in the sediment. Peters Memorandum at 1-2 (Ex. 3). The evidence submitted has disproved those potential problems, primarily because the copper in the sediment has been shown to be non-toxic up to the highest concentrations tested. (Woodward-Clyde Report, Sections 2.0 and 3.0. The aquatic chemistry, bioassay, toxicity and risk assessment studies are summarized in the Port District's November 22, 1991 Testimony at 12-21.)[8]

Another concern expressed in the Peters Memorandum supporting the 1,000 ppm cleanup level was a concern that, if the copper were ultimately shown to be toxic (which has now been shown not to be true), possible extension of the copper plume through migration posed an environmental threat to additional areas of San Diego Bay. (Peters Memorandum at 2-3 (Ex. 3); Peters Tr. at 44, lines 5-23. (Ex. 4)) Now, lab testing supports that the copper concentrate in the sediment is non-toxic, at least up to 18,755 ppm. Moreover, the recent studies reported in the Woodward-Clyde Report show no evidence that the sediment is moving laterally. The copper appears to be moving deeper into

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[8]The Peters Memorandum is replete with such references as to what "might" occur. In this regard, the Peters Memorandum is similar to the contentions in the EHC Petition, which present a shotgun approach to possible scenarios which might occur. (See Section D, infra.) The current evidence is sufficient to address all of these concerns.

the sediment because it is more dense than the rest of the sediment. As a result, any migration that is occurring is only making the copper less bioavailable, not more. (Port District November 22, 1991 Testimony at 6-7; Woodward-Clyde Report, Section 7.1.1.)

C. <u>The Regional Board Properly Considered Economic and Practical Factors in Changing the Cleanup Level From 1,000 ppm to 4,000 ppm.</u>

The EHC contends that it was improper for the Regional Board to consider economic or practical factors in changing the cleanup level from 1,000 ppm to 4,000 ppm. The EHC is incorrect.

The Regional Board's 1987 decision adopting the previous 1,000 ppm cleanup level was itself based, in part, on economic considerations. Finding ¶24 to Addendum 1 to the CAO contains an analysis of cost and feasibility considerations for five different options at each of three cleanup levels. The total cost estimate for a cleanup to 1,000 ppm based on ocean disposal was less than $500,000. (<u>Id</u>.) The current estimated cost of remediating the sediment to the 4,000 ppm cleanup level through the mining company option is estimated to exceed $4 million.[9]

Just as economic factors were properly included in the analysis in setting the original cleanup level in 1987, they were also properly included in the analysis in December, 1991. The Water Code authorizes the Regional Board and the State Board to

[9] At the Regional Board hearing on December 9 the Port District estimated that meeting a 4,000 ppm cleanup level would cost approximately $2.5 million. However, that estimate was based on removing, shipping and recycling 5,000 cu. yds. of sediment. Current estimations, including normal overdredge factors and additional overdredging needed to reach sediments which exceed the 4,000 ppm level, call for removing, shipping and recycling about 10,000 cu. yds. of sediment. Hopkins Decl., ¶2. (Ex. 7))

consider economic factors in water quality determination. Water Code §13000. In addition, Regional Boards must take economic considerations into account in establishing water quality objectives. Water Code §13241. The importance of considering economic impacts was also recognized by the State Board in Environmental Health Coalition, SWRCB Order No. WQ 91-10.

D. The Regional Board and State Board Should Not Take Into Account Imaginary and Unlikely Contingencies Posed by Petitioners in Determining the Cleanup Level.

Like the Regional Board analysis in 1987, the Petitions present a variety of possible scenarios, unsupported by any evidence, to support their contentions that the 4,000 ppm cleanup level poses some threat to San Diego Bay. The current evidence establishes beyond any doubt that the 4,000 ppm cleanup level is highly conservative and protective of all beneficial uses of San Diego Bay. In fact, the Regional Board Staff stipulated at the December 9 hearing that there would be no adverse biological impact to San Diego Bay at a 4,000 ppm cleanup level -- or higher. Hearing Tr. at 57.

For example, the EHC Petition questions whether the current cleanup level is inappropriate because it could cause potential difficulties under possible future scenarios involving future maintenance dredging at the site, prop wash, or changes in pH, salinity or water temperature. There is no evidence that any of these future contingencies cited by the Petitions would increase any risk of adverse impacts on the beneficial uses of San Diego Bay.

As is explained in Exhibit 1, increases in water temperature would not increase the bioavailability or toxicity of the copper located in the sediment. (Lee and Jones Comments at 8-9. (Ex. 1)) Any increase in pH or salinity would also not be expected to increase the copper's bioavailability or toxicity.[10] (Id.)

Prop wash and dredging activities apparently are a concern to the Petitioners because they might "stir up" the sediment and make the copper more bioavailable. However, prop wash and dredging activities cannot be expected to stir up sediments to a greater extent than the sediments exist in bioassay and biotoxicity testing elutriates. That testing has shown no adverse biological impacts at levels higher than 18,000 ppm, far above the Regional Board's 4,000 ppm cleanup level. (Summary of Bioassay and Toxicity Tests (Ex. 1, App. A at 21-22); Port District November 22, 1991 Testimony at 3, 12-17.)

Finally, the EHC Petition expresses a concern that if the cleanup is required only to the 4,000 ppm level, maintenance dredge spoils may not be easily disposable. That contention is also unsupportable. The bioassay and toxicity tests show no results incompatible with ocean disposal, at levels much higher than the 4,000 ppm cleanup level. (Id.) The 4,000 ppm cleanup level would also accommodate ordinary landfill disposal of remaining sediments because that cleanup level is lower than the California Title 22 limit. (Lee and Jones Comments at 9-10

[10] Moreover, any substantial change in pH (which is not anticipated in any event) would have many other much more serious biological impacts than increasing copper availability. Lee and Jones Comments at 8. (Ex. 1))

(Ex. 1); Port District November 22, 1991 Testimony at 12.) Thus, there is no reason to believe that disposal of dredge spoils after this cleanup to 4,000 ppm would be any more problematic than disposal of dredge spoils after a cleanup to the former level of 1,000 ppm advocated by the Petitioners.

The EHC Petition also questions whether the constituent metals of the copper concentrate (mercury, lead, zinc, silver, and arsenic) may have an adverse impact on the Bay. That question is also answered by the existing test results. The bioassays and toxicity tests conducted on these sediments have shown that any contaminants present in the sediments at the site, whether from the copper itself, other constituents in the copper concentrate, or from other sources, are non-toxic to the variety of organisms (including sensitive life stages of those organisms) that have been tested. (Lee and Jones Comments at 8. (Ex. 1)) Similarly, the benthic community diversity studies have shown that any differences or similarities between organism assemblages at the site were not related to the amount of copper concentrate in the sediments; therefore, they are also not associated with the other constituents derived from the copper ore concentrate that are also in the sediment. (Id.)

E. The 4,000 ppm Cleanup Level Does Not Contribute to a Violation of the EBE Water Quality Objective for Copper.

The EHC contends that the Regional Board is precluded from raising the cleanup standard from 1,000 ppm to 4,000 ppm because the difference will contribute to a violation of the EBE Plan's water quality objective for copper. From the technical information available, there is no relationship expected or found between the concentrations of copper in the sediments at the site and the concentrations of copper in the water column over those sediments. Moreover, there is certainly no basis for any contention that any difference between 4,000 ppm and 1,000 ppm in the sediments would make any difference in any contribution of the copper in these sediments to any copper in the water column.

The EHC's contention is based on faulty scientific analysis. The EHC bases its contention on attempts to derive water column concentrations from interstitial water concentrations and/or from elutriate concentrations. This approach used to develop and interpret the interstitial water data is technically invalid. Any correlation between the interstitial water concentrations and water column concentrations for copper is so low that statistically it is virtually irrelevant. (Lee and Jones Comments at 6-7; Lee and Jones Supplemental Testimony at 14-16. (Ex. 1, App. B)) Similarly, sediment elutriates used for toxicity testing do not provide any reliable estimate of water column concentrations for copper or for other metals. (Lee and Jones Comments at 7 (Ex. 1); Lee and Jones Supplemental Testimony at 16-19. (Ex. 1, App. B))

A comparison of data from the site also shows that there is no statistically relevant correlation between concentrations of copper in the sediment and concentrations in the water column. The EHC apparently assumes that the copper concentrations reported in a few samples of NCMT area water in 1986 properly describe the current water column concentrations. That sparse data cannot be considered sufficient or reliable for making that assessment in 1986. It certainly cannot be considered reliable for making that assessment today. Finally, it cannot be considered reliable in making any assessment based on the water column concentrations that would be achieved after cleanup to 4,000 ppm. (Lee and Jones Comments at 4-5 (Ex. 1); Lee and Jones Supplemental Testimony at 9-11. (Ex. 1, App. B))

This low correlation between sediment copper levels and water column copper levels is likely attributable, in large part, to the form of the copper utilized in Paco's operation and to its peculiar aquatic chemistry. The copper ore concentrate transferred at the NCMT was reportedly composed of finely divided cupric ferrous sulfide ($CuFeS_2$), which is highly insoluble in anoxic (oxygen-free) sediments such as those beneath the thin oxidized layer at the sediment surface at the NCMT. That form of copper, as it would exist in the sediments, is one of the most stable and insoluble forms of copper. (Woodward-Clyde Report at ES 2-3, quoted above; Port District November 22, 1991 Testimony at 17.) Therefore, it would be highly unlikely to be dispersed into the water column.

This lack of solubility and, therefore, lack of transferability to the water column, is also demonstrated by the mussel watch data. For example, the copper concentrations in body tissues in two species of mussels, including one living on the piling at the NCMT, are very similar to the concentrations of the same types of mussels from the NPDES control area off Chula Vista. (Port District November 22, 1991 Testimony at 15-16.)

All of this evidence refutes the EHC's unsupported contention that changing the cleanup level from 1,000 ppm to 4,000 ppm would somehow contribute to a violation of the EBE Plan water quality objective for copper.

F. The Numerical Water Quality Objectives of the EBE Plan Do Not Apply to This CAO Involving Sediment Cleanup; the 4,000 ppm Cleanup Level Complies with EBE Plan Requirements Because it Has No Adverse Impacts on Beneficial Uses.

Even if this Board finds, despite the evidence, that there is some factual basis for determining that the difference between the 4,000 ppm cleanup level and the 1,000 ppm cleanup level could contribute to a violation of the EBE Plan's water quality objective, that numerical objective is nevertheless inapplicable to this determination concerning the appropriate cleanup level. The EBE Plan is not designed to regulate existing sediment contamination. Rather, the EBE Plan is prospective. Its numerical objectives are designed for setting standards for effluent limitations for permitted discharges of waste into enclosed bays and estuaries. (EBE Plan at 1.)

Sediment quality is addressed in the EBE Plan only with respect to the narrative objectives, and not the numerical objectives of the plan. The narrative objectives section states:

> The concentration of toxic pollutants in the . . . sediments . . . shall not adversely affect beneficial uses.

(EBE Plan, p. 3.)

The evidence previously discussed clearly establishes that the 4,000 ppm cleanup level would not adversely affect any beneficial uses of San Diego Bay. All of the aquatic chemistry, bioassay, toxicity and risk assessment studies submitted establish that there are no adverse biological effects caused by the copper concentrate in the sediment, at levels much higher than the 4,000 ppm cleanup level adopted by the Regional Board. (Summary of Bioassay and Toxicity Tests (Ex. 1, App. A at 21-22); Port District November 22, 1991 Testimony at 3, 12-17.) Again, the Regional Board so stipulated at the hearing.

The natural occurrence of the mussel Mytilus edulis at the site is particularly compelling evidence supporting the conclusion that there is no adverse impact to any beneficial uses of San Diego Bay from the copper concentrations in the sediment. Embryos of this species have been found by the EPA to be the most acutely sensitive to copper of all the marine organisms it evaluated. This species presently occurs naturally off the NCMT in an area in which the sediments contained some of the highest concentrations of copper. (Port District November 22, 1991 Testimony at 15-16.)

The word "sediment" also appears in the EBE Plan in the definition of "objectionable bottom deposits," which, in turn are used in defining standards for determining "mixing zones." Again, however, there are no numerical sediment standards set in this context. Objectionable bottom deposits are defined as

> . . . accumulation of materials or substances on or near the bottom of a water body, which create conditions that adversely impact aquatic life, human health, beneficial uses or aesthetics.

(EBE Plan, Appendix A at 1-2.) The evidence establishes that the copper in the sediments at the NCMT does not have any adverse impact on aquatic life, human health, beneficial uses or aesthetics.

As previously discussed, this lack of adverse impact is most likely attributable to the particular form of the copper handled by Paco which is now located in the sediments off the NCMT. This form of copper is much less bioavailable, and therefore much less toxic, than other sources of copper in San Diego Bay, such as copper originating from anti-foulant paint, which is designed to be bioavailable and toxic. (Port District November 22, 1991 Testimony at 17.)

The overall water quality regulating scheme in California also supports that the EBE Plan does not regulate sediment quality. In 1989 Water Code §13391.5 was passed, defining sediment quality objectives. Those objectives are defined as levels which will support "the reasonable protection of beneficial uses of water or other prevention of nuisances." Water Code §13393 provides that standards should be based on, among other things, bioassays and adequately protecting the most sensitive aquatic organisms. The bioassay and toxicity studies as reported in the Woodward-Clyde Report and the other evidentiary submissions supporting the change in the cleanup level all establish that a sediment cleanup level of 4,000 ppm -- <u>and much higher</u> -- will protect these most sensitive aquatic organisms. The summary of toxicity test results (Ex. 1, App. A at 21-22) establishes that there was no significant difference in the response of test organisms subjected to concentrations much higher than 4,000 ppm, up to the highest levels tested. Also, the natural occurrence of <u>Mytilus edulis</u> at the site supports the contention that copper concentrations much higher than 4,000 ppm are protective of the most sensitive aquatic organisms.

Thus, the EBE Plan's water quality objective should not be applied to this CAO regarding sediment cleanup.[11]

G. The Mining Company Option is Contingent on Maintaining the Current 4,000 ppm Cleanup Level.

Other than the Port District's completion of landside remediation, the most significant progress in this case has been made in the settlement conferences being held before Magistrate McCue, which have resulted in the development of the mining company option. Now, after almost two years of additional chemical and toxicity tests for the mine, dredging tests, dewatering tests, transportation feasibility analysis, and other tests, the mining company option appears to be technically and financially feasible. As a result, compliance with the 4,000 ppm cleanup level prior to the April, 1993 deadline is within our grasp. However, if the cleanup level is changed from 4,000 ppm back to 1,000 ppm, the mining company option would not be financially or technologically feasible. At the very best, substantially more time would be lost in redeveloping the mining company option for the different cleanup level. At worst, the cleanup might not be

[11]Even if this Board should find that the EBE Plan's numerical water quality objectives apply to the copper content in these sediments, the Regional Board's 4,000 ppm cleanup level should nevertheless be upheld. The aquatic chemistry, bioassay and toxicity testing submitted by the parties constitute substantial compliance with the requirement for developing site-specific standards as contemplated by the EBE Plan. The site-specific bioassay and toxicity testing performed conclusively established that there are no adverse biological effects at copper concentrations much higher than 4,000 ppm, up to over 18,755 ppm (the highest level tested).

completed at all, for the lack of technical or financial means to accomplish it.

As previously described, the mining company option is the basis for a cooperative agreement reached in conferences before Magistrate McCue involving Paco, the Port District, all of the mining companies, the manufacturer of the clamshell bucket that failed during Paco's loading operations, and insurance companies for various parties. There is presently circulating among all of those participants a draft settlement agreement (almost in final form) that will accomplish the cleanup pursuant to the mining company option. (Hopkins Decl., ¶ 5. (Ex. 7))

However, that agreement is <u>contingent</u> upon maintaining the current 4,000 ppm cleanup level, because the mining company option itself is dependent upon that cleanup level. (<u>Id</u>.) Changing the cleanup level would affect two critical factors on which the mining company option is dependent: the volume of material and the copper concentration of the material. Changing either factor seriously jeopardizes the settlement and the mining company option.

After the Regional Board's decision to change the cleanup level to 4,000 ppm, technical meetings between the Port District and the mining company resulted in the development of a method for handling and recycling the anticipated volume of copper (10,000 cu. yds.) that will need to be dredged to reach the 4,000 ppm cleanup level. To obtain this capacity, the mining company has stated that it will need to construct significant capital improvements (at the expense of the project). The Port District's understanding is that this equipment is designed to handle the anticipated volume of the sediment. (Hopkins Decl., ¶ 4. (Ex. 7))

If the cleanup level is changed back to 1,000 ppm, the volume of sediment will more than double. In addition, the copper that may be reclaimed from the sediment in the recycling process will be dramatically reduced. Both of these fundamental changes would require a "return to the drawing board" for determining whether, and under what circumstances, the mining company option could be used for the remediation project. Also, of course, changing the cleanup level will increase the cost of the cleanup by approximately $3.5 million. (Hearing Tr. at 16.)

Therefore, for technical as well as financial reasons, the draft settlement agreements reached among all the parties to accomplish the cleanup are <u>explicitly contingent</u> upon maintaining the current 4,000 ppm cleanup level. (Hopkins Decl., ¶ 5. (Ex. 7)) The Regional Board's approval on December 9 of the mining company option as the recommended remedial action plan, and raising the cleanup level to 4,000 ppm, recognized that the cleanup would be much more likely to be achieved at that level. (Hearing Tr. at 93, Comments of Board Member Stockwell.)

The decision for the Regional Board obviously was made easier by the fact that there is no environmental difference between a cleanup at 1,000 ppm and 4,000 ppm. Moreover, it was also explicitly recognized by at least one Regional Board member that the 4,000 ppm cleanup level should still be sufficiently "punitive" to satisfy all interested parties because the total remediation cost at that level would be approximately $5.5

million, including landside remediation.[12] (Hearing Tr. at 91-92, Comments of Board Member Arant.)

H. The EHC's Requests for Biological Monitoring and Mitigation Programs Should be Denied for Both Procedural and Substantive Reasons.

Procedurally, the EHC request for an ongoing biological monitoring and mitigation program should be denied because it was raised so late in this proceeding. The EHC first raised this request in its November 26 written submission, only a few days before the December 9, 1991. The requests were properly denied by the Regional Board.

The concept of biological effects monitoring and mitigation had not been raised previously in any proceedings related to this CAO, dating back to December, 1985. The EHC's raising it now smacks of trying to exact an extra "pound of flesh" from the responsible parties in exchange for raising the cleanup level. This tendency of EHC was recognized by the Regional Board in reaching its decision to raise the cleanup level. (Hearing Tr. at 91-92, Comments of Board Member Arant.)

Substantively, the request for on-site monitoring or mitigation should be denied because there is no evidence that the copper in the sediment has caused any significant biological impact that would require monitoring or mitigation. As has been discussed, the biological evidence establishes that there are no

[12]The EHC Petition suggests that punitive steps are appropriate here because of the high value of the copper shipped through Paco's facility. The Port District, however, was compensated only on the basis of wharfage fees and square foot rent paid by Paco, not based or related to the value of the copper shipped.

adverse biological effects at a cleanup level of 4,000 ppm -- or higher.

The EHC request for on-site mitigation to restore the area of the cleanup should be denied. The only reason for any such restoration would be that the remediation activities themselves would cause harm to the significant benthic and aquatic community that could be disturbed by the remediation activity. The Woodward-Clyde Report refutes that contention, in its recommendation of clamshell dredging for the remediation program.[13] (Woodward-Clyde Report, Section 6.1.)

Finally, to the extent that the EHC contention contemplates off-site mitigation, it lacks legal authority. There is no statutory, regulatory or decisional authority for the Regional Board to require off-site mitigation as part of a cleanup and abatement order. Even if there were legal authority, off-site mitigation would not be appropriate in this case, where there is no evidence that the unauthorized discharges caused any significant biological harm.

IV. CONCLUSION: THE REGIONAL BOARD'S DECISION IN ADDENDUM NO. 7 TO RAISE THE CLEANUP LEVEL FROM 1,000 ppm TO 4,000 ppm SHOULD BE AFFIRMED.

The parties have, at long last, determined an economically and technologically feasible means of accomplishing the cleanup

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[13] The EHC's request for on-site mitigation after the cleanup raises one valid point, however. There currently exists a significant benthic and aquatic community at the site. The EHC's request for mitigating the area after dredging suggests that a "no-action" alternative would be the best means of protecting those communities and the beneficial uses of San Diego Bay. Therefore, the Port District requests that, if the cleanup level is to be changed at all, it should be increased to allow higher concentrations of copper within the sediment or changed to a no-action alternative.

through the mining company option. However, that feasibility is contingent on the 4,000 ppm cleanup level. While economic feasibility should not come at the expense of environmental quality, that would not be the case here. The evidence is clear that there is no environmental advantage to be gained from reimposing the former 1,000 ppm cleanup level. Therefore, the Petitions should be denied and the Regional Board's 4,000 ppm cleanup level should be affirmed. In the alternative, if the cleanup level is changed at all, it should be made less restrictive because the evidence clearly establishes that greater concentrations of copper are not harmful to the beneficial uses of San Diego Bay.

June 3, 1992

Respectfully Submitted,

for

David B. Hopkins
HILLYER & IRWIN
Counsel to San Diego Unified
Port District

Comments on

Environmental Health Coalition Petition for Review by State Water Resources Control Board of Regional Water Quality Control Board, San Diego Region's Adoption of Cleanup and Abatement Order 85-91 Addendum No. 7 on December 9, 1991; Submitted to State Water Resources Control Board January 8, 1992

G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D.
G. Fred Lee & Associates
El Macero, CA 95618

May 28, 1992

On January 8, 1992, the Environmental Health Coalition (EHC) filed a petition with the State Water Resources Control Board (State Board) to review the San Diego Regional Water Quality Control Board's (Regional Board's) adoption of Addendum No. 7 of Clean-up and Abatement Order No. 85-91 on December 9, 1991 for the copper-contaminated sediments near the National City Marine Terminal (NCMT). The EHC petition alleged that the Regional Board inappropriately adopted the 4,000 mg Cu/kg dry wt. clean-up objective for those sediments. We (Drs. Lee and Jones-Lee) conducted the risk assessment studies that supported the clean-up objective adopted, and submit these comments to address the technical issues raised by EHC in its petition.

OVERALL EVALUATION

The EHC petition is without technical merit. The 1,000 mg Cu/kg dry wt. clean-up objective originally proposed by the Regional Board and now supported by the EHC in its petition was based on a technically improper assessment of unreliable information. The adoption of the 1,000 mg Cu/kg dry wt. objective would cause a significant waste of public and private funds without improvement in water quality beyond that which could be achieved by the 4,000 mg Cu/kg dry wt. clean-up objective. It is our conclusion that the Regional Board's adoption of the 4,000 mg Cu/kg clean-up objective is technically appropriate, protective of the beneficial uses of the waters of San Diego Bay, and cost-effective in addressing the copper-contaminated sediment in the NCMT area. The results of toxicity tests conducted on sediments containing as much as 18,000 mg Cu/kg dry wt. (the highest concentration tested) showed that copper in those sediments was not toxic to the sensitive organisms tested. On the basis of the risk assessment we conducted and the written and oral testimony presented by the Port to the Regional Board at the December 9, 1991 hearing, the Regional Board staff stipulated at that hearing that there would be no biological effects that would result from a clean-up objective of 4,000 mg Cu/kg dry wt. - or higher (Hearing Transcript page 57).

BACKGROUND

In the spring of 1991, the San Diego Unified Port District (Port) and Paco Terminals selected us to conduct an aquatic life and public health risk assessment of the copper-contaminated sediments in the NCMT area. That risk assessment (Lee and Jones-Lee, 1991) was incorporated into the report entitled, "Remedial Action Alternatives for National City Marine Terminal" (WCC, 1991) submitted by the parties on August 1, 1991 pursuant to Directive 5 of Addendum No. 6 to Clean-up and Abatement Order No. 85-91. That risk assessment was based on the results of studies that had already been conducted on those sediments and their impacts on water quality, information from the literature, and studies to evaluate the reliability of previous studies and current conditions in the NCMT area. Particular emphasis was given to whether the 1,000 mg Cu/kg dry wt. objective initially selected by the Regional Board would be protective of the beneficial uses of San Diego Bay. Through an integrated evaluation of aquatic chemistry and aquatic toxicology information pertinent to the potential water quality impact of the copper in the NCMT-area sediment, we concluded in the risk assessment that

- the 1,000 mg Cu/kg clean-up objective was based on inappropriate interpretation and use of inadequate and unreliable data collected as part of previously conducted studies at the site;

- the copper in the sediment in the NCMT area was not toxic to sensitive aquatic organisms tested;

- organisms known to be particularly sensitive to copper toxicity live in areas of the NCMT area in which the sediments contain some of the highest concentrations of copper measured;

- from a technical perspective, the clean-up objective could be raised to at least 18,000 mg Cu/kg dry wt. (the highest level tested) and still protect beneficial uses of the Bay;

- the numbers and types of organisms in the NCMT area of San Diego Bay appear to be unaffected by the copper presently in the NCMT-area sediments.

We recommended to the Port and to the Regional Board that the clean-up objective be raised to 4,000 mg Cu/kg. That value was based on the finding of no toxicity associated with sediments containing substantially higher concentrations of copper, and the fact that the selection of a higher objective could prompt criticism that Department of Health Services' Title 22 materials classification levels were being exceeded.

We testified on the aquatic toxicity, water quality, and aquatic chemistry issues of the NCMT-area copper-contaminated sediment before the Regional Board on December 9, 1991. We also prepared the water quality portion of the Port's written testimony submitted on November 22, 1991 for that hearing. Included herewith as Appendix A are copies of transparencies given to the Regional Board members at that hearing; they summarize the key technical issues of our testimony. Included as Appendix B is Supplemental Testimony we prepared after the November 22, 1991 submission and before the Regional Board's December 9, 1991 hearing, to address technical aspects of Tentative Addendum No. 7 and to address written comments by the Environmental Health Coalition in a letter to the Regional Board dated November 26, 1991.

SPECIFIC COMMENTS ON EHC PETITION

Page 1 paragraph 2

EHC stated,

> *"This cleanup level* [4,000 mg Cu/kg] *is a violation of both Regional Board Order 85-91 Addendum #6, Directive 5 and causes a water quality standard violation under the Enclosed Bays and Estuaries Plan adopted by the State Water Resources Control Board."*

As discussed below, EHC's allegations of violations of the Order and of state "standards" (objectives) are unfounded; they also incorrectly imply that the so-called violations represent an impairment of designated beneficial uses of San Diego Bay. The risk assessment studies that we conducted demonstrated that such an implication is inappropriate and is contrary to the technical information that has been obtained regarding the impact of the copper-contaminated sediments in the NCMT area on various aspects of water quality in San Diego Bay. This point is discussed further below.

Page 2, Issues

EHC listed seven "reasons" that it claimed forms the foundation for its allegation that the Regional Board acted improperly in adopting Addendum No. 7 of Order 85-91. The succeeding five pages of the petition provided discussion of each of the "reasons." The technical aspects of those EHC contentions - "reasons" - and associated discussion are reviewed, by number, below.

EHC Contention 1. *"The criteria required to be met under Directive #5 of Addendum #6 of Order 85-91 were not met by the dischargers, thus the cleanup level should not have been changed."*

In its discussion, the EHC noted the requirement of Addendum No. 6 that an alternative clean-up strategy be in compliance with the California Water Quality Control Plan for Enclosed Bays and Estuaries of California, and cited the numeric, one-hour average concentration objective for copper of 2.9 μg/L. The EHC argument was,

> *"The dischargers did not demonstrate that a cleanup level, other than 1,000 ppm met the water quality standard for copper required in the EBE* [Enclosed Bays and Estuaries] *plan. In fact, the evidence available at the hearing showed that the new cleanup level well (sic) exceed the 2.9 ppb copper level (Please see discussion under issue #2). Allowing RPs* [responsible parties] *to advocate for a new cleanup level violates Directive 5 of Addendum #6."*

EHC did not specify what "evidence" was presented that it believed to show that a 4,000 mg Cu/kg dry wt. clean-up level would result in an exceedance of the copper objective. However, the "evidence" presented in EHC's "issue no. 2" cited as providing the evidence, was a reference to information that had been presented by the Regional Board staff in its *Tentative* Addendum No. 7, Finding no. 14. As a matter of record, after reviewing the full technical information on the matter of the water quality significance of the copper-contaminated sediments in the NCMT area, the Regional Board justifiably did not accept as technically valid any of Finding no. 14 in Tentative Addendum No. 7 or in the Errata Sheet No. 1 for Tentative Addendum No. 7 in its December 9, 1991 decision (Hearing Transcript page 94; Addendum No. 7 to Cleanup and Abatement Order No. 85-91 sent December 16, 1991). (That notwithstanding, the technical issues pertinent to that now-deleted unjustified "Finding" and technical documentation that refutes that "Finding" are discussed specifically and in detail in Appendix B (pp. 11 to 20) and in broader perspective by Lee and Jones-Lee (1991) incorporated into WCC (1991).) It is also noteworthy that Tentative Addendum No. 7 (as well as the final Addendum No. 7) acknowledged and did not challenge the results of the Lee and Jones-Lee (1991) risk assessment submitted to the Regional Board as WCC (1991), that showed that the copper in the NCMT-area sediments in concentrations greater than 1,000 mg Cu/kg dry wt. was not having an adverse impact on the beneficial uses of San Diego Bay. In fact, the Regional Board staff stipulated at the December 9, 1991 hearing that copper concentrations higher than 4,000 mg Cu/kg dry wt. in the NCMT-area sediments were not having adverse biological effects (Hearing Transcript page 57).

Key facts of the matter are as follows. The overriding criterion governing the clean-up objective should be the protection of the designated beneficial uses of San Diego Bay. The 4,000 mg Cu/kg dry wt. clean-up objective meets that requirement.

The EHC allegation in its contention no. 1 is not supported by the technical information available. First, the numeric water quality objectives only have applicability to the watercolumn, not to sediments or their interstitial waters, contrary to the "evidence" cited by EHC from Tentative Addendum No. 7. Second, by its citation, the EHC assumes that the copper concentrations reported in a few samples of NCMT-area water in 1986 properly describe the current watercolumn concentrations. As discussed in detail in Appendix B (pp. 9 to 11), those data cannot be considered sufficient or necessarily reliable for making that assessment in 1986, much less today. The evidence relative to the concentrations of available copper in the watercolumn today indicates that the organisms whose sensitivity to copper was the foundation of the US EPA criterion for copper (equivalent to the numeric objective) (*Mytilus edulis*) live naturally in the NCMT area and in fact were harvested as part of the WCC (1991) study from an area at the pierface of the NCMT at which the highest concentrations of sediment-associated copper in the area have been found. It is therefore apparent that whatever the concentration of available forms of copper in the watercolumn today, it is not sufficient to prevent the existence of that organism (see Lee and Jones-Lee, 1991; WCC, 1991 for further discussion).

The EHC referred to the tables of data of copper concentrations in elutriates of NCMT-area sediment as providing evidence of exceedance of the 2.9 μg Cu/L objective in San Diego Bay. By its statements EHC is asserting that sediment elutriates, being used for toxicity tests, provide a reliable estimate of concentrations of copper in the NCMT-area watercolumn. As discussed in Appendix B (pp. 16 to 18), laboratory tests of this type cannot be used to infer concentrations of contaminants in a watercolumn. We have published extensively on this topic and can state without reservation that EHC's use of concentrations of a contaminant in an elutriate bioassay to infer a violation of a watercolumn water quality objective near the NCMT is inappropriate.

The EHC allegation implies that since the numeric water quality objective is allegedly violated, an adverse impact to beneficial uses of the Bay is occurring. Toxicity tests conducted on NCMT-area sediments using sensitive test organisms at sensitive life-stages have shown that the sediments do not cause toxicity to those test organisms under test conditions more severe than would be expected in the watercolumn. Further, the mussel, *Mytilus edulis*, which has been reported by the US EPA to be the most acutely sensitive to copper in the embryo stage, has been found to be developing naturally in an area of the NCMT in which the sediments contain some of the highest concentrations of copper measured. It is evident that the copper in the NCMT-area watercolumn, irrespective of the sources, is not sufficient to preclude the existence of this highly copper-sensitive organism.

The EHC allegation draws unjustifiable and undocumented conclusions about the relationship between the copper ore concentrate in the sediment and the concentration of copper in the overlying water in the NCMT area, and contends that a clean-up objective of 1,000 mg Cu/kg dry wt. is needed in order to meet the numeric water quality objective. From the technical information available, however, there is no relationship expected or found between the concentrations of copper in the NCMT-area sediments and the concentrations in the watercolumn overlying those sediments. There is no justification to claim that removal sediment containing more than 1,000 mg Cu/kg dry wt. is needed in order to protect beneficial uses of the waters of the Bay or that such removal will have any influence on the concentrations of copper in the watercolumn.

The EHC allegation draws the unjustifiable and undocumented conclusion that a copper clean-up objective of 4,000 mg Cu/kg dry wt. would not comply with the Enclosed Bays and Estuaries Plan requirement to protect beneficial uses of the Bay. To the contrary, the technical information available and presented in the risk assessment and testimony of the Port indicates that a clean-up objective of more than 4,000 mg Cu/kg dry wt. would protect the beneficial uses of the Bay in accord with the Bays and Estuaries Plan as well as State Water Resources Control Board Resolution No. 68-16, 'Statement of Policy with Respect to Maintaining High Quality of Waters in California,' and the U.S. Environmental Protection Agency's Antidegradation Policy.

In conclusion, the technical information clearly shows that a clean-up objective of 4,000 mg Cu/kg dry wt. for the NCMT-area sediments will be protective of beneficial uses of San Diego Bay.

EHC Contention 2. *"The new cleanup level of 4,000 ppm is known to contribute to a water quality standard violation in San Diego Bay for Copper in violation of the standard of 2.9 ppb required in the EBE Plan."*

That claim of the EHC is without any technical foundation. The only "supporting" information provided by the EHC was quotation from Finding no. 14 of the *Tentative* Addendum No. 7, which as discussed above, was justifiably not supported by the Regional Board in its review of the matter on December 9, 1991. The technical aspects of that Finding are discussed in detail in Appendix B (pp. 11 to 22).

The unfounded claims of EHC regarding exceedances of water quality objectives associated with a 4,000 mg Cu/kg clean-up objective for the NCMT-area sediments were addressed above and in Appendix B.

EHC has reiterated the unjustifiable conclusion put forth in the Tentative Addendum No. 7 that the copper ore concentrate currently in the NCMT-area sediments contributes substantially to the copper concentrations measured in samples of the watercolumn and "interstitial water" in the NCMT area. However, from the technical information available, including data on copper concentrations in the watercolumn prior to the operations of Paco and copper concentrations in other areas of the Bay, we have concluded that the copper in the sediment in the NCMT area is not a major factor in controlling the concentration of copper in the watercolumn. Our position on this issue was supported by the Regional Board in its justified dismissal of Finding no. 14 of Tentative Addendum No. 7.

Tentative Addendum No. 7's claims, cited as support by EHC for its position, relied on inappropriate interpretation of statistical analyses and data manipulation to infer a relationship between the concentrations of copper in sediment and those in the associated interstitial water. As discussed in Appendix B, the approach that was used in the development and interpretation of the interstitial water data, that served as a basis for the EHC claim, was not technically valid. Inappropriate analytical procedures were used in the analysis of interstitial water copper and the processing of data inappropriately eliminated key data points in order to try to force a relationship between copper concentrations in the sediment and in the interstitial water. A proper examination of the data available on the copper concentrations in those sediments and in the associated interstitial waters shows that there is no relationship between the two. As discussed in Appendix B, there is no reliable technical information that supports the validity of, or need for, a 1,000 mg Cu/kg clean-up objective.

Tentative Addendum No. 7 used the chemical composition of toxicity test elutriates to drawn technically invalid conclusions regarding expected characteristics of the watercolumn and interstitial water in the NCMT area. While those invalid conclusions were justifiably dismissed by the Regional Board in its final Addendum No. 7, they were repeated by EHC as supporting evidence for its claim that the copper-contaminated sediments in the NCMT area are contributing to a violation of the state's objectives and of the "lawfulness" of the 1,000 mg Cu/kg clean-up objective. First, as discussed in Appendix B (pp. 16 to 19), it is inappropriate to use concentrations of copper measured in laboratory elutriates used for toxicity testing to draw inference about the concentrations of copper that could be present in the watercolumn or interstitial waters. Second, again as discussed in Appendix B, and contrary to the EHC's parroting of inappropriate claims made in Tentative Addendum No. 7, there are inadequate data upon which to develop any reliable relationship between the concentration of copper in elutriates developed in the WCC (1991) work and the concentration of copper in the associated sediment. The data that are available show that there is no meaningful, statistically valid relationship between the two parameters. Contrary to the claim by EHC, the copper concentrations measured in bioassay elutriates do **not** reveal *"what concentration of copper in sediment causes the elutriate's copper to be over 2.9 ppb."* Even if a statistically reliable relationship could be developed, it would be meaningless for establishing a clean-up level for NCMT-area sediment contaminated with copper.

Appendix B (pp. 21 and 22) discusses the technical aspects and implications of the inclusion of San Diego Bay on lists of waterbodies with "impaired" water quality. The inclusion of the NCMT area of San Diego Bay on any list of waterbodies with "impaired" water quality is an artifact of the manner in which waterbodies are listed; waterbodies are considered to be "impaired" if a numeric objective is exceeded. Thus, EHC's argument here merely duplicates its arguments regarding the alleged exceedance of the 2.9 μg Cu/L numeric standard, itself.

In the April 1991 Plan, the State Board recognized the unnecessarily restrictive nature of the objectives, and that there would be situations in which objectives would be exceeded (i.e., technical "violations" would occur) without an associated impairment of beneficial uses of the waterbody. The removal of sediments to achieve a clean-up objective of 1,000 mg Cu/kg in the NCMT area cannot be assumed to provide any significantly greater ability to prevent technical "violations" of the copper objective than a clean-up objective of 4,000 mg Cu/kg dry wt.

Therefore, contrary to the EHC contention, study results have **not** shown that the NCMT-area sediments *"are contributing to violation of water quality in San Diego Bay, and will continue unless cleaned up to a minimum of a 1,000 ppm standard."* as claimed by EHC. Moreover, both the existing chemical and biological/toxicological data and the aquatic chemistry and toxicology of copper indicate that the copper ore concentrate-contaminated sediment in the NCMT area is not adversely affecting beneficial uses of San Diego Bay.

EHC Contention 3. *"The cleanup level of 1,000 ppm originally set by the Regional Board was lawful and provided the minimum of protection necessary for the public and resources of the Bay."*

As we discussed in the risk assessment incorporated into WCC (1991), in the Port's November 22, 1991 written testimony to the Regional Board, and in Appendix B, the 1,000 mg Cu/kg clean-up objective was not developed on the basis of credible data and analysis.

In support of its contention no. 3, EHC raised the questions,

> *"What are the effects of the constituent metals in the copper such as mercury, lead, zinc, silver, and arsenic (These constituents of this copper product listed in Addendum #6, Directive #7) having (sic) on the bay? What conditions in the future such as changes in pH (i.e. what if the Bay became more acidic), changes in temperature (El Nino conditions), changes in salinity in Bay water (future increased discharges of reclaimed or saltier water) could cause a different environmental chemistry than currently exists and might cause the copper to be more soluble and thus more biologically available?"*

With respect to the first question about the potential impact of other contaminants in the copper ore concentrate, the bioassays that have been conducted showed that whatever the contaminants in the NCMT-area sediments, and whether those contaminants are from the copper ore concentrate or from other sources, there is no toxicity to a variety of sensitive test organisms and sensitive life-stages of organisms that have been tested (see Lee and Jones-Lee, 1991; WCC, 1991). Further, benthic community diversity studies reported on by Lee and Jones-Lee (1991) and WCC (1991) showed that whatever chemical contaminants were present in the NCMT-area sediment, from whatever sources, the differences and similarities between organism assemblages in that area are not related to the amount of copper in the sediments and are therefore not associated with other contaminants derived from the copper ore concentrate.

The remaining "questions" posed in the EHC statement comprised a shotgun listing of scenarios and "concerns" that reflected a lack of understanding of the Bay system and the environmental chemistry of copper. Pertinent issues and facts of the environmental chemistry, behavior, and toxicology of sediment-associated copper in a bay system such as San Diego Bay were addressed in detail by Lee and Jones-Lee (1991) and in the risk assessment section of WCC (1991). Marine systems are well-buffered with respect to pH. Therefore, the pH of a marine system cannot be reasonably expected to change to such an extent as to induce significant increases in the solubility of the sediment-associated copper in the NCMT area. Because the chronic safe concentrations of copper are about the same in freshwater and marine systems, a significant permanent alteration in salinity would be expected to affect organisms and organism assemblages directly more than through an increased availability of copper to them.

It would take a catastrophic event to change the pH or salinity of the San Diego Bay sufficiently to cause significant differences in the availability of sediment-associated copper in the NCMT area. The type of event or occurrence that would be required to cause such a change (e.g., earthquake to reshape the Bay) would be expected to have impacts immensely more far-reaching than would occur with increased availability of the sediment-associated copper.

Changes in temperature, such as those associated with El Niño conditions as raised by EHC, would not affect the availability of the sediment-associated copper in the NCMT area. Studies of the behavior of copper in ambient waters that have temperatures significantly different from those of San Diego Bay have shown that temperature is not a significant factor controlling copper availability in aquatic systems.

In summary, there is no technical or water quality significance that can be ascribed to the 1,000 mg Cu/kg clean-up objective proposed by the Regional Board staff for the NCMT-area sediments; it certainly cannot be claimed that that objective provides *"the minimum of protection necessary for the public and resources of the Bay"* as claimed by EHC. The information collected on the toxicity of the NCMT-area sediments and on the numbers and types of organisms present shows that the NCMT-area sediments contaminated with copper are not adversely affecting beneficial uses of San Diego Bay. While the copper-contaminated sediment near the NCMT may be in one area, contrary to the assertion of EHC that fact is insufficient reason to waste funds in removal of materials that are not causing adverse impacts on beneficial uses of the Bay.[1]

EHC Contention 4. *"The cleanup level of 4000 has no basis or rationale in biological impacts or water quality standards."*

As noted above, in Appendix B, and in previous submissions that have become part of the record on this matter, that fact is not disputed. The 4,000 mg Cu/kg clean-up objective was suggested based on (a) the finding of no toxicity associated with sediments containing substantially higher concentrations of copper, and (b) practical considerations.

If the clean-up objective for the NCMT-area copper-contaminated sediment were to be developed based on removal of sediment containing copper in concentrations known to cause water quality impact, it would be expected that no sediment removal would be required. This could be justified on the basis that organisms recognized by the US EPA to be among the most acutely sensitive to copper are known to exist in the areas containing the highest concentrations of copper found in the NCMT area, and based on the surveys that showed that the populations of organisms in the NCMT area are not related to the concentrations of copper in the sediment. At most, a biological effects-based clean-up objective could be established at 18,000 mg Cu/kg since toxicity tests of NCMT-area sediment containing that level of copper (the highest level

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[1] At the December 9, 1991 hearing, the EHC argued for an even lower clean-up objective of 390 mg Cu/kg dry wt. on the basis of the use of that value as an "apparent effects threshold" value in Puget Sound, WA. As discussed by Lee and Jones-Lee (1992) and briefly reviewed in Appendix B, the EHC position on that matter is without technical validity.

tested) showed no toxicity to sensitive marine organisms. Therefore, from a biological effects perspective, the clean-up objective of 4,000 mg Cu/kg dry wt. developed for expedience, is a factor of 4.5 below levels that are known to cause no toxicity to sensitive aquatic life in laboratory tests of the NCMT-area sediments.

In summary, contention 4 has no relevance to the acceptability of the 4,000 mg Cu/kg clean-up level recommended by the Regional Board.

EHC Contention 5. *"The claim that the Regional Board can allow for economic impact under the Federal Anti-degradation policy is misapplied."*

The discussion of contention 5 provided by EHC is predicated on the presumption that the sediment-associated copper in the NCMT area is responsible for impairment of beneficial uses of San Diego Bay. That presumption has been demonstrated to be unreliable (see Lee and Jones-Lee, 1991; WCC, 1991; December 9, 1991 testimony of Jones, Appendix B, and the discussion above). The focus of the State Board should be on the establishment of a course of action to protect beneficial uses of San Diego Bay. The fact that an RP or the San Diego Unified Port District may have "reserve funds" is no justification for the spending of those funds on removing sediment that is not causing a water quality problem. (As noted in the Brief filed herewith, the Port's available funds are fully committed to environmental clean-up and capital improvement projects.)

The EHC made the following statement in its discussion of its contention 5:

> *"Given that the Bay has been identified as having limited assimilative capacity for copper, the result of leaving a large reservoir of copper that is leaching into the watercolumn could prohibit future important economic development if future dischargers were forced to reduce copper in their discharges to accommodate continued copper loading from the Paco terminals site."*

Contrary to that statement, there is no reservoir of copper in the NCMT-area sediment that is "leaching into the watercolumn" as claimed by EHC. It appears that EHC is not distinguishing between the particulate forms of copper that could potentially cause "technical" violations of an objective, and the leaching of soluble-available forms of copper. Not only does the evidence not support the EHC claim that there is significant leaching of soluble forms of copper from sediments in the NCMT area, but also the evidence is strongly contrary to that claim.

EHC Contention 6. *"The issue of where future dredge spoils will go from maintenance dredging and at whose cost, was not addressed by the Regional Board's Order."*

The evaluation of the disposal alternatives available for the sediments dredged from any particular site is made based on the results of elutriate test bioassays of the sediments and the nature of open-water or other disposal sites. Elutriate test bioassays on NCMT-area sediments containing as much as 18,000 mg Cu/kg were conducted using a variety of sensitive test organisms in the risk assessment study of the NCMT-area sediments (Lee and Jones-Lee, 1991; WCC, 1991). While the sediments tested were not being evaluated for the purpose of assessing their suitability for open-water disposal, the results of those toxicity tests showed that elutriates of even the most heavily contaminated sediments tested (up to 18,000 mg Cu/kg - the highest concentration evaluated) were not toxic in the test systems. The clean-up objective supported by the Regional Board and now being reviewed by the State Board, however, is not 18,000 mg Cu/kg; it is 4,000 mg Cu/kg.

As discussed by US EPA and US COE (1991), Section 103 of Public Law 92-532 (the Marine Protection, Research, and Sanctuaries Act of 1972) regulating ocean disposal of dredged sediments

> *"prohibits dumping of certain constituents as other than trace contaminants unless they are rapidly rendered harmless. This is a key section of the regulations. TRACE CONTAMINANTS ARE NOT DEFINED IN TERMS OF NUMERICAL CHEMICAL LIMITS, BUT RATHER IN TERMS OF PERSISTENCE, TOXICITY, AND BIOACCUMULATION THAT WILL NOT CAUSE AN UNACCEPTABLE ADVERSE IMPACT AFTER DUMPING. This is expressed in regulatory language in paragraphs 227.6(b) and (c) [of PL 92-532]."*

Lee and Jones-Lee (1991, pp. 46 to 50) provided additional discussion of the potential impacts of dredging and disposal of sediment dredged from the NCMT area on aquatic life. It is clear from the work that has been done, that because the sediments are not toxic they could be considered suitable for ocean disposal. In our opinion, the presence of copper in those sediments at concentrations of 4,000 mg Cu/kg should have no impact on future maintenance dredging of the NCMT area.

EHC Contention 7. *"A mitigation monitoring plan requested by Environmental Health Coalition was not required by the Regional Board to mitigate the damage that was done by the RP during the time the copper was spilled."*

Once again in an attempt to support its contention, the EHC has reported its conjectures as fact in statements such as,

> *"The spill of the copper has resulted in degradation of the Bay."*

> *"Even though the copper has been lying the (sic) bottom of the Bay for years it undoubtedly contributed to negative effects on the benthic life in the bottom of the Bay when it was dumped. Since this was illegal dumping, the biological effects were not being tested for, but should be mitigated for nonetheless."*

As discussed elsewhere, such statements represent unfounded speculations by EHC that are contrary to the technical information that is available. The form of copper in the copper ore concentrate transferred from the NCMT (chalcopyrite) is well-known to be one of the most insoluble, least available forms of copper. Contrary to the statements made by EHC in its discussion of this contention, no adverse impacts of copper on aquatic life would have been expected to occur as a result of the introduction into the sediments of the copper ore concentrate.

Conclusions

The Conclusions presented on page 8 of the EHC petition continue to present incorrect assessments of the technical information available on the impacts of the copper-contaminated sediment in the NCMT area.

SUMMARY

There is no technical justification for requiring a clean-up objective of 1,000 mg Cu/kg. A clean-up objective of 4,000 mg Cu/kg dry wt. has been demonstrated to be protective of the beneficial uses of the San Diego Bay and is expected to be able to be implemented within the timeframe set forth by the Regional Board.

Questions on these comments can be addressed to the authors.

REFERENCES

Lee, G. F., and Jones-Lee, R. A., "Overview Aquatic Life Risk Assessment Copper-Contaminated Sediments at National City Marine Terminal," Submitted to Woodward-Clyde Consultants, San Diego, CA, Report of G. Fred Lee & Associates, El Macero, CA, July 22 (1991).

Lee, G. F., and Jones-Lee, R. A., "Sediment Quality Criteria Development: Technical Difficulties with Current Approaches, and Suggested Alternatives," Report of G. Fred Lee & Associates, El Macero, CA, January 6 (1992).

WCC (Woodward-Clyde Consultants), "Remedial Action Alternatives for National City Marine Terminal," Final Report to San Diego Unified Port District, July 26 (1991).

US EPA and US ACE (US Army Corps of Engineers), "Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual," EPA-503/8-91/001, February (1991).

Appendix A

Transparencies (Selected) Used or Provided to Regional Board at December 9, 1991 Proceedings on CAO 85-91, Addendum No. 7

Aquatic Life Risk Assessment

Copper-Contaminated Sediments near

National City Marine Terminal

G. Fred Lee, Ph.D. and R. Anne Jones, Ph.D.

Areas of Expertise:
- Aquatic Biology/Toxicology
- Aquatic Chemistry
- Environmental Engineering
- Public Health

30/15 yrs. Experience Evaluating the Significance of Chemical Contaminants in Sediments

Risk Assessment

- Selective, Sequential Testing and Evaluation of
  - **Aquatic Chemistry** (Chemical Nature, Fate and Transport) of Contaminant(s)) of Concern, and
  - Their **Aquatic Toxicology** (Impact) in a
  - Tiered Framework of Increasing Sophistication of Specificity
- Yield Assessment of
  - Adverse Impacts That the Given Situation Has on Designated Beneficial Uses
  - Degree of Contaminant Control Needed to Protect Designated Beneficial Uses
  - Evaluate Improvement in Water Quality That Could Be Achieved as a Result of Implementing Various Contaminant Control Approaches

Chemical Contaminants Exist in Aquatic Systems in a Variety of Forms, Only Some of Which Are Toxic-Available to Adversely Affect Aquatic Life

Summary of Results of Lee & Jones Risk Assessment Study

Findings:

- NCMT-Area Sediments Contain Copper to ≈50,000 mg Cu/kg dry wt. (at 2-3 ft deep)

- Toxicity Tests with NCMT-Area Sediments Containing ≈18,000 mg Cu/kg dry wt. Did Not Adversely Affect Sensitive Test Organisms

- Overall, 9 Different Types of Organisms Tested
  Considered 14 Response Parameters
  Shrimp, Flat Fish, Sea Urchin Eggs & Embryos, Clams, Worms, 2 Types of Amphipods, Fish Larvae, Pacific Oyster Embryos/Larvae
    - Embryos of Pacific Oyster Reported by US EPA to Be One of the Most Sensitive Organisms/Stages to Copper in Salt Water

- *Mytilus edulis* (mussel) Occurs Naturally in Area of NCMT in Which Sediments Contain Some of Highest Concentrations of Copper Reported
    - US EPA Found That Embryos of *Mytilus edulis* Were the Most Acutely Sensitive to Copper of the Marine Organisms It Evaluated
    - Sensitivity of *Mytilus edulis* Basis for US EPA Water Quality Criterion for Copper

Summary of Findings
Dr. G. Fred Lee and Dr. R. Anne Jones

Risk Assessment Conclusions

- Copper Ore Concentrate Now in NCMT-Area Sediments Is *Non-Toxic and Not Available*

- Copper in NCMT-Area Sediments Is *Not Having an Adverse Impact* on Beneficial Uses of San Diego Bay

- 1,000 mg Cu/kg dry wt. Clean-Up Objective Based on *Inappropriate Interpretation and Use of Unreliable Data*

- Clean-Up Objective *Could Be Raised and Still Protect* Beneficial Uses of San Diego Bay

Tentative Addendum No. 7
Released by Regional Board Staff
November 27, 1991

Demonstrates Significant Technical Problems with Support of 1,000 mg Cu/kg dry wt. Clean-Up Objective

Relies on Assumptions Demonstrated to Be Inappropriate, or Invalid

- Assumes "Violation" of Numeric Water Quality Objective for Copper (2.9 μg Cu/L) Caused by NCMT-Area Sediment **Not Valid**

- Assumes "Violation" of Numeric Water Quality Objective in NCMT Area Impairing Beneficial Uses - Sport and Commercial Fisheries **Not Valid**

- Assumes That Clean-Up Objective for NCMT-Area Sediments of 4,000 or 6,000 mg Cu/kg dry wt. Would Not Protect Beneficial Uses of San Diego Bay **Not Supported by the Existing Data**

- Used **Inappropriate Data and Statistical Manipulations** to Try to Show Relationship between Copper Concentrations in Sediment and Interstitial Water

  Used That Relationship in Establishment of Clean-Up Objective

(continues)

Tentative Addendum No. 7 Relies on Assumptions Demonstrated to Be Inappropriate, or Invalid (continued)

- Assumes Equilibrium Partitioning Approach Provides Valid Assessments and Is Applicable to Copper **Not Correct**

- Assumes Numeric Water Quality Objectives Applicable to Interstitial Water **Not Valid**

- Assumes Concentrations of Copper in Elutriate Can Estimate Concentrations of Copper in Watercolumn and Interstitial Water **Not Valid**

- It draws the **unjustifiable and undocumented conclusion** that a copper clean-up objective of 4,000 mg Cu/kg dry wt. would not comply with the Bays and Estuaries Plan requirement to protect beneficial uses of the Bay.

- It draws **unjustifiable and undocumented conclusions** about the relationship between the copper ore concentrate in the sediment and the concentration of copper in the overlying water in the NCMT area, and contends that a clean-up objective of 1,000 mg Cu/kg dry wt. is needed in order to meet the numeric water quality objective.

Conclusion

Tentative Addendum No. 7 Does Not Provide Valid Technical Support for 1,000 mg Cu/kg dry wt. Clean-Up Level

Tentative Addendum No. 7 Does Not Provide Valid Technical Refutation of Validity of 4,000 mg Cu/kg dry wt. or Other Clean-Up Level >1,000 mg Cu/kg dry wt.

1,000 mg Cu/kg dry wt. Clean-Up Objective Overly Conservative for Protection of Water Quality/Beneficial Uses

Clean-Up Objective Can Be Raised Considerably Above 1,000 mg Cu/kg dry wt. without Impairment of Beneficial Uses of San Diego Bay

Assumes "violation" of numeric water quality objective for copper caused by NCMT-area sediment

- There is no evidence that copper from the copper ore concentrate now associated with the NCMT-area sediments is, in fact, contributing to so-called violations of the objective for copper.
- Concentrations in watercolumn near NCMT before Paco operations were about the same as they were in 1986.
- Concentrations in watercolumn near NCMT consistent with concentrations found at other locations in San Diego Bay

Assumes "violation" of numeric water quality objective in NCMT area impairing beneficial uses - sport and commercial fisheries

- Numeric objective based on available forms of chemical; applied to total concentration
- NCMT-area sediment-associated copper unavailable to adversely affect aquatic life; demonstrated through toxicity tests, assemblages of organisms, existence of sensitive mussels in NCMT-area with elevated concentration of copper in sediment

Assumes that clean-up objective for NCMT-area sediments of 4,000 or 6,000 mg Cu/kg dry wt. would not protect beneficial uses of San Diego Bay

- After extensive study and review, no demonstrated adverse impact currently occurring due to existing copper ore contamination of NCMT-area sediments

(continues)

Used inappropriate data and statistical manipulations to try to show relationship between copper concentrations in sediment and interstitial water

- Procedures to separate "soluble" copper component of interstitial overestimated soluble fraction; judged unreliable in US EPA review (Ankley et al., 1991)
- Regression between copper concentration in sediment and in associated interstitial water unreliable
  - Inappropriate elimination of data points
  - Regression $r^2 = 0.14$ or 0.35
- Cupric ferrous sulfide highly insoluble; stable in anoxic sediments

Assumes equilibrium partitioning approach provides valid assessments and is applicable to copper

- Based on environmental chemistry of copper - cannot assume equilibrium
- Acid volatile sulfide normalization not appropriate especially for this system due to analytical considerations

Assumes numeric water quality objectives are applicable to interstitial water

- US EPA finding: "Further research is required to extend existing knowledge of pore water's suitability for evaluating sediment toxicity."
- Other considerations exert control over impacts of contaminants in interstitial water on aquatic life - D.O., organism defenses (e.g., tubes)

(continues)

Assumes concentrations of copper in elutriate can estimate concentrations of copper in watercolumn and interstitial water

- Elutriate tests not developed for estimating composition of interstitial water. US EPA also published conclusion that elutriates cannot be used for that purpose.
- Elutriate concentrations not applicable to watercolumn concentrations because they do not consider site-specific dilution.

It draws the unjustifiable and undocumented conclusion that a copper clean-up objective of 4,000 mg Cu/kg dry wt. would not comply with the Bays and Estuaries Plan requirement to protect beneficial uses of the Bay.

- The technical information available and presented in the risk assessment and testimony of the Port indicates that a clean-up objective of more than 4,000 mg Cu/kg dry wt. would protect the beneficial uses of the Bay in accord with the Bays and Estuaries Plan as well as State Water Resources Control Board Resolution No. 68-16, 'Statement of Policy with Respect to Maintaining High Quality of Waters in California,' and the U.S. Environmental Protection Agency's Antidegradation Policy.

(continues)

It draws unjustifiable and undocumented conclusions about the relationship between the copper ore concentrate in the sediment and the concentration of copper in the overlying water in the NCMT area, and contends that a clean-up objective of 1,000 mg Cu/kg dry wt. is needed in order to meet the numeric water quality objective.

- From the information available there is no relationship expected for found between the concentrations of copper in the NCMT-area sediments and the concentrations in the watercolumn overlying those sediments.
- There is no justification to claim that removal sediment containing more than 1,000 mg Cu/kg dry wt. is needed in order to protect beneficial uses of the waters of the Bay or that such removal will have any influence on the concentrations of copper in the watercolumn.

Summary Testimony of
G. Fred Lee, Ph.D. and R. Anne Jones, Ph.D.
G. Fred Lee & Associates
El Macero, CA

Dr. G. Fred Lee and Dr. R. Anne Jones (Lee and Jones) were contracted by the Port of San Diego through Woodward-Clyde Consultants (WCC) to conduct a water quality risk assessment for the copper ore concentrate present in the sediments near the National City Marine Terminal (NCMT)

The Lee and Jones report of the results of the risk assessment were submitted by WCC to Port and to San Diego Regional Board last August.

Objectives

- Investigate Whether Copper Ore-Contaminated Sediments near NCMT Is Adversely Affecting Beneficial Uses of San Diego Bay

- Evaluate Whether Attaining the Water Quality Control Board Order No. 85-91 Remediation Objective of 1,000 mg Cu/kg dry wt. Would Be Protective of Beneficial Uses of San Diego Bay

- Examine Existing and New Information for Implications for Impact on Beneficial Uses of San Diego Bay from Higher Remediation Objective

Risk Assessment Study

Approach

Synthesis Evaluation of

- ◄ Information Generated from Previous Studies, Augmented by
- ◄ Results of Summer 1991 Investigation

Facts Demonstrated by Data and Aquatic Chemistry and Toxicology of Copper

- Addition of Copper in NCMT-Area Sediments Has Not Significantly Changed the Concentrations in Overlying Water; Concentrations about the Same Before Introduction and 1986

- Copper in San Diego Bay Water Was above Current Objective Prior to NCMT Copper Ore Transfer Operations

- No Evidence That Copper in NCMT-Area Sediments is Contributing Significantly to Copper in Watercolumn or Interstitial Water

- Toxicity Tests of 9 Sensitive Organisms/Life Stages Showed No Toxicity Associated with Copper-Contamination of NCMT-Area Sediments
  Sediments Containing as Much as 18,750 mg Cu/kg dry wt. Tested

Copper Ore Concentrate as Source of Copper

Copper Exists in a Variety of Chemical Forms, Only Some of Which Are Available-Toxic to Aquatic Life

Copper Introduced into NCMT Area from Transfer of Copper Ore Concentrate:
Finely Divided Ore - Cupric Ferrous Sulfide

Cupric Ferrous Sulfide as Would Exist in Sediments:
One of the Most Stable, Insoluble, and Thus Unavailable Forms of Copper

In Contrast with Other Forms of Copper Introduced into San Diego Bay

Copper-Based Anti-Fouling Paints Applied to Hulls of Ships; Used at Electric Generating Stations

Purpose for Application and Use Is to Kill and Repel Aquatic Life

Expected to Initially Have Greater Availability to Aquatic Life Than Copper in an Ore

⇒ ***Availability of Copper Derived from Other Sources May Be Significantly Different from That Derived from Copper Ore Concentrate***

Remediation Objective of 1000 mg/kg
Technical Considerations

"Technical" Basis:

- ◂ Equilibrium Partitioning Approach with
- ◂ WESTEC Estimates of Interstitial Water Concentration of "Soluble" Copper

Basis Not Technically Valid

- ◂ Procedures Used by WESTEC to Separate "Soluble" Copper Component of Interstitial Water Overestimate "Soluble" Fraction
  - Filtration Method Can Allow Passage of Appreciable Amounts of Particulate, Non-Toxic Forms of Copper and Inclusion in Measurements of "Soluble" Copper
- ◂ Equilibrium Partitioning Approach Not Demonstrated to Be Applicable to Heavy Metals, Such as Copper, in This Type of Sediment
  - Based on Chemistry of Copper, Approach Would Not Be Expected to Be Appropriate for Copper in San Diego Bay Sediment
- ◂ Water Quality Criterion and Objective Values Not Appropriate for Judging Significance of Interstitial Water Copper
  - Sensitivity and Significance of Organisms
  - Dissolved Oxygen
- ◂ Relationship between Interstitial Water Copper and Sediment Copper Not Highly Significant (best $r^2 = 0.35$)
- ◂ Some Soluble Species of Copper Are Not Available-Toxic

Remediation Objective >1,000 mg Cu/kg
Consistent with Objectives of Ocean Plan
and Enclosed Bays and Estuaries Plan

Intent of Ocean Plan Objectives:

"to ensure the reasonable protection of beneficial uses and the prevention of nuisance."

Intent of Enclosed Bays and Estuaries Plan Objectives:

"to ensure the reasonable protection of beneficial uses and the prevention of nuisance."

California Water Quality Objective Equivalent to US EPA Water Quality Criterion

US EPA Criterion: Concentration That Would Not Cause Lethality to Embryo of Mussel, *Mytilus edulis*, Would Not Cause Chronic Toxicity

Mytilus edulis Live Naturally in NCMT Area, and Were Harvested as Part of Study from Area at NCMT Pierface at Which Highest Concentrations of Sediment-Associated Copper in Area Have Been Found

"Although Quite Limited, the Benthic Community Found near the Paco Terminal Pier Provides Evidence That Some Bivalvia Mollosks (sic - Bivalve Molluscs), *Like Clams, Mussels, Have Become Established on Sediment Which Is ... Quite High in Copper Ore."* *"These Adult and Juvenile Forms of Mussels in an Area Where They Would Have Had a* (sic - to) *Settle Out of the Water Column. So It Did Provide Information That This Wasn't Severely Toxic. Otherwise These Very Sensitive Stages of These Organisims* (sic - Organisms) *Wouldn't Have Been Able to Settle Out and Live and Mature into Adult Forms."*

Deposition of Greg Peters
July 24, 1991

Water Quality Significance of Potential Spreading of Copper Ore Concentrate in San Diego Bay

Evidence does not indicate substantial spreading.

Even if copper ore concentrate-contaminated sediment spreading occurred further into San Diego Bay, there would not likely be adverse impact on water quality

- Concern would be the oxidizing environment
- Oxidizing environment occurred during toxicity testing that showed no toxicity

SUMMARY OF TOXICITY TEST RESULTS
NCMT-AREA SEDIMENTS

Organism Type (Name)	Response
shrimp (Acanthomysis sculpta)	The 4-day survival in 100% elutriate from sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the control (no copper added) tests
flat fish (Citharichthys stigmaeus)	The 4-day survival in 100% elutriate from sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the control (no copper added) tests
sea urchin (Strongylocentrotus purpuratus)	The percent of fertilization of eggs in 100% elutriate from sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the control (no copper added) tests
	The percent of the fertilized eggs that exhibited normal development in 100% elutriate from sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the control (no copper added) tests
clam (Macoma nasuta)	The 10-day survival in sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the reference sediments
worm (Neanthes arenaceodentata)	The 10-day survival in sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the reference sediments
amphipod (Grandidierella japonica)	The 10-day survival in sediments containing 1520 and 6067 mg Cu/kg dry wt. was **not statistically different** from that in the reference sediments
	The organisms exposed for 10 days to sediments containing 1520 and 6067 mg Cu/kg dry wt. exhibited reburial behavior **not statistically different** from that exhibited by organisms exposed to the reference sediments
fish larvae (Menidia beryllina)	The 7-day survival in 100% elutriate from sediments containing as much as 18,755 mg Cu/kg dry wt. was **not statistically different** from that in the reference site tests

Organism Type (Name)	Response
	The growth of test organisms in elutriate from sediments containing as much as 18,755 mg Cu/kg dry wt. was **not statistically different** from that found in tests with reference site sediments
oyster larvae (Crassostrea gigas)	The survival of oyster larvae in elutriate from sediments containing as much as 18,333 mg Cu/kg dry wt. was **not statistically different** from that found in the control tests The incidence of larval abnormalities in oyster larvae after exposure to elutriates from sediments containing as much as 18,333 mg Cu/kg dry wt. was **not statistically different** than that found in the control (no copper added) tests
amphipod (Rhepoxynius abronius)	Mortality statistically greater than the controls was found in tests of sediments from all sites evaluated, irrespective of copper concentration in the sediment. **Mortality from sediments containing 18,333 mg Cu/kg same as from sediments containing 122 mg Cu/kg.** The significance of this finding is discussed in this section. The reburial of surviving organisms exposed to 18,333 mg Cu/kg was **not statistically different** from that of those exposed to 122 mg Cu/kg or from that of control.

APPENDIX B

Appendix B

Supplemental Testimony[1] of
G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D.
for the December 9, 1991 Hearing of
California Regional Water Quality Control Board, San Diego Region
Regarding NCMT Clean-Up and Abatement Order No. 85-91
Regarding Tentative Addendum No. 7

Summary

The California Regional Water Quality Control Board, San Diego Region (Regional Board) selected a clean-up objective of 1,000 mg Cu/kg dry wt. for the copper ore concentrate-contaminated sediments in the vicinity of the National City Marine Terminal (NCMT). That objective was developed based on very limited information on the role of the copper ore concentrate in the sediment in contributing copper to the interstitial water of the sediments of that region. Addendum No. 6 to the Clean-Up and Abatement Order No. 85-91 allows the development of an alternative clean-up objective to protect the designated beneficial uses of San Diego Bay. That Addendum specified that a risk assessment be conducted to support the alternative clean-up objective.

In the summer of 1991, we (Drs. Lee and Jones-Lee) worked through Woodward-Clyde Consultants under contract with the San Diego Unified Port District (Port) to conduct an aquatic life risk assessment of the copper-contaminated sediment in the vicinity of the NCMT. From that study we concluded:

- based on a detailed review of the aquatic chemistry of copper in the NCMT-area sediments and the results of aquatic organism toxicity tests on those sediments containing as much as about 18,000 mg Cu/kg dry wt. using sensitive organisms/life-stages, that the copper in the those sediments is not available and is not toxic;

- that the copper-contaminated sediments in the vicinity of the NCMT are not adversely affecting beneficial uses of San Diego Bay;

- that the 1,000 mg Cu/kg dry wt. objective would be protective of the beneficial uses of San Diego Bay and that that clean-up objective could be raised considerably and still protect the designated beneficial uses of San Diego Bay; and

- that the 1,000 mg Cu/kg dry wt. objective was based on inappropriate interpretation and use

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[1] This supplemental written testimony was prepared before the December 9, 1991 Regional Board hearing in response to issues raised in the Regional Board staff's Tentative Addendum No. 7, Errata Sheet No. 1 for Tentative Addendum No. 7, and written comments from the Environmental Health Coalition. All of those documents were issued after the Port's written testimony had been submitted. While some of the points raised herein were made at the December 9, 1991 hearing, many were not because of the severe time constraints.

of inadequate and unreliable data.

In November 1991, the Regional Board announced that a hearing would be held on December 9, 1991 for the Regional Board to consider whether the 1,000 mg Cu/kg dry wt. clean-up objective should be modified. Submission of testimony was required by November 22, 1991.

We submitted testimony to the Port regarding the impacts of the NCMT-area copper-contaminated sediments on water quality, that was incorporated into the Port's testimony that was submitted on November 22, 1991. That information served as a basis for the Port's recommending that the clean-up objective be raised to 4,000 mg Cu/kg dry wt. That clean-up objective was recommended based on:

- the fact that sediments containing copper in excess of that amount may be subjected to DHS Title 22 requirements governing "hazardous wastes;"
- the finding of the risk assessment that there is no evidence that the NCMT-area sediments that contain copper in excess of 4,000 mg Cu/kg dry wt. are having an adverse impact on beneficial uses of San Diego Bay;
- the finding of the risk assessment that achieving a 4,000 mg Cu/kg dry wt. objective would be protective of the designated beneficial uses of San Diego Bay;
- the fact that a 4,000 mg Cu/kg dry wt. clean-up objective could be readily implemented without further study of potential water quality impacts; and
- the fact that a 4,000 mg Cu/kg dry wt. objective would save several million dollars in public and private funds associated with the removal of sediments that, while contaminated with copper, are not toxic to aquatic life.

Tentative Addendum No. 7 to Clean-Up and Abatement Order No. 85-91 was issued on November 27, 1991. That Tentative Addendum acknowledged and did not challenge the finding of our risk assessment that the copper in the NCMT-area sediments in concentrations greater than 1,000 mg Cu/kg dry wt. was not having an adverse impact on the beneficial uses of San Diego Bay. It did, however, reaffirm the 1,000 mg Cu/kg dry wt. clean-up objective based on the position that the copper in the watercolumn above the NCMT-area sediment and in the associated "interstitial water" was above the 2.9 μg Cu/L numeric water quality objective applicable to the waters of San Diego Bay, adopted by the State Board in April 1991. Tentative Addendum No. 7 also claimed that the copper measured in the watercolumn above the NCMT-area sediments and in samples of "interstitial water" was derived from the copper ore concentrate associated with the sediments.

We have reviewed the technical assessment presented in Tentative Addendum No. 7; we conclude that Tentative Addendum No. 7 provided an inappropriate assessment of the technical information available, in an attempt to support the previously adopted clean-up objective. This supplemental testimony discusses in detail those areas of Tentative Addendum that are of particular concern. Specifically, Tentative Addendum No. 7:

- incorrectly assumed that the current numeric water quality objectives are appropriate for application to interstitial water. *The numeric water quality objectives only have applicability to the watercolumn, not to sediments or their interstitial waters.*

- unjustifiably assumed that the copper concentrations measured by WESTEC in a few samples of NCMT-area water in 1986 properly describe the current watercolumn concentrations. *The measurements of "soluble" copper in the NCMT-area water by WESTEC likely overestimated the amount of copper potentially available to cause toxicity to aquatic life. The WESTEC study program was insufficient to draw any reliable conclusions about a relationship between the concentrations of copper in the sediment and those in the interstitial water or the overlying water, about the sediment as a source of copper in the watercolumn near the NCMT, or about the comparative concentrations of copper that might occur in the watercolumn if the clean-up objective were 1,000 mg Cu/kg or 4,000 mg Cu/kg. Even if the WESTEC data properly described the concentrations of available forms of copper in the watercolumn in 1986, there is no technical basis upon which to assume that those measurements properly describe the current watercolumn concentrations. Based on the nature of chalcopyrite, the principal form of copper in the copper ore concentrate, and the aquatic chemistry of copper, there is no technical reason to believe that there would be a relationship between the concentration of copper in the sediment in the vicinity of the NCMT and the concentrations of available copper in the watercolumn at that site.*

- incorrectly implied that if the numeric water quality objective is exceeded, an adverse impact to beneficial uses of the Bay results. *Toxicity tests conducted on NCMT-area sediments using sensitive test organisms at sensitive life-stages have shown that the sediments do not cause toxicity to those test organisms under test conditions more severe than would be expected in the watercolumn. Further, the mussel, Mytilus edulis, which has been reported by the US EPA to be the most acutely sensitive to copper in the embryo stage, has been found to be developing naturally in an area of the NCMT in which the sediments contain some of the highest concentrations of copper. It is evident that the copper in the NCMT-area watercolumn, irrespective of the sources, is not sufficient to preclude the existence of this highly copper-sensitive organism.*

- unjustifiably concluded that the copper ore concentrate currently in the NCMT-area sediments contributes substantially to the copper concentrations measured in samples of the watercolumn and "interstitial water" in the NCMT area. *From the information available, including data on copper concentrations in the watercolumn prior to the operations of Paco and on copper concentrations in other areas of the Bay, we conclude that the copper in the sediment in the NCMT area is not a major factor in controlling the concentration of copper in the watercolumn.*

- unjustifiably and unsupportedly concluded that a copper clean-up objective of 4,000 mg Cu/kg dry wt. would not comply with the Bays and Estuaries Plan requirement to protect beneficial uses of the Bay. *To the contrary, the technical information available and presented in the risk assessment and in testimony of the Port indicates that a clean-up objective of more than 4,000 mg Cu/kg dry wt. would protect the beneficial uses of the Bay in accord with the Bays and Estuaries Plan as well as State Water Resources Control Board Resolution No. 68-16, 'Statement of Policy with Respect to Maintaining High Quality of Waters in California,' and the U.S. Environmental Protection Agency's Antidegradation Policy.*

- unjustifiably and unsupportedly concluded that there is a positive cause-and-effect relationship between the concentration of copper ore concentrate in the sediment and the concentration of copper in the overlying water in the NCMT area, and contended that a clean-up objective of 1,000 mg Cu/kg dry wt. is needed in order to meet the numeric water quality objective. *From the information available there is no relationship expected, or found, between the concentrations of copper in the NCMT-area sediments and the concentrations in the watercolumn overlying those sediments. There is no justification to claim that removal of sediment containing more than 1,000 mg Cu/kg dry wt. is needed in order to protect beneficial uses of the waters of the Bay or that such removal will have any influence on the concentrations of copper in the watercolumn.*

- relied on inappropriate interpretation of statistical analyses and data manipulation to infer a cause-and-effect relationship between the concentrations of copper in sediment and those in the associated interstitial water. *A proper examination of the data available on the copper concentrations in those sediments and in the associated interstitial waters shows that there is no relationship between the two.*

- made improper extrapolations from the chemical composition of toxicity test elutriates to draw technically invalid conclusions regarding expected characteristics of the watercolumn and interstitial water in the NCMT area. *Concentrations of copper measured in laboratory elutriates used for toxicity testing cannot be used to draw meaningful inference about the concentrations of copper that could be present in the watercolumn or interstitial waters.*

- unsupportedly and improperly concluded that "high levels" of copper in the San Diego Bay waters have caused San Diego Bay to have "impaired water quality" that is manifested as impaired "ocean commercial and sport fishing, shellfish harvesting, and marine habitat," and that the copper ore concentrate now associated with the NCMT-area sediments is responsible for exceedance of the numeric water quality objective for copper. *As discussed above, it is technically unjustified and inappropriate to suggest that the presence of the copper ore concentrate in the NCMT-area sediment is causing the so-called impaired water quality determined based on exceedance of numeric water quality objectives. It is also highly inappropriate to conclude, as the Regional Board staff has apparently done, that an exceedance of a numeric water quality objective represents an impairment of designated beneficial uses of San Diego Bay that is adversely affecting "ocean commercial and sport* *fishing, shellfish harvesting, and marine habitat." There is no evidence, nor would it be expected, that the copper ore concentrate is having an adverse impact on "ocean commercial and sport fishing, shellfish harvesting, and marine habitat." The available data for copper concentrations in the watercolumn of San Diego Bay show that in general, the concentrations of copper have not been significantly changed as a result of the presence of copper ore concentrate in the NCMT-area sediments.*

- incorrectly concluded that copper from the copper ore in the NCMT-area sediment is leading to violations of the copper water quality objective, and that the concentrations of copper in the sediment should therefore be curtailed to the maximum extent practicable. *There is no evidence that copper from the copper ore concentrate now associated with the NCMT-area sediments is, in fact, contributing to so-called violations of the water quality objective for copper. Further, there is substantial evidence that there is no relationship between the copper concentrations in the watercolumn, or interstitial water, or sediment elutriates, and the concentrations of copper in the associated sediments. Therefore, it is inappropriate to conclude that achieving a 1,000 mg Cu/kg dry wt. clean-up level will have any significantly different impact on achieving the 2.9 μg Cu/L objective than would achieving a 4,000 mg Cu/kg dry wt. or 6,000 mg Cu/kg dry wt., or some other clean-up objective.*

- The Environmental Health Coalition has suggested that a clean-up objective of 390 mg Cu/kg dry wt. be used for the NCMT-area sediments. *That group made a number of inaccurate statements regarding the validity of such a clean-up objective. However, the approach by which the 390 mg Cu/kg dry wt. value was developed (i.e., sediment toxicity tests) applied to the NCMT area would lead to a clean-up objective for the NCMT-area sediments in excess of 18,000 mg Cu/kg dry wt.*

We therefore conclude that the position of the Regional Board staff as presented in Tentative Addendum No. 7 is not justified based on the technical information available, and that a 4,000 mg Cu/kg dry wt. clean-up objective would be protective of the designated beneficial uses of San Diego Bay.

Introduction

On November 22, 1991, written direct testimony was submitted to the California Regional Water Quality Control Board, San Diego Region by David B. Hopkins, Esq. of Hillyer and Irwin on behalf of the Unified Port District of San Diego (Port) in the matter of the December 9, 1991 hearing on NCMT Clean-Up and Abatement Order No. 85-91. The elements of that testimony regarding the risk assessment that we (Drs. G. Fred Lee and Anne Jones-Lee) conducted in the spring of 1991 through Woodward-Clyde Consultants were developed from input provided by us. The risk assessment and related investigation had been undertaken on behalf of the Port pursuant to Directive 5 of Addendum No. 6. That Directive stipulated the technical foundation required for the support of an alternative clean-up strategy that could be developed by the Port and Paco. The technical foundation was to include the following:

a. *"The proposed copper concentration to be attained in the contaminated sediment in San Diego Bay will not alter the water quality of San Diego Bay to a degree which unreasonably affects the beneficial uses of San Diego Bay." "Using biological and chemical information, a risk assessment should be performed to evaluate if any beneficial uses of San Diego Bay are being adversely affected, and if so, what cleanup level would be expected to protect the beneficial uses."*
b. *"The proposed copper concentration to be attained in the contaminated sediments in San Diego Bay will comply with State Water Resources Control Board Resolution No. 68-16, 'Statement of Policy with Respect to Maintaining High Quality of Waters in California' and the U.S. Environmental Protection Agency's Antidegradation Policy contained in 40 CFR 131.12."*
c. *"The proposed copper concentration to be attained in the contaminated sediment in San Diego Bay will comply with State Water Resources Control Board's 'Water Quality Control Policy for the Enclosed Bays and Estuaries of California, May 1974,' and upon its adoption by the State Board, the 'Water Quality Control Plan for Enclosed Bays and Estuaries of California."*

"The findings and directives of Cleanup and Abatement Order No. 85-91 will be modified to reflect any necessary changes based on information submitted under this Directive."

The risk assessment conducted and the conclusions drawn from it are in full compliance with the stipulations in the Directive 5 of Addendum No. 6 cited above. Our review of the development of the 1,000 mg Cu/kg dry wt. clean-up objective showed it to have been developed on the basis of inappropriate analysis and interpretation of the technical information available. Based on our review of the existing technical information and the additional information developed in the spring/summer 1991 for the risk assessment, we concluded that the clean-up objective could be raised considerably and still protect the beneficial uses of San Diego Bay. We supported a clean-up level of 4,000 mg Cu/kg dry wt. as a conservative, protective value that could be implemented within the time constraints imposed on the Port by the Regional Board. The Port's written direct testimony submitted to the Regional Board by D. Hopkins reflected these findings and conclusions.

On November 27, 1991 the Regional Board staff issued "Tentative Addendum No. 7 to Cleanup and Abatement Order No. 85-91" after consideration of the Woodward-Clyde report of the risk assessment and the written direct testimony submitted by the Port. Subsequently but in advance of the December 9, 1991 hearing, the Regional Board staff issued "Errata Sheet No. 1 for Addendum No. 7 to Cleanup and Abatement Order No. 85-91." Further, the Environmental Health Coalition (EHC) submitted a letter dated November 26, 1991 in response to the Regional Board's announcement of a hearing on December 9, 1991 to consider the findings of the Port's remedial action alternatives report and the modification of the 1,000 mg Cu/kg clean-up objective. We have reviewed Tentative Addendum No. 7 and its "Errata Sheet No. 1," as well as the letter submitted by the EHC and have developed this supplemental testimony in response to the technical aspects of those documents.

Tentative Addendum Item 6.

Item 6 stated, *"Directive 5* [of Addendum No. 6 of the Clean-Up and Abatement Order 85-91] *provided that the regional Board would amend the findings and directives of Cleanup and Abatement Order No. 85-91 to reflect any necessary changes based on information submitted under Directive 5."* As noted above, the risk assessment conducted in the spring of 1991 and recommendations for revision of the clean-up level met the conditions outlined in Directive 5. However, the Regional Board staff has declined to support the alternative clean-up level developed pursuant to Directive 5 and supported by the risk assessment.

Tentative Addendum Item 7.
(There are two Item 7's; this comment addresses the first one)

As noted in Item 7, after issuance of Addendum No. 6, the State Water Resources Control Board adopted the Enclosed Bays and Estuaries Plan (Plan) in April 1991. The numeric objective contained in the Bays and Estuaries Plan was cited in Tentative Addendum No. 7 Item 7 as being 2.9 μg Cu/L. As discussed below, the Regional Board staff concluded in a subsequent section of the Tentative Addendum that the clean-up level it had adopted should not be increased because data on the concentration of copper in the watercolumn in the vicinity of the NCMT exceeded the 2.9 μg Cu/L numeric objective. The staff contended that that exceedance was due to the presence of the copper ore concentrate in the sediments, and that data showed exceedance of that numeric water quality objective in the interstitial waters of the region as well. The staff did not contend in the Tentative Addendum that the exceedance of the water quality objective represents an impairment of the beneficial uses of San Diego Bay.

As discussed below, even if the copper in the NCMT-area sediments were to have contributed to a technical violation of the current numeric water quality objective, such a technical violation cannot be presumed to represent an impairment of the beneficial uses of San Diego Bay.

As discussed in our risk assessment of the NCMT-area sediments in WCC (1991), it is well-known that chemical contaminants exist in aquatic systems in a variety of forms, only some of which are available-toxic to aquatic life. It is also well-known that this consideration is especially important with regard to sediment-associated contaminants since most sediment-associated contaminants are not toxic to aquatic life.

The position of the Regional Board staff expressed in Item 7 is that the current numeric water quality objective for copper has apparently been violated in the watercolumn near the NCMT. That position is based on a mechanical comparison of copper concentrations measured in 1986 with the numeric objective rather than on an assessment of the potential impact of that contaminant on beneficial uses of the Bay, and without regard for the information presented in the risk assessment that demonstrates the lack of toxicity and impact of the sediment-associated copper in the NCMT area. As discussed below, it is highly inappropriate to base the clean-up objective for the NCMT-area sediment on a numeric water quality objective when there is substantial evidence that the exceedance of the objective, if real, is not adversely affecting the beneficial uses of the waterbody. Further, even if the exceedance of the objective were found to be adverse (which is not the case) it would be highly inappropriate to assume that the exceedance is due to copper ore concentrate in the NCMT-area sediments.

The April 1991 Enclosed Bays and Estuaries Plan stated with regard to the Water Quality Objectives, "*This chapter sets forth limits or levels of water quality characteristics for enclosed bays and estuaries to ensure the reasonable protection of beneficial uses and the prevention of nuisance. The discharge of waste shall not cause violation of the narrative objectives of this plan.*" In the narrative water quality objectives in that Plan, it is stated, "*The concentrations of toxic pollutants in the water column, sediments, or biota shall not adversely affect beneficial uses.*" Clearly the intent and focus of the institution of water quality objectives is to protect beneficial uses. The fact that the Plan provides for development of site-specific water quality objectives by Regional Boards for situations in which the numeric water quality objectives are found to be inappropriate, is recognition that the attainment of the numeric objective is not always the ultimate goal. Rather, the ultimate goal is to protect the beneficial uses of the waters of the state without unnecessary expenditures for contaminant control.

Tentative Addendum Item 14.

In Item 14, the Regional Board staff stated that the 1,000 mg Cu/kg dry wt. clean-up objective should not be raised. However, in the five numbered subsections that were offered in support of its position, no technical basis was provided for the Board staff's contention that a 4,000 mg Cu/kg dry wt. clean-up level would not be protective. Furthermore, the analysis offered in support of the Regional Board staff's position contained technically inappropriate assessments of the information presented in the Woodward-Clyde report, the Port's November 22, 1991 written testimony, and other sources.

Item 14a. There are three statements made in Item 14a, each of which contained technically inappropriate assessments.

The first statement was, "*Existing information indicates that copper concentrations in both the water column and interstitial waters within the NCMT study area exceed the applicable copper water quality objective contained in the Bays and Estuaries Plan.*"

Regarding the Copper Concentrations in the Watercolumn:

The only data for the copper concentrations in the watercolumn in the NCMT area known to us that the Regional Board staff could have used to compare with the water quality objective were the few data derived from WESTEC (1986a) studies in 1986; we are aware of no more-recent data on copper concentrations in the watercolumn near the NCMT. The risk assessment reported in WCC (1991) addressed the technical aspects and water quality significance of the watercolumn copper concentrations reported by WESTEC (1986a), and the concentrations of copper found in the vicinity of the NCMT and other areas of the Bay, even before the Paco operations at the NCMT. Some of the key elements of the technical discussion provided in the risk assessment were summarized by the Regional Board staff in Tentative Addendum No. 7 Items 9e, 9f, 9g, and 9h. Key points, each discussed in our risk assessment, regarding the concentrations of copper in the watercolumn are noted below.

i) WESTEC (1986a) reported that concentrations of total copper in the waters 1 to 2 m above the sediment surface (at high and low tides) in an area where the sediment copper concentration was elevated (**19,800 mg Cu/kg dry wt.**) were 3 to 33 μg Cu/L; "soluble" copper concentrations were between <2 μg Cu/L and 8 μg Cu/L. Krett (1979) reported that the concentrations of "total" copper in the surface water at the nearby Navy Pier between June 1978 and July 1979 ranged from about 2.1 to 22.6 μg Cu/L; however, as we discussed in depth in the risk assessment portion of WCC (1991), the method of analysis used in that study would have underestimated the actual amount of total copper. Therefore, based on the data available, it may be concluded that the copper concentrations in the vicinity of the NCMT were about the same in the late 1970's prior to the copper ore transfer operations as they were in 1986.

ii) The concentrations of copper found in the vicinity of the NCMT in 1986 were in accord with what has been reported for other parts of San Diego Bay at the same, earlier, and later time periods.

iii) For the reasons discussed in detail in the risk assessment, because of the analytical procedures used, the measurements of "soluble" (available) copper made by WESTEC (1986a) likely overestimated the amount of copper in true solution and potentially available to cause toxicity to aquatic life.

iv) Even if the WESTEC data were representative of the truly soluble concentrations of copper in the NCMT area, it would be unlikely that that exceedance of the objective would result in an adverse impact on the beneficial uses of San Diego Bay. That is because of the likely presence of soluble, but non-toxic, copper complexes of the type discussed in the risk assessment report; copper reacts with organics and some inorganics to form soluble complexes that are measured as "soluble" copper but that are not toxic.

v) The US EPA reported that the embryos of the blue mussel (*Mytilus edulis*) were the most sensitive organism/stage to copper of all the saltwater species for which acute toxicity data were available and considered in the development of its marine water quality criterion. It was on the basis of the toxicity of copper to *Mytilus edulis* embryos that the criterion value of 2.9 μg Cu/L was developed. *Mytilus edulis* live naturally in the NCMT area and in fact were harvested as part of the 1991 risk assessment study from an area at the pierface of the NCMT at which the highest concentrations of sediment-associated copper in the area have been found. It is therefore apparent that whatever the concentration of available forms of copper in the watercolumn - in 1986 or now - it is not sufficient to prevent the existence of that most sensitive organism.

vi) It is technically inappropriate to mechanically compare the numeric water quality objective (equivalent to the US EPA criterion) with the total concentrations of copper in the watercolumn or with the concentration of the fraction reported by WESTEC as "soluble," for the purpose of assessing whether there is an impairment of the beneficial uses of the waters. The reasons for this are discussed in the risk assessment, but briefly it is because (a) the criteria values were based on the copper's being in 100% available forms; (b) copper exists in aquatic systems in a variety of forms, only some of which are available to adversely affect aquatic life; (c) some forms of soluble copper are not available to adversely affect aquatic life; (d) particulate forms of copper are not available to adversely affect aquatic life; (e) total copper and the fraction reported by WESTEC as "soluble" are unreliable measures of the copper available to adversely affect aquatic life; and (f) an aquatic organism most sensitive to copper, *Mytilus edulis*, occurs naturally in an area at the pierface of the NCMT at which the highest concentrations of sediment-associated copper in the area have been found.

vii) Even if the water quality objective were currently exceeded in the watercolumn in the NCMT area, and even if the exceedance could have been attributed to the copper ore concentrate in the sediment (which it cannot because the copper concentrations were about the same in 1986 as they had been in 1978-79), these conditions would be reflective of the current situation in which as much as 50,000 mg Cu/kg dry wt. are present in the bedded sediment, not the conditions that would be present after remediation to 4,000 mg Cu/kg. From a technical perspective, even if the current conditions resulted in an exceedance of the water quality objective. it cannot be concluded that removal of sediments containing >4,000 mg Cu/kg dry wt. will also result in exceedance of the numeric objective and that removal of the additional sediments containing between 1,000 and 4,000 mg Cu/kg dry wt. would result in compliance. Based on the information available, it appears that the concentration of copper in the Bay waters is not dependent on the copper concentrations in the sediment at the NCMT. This is because the sediment-associated copper in the NCMT area contaminated by copper ore concentrate is in largely unavailable forms. This point is discussed further in another section of this supplemental testimony.

Regarding the Concentrations of Copper in Interstitial Water:

There is no requirement in the Enclosed Bays and Estuaries Plan for meeting numeric water quality objectives in interstitial water. This was confirmed by D. Carlson of the State Water Resources Control Board staff (Carlson, 1991). As discussed in the risk assessment report, the concentration of a parameter measured in "interstitial water" is significantly controlled by the approaches used to collect the sediment, separate the interstitial water from the sediment, and maintain appropriate redox conditions during sample handling. Very few measurements of concentrations of chemicals in "interstitial water" can be considered to be reliable assessments of the concentrations that actually exist in the interstitial water of bedded sediments. This fact has been reiterated recently by the US EPA (Ankley *et al.*, 1991) in the draft report, "Sediment Toxicity Identification Evaluation: Phase I (Characterization), Phase II (Identification) and Phase III (Confirmation) Modifications of Effluent Procedures." There it is stated, *"Regardless of the aqueous fraction* [of interstitial-pore water] *used in the TIE* [toxicity identification evaluation], *the extraction method will strongly influence chemical composition and toxicity of the test sample."* Ankley *et al.* (1991) also concluded, *"Further research is required to extend existing knowledge of pore water's suitability for evaluating sediment toxicity."*

The information characterizing "interstitial water" copper concentrations in the NCMT area was developed by WESTEC (1986b, 1987); technical aspects of the use of those data in assessing the risk of the sediment-associated copper were discussed at length in the risk assessment report and summarized in the Port's November 22, 1991 written testimony. Some of the key elements of the technical discussion provided in the risk assessment were summarized by the Regional Board staff in Tentative Addendum No. 7 Item 9i. Key points, each discussed in our risk assessment, regarding reported concentrations of copper in the NCMT-area interstitial water and their significance are noted below.

i) WESTEC (1986b, 1987) reported concentrations of "soluble" copper in "interstitial water" samples that ranged from <2 to 480 μg Cu/L in areas of the NCMT where sediments were reported to contain total copper between about 13,000 and 23,900 mg Cu/kg dry wt. According to Peters (1987, 1991) the Regional Board staff used the equilibrium partitioning approach and those estimates of interstitial water concentrations of "soluble" copper in its development of the remediation objective of 1,000 mg Cu/kg dry wt. for the NCMT-area sediments. The technical inadequacies of that approach were discussed at length in the risk assessment (WCC, 1991). That approach is technically unreliable for a number of reasons which include the fact that the equilibrium partitioning approach has not been demonstrated to be applicable to heavy metals such as copper, and that there is a variety of reasons related to the chemistry of copper that that approach would not be appropriate for copper - such as that the fundamental assumption of equilibrium between the forms in solution in the interstitial water and the solid phases in the sediment would almost never be achieved.

ii) It is not technically justifiable to apply the water quality criteria or state water quality objectives to the interstitial waters for the purpose of judging the protection of aquatic life-related beneficial uses of the water. As noted above, this was recently also discussed by Ankley *et al.* (1991).

iii) The procedures used by WESTEC to separate the "soluble" copper component from the interstitial water likely resulted in higher values than the actual concentration of soluble forms in the interstitial water. Problems noted in the risk assessment and discussed recently by the US EPA (Ankley *et al.*, 1991) associated with making an appropriate assessment of the chemical composition of interstitial waters were discussed earlier in this supplemental testimony.

iv) Even if the sampling and analysis protocol used by WESTEC for the interstitial waters properly determined the amount of soluble copper in the interstitial waters of the bedded sediments, there are soluble species of copper that are not available to adversely affect aquatic life. Thus the concentration of "soluble" copper could overestimate the amount of available copper.

v) Since the reported concentrations of "soluble" copper in the NCMT-area interstitial water likely included some non-soluble forms as well as non-toxic soluble forms, the remediation objective selected (1,000 mg Cu/kg dry wt.) is likely to be more conservative than intended. That conclusion was noted by the Regional Board staff in Tentative Addendum No. 7 Item 9i.

Therefore, comparison of interstitial water concentrations as reported by WESTEC with the numeric water quality objective for copper adopted in April 1991 is not germane to the assessment of the impact that the copper ore concentrate-contaminated sediment may have on water quality in San Diego Bay. Furthermore, that comparison has no technical relevance to judging the appropriateness or protectiveness of a clean-up objective of 4,000 mg Cu/kg dry wt.

Item 14a continued with the second statement, *"While other sources may also be contributing to copper concentrations in the affected area, it is clear that copper ore in the sediment is contributing to copper levels in the water column and interstitial water."*

From our review of the existing data as part of the conduct of the risk assessment, we concluded that there is no evidence that the copper ore in the sediments near the NCMT is contributing to the copper levels found in the watercolumn in the vicinity of the NCMT. The technical aspects and significance of the concentrations of copper reported in the watercolumn in the NCMT area in 1986 were discussed above.

In addition, as discussed in detail with regard to Tentative Addendum No. 7 Item 14b, there is no evidence that the copper ore in the sediment is contributing to the copper concentrations reported for the interstitial waters. Based on the aqueous environmental chemistry of copper, the copper ore concentrate would not be expected to contribute copper substantially to the interstitial waters. As discussed in detail in the risk assessment, it is evident from our review of the literature and from our own substantial experience with sediment-associated contaminants (including copper) and our expertise in aquatic chemistry, that copper in the form of the finely divided cupric ferrous sulfide, that comprises the copper ore concentrate in the anoxic sediment near the NCMT, is one of the most stable, insoluble forms of copper. That means that the copper in that form does not readily go into solution, i.e., does not tend to leach into surrounding water. The risk assessment report also addressed mechanisms by which copper that could be slowly oxidized and solubilized under oxic conditions, can be readily removed from solution by precipitation and sorption reactions. This expected behavior is substantiated by the data reported by WESTEC (1986b, 1987). As discussed with regard to the Tentative Addendum Item 14b below, both of the WESTEC investigations clearly indicated that there is no relationship between sediment copper concentrations and the measured concentrations of copper in the associated "interstitial water." Finally, other sources (such as anti-foulant paints) contribute what would be expected to be at least initially more readily available forms of copper to the sediments.

The third statement of Item 14a was, *"The proposed increase in the copper cleanup level over 4,000 mg/kg does not comply with the Bays and Estuaries Plan because it appears that the copper ore sediments are substantially contributing to copper levels in the interstial (sic) water and water column."*

First, no proposal has been made for a clean-up level of "over 4,000 mg Cu/kg." Second, this statement is a non sequitur. As discussed above, the data offer no indication that the copper ore in the sediments is contributing, much less substantially contributing, to the copper levels in either the interstitial water or the watercolumn. To the contrary, the data demonstrate the lack of a relationship between the copper concentrations in the sediment and those reported for the associated interstitial water. As discussed in the risk assessment and in the Port's testimony it is apparent that the copper concentrations measured in 1986 in the watercolumn in an area near the NCMT that contained elevated concentrations of copper in the sediment, were similar to those in other areas of the Bay, even prior to the copper ore concentrate transfer operations at the NCMT.

There is no technical basis provided in Tentative Addendum No. 7 for the conclusion drawn by the Regional Board staff that a clean-up level of 4,000 mg/kg dry wt. would create non-compliance with the Bays and Estuaries Plan's numeric or narrative objectives. To the contrary, it is clear from the risk assessment that toxicity test results indicate that even the most-contaminated sediments tested were not toxic, and that there were no differences in other response parameters evaluated between the NCMT sediment areas contaminated with copper and areas of low sediment copper. The only thing that can be said to be elevated as a result of the copper ore concentrate in the sediments is the total copper concentration in the sediment. The conclusion made in Tentative Addendum No. 7 Item 14a, that based on the copper concentrations in the watercolumn and in the interstitial water "The proposed increase in the copper cleanup level over 4,000 mg/kg does not comply with the Bays and Estuaries Plan because it appears that the copper ore sediments are substantially contributing to copper levels in the interstial (sic) water and water column." is without technical foundation.

Item 14b. Referring to the so-called regression analysis between concentrations of copper in NCMT-area sediment and copper concentrations in the associated interstitial water reported in the WESTEC (1987) report, Item 14b stated,

> *"The regression line indicates that a sediment copper concentration of 7,000 mg/kg may be expected to produce an interstitial water copper concentration of about 50 μg/L. Although the relationship between the sediment and the interstitial water level is quite variable, core samples containing the highest sediment copper concentrations consistently had detectable levels of copper in the interstitial water (greater than 20 μg/L), while the less contaminated sediment frequently had interstitial water levels which were below this detection limit."*

It is clear from those statements that the so-called regression between interstitial water copper and sediment copper developed by WESTEC continues to be used as key support for the 1,000 mg Cu/kg clean-up level. However, the analysis reflected by the Regional Board staff's statement contains a number of significant technical deficiencies which are briefly discussed below.

i) The technical deficiencies in the determination and assessment of concentrations of copper in the "interstitial water" by WESTEC were discussed above and are thus not repeated here.

ii) The so-called "regression" developed by WESTEC (1987) and referred to in Item 14b, is appended to this supplemental testimony as Exhibit 1. The lower graph in Exhibit 1, labeled as Figure II, is the "regression" to which the statements of the Board staff refer. The lower graph (labeled Figure II) was developed from the upper graph (labeled Figure I) by removing two points from the correlation and associated statistics. Examination of the WESTEC (1987) report that provided those relationships reveals that those two points were simply dropped because *"each point was considered an aberrant value because it was so different from the other values, which suggests the sample may have been contaminated."* It is technically unjustifiable and inappropriate to simply exclude and disregard data on the basis that they do not fit a preconceived notion of what the relationship should be, and then simply assume that the samples must have been "contaminated." There must be rigorous and compelling technical justification for eliminating data from consideration. If quality control and sample handling technique was so poor that the only evidence of "contamination" comes when points are "so different from other values" that appear to represent a positive relationship, all of the data must be suspect. The fact is that based on the environmental chemistry of sediment-associated copper and on the sampling and analytical procedures used for "interstitial water" analysis (as discussed previously), the scatter shown in Figure I of Exhibit 1 would indeed be expected. Since the justification given by WESTEC (1987) for the exclusion of the two points in question was technically inadequate, it must be assumed that the relationship shown in Figure I in Exhibit 1 is the more reliable. It is clear that there is no significant relationship between the concentration of copper in the sediment and that in the associated interstitial water demonstrated by that figure.

iii) Even if it were assumed that Figure II in Exhibit 1 were the more appropriate, that correlation also does not demonstrate a reliable, much less predictive, relationship between concentrations of copper in the sediment and those in the associated interstitial water. An "r" "correlation value" of 0.59 was presented for the "better" adjusted relationship (Figure II in Exhibit 1); WESTEC claimed that that indicated a "significant" relationship between the interstitial water copper concentration and the copper concentration in the sediment. However, it is the r^2 value, the coefficient of determination, rather than the "r" value that should be used to judge the degree of relationship between the two. The r^2 value is a measure of the "strength" of the relationship or the proportion of the variation in the interstitial water concentration (in this case) that is explained or accounted for by, in this case, the concentration of copper in the sediment. Based on the r value presented, the r^2 value for that relationship is 0.35, which means that 65% of the variation is not explained by the sediment-associated copper. A relationship with an r^2 value of 0.35 is clearly a very poor relationship.

An unfortunate aspect of mechanical application of statistics that is apparently demonstrated here, is that numbers and relationships can be demonstrated to have some "statistical significance" that is an artifact of mathematical manipulation rather than indicative of environmental quality significance. It is clear that the WESTEC (1987) data show that there was no relationship between copper measured in the sediments and the copper measured in the interstitial water. If the two data points had not been eliminated (as should have been the case), and the strength of the correlation presented in Figure I of Exhibit 1 is examined, it is found that the r^2 value of that correlation is <0.14, clearly indicative of no relationship. A lack of relationship between the concentration of copper in NCMT-area sediment and the associated interstitial water had also been demonstrated in the preliminary (Phase I) investigation that WESTEC (1986b) reported.

iv. The Regional Board staff incorrectly assumed that the ability to draw a line-of-best-fit (what was called a "regression line") through a body of points and develop statistics for that line, establishes a cause-and-effect relationship. Such statistics cannot be used to determine or substantiate cause-and-effect. To develop such conclusions is a misuse of statistics and can, as it did in this case, lead to erroneous conclusions.

v. On the basis of Figure II shown in Exhibit 1, WESTEC (1987) made the prediction that the copper concentration in sediment that would be associated with an interstitial water concentration of 50 μg Cu/L would be 7,050 mg Cu/kg dry wt. Despite the fact that apparently statistical operations could be used to demonstrate some "significance" of that prediction (at a 1% confidence level), that prediction is no more reliable than the relationship upon which it was developed. Based on the WESTEC data presented in that figure, sediments containing as much as about 13,000 mg Cu/kg dry wt. had associated with them "interstitial water" that contained less than 50 μg Cu/L. No environmental quality significance can be ascribed to that concentration of copper in the sediment. The reason that reference was made in Tentative Addendum No. 7 Item 14b to that estimate made by WESTEC was not made clear by the Board staff.

vi. Even if the relationships shown in Exhibit 1 were reliable and predictive, and demonstrated to be based on a cause-and-effect relationship (which they are not), there is no known environmental quality significance that can be ascribed to the concentrations of copper in the "interstitial water." This point was discussed previously in this supplemental testimony. There it was noted that as recently as August 1991, the US EPA reported (Ankley *et al.*, 1991), *"Further research is required to extend existing knowledge of pore water's suitability for evaluating sediment toxicity."*

Item 14c. Item 14c addressed inferences made by the Regional Board staff regarding the oyster larvae elutriates.

i) Item 14c began, *"Additional evidence is provided by the copper concentrations found within the elutriates which were prepared for the oyster larvae toxicity tests, as reported in the Woodward-Clyde report."* It was not made clear what those results provided "evidence" of; it is presumed that the Regional Board staff sought to derive "evidence" to support its claim that the water quality objectives were not being met based on the results of chemical analyses of elutriates from the oyster larvae toxicity tests. That ambiguity and the succeeding statements in that item and Item 14d represent additional technical problems with the manner in which the data from the 1991 risk assessment study have been used in the development of Tentative Addendum No. 7.

ii) Item 14c continued with the statement, *"A plot of the total sediment copper concentration (dry weight) versus the resulting concentration found within the elutriate preparations, reveals that the copper ore clearly contributes to the copper found within these elutriates."* That statement is simply not technically founded. First, there are inadequate data upon which to define any reliable relationship between the concentration of acid-soluble copper (essentially the form measured) in the elutriate and the total concentration of copper in the sediment from which the elutriate was derived. If a line-of-best-fit were mechanically derived for the data, the correlation coefficient (r) would be 0.24 and the r^2 value would be 0.06. Therefore, the "plot" cannot be considered to illustrate a meaningful relationship between the copper (whatever the source) in the sediment and the acid-soluble copper concentrations in the elutriates; it certainly cannot be said to "reveal that the copper ore clearly contributes to the copper found within these elutriates."

iii) Because the density of cupric ferrous sulfide (the material composing the copper ore concentrate) is substantially greater than that of sea water (as noted in the risk assessment report and reiterated in Tentative Addendum No. 7 Item 9c), the copper-ore-concentrate-derived copper that may have been suspended into the elutriate during the elutriation mixing would most likely have settled quickly during the quiescent settling period. Because of the highly insoluble nature of the cupric ferrous sulfide, it is unlikely that the short duration of mixing of the sediment and water during elutriation would have caused the dissolution of much of the copper from that matrix. It has already been demonstrated that there was no relationship between the total copper concentration in the sediment and the concentration of copper in interstitial water of the sediment that would be contributed to the elutriate during elutriation.

iv) Even if the sediment-associated copper ore were contributing all of the copper measured in the elutriate, it is clear from the toxicity tests conducted on the elutriate that the copper in the elutriate was not available. Not only were the embryo/larval oysters not affected by the levels of copper present in those elutriates, but also the fish larvae (*Menidia beryllina*) exposed to elutriates of sediments that contained even higher concentrations of copper did not exhibit toxicity. Based on the concentrations of copper measured in the oyster larvae toxicity test elutriates, the EC50 (concentration that causes 50% of the test organisms to show developmental abnormalities) for the elutriate with the highest copper concentration was >52 μg Cu/L; in contrast, the reference toxicant test with the same type of organism using copper sulfate (readily available copper) resulted in an EC50 of 16.5 μg Cu/L. If only one-third of the copper measured in the elutriates were available, half of the test organisms would have been developmentally affected; as it was, none of the test organisms was affected. Similarly, the NOEC (no observed effects concentration) in the reference toxicant test with available copper was 10 μg Cu/L; in the elutriate with the highest copper concentration, the NOEC was >52 μg Cu/L. This indicates that less than 20% of the copper in that elutriate was available. Clearly the real issue to be addressed is *not* the concentration of copper in the elutriate, but rather whether or not the copper adversely affects aquatic life. It is for this reason that the attempts being made to try to mechanically equate water quality protection with the achievement of a particular concentration of a parameter in a matrix are unreliable.

Item 14d. Item 14d continued the Regional Board staff's examination of the concentrations of copper in the elutriates used for the oyster larvae toxicity tests. That item also contained technically inappropriate analysis of the information provided by the risk assessment study.

i) The first statement in Item 14d was, "*The method used to measure the copper concentrations contained within these elutriates (the acid soluble method) is the same method which is prescribed within the Enclosed Bays and Estuaries Plan to determine compliance with receiving water objectives.*" That statement is neither correct nor relevant. First, the Enclosed Bays and Estuaries Plan adopted in April 1991 states, "*Aquatic life water quality objectives for cadmium, chromium, copper, lead, nickel,* *silver, and zinc are based on the acid soluble fraction. Compliance with these objectives shall be determined using the total recoverable method or a method approved by the State Board's Executive Director and EPA."* [emphasis added]. We are not supporting the application of the water quality objectives to the total recoverable forms of contaminants, but do note the discrepancy evident in what has been claimed in Tentative Addendum No. 7. Second, that issue aside, there is no relevance in a comparison between analytical methods used for, or concentrations of copper in, objectives and elutriates of the type developed in the risk assessment study referred to in Item 14d. This point is discussed further below.

ii) Item 14d continued and concluded with the statement, *"Although the copper concentrations which are present within the elutriates may or may not reflect the concentrations which could be expected to occur within the water column near the tested sediments; (sic) they do indicate the relative level of copper which might be expected to occur within the interstitial water in these sediments."*

That statement is not correct. Concentrations of parameters in elutriates cannot be used assess, or draw any reliable conclusions or inferences about, the concentrations of those parameters in interstitial water or in the watercolumn near the sediments. During the 1970's, we conducted more than a million dollars of research for the Corps of Engineers developing and evaluating the use of the elutriate test for aquatic sediments. That procedure was never intended, nor is it reliable to be used, for making conjectures about the concentrations of chemicals, much less their potential impact, in interstitial water. The US EPA has recently published a paper that reaffirmed the fact that elutriates cannot be used to judge interstitial water contaminant concentrations (Ankley *et al.*, 1991). It is obvious that elutriates cannot be used to estimate watercolumn concentrations since the dilution that occurs in the watercolumn must be known on a site-specific basis; such information cannot be established without substantial additional study. Finally, even if elutriates could be used to assess the concentrations of chemicals in the watercolumn or interstitial water, it still does not address the issue of the appropriateness of a 4,000 mg Cu/kg clean-up level which is the issue under review.

Item 14e. Item 14e is a statement of support and exculpation of the Regional Board staff's previously recommended clean-up objective of 1,000 mg Cu/kg dry wt.

This item stated, *"Cleanup of the sediment to this level will markedly reduce any contributions of copper to the water column and interstitial water from the copper ore."* That statement is predicated on the assumption that the copper ore concentrate now associated with the NCMT-area sediment is now contributing copper to the watercolumn and interstitial water in amounts that are adversely affecting water quality. There is no technical support for the contention that the copper ore concentrate now associated with the sediment is responsible for or contributing to the concentrations of copper in either the interstitial water or in the watercolumn. The risk assessment study and our technical testimony have not only revealed that the sediment-associated copper as it exists now in the NCMT-area sediments is not having a demonstrable adverse impact on water quality-beneficial uses of San Diego Bay, but also that there is no relationship between the amount of copper in the sediment and the concentrations of copper in either the interstitial water or the watercolumn. Those findings are supported by the environmental chemistry and toxicology of copper.

Item 14e continued, with reference to the 1,000 mg Cu/kg dry wt. clean-up level, *"It is also clear from the Woodward-Clyde report that the cleanup level will be protective of the designated beneficial uses of San Diego Bay."* That statement is misleading because it ignores the fact that the risk assessment and our technical testimony presented through the Port indicate that achievement of that level is not necessary to protect the designated beneficial uses of the Bay. Thus, while the 1,000 mg Cu/kg dry wt. level is protective, it is overly protective and hence requires unjustified expenditures for unnecessary remediation. Our technical testimony presented by the Port, supported by the results of our risk assessment, indicates that a 4,000 mg Cu/kg dry wt. (or even much higher) clean-up level for the NCMT-area copper-contaminated sediments would also be protective of the designated beneficial uses of San Diego Bay.

Comments on Material in Errata Sheet No. 1
to Tentative Addendum No. 7

Item 1.

Item 1 in the errata sheet added another Finding to Tentative Addendum No. 7 that requires comment. The new item "14." stated,

> *"San Diego Bay is listed in the State Board's WQA* [1990 Water Quality Assessment] *as having impaired water quality due to high levels of four pollutants: copper, mercury, tributyltin (TBT), and polychlorinated biphenyls (PCB's)."*

It further stated,

> *"The beneficial uses that are considered impaired are ocean commercial and sport fishing, shellfish harvesting, and marine habitat."*

Review of the 1990 Water Quality Assessment shows that impaired use may be assessed based on demonstrations of adverse impacts on aquatic life or the wholesomeness of aquatic organisms for use as food, or if "a numerical measurement exceeds a specified criterion or objective." As discussed previously in this supplemental testimony, the overall goal for water quality evaluation and management programs at both the federal and state levels is the protection of the designated beneficial uses of waters without unnecessary expenditure for unjustified "remediation." The use of exceedances of numeric water quality objectives in the judgement of an impact on beneficial uses must be considered in light of that goal.

It is well-recognized in the technical community that in order for a chemical to adversely affect an aquatic organism, the organism must be exposed to sufficiently high concentrations of available forms of the chemical for a sufficient duration to be harmed; the critical concentration--duration of exposure relationship depends on the type and stage of the organism and the concentration, form(s), and nature of the chemical. As discussed above, the numeric water quality objectives are applied to total concentrations of chemicals irrespective of their availability or of the duration of organism exposure; as such, they cannot be directly related to beneficial use impairment. Where no data exist regarding the impacts or lack of impacts of a chemical or other condition on aquatic life or beneficial uses of a water, the objectives can and should be used to indicate potential problems that should be investigated further. However, where reliable data exist on the impacts of chemical contaminants on aquatic life, such as toxicity tests, organism assemblages, etc., that information should be considered more reliable for assessing the impacts than mechanical comparison of total concentrations with objectives. We believe that it was in this context that the 1990 Water Quality Assessment included comparison with numeric objectives as an indication of water quality "impairment."

In the case of the NCMT-area sediment contamination with copper ore concentrate, both the existing chemical and biological/toxicological data and the aquatic chemistry and toxicology of copper indicate that the copper ore concentrate-contaminated sediment in the area of the NCMT is not adversely affecting beneficial uses of San Diego Bay. As discussed above, it is certainly inappropriate to link the presence of the copper ore concentrate in the NCMT-area sediment with the so-called impaired water quality determined based on exceedance of numeric water quality objectives. It is also highly inappropriate to conclude, as the Regional Board staff has apparently done, that an exceedance of a numeric water quality objective represents an impairment of designated beneficial uses of San Diego Bay that is adversely affecting "ocean commercial and sport fishing, shellfish harvesting, and marine habitat." There is no evidence, nor would it be expected, that the copper ore concentrate is having an adverse impact on "ocean commercial and sport fishing, shellfish harvesting, and marine habitat."

Item 3.

The "new" Finding 14e contended that since the copper concentration in the "ambient" water of San Diego Bay exceeds the numeric water quality objective of 2.9 μg Cu/L, the waters of the Bay have "no assimilative capacity" for copper. The "new" Finding 14f contended that the copper ore concentrate in the NCMT-area sediment is contributing to the exceedance of the numeric water quality objective for copper expressed in the Enclosed Bays and Estuaries Plan, in the watercolumn and interstitial water. As discussed in detail elsewhere in this supplemental testimony, the Regional Board staff has assumed, without technical foundation and in some cases based on inadequate or erroneous interpretation of data, that the copper ore concentrate now associated with the NCMT-area sediments is responsible for an exceedance of the numeric objective. That is a highly inappropriate assumption and an assumption that is contrary to the substantial amount of data that have been generated regarding the impact of the copper ore concentrate-contaminated sediments on beneficial uses of San Diego Bay. The available data for copper concentrations in the watercolumn of San Diego Bay show that in general, the concentrations of copper have not been significantly changed as a result of the presence of copper ore concentrate in the NCMT-area sediments.

The "new" Finding 14f also contended, *"Contributions of copper from the copper ore leading to violations of the copper water quality objective should be curtailed to the maximum extent practicable."* There is no evidence that copper from the copper ore concentrate now associated with the NCMT-area sediments is, in fact, contributing to so-called violations of the objective for copper. Further, there is substantial evidence that there is no relationship between the copper concentrations in the watercolumn, or interstitial water, or sediment elutriates, and the concentrations of copper in the associated sediments. Therefore, it is inappropriate to conclude that achieving a 1,000 mg Cu/kg dry wt. clean-up level will have any significantly different impact on the "violations" of the 2.9 μg Cu/L objective than would achieving a 4,000 mg Cu/kg dry wt. or 6,000 mg Cu/kg dry wt., or some other clean-up objective.

Environmental Health Coalition Position

A November 26, 1991 letter from L. Hunter of the Environmental Health Coalition (EHC) to Chairman Badger of the Regional Board outlined an indication of the EHC position on the issue of the Paco Terminal clean-up level. In that letter, Ms. Hunter quoted from two EHC documents. One was a letter to the Regional Board staff prepared in November 1990. The excerpt from that letter stated in part, *"The 1,000 ppm was set as the cleanup level because Regional Board staff determined that 1,000 ppm was the highest level allowable which would be expected to preserve the beneficial uses of the Bay and comply with the Ocean Plan."* As discussed in the risk assessment as well as elsewhere in this supplemental testimony, the EHC's description of the basis for the selection of the 1,000 mg Cu/kg dry wt. clean-up objective is inaccurate and misleading.

In her November 26, 1991 letter, Ms. Hunter also quoted from April 2, 1991 EHC testimony before the San Diego Unified Port Commission. That quotation stated in substantive part, *"The Cleanup level adopted by the Puget Sound Sediment Standards is 390 ppm for copper which, they have determined is the level above which there are always deleterious effects on marine life observed. Should there be an effort to change the cleanup level (at Paco Terminals) to one higher than 1000 ppm, EHC will advocate for the Puget Sound cleanup level of 390 ppm."* The EHC has mis-stated the facts regarding the validity of the 390 mg Cu/kg dry wt. value. That value was derived from the Long and Morgan (1990) report and represents their 50-percentile ("ER-M") value and has been applied as an "apparent effects threshold" (AET). We have discussed in detail the technical aspects, mis-use, and appropriate use of the information provided by Long and Morgan (1990) (Lee and Jones-Lee, 1992). An application of an "ER-M" value or an AET approach for a clean-up objective for NCMT-area sediments is unreliable and not technical defensible. Fundamental technical deficiencies include the following. The approach is based on the assumption of a relationship between the bulk chemical composition of a sediment and the toxicity of the sediment to aquatic life, a relationship that has been demonstrated to not exist for heavy metals and many other chemical contaminants. The approach inappropriately uses co-occurrence of conditions as though they were cause-and-effect relationships. For example, it assumes that the co-occurrence of laboratory toxicity associated with a sediment and the presence of a particular concentration of a chemical in that sediment indicates that the toxicity is caused by that contaminant; it makes that assumption for every measured chemical contaminant in that sediment. Each of the factors upon which the AET is based can vary significantly without reflecting in any way on the impacts that the contaminants present in a sediment have on the beneficial uses of the waterbody in which the sediments are located. The numbers and types of organisms present in a sediment depend on a variety of often ill-defined physical factors not related to the chemical contaminant characteristics of the sediment. In addition, the approach is dependent upon having a truly appropriate reference site which exists only in theory. The "toxicity tests" used by US EPA Region X for the development of AET values for Puget Sound were conducted on sediment extracts using the Microtox procedure, an approach that is known to be unreliable for environmental samples.

AET values developed for Puget Sound, even if appropriate for that location, cannot be directly transposed to the San Diego Bay system. While the approach itself is unreliable, if California regulatory agencies were to use the site-specific AET approach for the NCMT-area sediments, the clean-up objective that would result would be more than 18,000 mg Cu/kg. That is because the site-specific testing of those sediments (that would form the basis for the AET value) has shown that NCMT-area sediments containing as much as 18,000 mg Cu/kg (the highest concentration tested) have shown no impact on sensitive aquatic organisms, organisms sensitive to copper have been found living associated with NCMT-area sediments containing copper above that level, and the numbers and types of aquatic organisms in the copper-contaminated NCMT-area sediments were similar to those found outside of that area. Now in its position, the EHC is no longer recommending the Puget Sound AET value but is attempting to convince the State Board that the Regional Board's original clean-up objective of 1,000 mg Cu/kg has technical validity. As discussed previously, that clean-up objective was based on inappropriately conducted analysis and interpretation of data. It is clear that the EHC position in the matter of the clean-up objective for the NCMT-area sediments is not technically valid.

Conclusions

It is concluded that there is no technical justification for suggesting the need to impose a 1,000 mg Cu/kg dry wt. clean-up objective for the NCMT-area sediments. The recommended alternative clean-up objective of 4,000 mg Cu/kg dry wt. will be protective of beneficial uses of San Diego Bay and will minimize unnecessary expenditures for removal of copper-contaminated sediments that are not adversely affecting beneficial uses of the Bay. we would be happy to meet with the Board staff and others to answer any questions or discuss any of these issues.

References

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Krett, S. M., *Productivity and Diversity of Phytoplankton in Relation to Copper*, MS Thesis, San Diego State University, San Diego, CA (1979).

Lee, G. F., and Jones-Lee, A., "Sediment Quality Criteria Development: Technical Difficulties with Current Approaches, and Suggested Alternatives," Report of G. Fred Lee & Associates, El Macero, CA, January 6 (1992).

Long, E., and Morgan, L., "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program," NOAA Technical Memorandum NOS OMA 52, NOAA, Seattle, WA March (1990).

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Peters, G., staff member Water Quality Control Board, San Diego Region, personal communication to G. Fred Lee (1991).

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WESTEC (WESTEC Services, Inc.), "Evaluation of Copper in Interstitial Water from Sediments at Paco Terminals, San Diego Bay, Phase II," Prepared for Paco Terminals, Inc., National City, CA, WESTEC Services, In., San Diego, CA, March (1987).

EXHIBITS

Exhibit 1

Relationship between Copper Concentrations in
Interstitial Water and in Sediment near NCMT
(from WESTEC, 1987; WCC, 1991*)

Figure I

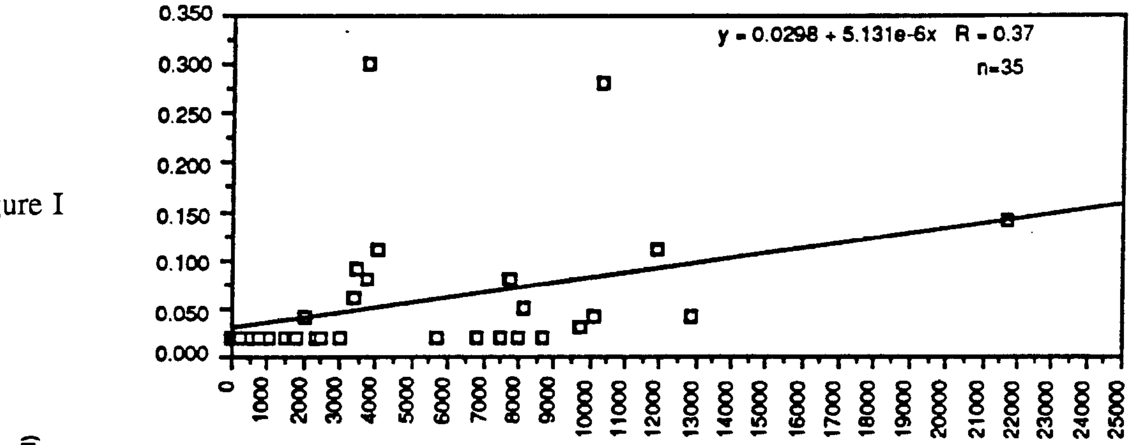
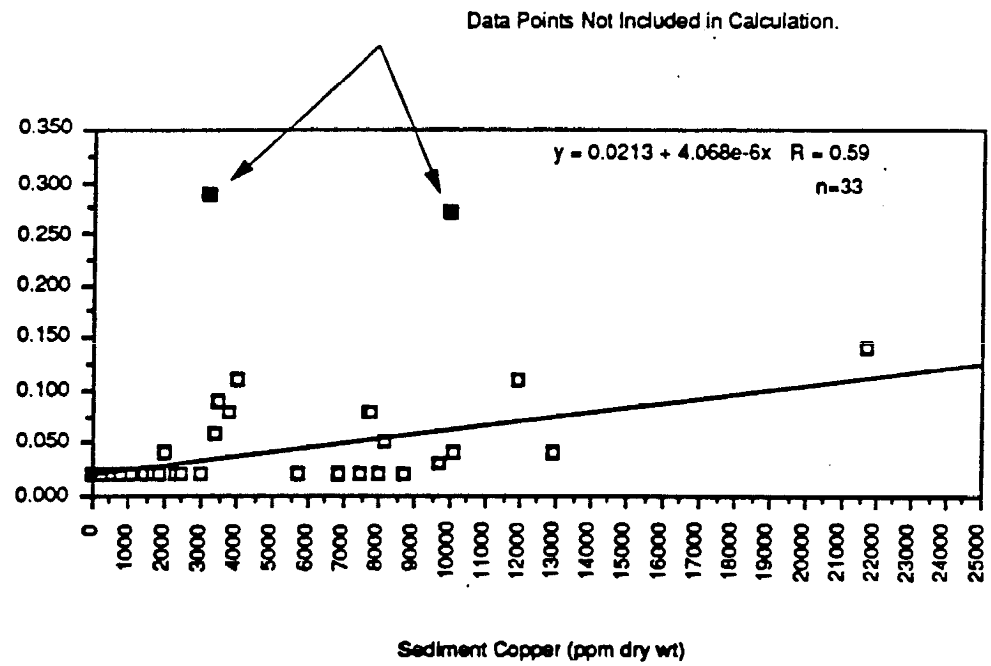


Figure II



*Woodward-Clyde Consultants, "Remedial Action Alternatives for National City Marine Terminal," Final Report, Prepared for San Diego Unified Port District, San Diego, CA, July 26 (1991).

APPENDIX C

SUMMARY INFORMATION

NAME: G. Fred Lee

ADDRESS: 27298 E. El Macero Dr.
El Macero, CA 95618

SOCIAL SECURITY:
573-42-8765

DATE & PLACE OF BIRTH:
July 27, 1933
Delano, California, USA

TELEPHONE:
916/753-9630
(home/office)

EDUCATION

Ph.D.	Environmental Engineering & Environmental Science, Harvard University, Cambridge, Mass. 1960
M.S.P.H.	Environmental Science-Environmental Chemistry, School of Public Health, University of North Carolina, Chapel Hill, NC 1957
B.A.	Environmental Health Science, San Jose State University 1955

ACADEMIC AND PROFESSIONAL EXPERIENCE

Current Position:
Consultant, President G. Fred Lee and Associates

Previous Positions:
Distinguished Professor, Civil and Environmental Engineering, New Jersey Institute of Technology, Newark, NJ 1984-89
Senior Consulting Engineer, EBASCO-Envirosphere, Lyndhurst, NJ (part-time) 1988-89
Coordinator, Estuarine and Marine Water Quality Management Program, NJ Marine Sciences Consortium Sea Grant Program 1986-1988
Director, Site Assessment and Remedial Action Division, Industry Cooperative Center for Research in Hazardous and Toxic Substances, New Jersey Institute of Technology et al., Newark, NJ 1984-1987
Professor, Environmental Engineering, Colorado State University 1978-1982
Professor, Environmental Engineering & Sciences; Director, Center of Environmental Studies, University of Texas at Dallas 1973-1978
Professor of Water Chemistry, Department of Civil & Environmental Engineering, University of Wisconsin-Madison 1961-1973

REGISTRATION

Registered Professional Engineer, State of Texas, Registration No. 39906

EXAMPLES OF GOVERNMENTAL and PROFESSIONAL SOCIETY EXPERIENCE

AGENCY	TYPE OF ACTIVITY
US Environmental Protection Agency	Panel section leader on lake restoration
Wisconsin Department of Natural Resources	Advise on use of pesticides for fish management programs. Member of thermal pollution study criteria committee
Attorney General, State of Illinois	Assist in preparation of lawsuit against US Steel Corporation on the effects of the discharge of wastewater on water quality in southern Lake Michigan
State of Wisconsin	Member, committee on groundwater quality control, 1970-73
US-Canada International Joint Commission	Member, research advisory board committee on eutrophication research, 1973-76
Great Lakes Basin Commission	Member, ad hoc committee on water quality modeling, 1974
US Public Health Service	Advise drinking water standards for PCB's, 1970-71
State of Wisconsin	Secretary, Technical Advisory Council of Wisconsin Pesticide Review Board
City of Madison, Wisconsin	Vice Chairman, Lake Mendota Problem Committee
Madison Metropolitan Sewerage District	Evaluate effect of wastewater disposal on water quality in receiving waters
President's Council on Environmental Quality	Advise on the role of phosphate in the eutrophication of natural waters. Advise on methods for control of chemical pollution of natural waters. Assist in development of toxic chemical control legislation
US Army Environmental Hygiene Agency	Advise water supply and wastewater disposal at Army installations, military bases, and munitions work, 1972-74
National Academy of Sciences, National Academy of Engineering	Advise on the development work plan for National Commission on Water Quality
National Commission on Water Quality	Review of the 1972 Amendments to the Federal Water Pollution Control Act

US Environmental Protection Agency	Advisor to Task Force on Ocean Dumping, 1973
US Army Corps of Engineers	Member, advisory panel on development of program for determining effect of dredged material disposal on water, 1972-77
Dane County Planning Commission	Advise on potential effects of wastewater irrigation on water quality in Dane County, Wisconsin
US Army Corps of Engineers - San Francisco District	Review dredge spoil disposal criteria research program for San Francisco Bay
US Comptroller General of GAO	Review the effectiveness of the Federal research grant programs in the area of water quality management, 1973
US Environmental Protection Agency	Member, steering committee for chemical and biological studies on Lake Ontario as part of the International Field Year for the Great Lakes, 1973-74
Tennessee Valley Authority	Advise on water quality monitoring program for evaluating environmental impact of hydro and steam electric power production, 1974
National Oceanic & Atmospheric Administration	Advise on Great Lakes water quality modeling, 1974
WAPORA - Attorney General, State of Illinois	Advise on litigation on impact of State of Illinois
	Milwaukee municipal wastewater discharge on water quality of Lake Michigan
US Environmental Protection Agency	Represent US EPA at International Workshop on OECD-Eutrophication Program, 1975
Property Owners, City of Sachse, Texas	Conduct study on the impact of sanitary landfills on environmental quality
City of Dallas Water Utilities	Advise on study of water quality in Lake Ray Hubbard
State of New Mexico	Advise on approach for assessing nutrient load and effects on water quality in New Mexico impoundments
City of Dallas Health Department	Advise on water quality studies
US Environmental Protection Agency	Review reports on Lake Ontario water quality
	Develop water quality research strategy for the Great Lakes

International Joint Commission for Water	Serve as chairman of Research Advisory Board the Great Lakes Committee that defines research needs for thermal pollution, dredged material disposal, oil spills, and water level regulation
OECD Eutrophication Program	Serve as US representative to Technical Bureau of OECD Eutrophication Program
Attorney General, State of Texas	Advise on environmental impact of sanitary landfills on surface and groundwater quality
New York District of the US Army Corps of Engineers	Develop monitoring program to evaluate the significance of contaminants in dredged sediments on water quality in the New York Bight
Parks Department, City of Chicago	Advise on water quality management of park lagoons
National Oceanic and Atmospheric Administration	Assist in selection of the 20 most important New York Bight Study contaminants entering the New York Bight
US Environmental Protection Agency	Review pretreatment requirements for wastewaters produced by steam electric generating stations before discharge to public domestic wastewater sewerage systems
US Environmental Protection Agency	Advise on development of Ocean Dumping Regulations, 1976
US Environmental Protection Agency - US Army	Assist in developing benthic organism bioassay Corps of Engineers procedure
New York District of US Army Corps of Engineers	Evaluate significance of ocean dumping of dredged sediment on water quality in the New York Bight
US-Canada International Joint Commission Research	Member of Expert Committee on Engineering and Advisory Board for the Great Lakes Technical Aspects of Great Lakes Water Quality
City of Denison, Texas	Advise on lawsuit on environmental impact of city's wastewater discharges
University of Puerto Rico Center for Energy and Environment	Advise on research program on environmental impact of energy development
Emilia-Romagna Region - Italian Government	Advise on research program for control of eutrophication of nearshore waters of Adriatic Sea
US Environmental Protection Agency	Advise on study designed to evaluate the environmental impact of dredging and dredged material disposal

American Fisheries Society	Reviewer of US EPA Quality Criteria for Water; Section Coordinator of Phosphate Section
US Corps of Engineers - New Orleans District	Advise on Dredged Material Disposal Criteria
US Environmental Protection Agency	Review Water Quality Criteria - toxic chemicals
The Netherlands Government Rijkswaterstaat	Advise on development of environmental quality management programs for the Delta Works dams on the Rhine River Estuary
Spanish Government Ministry of Public Works	Advise on water quality management plans for Spanish impoundments
State of Florida	Advise on control of nutrients from drained wetlands
US Department of Energy	Advise on award of contracts for work in the area of conservation and energy production in association with disposal of municipal wastewater sludges
US Environmental Protection Agency	Member of workshop panel devoted to defining research needs in the area of transport and fate of toxic chemicals in the environment
US-Canada IJC Research Advisory Board for Great Lakes	Member subcommittees of ETA devoted to Water Quality environmental impact of dredging on Great Lakes water quality and
	Available forms of contaminants in Great Lakes waters
Joint Industry-Governmental Agency Group	Participate in workshops estimating the hazard of chemical substances to aquatic life
US Department of Interior Fish and Wildlife Service	Participant in workshop devoted to modeling of the effect of instream flow on water quality
US Environmental Protection Agency	Advisor on measurement of available phosphorus in domestic wastewater treatment plant effluents
Fort Collins, Colorado	Advisor on impact of wastewater discharges on water quality in the Poudre River
Platte River Power Authority	Advisor on water quality management in cooling water impoundment
Northwest Colorado Council of Governments	Advisor on development of eutrophication study program for Dillon reservoir
State of Colorado Department of Health	Advisor on PL 92-500, Section 314-A lake classification studies

Denver Regional Council of Governments	Advisor on water quality studies
Pueblo Area Council of Governments	Conduct study on impact of Pueblo's wastewaters on Arkansas River water quality
Cities of Fort Collins and Loveland, Colorado	Evaluate water quality impacts of chlorine and ammonia in domestic wastewaters
Governor Lamm - Colorado, Lowry Hazardous Waste Disposal Task Force	Evaluate environmental impact of hazardous waste disposal at Lowry disposal site, Denver, Colorado
Attorney General, State of New York	Advise on procedures for long term storage of hazardous wastes
Longmont, Colorado	Advise on domestic wastewater impact on water quality in the St. Vrain River
Colorado Springs, Colorado	Advise on impact of domestic wastewater discharge on water quality in Fountain Creek
US Environmental Protection Agency	Evaluation of National Eutrophication Survey results
US Army Corps of Engineers, Norfolk District	Advise on environmental impact of dredging sediment containing kepone and other contaminants
	Develop water quality monitoring program for dredging North Landing River channel
US Army Corps of Engineers Rock Island District	Advise on impacts of chemical contaminants in upper Mississippi River sediments on water quality aspects of dredged sediment disposal
Brush, Colorado	Advise on impact of location of hazardous waste disposal site in watershed for domestic water supply
US Environmental Protection Agency	Review draft water quality criteria document for ammonia
Colorado Department of Health - Water Quality	Member bioassay guidelines committee Division
Dominican Republic	Advise on water quality in proposed domestic water supply reservoir
Ministry of Public Works of Argentina	Advise on modeling of eutrophication in Argentine lakes and reservoirs and on approaches for establishing water quality criteria and standards
US Environmental Protection Agency	Peer reviewer, site-specific water quality criteria guidelines

National Oceanic & Atmospheric Administration	Participant in workshop on development of meaningful measures of marine pollution impacts
US Environmental Protection Agency	Develop guidance document for implementing ammonia water quality criteria in permitted discharges
US AID and Jordanian National Planning Council	Evaluate proposed water quality and development of monitoring program for Jordan
Olathe, Kansas	Development of water quality management program for Lake Olathe
US EPA, US COE, API, and CMA	Member planning committee US EPA, Corps of Engineers, Chemical Manufacturers Association, and American Petroleum Institute, sponsored workshop on Hazard Assessment Techniques for Contaminants in Aquatic Sediments
South African Water Research Commission	Advise on application of OECD eutrophication study results to South African impoundments
Government of Swaziland - US AID	Evaluate safety of use of household bleaches for home water supply disinfection
US Environmental Protection Agency	Peer reviewer for lead and chromium ambient water quality criteria
Pan American Health Organization - World Health	Advise government of Argentina on water quality management in impoundment
Brazos River Authority	Evaluation of therapeutic value of Stovall Hot Wells water
US Congress Office of Technology Assessment	Review draft report on inadequacies of federal legislation governing land disposal of hazardous waste
Michigan Toxic Substance Control Commission	Advise on adequacy of Michigan legislation governing land disposal of waste
California State Water Quality Control Board	Review proposed regulations for land disposal of waste
US Army Construction Engineering Research	Advise on studies and the development of control Laboratory program for Fort Dix, New Jersey groundwater contamination problems
Texas Legislative Council Joint House Senate Hazardous Waste Committee	Advise on hazardous waste management approaches for the state of Texas
State of Texas Comptroller's Office	Advise on hazardous waste taxation

United Nations Water Power Research Station at Poona, India	Advise on water quality management for hydropower developments and for nearshore and marine waters
Canadian River Municipal Water Authority	Advise on methods for the control of fresh water sponge growth in transmission lines and THM control
Tunisian Ministry of National Economy	Advise on the development of water quality management programs for Tunisian industry
Argentine Ministry of Public Health and Social Affairs	Advise on approaches for developing water quality criteria and standards, management of water quality in Argentine reservoirs, and hazardous waste management
The State of New Jersey, Dept. of Treasury	Review qualifications of consulting engineering firms for work in hazardous substance & waste management
Liberty State Park Commission, New Jersey	Review water quality problems associated with Port Liberte, NJ development
State of California Water Resources Control Board	Assist in development of long-range strategy for managing California's groundwater quality
Governor's Panel on Water Quality of New Jersey	Co-chairman and advise on evaluation of water Coastal Waters quality conditions and trends in New Jersey coastal waters
State of Vermont Department of Water Resources	Advise on developing revised phosphorus Environmental Engineering management strategy for Lake Champlain
US Army Construction Engineering Research	Advise on the use of landfill leachate recycle for Laboratory leachate treatment and disposal
Scotland and Robson Counties, City of Laurinburg, NC	Evaluate the potential public health and water quality impacts of a proposed hazardous waste treatment facility on the Lumber River
Wayne County, IL	Evaluate the potential environmental problems of a proposed sanitary landfill
Newark Watershed Conservation and Development Corporation	Evaluate the environmental and public health aspects of an open-burning open-detonation hazardous waste treatment facility
Foundation de L'Eau, France	Impact of detergent phosphate bans on water quality
US Environmental Protection Agency	Reviewer of US EPA draft document on domestic wastewater dechlorination

Green Pond Lake End Board, NJ	Advise on Green Pond Lake water quality management, 1987
NY Academy of Sciences Public Policy Program	Advise on management of PCB's in the Hudson River system, 1988
USSR Academy of Sciences	Advise on water quality management programs for Volga River system, May 1987-
National Water Well Association	Review content of workshops and short courses, 1987
US Environmental Protection Agency	Reviewer of Office of Toxic Substances/Test Rules Development Branch documents for evaluation of public health and environmental impact of new chemicals
Ebasco-Envirosphere Rem III	Advise on work plan for Solvent Savers Site and Niagara County, NY Refuse landfill, 1988-89
NJ Department of Environmental Protection	Member of NJ DEP Thermal Discharge Evaluation Committee, 1989
San Gabriel Basin Main Watermaster	Advise on groundwater quality impacts of proposed landfill expansion, 1989-
North Carolina Attorney General	Advise on appropriate degree of treatment of hazardous waste treatment facilities wastewater discharges on public health and environmental quality, 1988-89
Department of Health Booton Township NJ	Advise on evaluation of potential impact of development of a lake's watershed with septic tank wastewater disposal systems on lake water quality, 1989
Metropolitan Water District of Southern California	Recommend revised California regulations governing landfilling of solid wastes as part of revisions of Subchapter 15, 1990-
	Review potential public health and environmental problems of San Diego County Department of Public Works proposed North County Class III landfills, 1990-
	Assist in litigation on the Azusa landfill expansion, 1990-
Port of Oakland, CA	Advise on management of contaminated dredged sediments, 1990
City of Sacramento, CA	Advise on adequacy of hazardous chemical clean-up as part of redevelopment of the Southern Pacific Railyard site, 1990-

California Regional Water Quality Control Board staff	Review potential public health and environmental San Francisco Region aspects of the proposed Apanolio Canyon landfill, July 1990
City of Pittsburg, CA	Review potential public health and environmental aspects of the proposed Keller Canyon Landfill, August 1990-

EXAMPLES OF
INDUSTRIAL CONSULTING EXPERIENCE

FIRM OR AGENCY	TYPE OF ACTIVITY
Commonwealth Edison Company	Advise on effect of thermal discharge of nuclear electric generating station on water quality in Lake Michigan
N.E. Issacson & Associates	Evaluate potential water quality in proposed impoundment of land development. Evaluate effect of septic tank wastewater disposal system on surface and groundwater quality
Wisconsin Electric Power Company	Advise on study of effect of thermal discharges of thermal electric generating station on water quality
James Lonsdorf, Attorney	Evaluate effect of sanitary landfill drainage on groundwater quality
United Engineers	Design study program and model for chlorine persistence in thermal discharge plume in Delaware River estuary
Inland Steel Development Corporation	Evaluate potential effects of land development on water quality in Lake Monroe, Ind.
Reserve Mining Company	Advise on analytical methods, sampling program and procedures for the study of the effect of taconite tailings on water quality
Procter & Gamble Company	Review studies on NTA and other compound's potential effect on environmental quality
Automated Environmental Systems	Member of Board of Directors, 1970-71
Bear Creek Mining, Kennecott Copper Corporation	Advise on water quality impact of proposed copper mining activity
WAPORA - US Army Corps of Engineers	Evaluate potential for eutrophication in proposed impoundment on the upper Delaware River
Inland Steel Corporation	Assist in evaluation of environmental impact of company's wastewater discharge
Hooker Chemical Company	Advise on the use of hazard assessment approach for evaluating the water quality significance of chemical contaminants
Mission Viejo Development	Advise on water quality impacts of potential wastewater discharges

Outboard Marine Corporation	Advise on water quality significance of PCB's in sediments
Amoco Oil Company	Investigate environmental significance of gasoline spill
Allied Chemical Company	Advise on approaches that should be used to evaluate the environmental impact of contaminants in solid wastes
Appalachian Timber Services, Inc.	Advise on impact of phenolics, copper, chromium solid waste on surface and groundwater quality
E. I. DuPont	Advise on approach to assess environmental hazard of chemical railroad car spills
J. Rupp	Advise on land development in wetlands area in Minnesota
Stauffer Chemical Company	Advise on aquatic toxicity facility and program development
Technical Testing Laboratories, Inc.	Advise on water quality impact of chemical waste disposal on groundwater quality
Neville Chemical Co.	Advise on litigation of hazardous waste disposal on contamination of municipal water supply well
Adolph Coors Company	Evaluate water quality impacts of industrial wastewater discharges
Grinnell Fire Protection Systems, Inc.	Evaluate performance of plating waste treatment plant and develop approach for management of hazardous wastes
Mobil Chemical - Pasadena, Texas	Evaluate impact of ammonia discharges on water quality in Houston Ship Channel
Nekoosa Edwards, Inc.	Advise on water quality management program for company's water supply
US Steel Corporation	Advise on environmental impact of wastewaters on water quality
Monsanto Chemical Company	Advise on environmental impact of products
Foley and Lardner, Attorneys	Consultant, environmental impact of paper mill discharges
Gould, Inc.	Advise on environmental impact of plating wastes on fresh water clams
Illinois Petroleum Council	Advise on water quality standards for cyanide and metal cyanide complexes

FMC Corporation	Advise on impact of detergent phosphate on water quality
Zimpro, Inc.	Advise on potential areas for business expansion
A. Halff, Engineers	Advise on water quality in Town Lake in Dallas, Texas
Acme Brick Company	Advise on environmental impact of land disposal of chemical wastes
Follett Publishing Company	Technical consultant for book entitled <u>Water</u>
El Paso Natural Gas Company	Evaluate environmental impact of dredging channel in Matagorda Bay, Texas
Genesis II, Inc.	Advise on technical aspects of new product development
Procter & Gamble Company, Japan	Evaluate significance of detergents as a cause of water pollution problems in Japan
King Industries	Advise on environmental impact of dredging Norwalk, Connecticut Harbor channel on water quality
Cotter Company	Advise on adequacy of domestic water treatment plant operations
Allied Chemical Company	Advise on water quality significance of ammonia
Idarado Mining Co., Telluride, CO	Advise on water quality impact of heavy metal mine tailings and drainage
Kraft Foods, Inc., Northbrook, IL	Advise on impact of wastewater ammonia and BOD discharges on receiving water quality in Lakeland, Florida
Trammel Crow, Inc., Dallas, TX	Advise on water quality management in Crystal Lake, West Orange, NJ
	Develop water quality management program for new office complex
Zukowski, Rogers & Flood, Esqs., Crystal Lake, IL	Assist in evaluating environmental impact of proposed sanitary landfill
US EPA Washington, DC	Reviewer for Toxic Substances/Test Rules Development Branch documents for evaluation of public health and environmental impact of new chemicals

Ebasco-Envirosphere Rem III	Advise on work plan for Solvent Savers Site and Niagara County, NY Refuse site; review CIC Edison, NJ Site PCB and Dioxin remediation; rewrite Brick Township Phase I RI/FS report; Pearch Water Site PCB Treatability Studies; develop RI/FS investigation guidance manual, 1988-89
Unilever, R&D Headquarters, The Netherlands	Evaluate impact of phosphate on water quality in lakes and reservoirs
H. A. Bogorad	Review potential water quality in proposed hydropower impoundment
IBM Corporation	Review long-range management strategy for hazardous wastes
PSE&G (Public Service Energy and Gas)	Advise on managing gasification residues and other areas of water quality management
McHenry County Defenders, IL	Review potential water quality problems associated with siting a new sanitary landfill
Schmeltzer, Aptaker and Shepard, Attorneys, Washington, DC	Advise on water quality problems associated with disposal of industrial waste in a sanitary landfill
D. Walsh, Attorney and W. Kelly	Advise on the impact of land development on water quality in Lake Tahoe, CA/NV, 1989
Sturbridge Lakes, NJ	Advise on water quality management for Sturbridge Lakes, 1989
CP Chemical, Seawaren, NJ	Advise on control of toxicity in hazardous waste treatment facility's wastewater discharges, 1989
Exxon Research & Engineering Co., Annadale, NJ	Evaluate potential for algal bloom development as result of use of bioremediation nutrients on oil spill beach residues in Prince William Sound, Alaska, 1989
Delta Wetlands, Lafayette, CA	Evaluate potential water quality-trihalomethane formation potential in proposed water supply storage reservoirs in Sacramento and San Joaquin River Delta, 1989
Dart and Kraft Inc., Northbrook, IL	Evaluate impact of phosphorus from wastewaters on receiving water quality
	Evaluate impact of wastewater discharges on receiving water quality, Melrose, MN
Newport City Development, Jersey City, NJ	Advise on remediation of coal tar waste sites
CDM Inc., Edison, NJ	Review Superfund RI/FS for Ft. Dix landfill

Yellow Ribbon Panel, Vernon, NJ	Advise on the public health and environmental hazards of disposal of radium waste near Vernon
Orbe, Nugent and Collins, Attorneys, Ridgewood, NJ	Advise on impact of landfill on surface and groundwater quality
Wyman-Gordon Co., North Graton, MA	Advise on water treatment system for high purity argon recovery
Save Our Shores, Neptune, NJ	Advise on sanitary quality of New Jersey coastal waters
Levy & Angstreich, Attorneys, Cherry Hill, NJ	Advise on public health impact of hazardous waste landfill on nearby residents
General Foods, Inc., White Plains, NY	Evaluate potential aquatic life toxicity of animal fat residues in industrial wastewater discharges to Boston Harbor, 1989
Simpson Paper Co., Anderson, CA	Evaluate appropriate wastewater discharges for dioxins, 1990-
	Assist in litigation on the environmental impact of waste water discharges to coastal waters of Northern California, 1990-
Hancock, Rothert & Bunshoft, Attorneys, San Francisco, CA	Assist in Aerojet litigation on TCE contamination of groundwater, 1990-

Member, Task Force Committee on Radioactivity in Drinking Water, 1987-
Member, Natural Resources Committee, Greater Sacramento Chamber of Commerce, 1990-
Member, Air and Waste Committee, and Water Resources Committee California Chamber of Commerce, 1990-

HONORS AND AWARDS

Elected member of the following:
- Sigma Xi
- Delta Omega, Honorary Public Health Scholastic Society
- Phi Lambda Upsilon, Honorary Chemistry Scholastic Society
- Diplomate, American Academy of Environmental Engineers

Tied for first place for best paper presented at the Fifth Annual ASTM Aquatic Toxicology meeting in Philadelphia, PA, October, 1980

JAWWA paper selected by the Resources Division of the AWWA as the best paper published in the Journal during the year, 1986

US Representative, World Federation of Engineering Organizations First World Congress on Engineering and the Environment, Buenos Aires, Argentina, November, 1981

Received Certificate of Appreciation from the Corps of Engineers for work on the Dredged Material Research Program, 1978

Received Certificate of Appreciation from the Lubbock County Water Control and Improvement District No. 1 for work in Water Quality Management of Buffalo Springs Lake, 1982

RESEARCH INTERESTS

Chemical and biological water quality aspects of surface and groundwater supplies

Chemistry and biochemistry of municipal and industrial water and wastewater treatment

Chemical aspects of water pollution control in surface and groundwaters, rivers, lakes, estuaries and the oceans

Sources, significance and fate of chemical contaminants in the environment

Implementation of environmental research results into public policy

Development of hazard assessment approach for assessing environmental impact of chemicals

Development of technically valid, economical and environmentally protective approaches for management of solid and hazardous wastes

G. FRED LEE'S UNIVERSITY GRADUATE LEVEL TEACHING EXPERIENCE

Taught Recently:

- Aquatic Chemistry (Minteq based)
- Impact of Contaminants on Water Quality - Water Quality Modeling
- Physical/Chemical Treatment of Water, Wastes, and Leachates
- Solid & Hazardous Waste Generation, Treatment, and Disposal
- Hazardous Waste Management Engineering
- Applied Limnology and Oceanography
- Water & Wastewater Analysis
- Water Quality Field Study Methodology
- Special Topics in Solid & Hazardous Waste Management
- Unit Processes of Water and Wastewater Treatment Laboratory
- Advanced Water Quality Modeling
- Hazardous Waste Management Engineering

Taught Previously:

- Estuarine & Marine Chemistry
- Coastal and Estuarine Processes - Field Course
- Applied Radiochemistry, Radioactive Waste Problems & Management
- Advanced Techniques of Water & Wastewater Analysis
- Introduction to Environmental Engineering
- Colloidal Chemistry of Water & Wastes

ENVIRONMENTAL IMPACT OF

DREDGING AND DREDGED MATERIAL DISPOSAL AND

RELATED PAPERS AND REPORTS

Prepared by G. Fred Lee, R. Anne Jones, and their associates

278. Lee, G. F., and Jones, R. A., "Evaluation of Water Quality Aspects of Sediment-Associated Contaminants," Presented at Western Dredging Association, Pacific Chapter Meeting, Ventura, CA, August (1990). (Outline of Presentation).

269. Lee, G. F., and Jones, R. A., "Water Quality Significance of Contaminants Associated with Sediments: An Overview," IN: Fate and Effects of Sediment-Bound Chemicals in Aquatic Sediments, Pergamon Press, Elmsford, NY, pp. 1-34 (1987).

271. Jones, R. A., and Lee, G. F., "Toxicity of U.S. Waterway Sediments with Particular Reference to the New York Harbor Area," in Chemical and Biological Characterization of Sludges, Sediments, Dredge Spoils and Drilling Muds, ASTM STP 976 pp. 403-17 ASTM Philadelphia, PA (1988).

266. Lee, G. F., and Jones, R. A., "Assessing the Potential Water Quality Hazards Caused by Disposal of Radium-Containing Waste Solids by Soil Blending," Proc. NWWA Conference - Radon, Radium and Other Radioactivity in Ground Water, Lewis Publishers, Inc., Chelsea, MI, pp. 511-520 (1987).

250. Lee, G. F., and Jones, R. A., "Evaluating the Water Quality Significance of Dredged Sediments," IN: Dredging and Dredged Material Disposal Proc ASCE Conference pp. 1050-61 (1984).

268. Lee, G. F., and Jones, R. A., "Assessment of the Degree of Treatment Required for Toxic Wastewater Effluents," Proc. Int. Conf. on Innovative Biological Treatment of Toxic Wastewaters, US Army Construction Engineering Research Laboratory, Champaign, IL, pp. 652-677 (1987).

262. Lee, G. F., and Jones, R. A., "Water Quality Hazard Assessment for Domestic Wastewaters," Environmental Hazard Assessment of Effluents, Pergamon Press, New York, pp. 228-246 (1986).

227. Lee, G. F., and Jones, R. A., "Water Quality Aspects of Dredged Material Disposal in the Gulf of Mexico near Galveston, Texas," IN: Proceedings of the 14th Dredging Seminar CDS Report No. 263, Center for Dredging Studies, Texas A&M University, College Station, TX, pp. 234-300 (1982).

238. Lee, G. F., and Jones, R. A., "Evaluation of Potential Water Quality Problems Associated with Highway Excavation and Fill," IN: Leachate: Terrain Analysis, National Academy of Sciences, Transportation Research Board Record 892, pp. 1-7 (1982).

155. Saleh, F. Y., Lee, G. F., and Butler, J. S., "Kepone and Other Selected Hydrocarbon Pesticides and PCB Behavior during Hydraulic Dredging of the James River near Hopewell, Virginia," Jour. Env. Science Health, A13:261-294 (1978).

180. Lee, G. F., Jones, R. A., and Rast, W., "Availability of Phosphorus to Phytoplankton and Its Implication for Phosphorus Management Strategies," IN: Phosphorus Management Strategies for Lakes, Ann Arbor Press, pp. 259-303 (1980).

195. Lee, G. F., and Jones, R. A., "Application of Hazard Assessment Approach for Evaluation of Potential Environmental Significance of Contaminants Present in North Landing River Sediments upon Open Water Disposal of Dredged Sediment," Proc. Old Dominion University/Norfolk District Corps of Engineers symposium, "Dredging Technology: A Vital Role in Port Development," August (1981).

205. Jones, R. A., and Lee, G. F., "The Significance of Dredging and Dredged Material Disposal as a Source of Nitrogen and Phosphorus for Estuarine Waters," IN: Estuaries and Nutrients, Humana Press, Clifton, NJ, pp. 517-530 (1981).

209. Jones, R. A., Mariani, G. M., and Lee, G. F., "Evaluation of the Significance of Sediment-Associated Contaminants to Water Quality," Published in: Proc. of Am. Water Resources Assoc. Symposium, Utilizing Scientific Information in Environmental Quality Planning, AWRA, Minneapolis, MN, pp. 34-45 (1981).

217. Lee, G. F., and Jones, R. A., Discussion of: "Dredged Material Evaluations: Correlation between Chemical and Biological Evaluation Procedures," Journ. Water Pollut. Control Fed. 54:406-7 (1982).

218. Lee, G. F., and Jones, R. A., "Assessing Environmental Impacts of Open Water Disposal of Dredged Sediments," World Dredging 18:20-22 (1982).

243. Lee, G. F., and Jones, R. A., "Translation of Laboratory Results to Field Conditions: The Role of Aquatic Chemistry in Assessing Toxicity," Aquatic Toxicology and Hazards Assessment Sixth Symp., ASTM STP 802, American Society for Testing and Materials, pp. 328-349, Philadelphia, PA (1983).

244. Newbry, B. W., and Lee, G. F., "A Simple Apparatus for Conducting In-Stream Toxicity Tests," J. Testing and Evaluation, ASTM 12:51-53 (1984).

221. Lee, G. F., Jones, R. A., and Newbry, B. W., "Water Quality Standards and Water Quality," Journ. Water Pollut. Control Fed. 54:1131-38 (1982).

225. Nienke, G. E., and Lee, G. F., "Sorption of Zinc by Lake Michigan Sediments," Implications for Zinc Water Quality Criteria - Standards, Water Res. 16:1373-78 (1982).

115. Lee, G. F., "Potential Environmental Problems of Dredging and Dredged Material Disposal" Proc. 6th Pacific Coast Conference on Dredging, pp. 62-68 (1975).

123. Lee, G. F., "Dredged Material Research Problems and Progress," Environmental Science and Technology 10:334-338 (1976).

124. Lee, G. F., Lopez, J. M., and Piwoni, M. D., "An Evaluation of the Factors Influencing the Results of the Elutriate Test for Dredged Material Disposal Criteria," Proc. ASCE Specialty Conference on Dredging and Its Environmental Effects, Amer. Soc. Civil Engr., pp. 253-288 (1976).

125. Lee, G. F., "Recent Advances in Assessing the Environmental Impact of Dredged Material Disposal," Proc. World Dredging Conference, San Pedro, California, pp. 551-578 (1976).

130. Lee, G. F., "Significance of Chemical Contaminants in Dredged Sediments on Estuarine Water Quality," Proc. Estuarine Pollution Control and Assessment Conference, Pensacola, FL, February, 1975. US Environmental Protection Agency, pp. 211-226 (1977).

133. Lee, G. F., "Summary of Studies on the Release of Contaminants from Dredged Sediment on Openwater Disposal," IN: Interactions between Sediments and Fresh Water, W. Junk, Purdoc, the Hague, pp. 444-446 (1977).

138. Lee, G. F., and Mariani, G. M., "Evaluation of the Significance of Waterway Sediment-Associated Contaminants on Water Quality at Dredged Material Disposal Sites," Aquatic Toxicology & Hazard Evaluation, American Society for Testing and Materials, Special Publication No. 634, pp. 196-213 (1977).

139. Lee, G. F., "Discussion of paper by Mueller et al., 'Contaminants in the New York Bight,'" Journ. Water Pollut. Control Fed. 49:1920-1921 (1977).

141. Lee, G. F., Lopez, J. M., and Mariani, G. M., "Leaching and Bioassay Studies on the Significance of Heavy Metals in Dredged Sediments," Proc. of International Conference on Heavy Metals in the Environment, Toronto, Canada, 1975, Part II, pp. 731-764 (1977).

149. Saleh, F. Y., and Lee, G. F., "Analytical Methodology for Kepone in Water and Sediment," Environ. Sci. & Technol. 12:297-301 (1978).

155. Saleh, F. Y., Lee, G. F., and Butler, J. S., "Kepone and Other Selected Hydrocarbon Pesticides and PCB Behavior during Hydraulic Dredging of the James River near Hopewell, Virginia," Jour. Env. Science Health, A13:261-294 (1978).

R-20 Lee, G. F., and Plumb, R. H., "Literature Review on Research Study for the Development of Dredged Material Disposal Criteria," Contract Report D-74-1 US Army Corps of Engineers WES, Vicksburg, MS, June (1974).

R-24 Lee, G. F., Piwoni, M. D., Lopez, J. M., Mariani, G. M., Richardson, J., Homer, D. H., Saleh, F. Y., "Research Study for the Development of Dredged Material Disposal Criteria," Contract Report D-54-4 US Army Corps of Engineers, WES, Vicksburg, MS, November (1975).

R-28 Lee, G. F., Lanza, G. R., and Mariani, G. M., "Significance of Sediment Associated Contaminants in Water Quality Evaluation," Environmental Engineering, Colorado State University, Fort Collins, Occasional Paper No. 11, November (1976).

R-29 Saleh, F. Y., and Lee, G. F., "Analytical Methodology for Chlorinated Hydrocarbon Pesticides and Polychlorinated Biphenyls in Water, Elutriate and Sediments Using EC-GC," Environmental Engineering, Colorado State University, Fort Collins, Occasional Paper No. 12, December (1976).

R-35 Lee, G. F., Bandyopadhyay, P., Butler, J., Homer, D. H., Jones, R. A., Lopez, J. M., Mariani, G. M., McDonald, C., Nicar, M. J., Piwoni, M. D., and Saleh, F. Y., "Investigation of Water Quality Parameters at the Offshore Disposal Site, Galveston, Texas," Technical Report No. D-77-20, US Army Corps of Engineers, WES, Vicksburg, MS (1977).

R-44 Lee, G. F., Jones, R. A., and Mariani, G. M., "Comments on US EPA-Corps of Engineers Dredged Sediment Bioassay Procedures," Environmental Engineering, Colorado State University, Fort Collins, Occasional Paper No. 26, December (1977).

R-46 Lee, G. F., and Jones, R. A., "An Assessment of the Environmental Significance of Chemical Contaminants Present in Dredged Sediments Dumped in the New York Bight," Occasional Paper No. 28, Department of Civil Engineering, Environmental Engineering Program, Colorado State University, Fort Collins, CO, December (1977).

R-47 Lee, G. F., and Jones, R. A., "Dredged Material Analytical Quality Control Programs and Dredged Material Disposal Monitoring Programs," Occasional Paper No. 29, Department of Civil Engineering, Environmental Engineering Program, Colorado State University, Fort Collins, CO, December (1977).

R-53 Lee, G. F., Jones, R. A., Saleh, F. Y., Mariani, G. M., Homes, D. H., Butler, J. S., and Bandyopadhyay, P., "Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release during Open Water Disposal of Dredged Sediment and Environmental Impact of Open Water Dredged Materials Disposal, Vol. II: Data Report," Technical Report D78-45, US Army Corps of Engineers WES, Vicksburg, MS, 1186 pp., August (1978).

R-88 Lee, G. F., and Jones, R. A., "Significance of PCBs in Dredged Sediment," Final Report to US Army Engineer Waterways Experiment Station, August (1979).

R-89 Lee, G. F., "Comments on US Environmental Protection Agency's Guidelines for Specification of Disposal Sites for Dredged and Fill Material," Part IV, Federal Register, Volume 45, No. 249, Wednesday, December 24, 1980. Occasional Paper No. 58, Department of Civil Engineering, Environmental Engineering Program, Colorado State University, Fort Collins , CO, March (1981).

R-97 Lee, G. F., and Jones, R. A., "A Hazard Assessment Approach for Assessing the Environmental Impact of Dredging and Dredged Sediment Disposal for the Upper Mississippi River," Report to Rock Island District, Corps of Engineers, Rock Island, IL, (1981).

R-98 Lee, G. F., and Jones, R. A., "Guideline for Conducting Environmental Study Programs for Assessing the Water Quality Impact of Dredged Sediment Disposal in the Upper Mississippi River System," Report to Rock Island District, Corps of Engineers, Rock Island, IL, June (1981).

R-99 Lee, G. F., and Jones, R. A., "Relationship between the Hazard Assessment Approach for Dredged Sediment Disposal in the Upper Mississippi River System and the Recommendations of the GREAT I and II Studies," Report to Rock Island District, Corps of Engineers, Rock Island, IL, June (1981).

R-100 Lee, G. F., and Jones, R. A., "Important Elements of a Cost-Effective Water Quality Monitoring Program for Dredged Sediment Disposal Operations in the Upper Mississippi River System," Report to Rock Island District, Corps of Engineers, Rock Island, IL, June (1981).

R-54 Jones, R. A., and Lee, G. F., "Evaluation of the Elutriate Test as a Method of Predicting Contaminant Release During Open Water Disposal of Dredged Sediment and Environmental Impact of Open Water Dredged Material Disposal, Vol. I: Discussion," Technical Report D78-45, US Army Corps of Engineers, WES, Vicksburg, MS, 217 pp., August (1978).

R-55 Lee, G. F., and Jones, R. A., "The Importance of Focusing Pollution Control Programs on Available Forms of Contaminants," Occasional Paper No. 32, Department of Civil Engineering, Environmental Engineering Program, Colorado State University, Fort Collins, CO, (1978).

R-60 Lee, G. F., and Jones, R. A., "Research Needs in the Area of the Role of Sorption-Desorption in Predicting the Environmental Chemistry-Fate of Chemical Contaminants in a Hazard Assessment Program," Occasional Paper No. 37, Department of Civil Engineering, Environmental Engineering Program, Colorado State University, Fort Collins, CO, December (1978).

R-61 Lee, G. F., and Jones, R. A., "Water Quality Research Needs for Proposed Apalachicola Estuarine Research Sanctuary," Occasional Paper No. 38, Department of Civil Engineering, Environmental Engineering Program, Colorado State University, Fort Collins, CO, January (1979).

APPENDIX D

SUMMARY RESUME

NAME: Rebecca Anne Jones
(Anne Jones Lee)

TELEPHONE:916/753-9630

ADDRESS: 27298 E. El Macero Dr.
El Macero, CA 95618

PLACE OF BIRTH:
Menominee, Michigan, USA

EDUCATION

Ph.D. Environmental Sciences, The University of Texas at Dallas, Richardson, TX, 1978.
Areas of Specialization: Aquatic Chemistry, Aquatic Biology, Water Quality Control

M.S. Environmental Sciences, The University of Texas at Dallas, Richardson, TX, 1975

B.S. Biology, Southern Methodist University, Dallas, TX, 1973

ACADEMIC AND PROFESSIONAL EXPERIENCE

CURRENT POSITION

Vice President, G. Fred Lee & Associates

PREVIOUS POSITIONS

1984 - 1989 Associate Professor of Civil and Environmental Engineering, New Jersey Institute of Technology, Newark, NJ

1988 - 1989 Consulting Engineer, Ebasco-Envirosphere, Lyndhurst, NJ (part-time)

1984 - 1988 Director of Environmental Engineering Laboratories, Department of Civil and Environmental Engineering, NJIT, Newark, NJ

1982 - 1984 Research Associate and Lecturer, Department of Civil Engineering, Texas Tech University, Lubbock, TX

1982 Coordinator for Aquatic Biology, Fluor Engineers Advanced Technology Division, Irvine, CA

1978 - 1981 Research Assistant Professor, Department of Civil Engineering, Colorado State University, Fort Collins, CO

1973 - 1974 Research Technician, Frito-Lay Research and Development Laboratory Irving, TX

SUMMARY OF PROFESSIONAL REPORTS AND PUBLICATIONS

Published more than 85 professional papers, and co-authored 90 reports and occasional papers. Topic areas addressed include:

* Sources, significance, fate, and control of chemical contaminants in fresh water, marine, and estuarine systems

* Environmental impact of various types of wastewater discharges including mining, electric generating station, domestic, and industrial

* Causes and control of eutrophication; groundwater quality; impact of land disposal of municipal and industrial wastes; environmental impact of dredging and dredged sediment disposal; water quality modeling; hazard assessment of new and existing chemicals; water quality criteria and standards; water supply water quality; assessment of actual environmental impact of chemical contaminants on water quality; toxicity of sediments

SUMMARY OF PROFESSIONAL PRESENTATIONS

Presented 35 lectures and professional papers at professional society meetings, short courses, universities, public service groups, and national and international conferences.

PROFESSIONAL SOCIETY MEMBERSHIP AND ACTIVITIES

American Chemical Society
American Fisheries Society
American Public Health Association
American Society for Civil Engineers
American Society for Limnology and Oceanography
American Society for Testing Materials Committee E-47 on Biological Effects and Environmental Fate
American Water Works Association; Past secretary and co-chairperson of Quality Control in Reservoirs Committee
Sigma Xi
Society of Environmental Toxicology and Chemistry
Society of Women Engineers
Water Pollution Control Federation; Co-Chairman, Water Pollution Control Federation Standard Methods Subcommittee, "Interpretation and Application of Bioassays," 1979-1988

AWARDS

Charles B. Dudley Award - American Society for Testing and Materials award for contribution to, Hazardous Solid Waste Testing, "Application of Site-Specific Hazard Assessment Testing to Solid Wastes," published (1984).

1986 Best Paper of the Year - American Water Works Association Resources Division award for paper published in the Journal, "Is Hazardous Waste Disposal in Clay Vaults Safe?" (1986)

TEACHING EXPERTISE AND EXPERIENCE

Microbiological Aspects of Environmental Engineering
Introductory Chemical Aspects of Environmental Engineering
Aquatic Toxicology
Water and Wastewater Analysis
Introduction to Water and Wastewater Treatment
Introduction to Environmental Engineering
Faculty Director of Women in Science and Engineering Program (1988)

EXAMPLES OF WORK WITH GOVERNMENTAL AGENCIES

AGENCY	TYPE OF ACTIVITY
New York District of the U.S. Army Corps of Engineers	Develop monitoring program to evaluate the significance of contaminants in dredged sediments on water quality in the New York Bight
National Oceanic and Atmospheric Administration New York Bight Study	Assist in selection of the 20 most important contaminants entering the New York Bight
New York District of U.S. Army Corps of Engineers	Evaluate significance of ocean dumping of dredged sediment on water quality in the New York Bight
City of Denison, Texas	Advise on lawsuit on environmental impact of city's wastewater discharges
Emilia-Romagna Region - Italian Government	Advise on research program for control of eutrophication of nearshore waters of Adriatic Sea
Spanish Government Ministry of Public Works	Advise on water quality management plans for Spanish impoundments
State of Florida	Advise on control of nutrients from drained wetlands
U.S.-Canada IJC Research Advisory Board for Great Lakes Water Quality	Available forms of contaminants in Great Lakes waters
Fort Collins, Colorado	Advise on impact of wastewater discharges on water quality in the Poudre River
Platte River Power Authority	Advise on water quality management in cooling water impoundment
Northwest Colorado Council of Governments	Advise on development of eutrophication study program
Pueblo Area Council of Governments	Conduct study on impact of Pueblo's wastewaters on Arkansas River water quality
Cities of Fort Collins and Loveland, Colorado	Evaluate water quality impacts of chlorine and ammonia in domestic wastewaters
Colorado Springs, Colorado	Advise on impact of domestic wastewater discharge on water quality in Fountain Creek
U.S. Army Corps of Engineers Norfolk District	Develop water quality monitoring program for dredging North Landing River channel

U.S. Army Corps of Engineers Rock Island District	Advise on impacts of chemical contaminants in upper Mississippi River sediments on water quality aspects of dredged sediment disposal
U.S. Environmental Protection Agency	Review draft water quality criteria document for ammonia
Dominican Republic	Advise on water quality in proposed domestic water supply reservoir
US Army Corps of Engineers	Advise on water quality significance of PCB's in dredged sediments
US EPA	Develop guidance document for implementing ammonia water quality criteria in permitted discharges
US AID and Jordanian National Planning Council	Evaluate proposed water quality and development of monitoring program for Jordan
South African Water Research OECD Commission	Advise on application of eutrophication study results to South African impoundments
US Congress Office of Technology Assessment	Review draft report on inadequacies of federal legislation governing land disposal of hazardous waste
Michigan Toxic Substance Control Commission	Advise on adequacy of Michigan legislation governing land disposal of waste
US Army Construction Engineering Research Laboratory	Advise on the use of landfill leachate recycle for leachate treatment and disposal
Newark Watershed Conservation and Development Corporation	Evaluate the environmental and public health aspects of an open-burning/open detonation hazardous waste treatment facility
USSR Academy of Sciences	Advise on water quality management programs, May 1987 - present
City of Richmond, RI	Advise on long-term public health & environmental impacts of proposed solid waste landfill
Main Watermaster, San Gabriel Valley, CA and the Metropolitan Water District of Southern CA	Evaluate the potential impact of expanding a sanitary landfill on groundwater quality, currently active
Metropolitan Water District of Southern CA	Recommend revised State of California regulations for landfilling of solid wastes, currently active
Metropolitan Water District of Southern CA	Review potential public health and environmental problems of the San Diego County Department of Public Works proposed North County Class III Landfills, currently active
Port of Oakland, CA	Advise on the management of contaminated dredged sediments, currently active

City of Sacramento, CA	Advise on adequacy of hazardous chemical clean-up as part of redevelopment of the Southern Pacific Railyard site, 1990-
City of Pittsburg, CA	Review potential public health and environmental aspects of the proposed Keller Canyon Landfill, August 1990-
	Assist in litigation on the adequacy of CEQA review of Contra Costa County's Solid Waste Management Plan

EXAMPLES OF WORK WITH INDUSTRIES

FIRM OR AGENCY	TYPE OF ACTIVITY
El Paso Natural Gas Company	Evaluate environmental impact of dredging channel in Matagorda Bay, Texas
Genesis II, Inc.	Advise on technical aspects of new product development
Procter & Gamble Company, Japan	Evaluate significance of detergents as a cause of water pollution problems in Japan
King Industries Norwalk, Connecticut	Advise on environmental impact of dredging harbor channel on water quality
Mission Viejo Development	Advise on water quality impacts of potential wastewater discharges
Appalachian Timber Services, Inc.	Advise on impact of phenolics, copper, chromium solid waste on surface and groundwater quality
Grinnell Fire Protection Systems, Inc.	Evaluate performance of plating waste treatment plant and develop approach for management of hazardous wastes
Mobil Chemical - Pasadena, Texas	Evaluate impact of ammonia discharges on water quality in Houston Ship Channel
Public Service Energy & Gas	Advise on managing gasification residues and other areas of water quality management
Kraft Foods, Inc. Northbrook, IL	Advise on impact of ammonia in wastewater discharges on receiving water quality in Lakeland, FL
Ebasco-Envirosphere REM III	Advise on Work Plan for Solvent Superfund Contract Savers, Niagara County Refuse, and Maxey Flats Sites
	Rewrite Brick Township Phase I RI/FS
	Develop guidance document for Work Plan development
Land Developer Lake Tahoe, NV	Advise on the impact of residential watershed development on Lake Tahoe water quality, summer - fall 1989
CP Chemical of Sea Warren, NJ	Advise on control of toxicity in a hazardous waste treatment facility's water discharge, spring 1989
Exxon Research & Engineering Co. Corporate Research Laboratory, Annadale, NJ	Evaluate the potential for algal bloom development as a result of bioremediation nutrients on oil spill beach residues in Prince William Sound, Alaska, July 1989

JEAN ANN NICHOLS

oceanography
environmental assessment

EDUCATION

Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program: Ph.D., Biological Oceanography, 1975
Pomona College: B.A., Zoology, 1969

Additional Formal Coursework:
University of California, Irvine: Management Institute, 1987
Stanford University: Business Management Institute (WACUBO), 1984
California Business Law Institute, California Environmental Quality Act Seminar Environmental Regulation, 1982

PROFESSIONAL HISTORY

Center for Coastal Studies, Scripps Institution of Oceanography: Academic Administrator and Research Oceanographer, 1986 - 1991
Scripps Institution of Oceanography, University of California, San Diego: Management Fellow, 1984 - 1986
University of California, San Diego: Staff Assistant Provost, 1982 - 1986
Lockheed Ocean Laboratories: Associate Research Scientist, 1980 - 1982
Marine Institute, Sapelo Island, University of Georgia: Research Associate, 1977 - 1979
Southeastern Massachusetts University: Assistant Professor, 1975 - 1977
Bridgewater State College, Massachusetts: Instructor, 1974
Woods Hole Oceanographic Institution, Massachusetts: Research Fellow, 1970 - 1975
University of California, San Francisco: Research Assistant, 1969 - 1970

REPRESENTATIVE EXPERIENCE

Dr. Nichols has twenty years experience in marine environmental analysis. She has participated in numerous projects assessing environmental stress. Projects were funded by U.S. Army Corps of Engineers, U.S. Navy, EPRI, California Water Quality Control Board and private industry. Relevant project experience includes:

- Remedial Action Plan for contaminated sediments, Port of San Diego.
- Assessment of benthic response to Woods Hole, Massachusetts sewage outfall.
- Assessment of benthic recovery after dredging Chatham, Massachusetts.
- Feasibility Assessment of ocean disposal of baled solid waste.
- Environmental Impact Assessment for Deep-Sea Manganese Nodule Mining Claim

NICHOLS-JA2 8/91-12711

EXHIBIT 2

- Assessment Potential of Usage of Remote Sensing Techniques for Monitoring Outfall discharges.

- Evaluation of Management of Antifouling Paint to Minimize adverse environmental impacts.

- Member Board of Directors for development of Nature Interpretive Center, Gunpowder Point, Chula Vista, California

- Member SANDAG Outer Continental Shelf Task Force for review of offshore oil and gas development in conjunction with Federal MMS Lease Sales in Southern California.

AFFILIATIONS

Marine Technology Society, San Diego: Section Treasurer, 1983; Secretary, 1982
Sigma Xi

PUBLICATIONS

Available upon request

3

RB-37

6-30-87

To: PACO terminal File, LM, DB
Fm: GP
Re: Data Review for Cleanup

In reviewing the various data reports that have been compiled by Weston, Inc. regarding PACO investigations, there are a number of factors which must be recognized when formulating an appropriate cleanup standard. I have attempted to list some of the most important factors below:

1) Although attempted correlations made between sediment copper (T) and various benthic community indices were negative, these communities are are already degraded by other factors in addition to copper. Vessel propwash has a major influence on most of the bay area under study here. Hence, it is still possible that a correlation between both total recoverable and leachable sediment high in copper ore and benthic community indices might have been found in areas which have diverse benthic communities not already greatly impacted by other environmental stresses.

Exhibit 3

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2) Although quite limited, the benthic community found near the PACO Terminal Pier provides evidence that some benthic [illegible] have become established or [illegible] which is [illegible] composed of [illegible] are [illegible] stages [illegible] of the year [illegible] seasons.

WB37 mcmahon

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17

included the planktonic larval, settling form, juvenile, and adult forms. We have no information as to whether or not the bivalves reproductive potential is norm. Most crustaceans are absent from the PACO terminal area. Apparently this was the case prior to the copper ore loading operation (based on pre-1979 studies). The peculiar absen of a normal crustacean community supports a conclusion that the existing benthos might not respond to additional environmental insults the way a more diverse and sensitive community would.

[question/answer]

3). Since the benthos near PACO Terminal is already depressed, why should there be a cleanup of the copper ore which is just one additional stress of a not-very-well-defined magnitude? a) Other environmental stresses which are effecting the organisms which are present near the PACO terminal might be lessened in the future with better controls over boat bottom paints and painting techniques, reduced vessel wastes, and reduced urban runoff problems. Allowing the copper ore to remain at the site may permanently limit the vitality of any benthic community which can develop there. b) Proba more important is the prospect that the copper ore will eventually migrate far beyond the PACO terminal area and impact areas which now have very diverse benthic communities. Whereas cleanup is feasible in its present limited geographic area, once the ore is distributed throughout the bay (via prop wash

3/4 6-30-

and tidal transport) cleanup would become almost impossible. The bay could potentially remain degraded by copper ~~ore~~-contaminated sediment, long after most ~~non~~ point sources of contamination have been corrected.

4) Establishing a cleanup standard of 1000 mg/Kg (Total Recoverable Copper), and instituting an effective monitoring program to determine if additional cleanup is needed, is a sound approach. The TTLC for copper is 2500 mg/Kg the background level in much of S.D. Bay seems to be around 100 mg/Kg or so. A relationship has been shown to exist between copper content in PACO-area sediment and the copper level found within the interstitial water in these sediments. Ocean Plan objectives for copper (50 ug/l - Instantaneous Maximum, and 20 ug/l Daily Maximum) are generally exceeded within the interstitial water near PACO Terminal. The impact of such copper levels on benthic community structure is not clear, but may likely have at least chronic effects on some species.

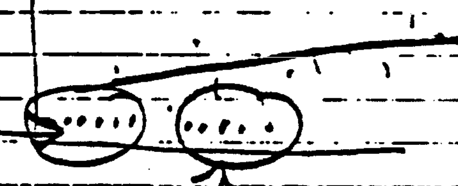
An ongoing, post cleanup, monitoring program should include both biological + chemical monitoring. 11A [illegible] Mussel watch type program should be considered unless a better bioaccumulating organism could be [illegible] 114. A [illegible] A sampling [illegible] 1L needs [illegible] [illegible] sound data base for review.

4/4 6-30

5) The limit of detection of interstitial water copper went from 0.002 mg/l in Phase I of this study to 0.02 mg/l in Phase II. Given the reduced resolution of the data, a good regression line extending near zero was not [illegible]. Hence, the regression line does not provide info on the Total Cu Concentration of sediment which would [illegible] interstitial water levels at the 0.020 to 0.005 [illegible] range of the Ocean Plan objectives (Daily max and 6 mo. median respectively). No interference was cited by Westec's lab for the lesser resolution. Of 16 samples having conc. of ≤0.020 mg/l only 9 had sufficient sample to re-analyze.

I suggested to Westec that in an attempt to anticipate the improvement which might be possible in the regression line if all the ≤ 0.020 samples were re-done, they should

a) treat the ≤0.020 data plots as 2 groups



b) group 1 should be assumed to be 0.02 mg/l

c) group 2 should be assumed to be 0.00[illegible] mg/l

d) then redo regression analysis

(See Phase III handout)

They did this and were thus able to predict interstitial water levels of 0.050 and 0.020, but still not 0.005 mg/l. I believe this would be the best resolution possible by simply redoing the existing sampling points

CUT 004123

Table 1. Results of interstitial water samples collected at Paco Terminals NPDES Station S-4, February 4, 1987.

Station (Distance in feet)	pH Surface Sediment	pH Bottom Sediment	Depth of Core Penetration (cm)	Interstitial Water Volume (ml)	Interstitial Water Copper (mg/l)	Sediment Copper (mg/kg)	Comments (SU = surface of sample undisturbed)
0a	7.26	7.25	28.0	70	0.140	21,700	SU; worm tubes, worm, shrimp
0b	7.07	7.24	19.5	85	0.040	12,900	SU; worm tubes, crab
10a	7.20	7.53	25.0	50	0.280	10,300	SU; worm tubes, crab
10b	7.18	7.16	29.0	60	0.080	7,770	SU; worm tubes
20a	7.30	7.17	22.5	60	0.040	10,100	Disturbed; no biota visible
20b	7.24	7.28	24.5	70	0.110	11,900	SU; crab, worm tubes, green algae
30a	7.10	6.96	26.2	90	0.020	8,720	SU; worm tubes
30b	7.22	7.06	28.5	20	0.300	3,720	SU; worm tubes
40a	7.01	7.05	25.0	90	0.050	8,160	SU; worm (swimming), caprellid
40b	7.13	7.21	22.0	100	0.020	8,020	SU; worm tubes
50a	7.20	7.10	24.5	80	0.080	3,740	SU; worm swimming
50b	7.40	7.14	28.5	100	0.110	4,020	SU; worm tubes
60a	7.10	7.18	25.5	100	0.060	3,370	SU; worm tubes
60b	7.23	7.05	26.0	48	0.080	7,690	Live fish (retained), worm tubes
70a	7.14	7.36	29.0	110	0.020	7,490	SU; live Nassarius sp. (small)
70b	7.30	7.14	23.5	70	0.030	9,700	Disturbed; worm tubes
80a	7.26	7.25	26.5	56	<0.020	6,830	Disturbed; no biota visible
80b	7.11	7.19	25.5	79	0.020	5,680	Disturbed; worm tubes
90a	7.04	7.04	23.0	80	<0.020	2,970	SU; worm tubes
90b	7.11	7.10	25.0	97	<0.020	2,440	SU; worm tubes
100a	7.35	(1)	19.0	98	0.090	3,480	SU; worm tubes; sand and shell on bottom of core
100b	7.16	7.35	20.0	100	0.040	2,000	Disturbed: no biota visible
110a	7.10	7.31	17.3	48	<0.020	731	Disturbed: no visible biota; oyster shell on bottom of core
110b	7.20	7.12	14.5	80	<0.020	2,290	Disturbed: no biota visible
120a	7.06	7.16	22.6	75	<0.020	1,040	SU; live worm, holes, clam shell on bottom of core
120b	7.11	7.07	18.3	70	<0.020	1,710	SU; live worm, crab
130a	7.01	(1)	13.4	34	<0.020	1,810	SU; unknown biota saved, sand on bottom of core
130b	7.12	(1)	12.9	30	<0.020	1,490	SU; worm tubes; sand on bottom of core
140a	7.00	(1)	17.5	30	<0.020	21	SU; crab (saved with 130A), worm tubes
140b	7.05	(1)	15.2	20	<0.020	159	SU; live worm (saved with 130A); sand on bottom of core
150a	7.16	(1)	19.3	80	<0.020	552	SU; worm tubes
150b	7.15	(1)	19.5	70	<0.020	86	SU; many worm tubes, sand and shell on bottom of core
160a	7.11	7.11	19.9	39	<0.020	256	SU; worm tubes, burrow
160b	7.17	7.31	23.5	10	(2)	261	SU; worm tubes, burrow
170a	7.12	7.18	21.0	70	<0.020	105	SU; worm tubes
170b	7.05	7.20	21.6	50	<0.020	122	SU; worm tubes

(1) Too much sand and/or shell material to insert pH probe into sample.
(2) Insufficient sample

4

COPY

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA
IN AND FOR THE COUNTY OF SAN DIEGO

PACO TERMINALS, INC., PLAINTIFF, VS. AMERICAN HOME ASSURANCE COMPANY, ET AL., DEFENDANTS.	CONSOLIDATED CIVIL ACTION CASE NOS. 602586 AND 602587
PACO TERMINALS, INC., PLAINTIFF, VS. CALIFORNIA INSURANCE GUARANTY ASSOCIATION, ET AL., DEFENDANTS.	
SAN DIEGO UNIFIED PORT DISTRICT, INTERVENOR.	

DEPOSITION OF GREG PETERS
SAN DIEGO, CALIFORNIA
JULY 24, 1991

REPORTED BY CRAIG A. BROWN, CSR NO. 7440

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(619) 236-0333

Exhibit 4

A. MORE OR LESS THE SAME ANALYSIS.
Q. OKAY. THIS DATA SHOULD REVEAL IF PERHAPS THREE REPLICATES MIGHT BE SUFFICIENT. OKAY?
A. YES.
Q. CAN YOU HELP READ THAT NEXT ONE.
A. "WESTEC WILL KEEP ALL SAMPLES FOR POSSIBLE LATER ANALYSIS FOR ADDITIONAL PARAMETERS." SOMETHING ABOUT MAY HELP INTERPRET TOTAL COPPER TO INTERSTITIAL COPPER CORRELATION.
Q. OKAY. THE LAST PART OF THAT THING IS ALMOST HOPELESS FOR ME TO READ.
A. YES.
Q. OKAY. LET ME NEXT ASK YOU TO TAKE A LOOK AT WHAT HAS INDEED PREVIOUSLY BEEN MARKED AS EXHIBIT 37. THE REPORTER DOESN'T NEED TO MARK THIS BECAUSE IT IS IN HIS FILES. LET ME ASK YOU TO TAKE A MINUTE TO REVIEW THIS, MR. PETERS.
FIRST OFF, MR. PETERS, THIS IS A MEMO IN YOUR HANDWRITING?
A. YES.
Q. AND THE DATE ON THE MEMO IS CORRECT, IS IT? JUNE 30, 1987?
A. THAT SEEMS REASONABLE.
Q. OKAY. BEFORE WE TALK ABOUT SOME OF THE SUBSTANCE IN HERE, COULD YOU BRIEFLY DESCRIBE FOR ME WHAT CAUSED THIS MEMO TO BE GENERATED?
A. AT THAT TIME WE HAD A NUMBER OF MEETINGS,

INTERNALLY AND WITH PACO AND WESTEC, THEIR CONSULTANTS REGARDING WHAT THE CLEANUP LEVEL WOULD BE. AT THAT TIME INTERNALLY WE DECIDED THAT -- I WAS TALKING TO THE EXECUTIVE OFFICER, AND HE THOUGHT THAT WOULD BE GOOD SOUND LEVEL OF CLEANUP OF A THOUSAND WITH THE IDEA THAT AFTER A THOUSAND WAS CLEANED UP, THAT A MONITORING PROGRAM BE INSTITUTED TO INSURE THAT THAT WAS ADEQUATE CLEANUP.

Q. OKAY.

A. AND I WANTED IT FOR THE RECORD SO THAT IF SOMEONE QUESTIONED HOW WE POSSIBLY COULD HAVE ARRIVED AT A THOUSAND, THIS WOULD SUPPLY A RECORD OF THE RATIONALE THAT WENT INTO THAT DECISION.

Q. THIS IS, IN EFFECT, A MEMO TO DESCRIBE YOUR RATIONALE IN ARRIVING AT A RECOMMENDATION FOR A CLEANUP LEVEL OF A THOUSAND PARTS PER MILLION IN COPPER?

A. YES.

Q. OKAY. I'M LOOKING AT THE FIRST NUMBERED SECTION OF THE MEMO ABOUT A THIRD OF THE WAY DOWN. AND YOU GOT SOME HANDWRITTEN CODE ALSO AND STUFF IN HERE. I WANT TO MAKE SURE FOR THE RECORD IT IS CLEAR WHERE ALL THIS FITS INTO THE EQUATION HERE.

IT SAYS, "ALTHOUGH ATTEMPTED CORRELATIONS MADE BETWEEN SEDIMENT COPPER," AND THEN SHOULD THAT NEXT -- THAT BLOCKED IN PHRASE BE FIT IN THERE NEXT?

A. YES.

Q. OKAY. IN OTHER WORDS, IT SHOULD READ SEDIMENT COPPER BOTH TOTAL RECOVERABLE AND LEACHABLE?

A. YES.

Q. THEN IS IT BENEFICIAL INDICES WITH NEGATIVE?

A. YES.

Q. THESE COMMUNITIES ARE ALREADY DEGRADED BY OTHER FACTORS IN ADDITION TO COPPER?

A. YES.

Q. THE PHRASE THAT YOU INSERTED IN HERE OR CIRCLED AND INSERTED THAT SAYS TOTAL RECOVERABLE AND LEACHABLE -- WHAT DO YOU MEAN BY TOTAL RECOVERABLE SEDIMENT COPPER?

A. ALL THOSE ARE IS TWO DIFFERENT ANALYTICAL METHODS. ONE YOU USED VERY STRONG NITRIC ACID AND HEAT TO DIGEST THEM. AND THE OTHER ONE YOU USED A VERY MUCH WEAKER ACID SOLUTION.

Q. THOSE TWO DIFFERENT TECHNIQUES ARE TOTAL RECOVERABLE AND LEACHABLE?

A. YES.

Q. OKAY. YOU SAY IN HERE IN THE SECOND PART OF THIS SENTENCE THAT THE BENTHIC COMMUNITY ARE ALREADY DEGRADED BY OTHER FACTORS IN ADDITION TO COPPER. WHAT OTHER FACTORS WERE YOU REFERRING TO?

A. THAT WAS MAINLY FROM INFORMATION THAT WAS PROVIDED BY WESTEC AND THE REFERENCED OTHER STUDIES AND HAD PHOTOCOPIES OF SOME OF THE PAGES FROM THE OTHER STUDIES THAT INDICATED, THAT DUE TO VESSEL PROP WASH INFLUENCING, THE AREA AND THE FACT THAT

IT HAD BEEN DREDGED, THE MAIN CHANNEL HAD BEEN DREDGED, THAT THERE WAS SOME LIMITATION TO THE BENTHIC COMMUNITY THAT IS ABLE TO ESTABLISH ITSELF UNDER THOSE CONDITIONS.

Q. AND JUST SO IT'S CLEAR FOR THOSE READING THE RECORD LATER, WHAT DO YOU MEAN BY BENTHIC COMMUNITY?

A. BOTTOM DWELLING ORGANISIMS.

Q. AND SO THERE IS A DISCUSSION ABOUT VESSEL PROP WASH. AND THEN IT SAYS VESSEL PROP WASH IS A MAJOR INFLUENCE ON MOST OF THE BAY AREA UNDER STUDY. IS IT THERE? IS THAT THE NEXT WORD? UNDER STUDY HERE.

A. YES.

Q. HENCE IT IS -- STILL IT LOOKS LIKE SOME OF THAT MAY BE CUT OFF. CAN YOU HELP READ WHAT THAT SAYS.

A. IT IS STILL POSSIBLE THAT A CORRELATION BETWEEN -- THEY MIGHT EXIST IN AN AREA THAT WASN'T SO IMPACTED.

Q. I GOT IT. OKAY. LOOKS TO BE KIND OF A STRAY WORD DOWN THERE JUST TO THE RIGHT OF THE LITTLE BOX. LOOKS LIKE IT'S A THAT?

A. YES. STILL POSSIBLE THAT A CORRELATION.

Q. OKAY.

MS. SCHARDEIN: MAYBE YOU SHOULD HAVE HIM READ IT -- IF YOU HAVE HIM READ THAT SENTENCE.

BY MR. ROBINSON:

Q. WOULD YOU READ THAT LAST SENTENCE ON THAT FIRST SECTION THERE FOR US, THE ONE THAT STARTS HENCE.

A. "HENCE IT IS STILL POSSIBLE THAT A CORRELATION BETWEEN SEDIMENT HIGH IN COPPER ORE AND BENTHIC COMMUNITY INDICES MIGHT BE FOUND IN AREAS WHICH HAVE DIVERSE BENTHIC COMMUNITIES NOT ALREADY GREATLY IMPACTED BY OTHER ENVIRONMENTAL STRESSES."

Q. CAN YOU PUT THAT IN LAY TERMS FOR US?

MR. HOPKINS: I THINK IT SAYS INDICES MIGHT HAVE BEEN FOUND.

MR. ROBINSON: OKAY.

THE WITNESS: OKAY.

BY MR. ROBINSON:

Q. AND I WONDER IF YOU COULD PERHAPS SIMPLIFY THE NOTION IN THIS SENTENCE FOR US.

A. WHAT WE WANTED TO HAVE THEM DO IS LOOK AT AREAS THAT HAD HIGH COPPER CONCENTRATION IN THE SEDIMENT AND WHAT OTHER ORGANISIMS WERE PRESENT AND RADIATE OUT AWAY FROM THE PIERFACE WHERE THE COPPER LEVEL DROPS AND FIND OUT IF YOU HAVE A MORE DIVERSE POPULATION OF ORGANISIMS IN THOSE AREAS WHERE THERE'S LESS COPPER.

Q. I SEE.

A. AND WE DIDN'T FIND THAT TO BE THE CASE.

Q. OKAY.

A. BUT THE POPULATION OF ORGANISMS WAS ALREADY QUITE DEPRESSED EVERYWHERE EQUALLY.

Q. OKAY.

A. AND WHAT I'M GETTING AT HERE, IF YOU PUT THAT COPPER ORE IN AN AREA THAT DIDN'T HAVE PROP WASH AND THESE OTHER STRESSES, PERHAPS YOU WOULD ACTUALLY SEE AN ENVIRONMENTAL AFFECT THERE THAT WE COULDN'T SEE HERE.

Q. OKAY. AND HOW ABOUT THE SECOND SECTION THERE? IT'S ALSO A LITTLE BIT DIFFICULT TO READ AT THE BOTTOM OF THE PAGE. CAN YOU HELP US OUT ON THIS?

A. "ALTHOUGH QUITE LIMITED, THE BENTHIC COMMUNITY FOUND NEAR THE PACO TERMINAL PIER PROVIDES EVIDENCE THAT SOME BIVALVIA MOLLOSKS," LIKE CLAMS, MUSSELS, "HAVE BECOME ESTABLISHED ON SEDIMENT WHICH IS" -- AND THAT LINE IS MISSING. WHICH IS QUITE HIGH IN COPPER ORE.

Q. OKAY. AND THEN IT GOES ON AND SAYS ON THE SECOND PAGE INCLUDING --

A. YES. PLATONIC LARVAE. SETTLING FORM, JUVENILE AND ADULT FORMS.

THAT WAS JUST THE OBSERVATION THAT WESTEC FOUND. THESE ADULT AND JUVENILE FORMS OF MUSSELS IN AN AREA WHERE THEY WOULD HAVE HAD A SETTLE OUT OF THE WATER COLUMN. SO IT DID PROVIDE INFORMATION THAT THIS WASN'T SEVERELY TOXIC. OTHERWISE THESE VERY SENSITIVE STAGES OF THESE ORGANISIMS WOULDN'T HAVE BEEN ABLE TO SETTLE OUT AND LIVE AND MATURE INTO ADULT FORMS.

Q. OKAY. AND THEN YOUR NEXT SENTENCE READS, "WE HAVE NO INFORMATION AS TO WHETHER OR NOT THE BIVALVES REPRODUCTIVE POTENTIAL IS NORMAL"?

A. YES.
Q. I'LL LEAVE IT TO SOMEONE ELSE TO ASK YOU MORE DETAILED QUESTIONS ABOUT THAT. AND THEN, "MOST CRUSTACEANS ARE ABSENT FROM THE PACO TERMINAL AREA"?
A. YES.
Q. APPARENTLY THIS WAS THE CASE PRIOR TO THE COPPER ORE LOADING OPERATION BASED ON PRE-1979 STUDIES.
A. AND THOSE WERE CITED BY WESTEC AND SUPPLIED BY WESTEC INDICATING IN A SURVEY DONE MUCH PRIOR TO PACO TERMINAL BEING THERE, ALSO FOUND THE SAME LACK OF CRUSTACEANS. AND CRUSTACEANS ARE QUITE SENSITIVE TO COPPER.
THERE AGAIN, THEM NOT BEING THERE, WE WEREN'T ABLE TO DETERMINE WHAT AFFECT THE COPPER WOULD OF HAD SINCE THEY WERE NEVER THERE TO START OUT WITH.
Q. CAN YOU READ THE NEXT SENTENCE FOR US.
A. STARTING WITH APPARENTLY?
Q. I THINK STARTS THE PECULIAR.
A. "THE PECULIAR ABSENCE OF A NORMAL CRUSTACEAN COMMUNITY SUPPORTS A CONCLUSION THAT THE EXISTING BENTHOS MIGHT NOT RESPOND TO ADDITIONAL ENVIRONMENTAL INSULTS THE WAY MORE DIVERSE AND SENSITIVE COMMUNITY WOULD."
Q. OKAY. AND THEN HOW ABOUT THE THIRD SECTION ON THERE? COULD YOU READ THAT FOR US.
A. "SINCE THE BENTHOS NEAR PACO TERMINAL IS ALREADY DEPRESSED, WHY SHOULD THERE BE A CLEANUP OF THE COPPER ORE WHICH

IS JUST ONE ADDITIONAL STRESS OF A NOT VERY WELL-DEFINED MAGNITUDE."

Q. BEFORE YOU GO ON ANY FURTHER, THERE ARE A COUPLE OF WORDS THAT ARE IN BRACKETS UP BEGINNING ON THE SECTION THAT IS NUMBER 3. DO YOU SEE WHERE I AM TALKING ABOUT?

A. SEEM LIKE A PARTIAL UNDERLINE. I DON'T KNOW WHY. OH, QUESTIONS, ANSWERS. I MUST HAVE BEEN LOOKING AT QUESTIONS THAT WE MIGHT BEEN FACED WITH. TYPICAL QUESTIONS -- IF IT'S NOT HURTING ANYTHING, WHY DO YOU WANT TO REMOVE ANYTHING.

Q. OKAY. THE PHRASING OF THIS QUESTION ABOUT SINCE THE BENTHOS AND SO ON AND SO FORTH --

A. THAT WOULD BE A QUESTION THAT WE SHOULD LEGITIMATELY ASK OURSELVES WHEN WE REQUIRE A CLEANUP.

Q. OKAY. AND THEN SECTION WHERE IT STOPS. CAN YOU READ THAT.

A. YES. SOME RATIONALES FOR WHY YOU WOULD WANT TO CLEANUP EVEN THOUGH THIS AREA IS IMPACTED BY OTHER THINGS.

Q. OKAY.

A. YOU WANT ME TO READ THAT?

Q. IF YOU WOULD, PLEASE.

A. "OTHER ENVIRONMENTAL STRESSES WHICH ARE AFFECTIG THE ORGANISIMS WHICH ARE PRESENT NEAR THE PACO TERMINAL MIGHT BE LESSENED IN THE FUTURE WITH BETTER CONTROLS OVER BOTH BOTTOM PAINTS AND PAINTING TECHNIQUES, REDUCED VESSEL WASTES AND REDUCED URBAN RUNOFF PROBLEMS. ALLOWING THE COPPER ORE TO

REMAIN AT THE SITE MAY PERMANENTLY LIMIT THE VITALITY BENTHIC COMMUNITY WHICH CAN DEVELOP THERE."

THAT WAS ONE OF THE REASONS.

Q. B IS ANOTHER REASON.

A. "PROBABLY MORE IMPORTANT IS THE PROSPECT THAT THE COPPER ORE WILL EVENTUALLY MIGRATE FAR BEYOND THE PACO TERMINAL AREA AND IMPACT AREAS WHICH NOW HAVE VERY DIVERS BENTHOS COMMUNITIES. WHEREAS CLEANUP IS FEASIBLE IN ITS PRESENT LIMITED GEOGRAPHIC AREA, ONCE THE ORE IS TRANSPORTED THROUGHOUT THE BAY, VIA PROP WASH AND TIDAL TRANSPORT, CLEANUP WOULD BECOME ALMOST IMPOSSIBLE. THE BAY COULD POTENTIALLY REMAIN DEGRADED BY COPPER ORE CONTAMINATE SEDIMENT LONG AFTER MOST OTHER NON-POINT SOURCES OF CONTAMINATION HAVE BEEN CORRECTED."

Q. AND THEN YOUR SECTION NO. 4, COULD YOU READ THAT INTO THE RECORD FOR US, PLEASE.

A. "ESTABLISHING A CLEANUP STANDARD OF 1,000 MILLIGRAMS PER KILOGRAM TOTAL RECOVERABLE COPPER AND INSTITUTING AN EFFECTIVE MONITORING PROGRAM TO DETERMINE IF ADDITIONAL CLEANUP IS NEEDED IS A SOUND APPROACH. THE TOTAL THRESHHOLD LEVEL CONCENTRATION FOR COPPER IS 2500 MILLIGRAMS PER KILOGRAM. THE BACKGROUND LEVEL IN MUCH OF SAN DIEGO BAY SEEMS TO BE AROUND 100 MILLIGRAMS PER KILOGRAM OR SO."

Q. LET ME STOP YOU RIGHT THERE IF I CAN. THERE IS A REFERENCE IN HERE TO WHAT'S ABBREVIATED TTLC. THE TOTAL --

A. YES. TOTAL THRESHHOLD I BELIEVE.

Q. 2500?

A. THAT IS A PUBLIC HEALTH STANDARD. IF YOU EXCEED 2500 MILLIGRAMS PER KILOGRAM IN DRY WEIGHT, CONSIDERED A HAZARDOUS SUBSTANCE.

Q. SET BY SOME FEDERAL STANDARD?

A. STATE HEALTH DEPARTMENT.

Q. ALL RIGHT. IF YOU COULD GO AHEAD AND CONTINUE THEN.

A. I WAS GIVEN A RANGE THERE. ONE THING WE SHOULD TAKE INTO CONSIDERATION IS THE PUBLIC HEALTH DEPARTMENT LEVEL FOR DISPOSAL AS A LANDFILL. IF IT'S HIGHER THAN 2500 MILLIGRAMS PER KILOGRAM, IT'S CONSIDERED HAZARDOUS WASTE. ANOTHER ONE WE SHOULD BE CONSIDERING IS THE FACT THAT AROUND THE BAY SEEMS TO BE AN AVERAGE CONCENTRATION OF AROUND 100 MILLIGRAMS PER KILOGRAM OR SO.

THEN, "A RELATIONSHIP HAS BEEN SHOWN TO EXIST BETWEEN COPPER CONTENT IN PACO AREA SEDIMENT AND THE COPPER LEVEL FOUND WITHIN THE INTERSTITIAL WATER IN THESE SEDIMENTS. OCEAN PLAN OBJECTIVES FOR COPPER, PARENTHESIS, 50 MICROGRAMS PER LITER INSTANTANEOUS MAXIMUM AND 20 MICROGRAMS PER LITER DAILY MAXIMUM ARE GENERALLY EXCEEDED WITHIN THE INTERSTITIAL WATER NEAR PACO TERMINAL. THE IMPACT OF SUCH COPPER LEVELS ON BENTHOS COMMUNITY STRUCTURE IS NOT CLEAR BUT MAY LIKELY HAVE AT LEAST CHRONIC EFFECTS ON SOME SPECIES."

Q. OKAY. THE REFERENCE THERE ABOUT THE OCEAN PLAN

OBJECTIVES FOR COPPER, 50 MICROGRAMS PER LITER -- WHAT DOES THAT REFER TO?

A. THAT'S THE WATER COLUMN CONCENTRATION, THAT IF YOU WERE TO EXCEED IT WOULD HAVE SOME ADVERSE AFFECT ON AQUATIC ORGANISIMS. AND DAILY MAXIMUM IS THE AMOUNT OF THE EXPOSURE -- THE LENGTH OF EXPOSURE THAT THEY ARE EXPOSED TO IT.

Q. OKAY.

A. DID I GET THE LAST SENTENCE?

Q. YES.

A. THE IMPACT OF SUCH -- DID I ALREADY COVER THAT?

Q. YES. YOU LEFT OFF ON THE NEXT PARAGRAPH?

A. AN ONGOING POST-CLEANUP MONITORING PROGRAM SHOULD INCLUDE BOTH BIOLOGICAL AND CHEMICAL MONITORING. AN EXTENSIVE MUSSEL WATCH TYPE PROGRAM SHOULD BE CONSIDERED UNLESS A BETTER BIOACCUMULATING ORGANISM COULD BE UTILIZED. A LARGE SAMPLE SIZE WILL BE NEEDED."

Q. THEN WE LOSE THAT LAST LINE AGAIN BECAUSE OF THE POOR COPY.

A. BUT BASICALLY YOU NEED A LARGE SAMPLE SIZE BECAUSE THERE COULD BE QUITE A VARIABILITY IN THE WAY THE MUSSELS ARE RESPONDING.

Q. OKAY. AND ON THE LAST PAGE HERE NOW IF YOU COULD JUST READ SECTION 5 FOR US.

A. "THE LIMIT OF DETECTION OF INTERSTITIAL WATER COPPER WENT FROM POINT 002 MILLIGRAMS PER LITER IN PHASE I OF

THIS STUDY TO POINT 02 MILLIGRAMS PER LITER IN PHASE II."

Q. IF I COULD STOP YOU RIGHT HERE. PHASE I AND II REFERRING TO THE WESTEC STUDY?

A. YES. THEY DID IT IN TWO PHASES. THE PRELIMINARY INVESTIGATION, AND THEN THEY WENT OUT AND COLLECTED MUCH MORE EXTENSIVE SAMPLE.

Q. IF YOU COULD CONTINUE.

A. "GIVEN THE REDUCED RESOLUTION OF THE DATA, A GOOD REGRESSION LINE EXTENDING NEAR ZERO WAS NOT OBTAINED. HENCE THE REGRESSION LINE DOES NOT PROVIDE INFORMATION ON THE TOTAL COPPER CONCENTRATION OF SEDIMENT WHICH WOULD PRODUCE INTERSTITIAL WATER LEVELS AT THE POINT 02 OR POINT 005 MILLIGRAMS PER LITER RANGE OF THE OCEAN PLAN OBJECTIVES. SODIUM -- WAS CITED BY WESTEC'S LAB FOR THE LESSER RESOLUTION. OF 16 SAMPLES HAVING CONCENTRATIONS OF LESS THAN POINT 02 MILLIGRAMS PER LITER, ONLY 9 HAD SUFFICIENT SAMPLE TO BE REANALYZED."

I'LL JUST ADD IT. I CALLED THEM AND WANTED TO KNOW IF THEY COULD REANALYZE THESE, AND THEY DIDN'T HAVE SUFFICIENT AMOUNT OF SAMPLE TO REANALYZE THEM. SO WE HAD HAVE THEM GO OUT AND RE-COLLECT THEM OR THERE WAS NO OTHER WAY.

Q. OKAY.

A. SO THEN I WANTED TO LOOK AT -- WELL, BEFORE I REQUIRE THEM TO GO OUT AND RE-COLLECT THEM, LET'S LOOK AT THE WIDEST RANGE OF RESULTS WE COULD GET IF THEY WERE GOING TO GO OUT AND RE-COLLECT THEM. IF WE COULD ACTUALLY TURN THESE LESS

THAN POINT 02'S TO ACTUAL DATA POINTS TO SOME VALUE.
THEN I WILL READ ON.
MR. HOPKINS: CAN I INTERRUPT FOR A SECOND, BILL? I WANT TO CLARIFY SOMETHING SINCE WE ARE TRYING TO DECIPHER THIS MEMO.
MR. ROBINSON: YES.

EXAMINATION

BY MR. HOPKINS:
Q. MR. PETERS, YOU DESCRIBED THE CONCENTRATIONS IN PARAGRAPH 5 AS BEING MICROGRAMS PER LITER. OR MILLOGRAMS PER LITER I MEAN.
A. WHY AM I DOING THAT?
Q. AREN'T THEY IN FACT MICROGRAMS PER LITER? I'M ASKING YOU TO COMPARE THEM OVER TO PARAGRAPH 4.
A. YES. THEY SHOULD BE MICROGRAMS.
MR. ROBINSON: OKAY. FAIR ENOUGH. THANK YOU.

EXAMINATION

BY MR. ROBINSON:
Q. IF YOU COULD CONTINUE ON FOR US, THE PART THAT I SUGGESTED.
A. "I SUGGESTED TO WESTEC THAT IN AN ATTEMPT TO ANTICIPATE THE IMPROVEMENT WHICH MIGHT BE POSSIBLE IN THE REGRESSION LINE, IF ALL THE LESS THAN OR EQUAL TO POINT 02

SAMPLES WERE REDONE, THEY SHOULD" -- AND THEN I HAVE FOUR DIFFERENT THINGS THEY COULD DO. "TREAT ALL THE LESS THAN OR EQUAL TO POINT 02 DATA PLATS AS TWO GROUPS. GROUP 1 SHOULD BE" -- THEY WOULD ALL ASSUMED TO BE POINT 02 AND GROUP 2, THAT THEY SHOULD BE ASSUMED TO BE POINT 002.

Q. UH-HUH.

A. THEN REDO THE REGRESSION ANALYSIS.

AND THEN I STATE, THEY DID THIS AND WERE THUS ABLE TO PREDICT INTERSTITIAL WATER LEVELS OF POINT 05 AND POINT 02 BUT STILL NOT ABLE TO GET -- STILL NOT -- POINT 005 SHOULD BE MICROGRAMS PER LITER.

Q. UH-HUH.

A. I BELIEVE THIS WOULD BE THE BEST RESOLUTION POSSIBLE.

SOMETHING ABOUT IF THEY WERE TO REDO THE SAMPLE --

MR. HOPKINS: SIMPLY REDOING THE EXISTING SAMPLING POINTS?

THE WITNESS: YES. THAT'S GOOD.

BY MR. ROBINSON:

Q. I WONDER IF YOU WOULD HELP OR TRY TO SIMPLIFY FOR US THE POINT THAT'S BEING MADE HERE IN THIS SECTION 5 OF YOUR MEMO.

IN OTHER WORDS, WHAT IS THIS ALL ABOUT?

A. THE PROBLEM WAS IN ORDER TO LOOK AT WHAT LEVEL OF CLEANUP IS NECESSARY TO ACTUALLY GET THE INTERSTITIAL WATER

LEVEL DOWN TO THAT RANGE FOR LONG TERM OF EXPOSURE OF POINT 005 MICROGRAMS PER LITER, FIVE PARTS PER BILLION, WE DIDN'T REALLY HAVE ANY DATA POINTS DOWN THERE BECAUSE WE DIDN'T HAVE IT IN THE WATER THAT LOW.

YOU HAD TO DRAW YOUR LINE IN THAT DATA RANGE AND HAVE TO BRING IT DOWN AND SPECULATE AS TO WHAT LEVEL OF CLEANUP WOULD ACTUALLY PRODUCE THAT LEVEL IN THE INTERSTITIAL WATER.

Q. I SEE.

A. SO THERE WAS -- WE WANT TO LOOK AT THIS SPECULATING WHERE THAT LINE WOULD END UP BEING, IF WE WERE ABLE TO GET BETTER RESOLUTION ON THOSE POINT 02 VALUES AND ABLE TO TURN THEM PERHAPS ALL THE WAY DOWN TO POINT 002, HOW MUCH WOULD THAT AFFECT THAT LINE.

Q. OKAY.

A. IT TURNED OUT IT WOULDN'T AFFECT IT VERY MUCH.

Q. WHEN YOU SAY THAT LINE, THAT LINE IS A PLOT OF WHAT AGAINST WHAT?

A. PLOT OF THE TOTAL RECOVERABLE COPPER CONCENTRATION IN THE SEDIMENT VERSUS THAT AMOUNT OF COPPER THAT WAS FOUND IN THE WATER IN THE SEDIMENT, THE INTERSTITIAL WATER.

Q. OKAY. CAN YOU TELL ME IF YOU HAD ANY INVOLVEMENT IN ANALYZING THE CLEANUP ACTIVITIES SUBSEQUENT TO YOUR MEMO HERE IN JUNE OF '87?

A. I THINK I MUST HAVE REVIEWED A COUPLE OF THINGS. BUT I DON'T RECALL.

Q. YOU DON'T RECALL ANY ACTIVE WORK ANALYSIS THAT YOU HAVE DONE IN '87 BEYOND THIS MEMO THAT WE JUST LOOKED AT?

A. NO.

Q. OKAY. THIS MEMO -- I NOTICE IT'S DIRECTED TO THE FILE AS WELL AS TO LM, LANCE MC MAHAN?

A. YES.

Q. AND DB, DAVE BARKER?

A. YES.

Q. OKAY. AND WERE THOSE INDIVIDUALS THAT YOU WERE CONSULTING WITH OR INTERACTING WITH IN TERMS OF ESTABLISHING THIS THOUSAND PARTS PER MILLION CLEANUP LEVEL?

A. I WASN'T WORKING WITH LANCE ON THAT ONE. HE WAS BEING SUPERVISED BY DAVE BARKER TO PUT TOGETHER THE CLEANUP AND ABATEMENT ORDER AND SO FORTH.

I WOULD SAY I HAVE HAD BEEN WORKING ON THE CLEANUP LEVEL ALONG WITH MY SUPERVISOR, ART COE, AND LADIN DELANEY AND JOINTLY WITH DAVID BARKER.

Q. OKAY. SO IS IT FAIR TO SAY, THEN, THAT THE DETERMINATION TO ESTABLISH A CLEANUP LEVEL OF A THOUSAND PARTS PER MILLION WAS BASED ESSENTIALLY ON YOUR RECOMMENDATION FOR THE REASONS OUTLINED --

A. I THINK I HAD AN INFLUENCE OVER LADIN. THESE ARE THE PROS AND CONS OF A CLEANUP LEVEL.

Q. OKAY. WERE THERE DISCUSSIONS WITH LADIN OR OTHERS ABOUT THE SUBSTANCE OF THIS MEMORANDUM AND THE APPROPRIATENESS

EXTENT OF THIS MATERIAL WOULD BE AND HOW MUCH IT WOULD COST TO REMOVE IT ALL.

Q. DO YOU RECALL PACO HAVING -- OR WESTEC HAVING SUBMITTED ANY DATA WITH RESPECT TO THE 2500 PART PER MILLION CLEANUP LEVEL?

A. YES. I REMEMBER SEEING PLOTS OF THE PIERFACE WHERE YOU HAD, I THINK, THE 2500 CONCENTRATIONS THAT WAS REAL CLOSE TO THE PIERFACE. I DON'T BELIEVE THERE WAS ANYTHING AROUND THE STORM DRAIN AT THE 2500 LEVEL.

AND THE THOUSAND LEVEL WAS A MILLION FURTHER AWAY, AND THE 100 LEVEL I BELIEVE WAS QUITE A DISTANCE AWAY. IN FACT I THINK YOU CONTINUE ON THROUGHOUT SAN DIEGO BAY TO CHASE DOWN THE 100.

Q. SO YOU RECALL SOME ANALYSIS OF DIFFERENT QUANTITIES OF SEDIMENT AT THOSE DIFFERENT LEVELS?

A. YES.

Q. DO YOU RECALL ANY ANALYSIS OF DIFFERENT BIOLOGICAL IMPACTS AT THOSE DIFFERENT LEVELS?

A. NO. THAT'S SOMETHING WE ALREADY LOOKED AT. THE BIOLOGICAL COMMUNITY THERE WAS REALLY NOT DIVERSE ENOUGH IN ORDER TO GET A GOOD RELATIONSHIP BETWEEN COPPER CONCENTRATION AND WHAT KIND OF COMMUNITY WAS LIVING THERE.

Q. TRYING TO SUMMARIZE YOUR MEMO AS A WHOLE, IT SEEMS TO ME A FAIR SUMMARY THAT AT THE TIME THIS MEMO WAS WRITTEN YOU DIDN'T HAVE ANY GOOD DATA FROM ANY SOURCE ON THE EFFECT OF THE

COPPER ON A MORE DIVERSE BENTHOS OR BIOLOGICAL COMMUNITY; IS THAT CORRECT?

A. YES.

Q. AND THAT WOULD BE TRUE FOR THE THOUSAND PARTS PER MILLION OR THE 2500 PARTS PER MILLION OR ANY OTHER LEVEL. IS THAT RIGHT?

A. YES. TO MY KNOWLEDGE.

Q. ON PAGE 3 OF YOUR MEMO YOU TALK ABOUT THE TTLC FOR COPPER. AND I THINK YOU TESTIFIED THAT THAT IS A STATE TL STANDARD; IS THAT CORRECT?

A. YES.

Q. AND THAT'S A STANDARD FOR PUTTING MATERIAL INTO LANDFILLS; IS THAT CORRECT?

A. YES. WHICH I -- ONE OF THE THINGS -- HOW CAN YOU EXPLAIN TO THE PUBLIC THAT YOU ARE GOING TO LEAVE MATERIAL IN EXCESS OF 2500. THAT'S A HAZARDOUS WASTE.

WELL, THEY ARE SOMEWHAT APPLES AND ORANGES. IT'S LABELED AS A HAZARDOUS WASTE BECAUSE IT COULD LEACH OUT IN A LANDFILL AND CONTAMINATE GROUND WATERS. AND THAT'S WHAT THAT IS ALL DESIGNED FOR. IT'S NOT DESIGNED TO DETERMINE WHETHER COPPER ORE IS INJURIOUS TO A MARINE SYSTEM IN THE SEDIMENT TO THAT MARINE SYSTEM.

Q. YOU ANTICIPATED MY VERY QUESTION. WELL DONE.

A. BUT IT'S DEFINITELY SOMETHING THAT -- IT WOULD -- CONCENTRATIONS YOU WOULD WANT TO HONE IN ON. IF YOU WANT TO

LEAVE IT AT 2500 AND HIGHER, YOU ARE LEAVING A HAZARDOUS WASTE. YOU BETTER HAVE -- AND YOU COULD AS LONG AS YOU HAVE REAL GOOD BIOLOGICAL DATA THAT THAT STUFF IS NOT INJURIOUS AT 3,000 OR 5,000. WE DIDN'T HAVE THAT.

Q. IS THE TTLC OF 2500 MILLIGRAMS PER KILOGRAM IN DRY WEIGHT OR WET WEIGHT? IF YOU KNOW.

A. I BELIEVE THAT'S DRY WEIGHT. I DON'T KNOW ABOUT TTLC. I THINK THAT IS THE LEACH. THAT COULD BE WET WEIGHT. I'M QUITE SURE THAT THE OTHER IS DRY WEIGHT.

Q. DO YOU HAVE ANY BETTER INFORMATION TODAY ON THE BIOLOGICAL AFFECTS OF COPPER CONCENTRATE ON MARINE ORGANISIMS OF THE TYPES THAT MIGHT BE FOUND IN A MORE DIVERSE BIOLOGICAL COMMUNITY IN SAN DIEGO BAY?

A. NO.

Q. GOING BACK TO THE CLEANUP LEVELS THAT YOU BELIEVE PACO ANALYZED, TO THE BEST OF YOUR RECOLLECTION WERE THOSE THREE POTENTIAL CLEANUP LEVELS CHOSEN BY THE REGIONAL BOARD STAFF?

A. YES. I'M THINKING PERHAPS THAT LOWER ONE MIGHT HAVE BEEN 300 RATHER THAN 100. I AM SITTING HERE THINKING ABOUT THAT. THAT LOWER ONE PERHAPS WAS 300. AND BECAUSE THAT WAS CERTAINLY ONE THAT I WAS THINKING ABOUT, BECAUSE AS YOU GET CLOSE TO THE NAVY FACILITY ON THE NORTH SIDE OF THEM, WE HAD SOME VALUES I BELIEVE AROUND 300. WE HAD TO BE REALISTIC AND HAVE SOME OUTER BOUNDS TO THE CLEANUP.

Q. SOMEWHERE IN YOUR MEMO, AND I CONFESS I CAN'T FIND

IT, YOU SAY LEACHABLE COPPER. IS LEACHABLE COPPER THE SAME AS DISSOLVED OR SOLUBLE?

A. I WAS USING THEM INTERCHANGEABLY. THAT MATERIAL WHICH COULD DISSOLVE.

MR. ROBINSON: PAGE 1, DAVE. THE THING IN THE BOX.

THE WITNESS: SOLUBLE.

MR. HOPKINS: VERY GOOD.

BY MR. HOPKINS:

Q. IN EXHIBIT 171 YOU REFERRED TO LEVELS OF DISSOLVED OXYGEN AND PH. DID I UNDERSTAND YOU CORRECTLY THAT THE HIGHER THE VALUES FOR DISSOLVED OXYGEN AND PH, THE GREATER YOU WOULD ASSUME TO BE THE BIOLOGIC AVAILABILITY OF ANY METAL SUCH AS COPPER IN THE WATER?

A. NO. MOST DEFINITELY THE LOWER THE PH, THE MORE ACIDIC THE COPPER WOULD BE MORE AVAILABLE. I'LL REPHRASE THAT. THE COPPER WOULD TEND TO DISSOLVE INTO THE AQUEOUS FORM MORE READILY AS YOU LOWER THE PH. THERE'S SOME ARGUMENT AS TO WHETHER IT'S -- ONCE IT'S DISSOLVED, WHETHER IT'S AS TOXIC AT A LOWER PH AS IT IS AT A HIGHER PH. IT'S IN SO MUCH HIGHER CONCENTRATION, THERE IS A DIFFERENT --

Q. LET ME STOP YOU THERE AND UNDERSTAND ABOUT PH. YOU ARE SAYING THE LOWER THE PH, THEN THE GREATER THE LIKELIHOOD THAT THE COPPER WILL DISSOLVE --

A. YES.

Q. -- IN THE WATER?

A. YES.

Q. BUT THAT ANOTHER FACTOR IS THAT THERE IS SOME EVIDENCE THAT IN THAT LOWER PH ENVIRONMENT IT MAY NOT BE AS TOXIC?

A. YES. BUT IT'S ALMOST NOT WORTH EVEN CONSIDERING. BECAUSE THE MAGNITUDE OF WHAT IT DISSOLVES IS SO MUCH GREATER AS YOU REDUCE THE PH, THAT THE FACT THAT AN 8 PART PER BILLION AT ONE PH VERSUS 8 PART PER BILLION AT A SLIGHTLY MORE ACIDIC PH, THERE IS A SLIGHT DIFFERENCE IN THE BIOLOGICAL RESPONSE TO ORGANISIMS TO THAT. THERE'S A MUCH MORE DRAMATIC INCREASE IN THE SOLUBILITY AS YOU REDUCE THE PH THAT --

PERHAPS I SHOULDN'T HAVE SAID ANYTHING. I JUST RECALL WHEN I SAW A PAPER ON THAT, I THOUGHT THAT'S INTERESTING BECAUSE THAT GOES JUST THE OTHER WAY AND MIGHT HELP NEGATE THE FACT THAT IT'S MORE SOLUBLE AS A REDUCED PH. IT'S INCONSEQUENTIAL.

Q. HOW ABOUT THE LEVEL OF DISSOLVED OXYGEN? ANY CORRELATION BETWEEN THE LEVEL OF DISSOLVED OXYGEN AND THE AVAILABILITY OF THE COPPER?

A. THERE IS -- RIGHT OFFHAND I COULDN'T EXPLAIN IT FOR THE DIFFERENT METALS. I BELIEVE GENERALLY THE MORE ANAEROBIC THERE IS AN INCREASE TOWARDS GREATER SOLUBILITY IN ANAEROBID CONDITIONS.

ALSO TO PROVIDE ADDITIONAL INFORMATION, THAT IF YOU FOUND A LESSER AMOUNT OF ORGANISIMS IN A PARTICULAR AREA WHICH

HAD A HIGHER COPPER CONCENTRATION, THAT IT WASN'T DUE TO THE FACT THAT THERE WASN'T ANY OXYGEN IN THE SEDIMENT.

AND I HAD WESTEC TRY TO GET AS MUCH INFORMATION AS THEY COULD. I TOLD THEM AT LEAST TO MAKE VISUAL OBSERVATIONS OF WHAT IS LIVING IN THE CORES AND LIVING ON THE SEDIMENT WHEN YOU COLLECT THE CORES. SO GET THE MOST INFORMATION POSSIBLE SO WE CAN DOCUMENT, WHETHER IT'S A BIOLOGICAL DESERT OUT THERE OR CRITTERS LIVING EVERYWHERE.

Q. YOU ARE NOT SURE AS YOU SIT HERE TODAY IN WHICH -- WHETHER IT'S A DIRECT CORRELATION OR AN INVERSE CORRELATION BETWEEN DISSOLVED OXYGEN AND DISSOLVED TOXICITY?

A. IF IT WAS IN DIRECT OR INDIRECT BETWEEN DISSOLVED OXYGEN LEVEL AND THE SEDIMENT OF SOLUBILITY OF THE METAL IN SEDIMENT AND -- I WOULDN'T WANT TO VENTURE A GUESS ANY MORE BECAUSE SINCE THE MAIN FACTOR THAT SEEMS TO BE IMPORTANT IS - FAMILIAR WITH ACID SOLUBLE SULFITES?

Q. YES.

A. THAT'S WHERE IT'S ALL AT. I WOULD GO WITH THAT ONE.

MR. HOPKINS: WITH THE BLESSING OF COUNSEL HERE IN THIS ROOM, IF THEY HAVE NO OBJECTION TO SPEAKING WITH YOU IN PRIVATE, I WON'T ASK ANY FURTHER QUESTIONS.

MR. ROBINSON: ARE YOU FINISHED?

MR. HOPKINS: YES.

MR. ROBINSON: I DON'T HAVE ANY FOLLOW UP. ANYBODY

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COPY

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF SAN DIEGO

PACO TERMINALS, INC., PLAINTIFF, VS. AMERICAN HOME ASSURANCE COMPANY, ET AL., DEFENDANTS.	CONSOLIDATED CIVIL ACTION CASE NOS. 602586 AND 602587
PACO TERMINALS, INC., PLAINTIFF, VS. CALIFORNIA INSURANCE GUARANTY ASSOCIATION, ET AL., DEFENDANTS.	
SAN DIEGO UNIFIED PORT DISTRICT, INTERVENOR.	

DEPOSITION OF DAVID BARKER

SAN DIEGO, CALIFORNIA

APRIL 5, 1991

VOLUME II

REPORTED BY CRAIG A. BROWN, CSR NO. 7440

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Exhibit 5

Q. OKAY.

A. I WOULD LIKE TO AMEND THAT ANSWER. THE PURPOSE OF THIS LETTER WAS TO ADVISE THEM OF VIOLATIONS OBSERVED BY MR. BAKER ON A CERTAIN DAY DURING HIS INSPECTION.

Q. OKAY. I WILL SHOW YOU WHAT PREVIOUSLY HAS BEEN MARKED AS EXHIBIT 37. IT IS A HANDWRITTEN MEMORANDUM FROM SOMEONE BY THE INITIALS G P ON THE SUBJECT OF DATA REVIEW FOR CLEANUP. I BELIEVE YOUR INITIALS ARE LISTED AS ONE OF THOSE TO WHOM THE MEMORANDUM IS DIRECTED. I WILL ASK YOU TO REVIEW THAT BRIEFLY.

A. OKAY.

Q. DO YOU RECALL HAVING SEEN THIS MEMORANDUM BEFORE?

A. YES.

Q. WHAT WAS THE CONTEXT IN WHICH YOU SAW THIS MEMORANDUM?

A. AT THIS TIME I RECALL THAT THE REGIONAL BOARD STAFF WAS INVOLVED IN FORMULATING A CLEANUP LEVEL FOR THE COPPER SEDIMENT. AND THAT IN DETERMINING WHAT THAT LEVEL SHOULD BE, I HAD REQUESTED THE ASSISTANCE OF GREG PETERS, WHO IS OUR STAFF BIOLOGIST--HE IS AN ENVIRONMENTAL SPECIALIST--AND REQUESTED HIS THOUGHTS ON THAT.

Q. THIS MEMORANDUM IS IN RESPONSE THEN TO YOUR REQUEST TO HIM?

A. YES, IT IS.

Q. THE NEXT THING I WILL SHOW YOU IS AN EXHIBIT THAT

TODAY.

MR. ROBINSON: APRIL 7TH. 37 YOU SAID?

MR. HOPKINS: RIGHT. EXHIBIT 37.

BY MR. HOPKINS:

Q. MR. BARKER, THIS MEMO IS WRITTEN BY GREG PETERS WHO IS A BIOLOGIST ON THE STAFF OF THE REGIONAL BOARD; IS THAT CORRECT?

A. YES.

Q. AND I BELIEVE IT'S ALREADY BEEN ESTABLISHED--AND CORRECT ME IF I AM WRONG--THIS MEMO WAS WRITTEN AT THE TIME THAT THE CLEANUP LEVEL WAS BEING SET THAT WOULD BE PUT INTO THE CLEANUP AND ABATEMENT ORDER OR ITS ADDENDUM; IS THAT RIGHT?

A. YES.

Q. I NOTE THAT THIS MEMO CONCLUDES THAT 1,000 PARTS PER MILLION CLEANUP LEVEL WOULD BE APPROPRIATE.

ARE YOU AWARE OF ANY OTHER BIOLOGIC INFORMATION TAKEN INTO ACCOUNT BY THE REGIONAL BOARD STAFF IN REACHING THE 1,000 PART PER MILLION CLEANUP LEVEL OTHER THAN WHAT IS IN THIS MEMO?

A. I CAN'T RECALL RIGHT NOW IF THIS WAS THE SOLE BASIS FOR DETERMINING THAT THAT WAS 1,000 PARTS PER MILLION.

Q. BASED ON THAT ANSWER, WOULD IT BE FAIR TO SAY, AS YOU SIT HERE, YOU CAN'T THINK OF ANY OTHER BIOLOGIC INFORMATION THAT WENT INTO THE THOUSAND PARTS PER MILLION CLEANUP LEVEL?

A. THERE MAY HAVE BEEN OTHER INFORMATION WHICH WAS

VERBALLY DISCUSSED BETWEEN MR. PETERS AND MYSELF. HE WAS THE CHIEF ADVISOR ON DETERMINING THE CLEANUP LEVEL AT THE SITE. AND WE HAD DISCUSSIONS ON VARIOUS MATTERS RELATED TO THAT WHICH ENTERED INTO THE DECISION.

Q. AS FAR AS YOU KNOW IS THERE ANY BIOLOGIC INFORMATION THAT WENT INTO THE THOUSAND PARTS PER MILLION CLEANUP LEVEL FROM ANY OTHER SOURCE OTHER THAN MR. PETERS?

WE CONSULTED WITH THE DEPARTMENT OF FISH AND GAME SO REVIEWED THE INFORMATION SUBMITTED BY THE CONSULTANT 'ERMINALS. EXCUSE ME. AND ADDITIONAL INFORMATION SUCH ..E RESULTS FROM THE STATE MUSSEL WATCH PROGRAM.

Q. WAS MR. PETERS THE PERSON WHO HAD THOSE DISCUSSIONS WITH THE FISH AND GAME? THE PERSON FROM THE REGIONAL BOARD STAFF HAD DISCUSSIONS WITH FISH AND GAME?

A. YES. HE AND I -- WELL, MR. PETERS WAS THE LEAD COORDINATOR BETWEEN OUR OFFICE AND FISH AND GAME.

MR. HOPKINS: I HAVE NO FURTHER QUESTIONS. THANKS.

(EXAMINATION)

BY MR. ROBINSON:

Q. I'LL TRY TO KEEP MY FOLLOW-UP QUESTIONS BRIEF, MR. BARKER. WE WILL MAKE OUR 3:30 COMPLETION TIME.

I WANT TO SHOW YOU A PACKET OF MATERIALS THAT I'M GOING TO HAVE MARKED AS AN EXHIBIT TOGETHER. THIS IS THE ONLY COPY I GOT FOR THE TIME BEING. I WOULD LIKE TO ASK YOU TO KEEP

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COPY

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IN AND FOR THE COUNTY OF SAN DIEGO

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SAN DIEGO UNIFIED PORT DISTRICT, INTERVENOR.	

DEPOSITION OF LANCE MC MAHAN

SAN DIEGO, CALIFORNIA

JULY 25, 1991

VOLUME III

REPORTED BY CRAIG A. BROWN, CSR NO. 7440

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Exhibit 6

MR. HOPKINS: COUNSEL, WHAT NUMBERS ARE YOU ON NOW?
MR. ROBINSON: 130 THROUGH 135.
THE WITNESS: LOOKING AT ONE OR TWO OF THEM, YES.
BY MR. ROBINSON:
Q. WERE THESE ALSO TAKEN AS PART OF YOUR EVALUATION AND DOCUMENTATION OF THE OPERATIONS AS PART OF THE ENFORCEMENT ACTION?
A. YES.
Q. OKAY.
MR. ROBINSON: THOSE ARE ALL THE QUESTIONS I GOT, MR. MC MAHAN. I WILL LET OTHER PEOPLE TALK WITH YOU FOR A WHILE IF THEY WANT.
MS. SCHARDEIN: I DON'T HAVE ANY FURTHER QUESTIONS.
MS. MANGINI: NO QUESTIONS.
MR. RICHTER: NO QUESTIONS.
MR. SOKOL: I DON'T HAVE ANY QUESTIONS.

EXAMINATION

BY MR. HOPKINS:
Q. MR. MC MAHAN, IN A PRIOR SESSION OF YOUR DEPOSITION YOU DISCUSSED EXHIBIT 37 -- YOU WERE QUESTIONED ABOUT EXHIBIT 37 WHICH IS A MEMO FROM GREG PETERS TO THE PACO TERMINAL FILE TO L.M. WHICH IS YOU AND TO D.B. WHICH IS DAVE BARKER. IN GENERAL THIS MEMO DISCUSSES THE THOUSAND PART PER MILLION CLEANUP LEVEL AND THE MEANS OF ARRIVING AT THAT. IN YOUR -- I WON'T ASK HIM

ANY QUESTIONS ABOUT THE MEMO. I'M TRYING TO SET THE STAGE FOR WHERE WE ARE GOING.

IN YOUR PRIOR TESTIMONY ABOUT THAT MEMO YOU MENTIONED THAT YOU -- THE REGIONAL BOARD STAFF WAS CONSIDERING CLEANUP LEVELS BETWEEN 100 PARTS PER MILLION AND 2500 PARTS PER MILLION FOR THE SEDIMENT. MY RECOLLECTION IS THAT 100 PARTS PER MILLION WAS APPROXIMATELY BACKGROUND AND THAT 2500 PARTS PER MILLION WAS THE TTLC LEVEL AND THEREFORE THAT SET THE RANGE.

IS THAT CONSISTENT WITH YOUR RECOLLECTION OF THE PARAMETERS THAT WERE UNDER DISCUSSION FOR THE CLEANUP LEVEL?

A. YES.

Q. OKAY. I WANT TO FOCUS ON THAT TTLC LEVEL. THAT TTLC LEVEL STEMS FROM STATE OF CALIFORNIA TITLE 22; IS THAT CORRECT?

A. YES.

Q. AND ISN'T IT ALSO CORRECT THAT THAT 2500 PARTS PER MILLION LEVEL IS DESIGNED TO SET A LEVEL FOR DISPOSAL IN NONHAZARDOUS WASTE LANDFILLS?

A. YES.

Q. AND ISN'T IT ALSO CORRECT THEN THAT THAT 2500 PARTS PER MILLION LEVEL WAS NOT SET WITH REFERENCE TO ANY MARINE ENVIRONMENT MEANING AN OCEAN ENVIRONMENT OR A BAY ENVIRONMENT?

A. CORRECT.

Q. DO YOU HAVE ANY KNOWLEDGE AS TO WHETHER THE TTLC LEVEL IS A CONCENTRATION IN WET WEIGHT OR DRY WEIGHT?

A. YES.
Q. DO YOU KNOW WHICH IT IS?
A. WET WEIGHT.
Q. WOULD I BE CORRECT THAT 2500 PARTS PER MILLION WET WEIGHT WOULD TRANSLATE TO A HIGHER PARTS PER MILLION DRY WEIGHT?
A. YES.
Q. WOULD I BE IN THE BALLPARK THAT 2500 PARTS PER MILLION WET WEIGHT WOULD BE 4,000 PARTS PER MILLION DRY WEIGHT?
A. GIVEN CONCENTRATION OF WATER, YES.
Q. THAT'S WHAT IT WOULD DEPEND UPON IS HOW MUCH WATER IS --
A. HOW MUCH WATER IS IN IT.
Q. OKAY.
A. OFF THE RECORD?
MS. SCHARDEIN: YOU WANT TO ELABORATE?
MR. HOPKINS: FINE WITH ME. LET'S JUST KEEP GOING. MAKE LIFE EASIER.
MS. SCHARDEIN: OFF THE RECORD.
(DISCUSSION OFF THE RECORD)
BY MR. HOPKINS:
Q. COULD YOU TAKE A LOOK AT PHOTOS 125 THROUGH 128, PLEASE, AGAIN. I DON'T THINK YOU NEED TO TAKE THEM OUT. THEY BACK UP TO ONE ANOTHER.
A. OKAY.
Q. AM I CORRECT THAT THOSE PHOTOS CORRESPOND TO THE

7

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego**
Unified Port District

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

DECLARATION OF DAVID B. HOPKINS

REGARDING IMPLEMENTATION OF

THE MINING COMPANY OPTION

Submission Date:	June 3, 1992
Workshop Date:	[Not set]
Hearing Date:	[Not set]

EXHIBIT 7

I, DAVID B. HOPKINS, being duly sworn, state as follows:

1. I am an attorney at law and a shareholder in the law firm Hillyer & Irwin, special environmental counsel to the San Diego Unified Port District on this matter. The purpose of this declaration is to provide evidence concerning events that have taken place since the Regional Board's decision on December 9, 1991 to adopt Addendum No. 7 to Cleanup and Abatement Order No. 85-91, raising the cleanup level under the CAO from 1,000 ppm to 4,000 ppm.

2. After the December 9 decision, the Port District had reason to review more carefully its expenditures incurred in landside remediation at the site. At the Regional Board hearing on December 9, the Port District reported those expenditures at approximately $1.3 million. After the hearing, the Port District was required to review all such figures to prepare for depositions noticed by Paco's attorneys for insurance company litigation pending in Alabama. A review of those records established that the Port District's total landside remediation expenditures were approximately $1.5 million. All of these expenditures were incurred to comply with the Regional Board's order to abate any continuing discharges of copper from the site.

3. After the Regional Board decision, the Port District had reason to recalculate the volume of sediment required to be dredged to meet the 4,000 ppm cleanup level. At the hearing, Port District witnesses testified that the quantity would be 5,000 cu. yds. However, the testimony also established that the 5,000 cu. yds. did not include any overdredge factor or additional dredging necessary to gain access to sediments containing copper greater than

4,000 ppm. Including these factors, the current estimate of sediment volume to be dredged to meet the 4,000 ppm cleanup level is 10,000 cu. yds. It is estimated that this doubling of the quantity of sediment to be dredged subject to the 4,000 ppm cleanup level has added over $1 million to the cleanup cost.

4. Since December 9, 1991 the Port District and the mining companies have been working diligently to determine the ideal means of implementing the mining company option. Attached hereto as Appendix A is the Port District's April 30, 1992 report to the Regional Board concerning completion of the mining company pilot project during February - April, 1992. The pilot project was a success in that it enabled engineers from the mining company and consultants from the Port District to agree on the form in which the material is to be shipped to the mining company, and the method and timing of transport.

5. In mid-May, 1992 the mining company notified the Port District of the specifications for the material required for the pilot project and the capital and operating costs likely to be incurred for the project. It is the Port District's understanding from those communications, and from other communications, that the capital expenditures and the estimations of operating costs are dependent upon the current cleanup level, and on the quantities of sediment and minimum copper content of the sediment to be expected pursuant to that cleanup level.

6. In 1992 additional meetings have taken place among the parties to Magistrate McCue's settlement discussions. As a result, a settlement agreement among all the parties is almost in final

form. All of the drafts of the settlement agreement that have circulated in 1992 have been contingent upon the cleanup level remaining at 4,000 ppm. All of the parties understand that changing the cleanup level to a lower concentration of copper will drastically increase the cost of settlement and render settlement through the mining company option unattainable for economic and practical reasons. Although the mining company is approaching the project as a commercial venture, the mining company has made it clear that it is unwilling to enter into such a commercial venture with parties with whom they are litigating, which would be the case if the settlement agreements cannot be consummated. In addition, it is the Port District's understanding that there are substantial uncertainties that the mining company option could be technically feasible if the cleanup level were rolled back to the former 1,000 ppm level set in 1987. For all of these reasons, all of the draft settlement agreements are contingent upon maintaining the Regional Board's December 1991 cleanup level of 4,000 ppm.

I declare under penalty of perjury under the laws of the State of California that this Declaration is true and correct, and that it was executed on June 3, 1992, in San Diego County, California.

David B. Hopkins
HILLYER & IRWIN
Attorneys for San Diego
Unified Port District

FILE COPY

WILLIAM HILLYER
OSCAR F. IRWIN
NORMAN R. ALLENBY
HENRY J. KLINKER
BROWN B. SMITH
JAMES G. EHLERS
JAMES E. DRUMMOND
PETER J. IPPOLITO
GARY S. HARDKE
HOWARD A. ALLEN
ROBERT J. HANNA
KENT W. HILDRETH
JONATHAN S. DABBIERI
HOWARD E. SUSMAN
DAVID B. HOPKINS
ROBERT L. ZAJAC
CHARLES J. INGBER
MICHAEL F. MILLERICK
MURRAY T. S. LEWIS
JOHN C. O'NEILL
STEVEN M. HILL
DONALD L. CUPIT
MARK G. BUDWIG

HILLYER & IRWIN
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
550 WEST C STREET, 16TH FLOOR
SAN DIEGO, CALIFORNIA 92101-3540

TELEPHONE (619) 234-6121
FAX (619) 595-1313

CURTIS HILLYER (1872-1951)
LESA CHRISTENSON
MARK D. MARTIN
STEVEN C. SAYLER
DEB C. PEDERSDOTTER
STEPHEN M. BRIGANDI
NANCY J. SKOVHOLT
TAD SETH PARZEN
JAMES M. CADY
ROBERT J. LOFGREN
RANDA M. TRAPP
EVELYN R. WIGGINS
TIMOTHY J. NASH
LINDA K. HAMMACHER
LORNE R. POLGER
CRAIG A. BROWN
ROBIN M. STEMEN
DAVID B. BERGQUIST

R. DAVID MULCAHY
DIRECTOR OF ADMINISTRATION

April 30, 1992

IN REPLY REFER TO
OUR FILE
8481.14

Mr. Arthur L. Coe, Executive Officer
CALIFORNIA REGIONAL WATER QUALITY
CONTROL BOARD -- San Diego Region
9771 Clairemont Blvd., Suite B
San Diego, California 92124

Re: Cleanup and Abatement Order No. 85-91
Paco Terminals Site

Dear Mr. Coe:

This is to report to the Regional Board completion of the Mining Company Pilot Project and to report on the status of the decision by Cyprus Mining Company (Cyprus) whether to accept for recycling material dredged from San Diego Bay pursuant to the Cleanup and Abatement Order. In summary, the Mining Company Pilot Project has been completed. The pilot project was a success in that it enabled engineers from Cyprus and consultants from the Port District to agree on the form in which the material is to be shipped to Cyprus, and the method and timing of transport. Engineers from Cyprus and consultants from the Port District are in agreement that the material should be delivered to the mine in a slurry form (that is, not dried), sieved through a 1/4" screen, and shipped by rail in solid bottom gondola cars. Cyprus has also requested that the material be shipped on a schedule such that it will arrive at the Sierrita facility in "lots" of five rail cars per day.

Cyprus has received sample material in this and other forms, both during and before the pilot project. In approximately September, 1990, Paco, the Port District and Cyprus shared equally the cost of Cyprus extracting and analyzing sediment samples from the site for the purpose of determining whether Cyprus can extract copper from the sediment. Pursuant to a Stipulated Order entered by Magistrate McCue on August 22, 1990, all of the data, including Cyprus' analysis, reports or conclusions based on those samples were not disclosed to any one other than Cyprus, Cyprus' attorneys and consultants. In addition, as part of the pilot project, the Port District provided to Cyprus additional chemical analysis of the dredged material. (See enclosure 1.)

As a result of all the information now available to Cyprus, Cyprus does not anticipate any technical problems in handling the material or in reclaiming or recycling the copper. Still, Cyprus has not yet made a final commitment to the Port District, Paco or any of the other parties involved in the settlement conferences before Magistrate McCue to accept the material and to complete the Mining Company Pilot Project.

Nevertheless, the Port District is now optimistic that such a commitment may be obtained as a result of ongoing multi-party negotiations under the auspices of Magistrate McCue. In fact, after counsel for the Port District sent an advance copy of this letter to counsel for Cyprus (Leighton M. Anderson of Smaltz & Anderson), Mr. Anderson sent a return letter stating, in part, that "Cyprus has made a commitment to proceed with the project, subject to the San Diego Unified Port District's compliance with all of Cyprus' technical, legal, contractual and economic requirements, [which] we will express . . . in a letter that we plan to send to you by the end of next week." The Port District is optimistic that Cyprus' conditions will constitute only normal commercial conditions that will be consistent with the requirements of the Cleanup and Abatement Order and the multi-party negotiations conducted under Magistrate McCue's auspices, and that a final commitment will be obtained quickly.

The Port District regrets that it does not have a final commitment from Cyprus by the May 1 deadline set in Addendum No. 7 to the Cleanup and Abatement Order for Cyprus to determine whether or not it will participate in the Mining Company Option. As the Regional Board is aware, that commitment is solely within Cyprus' control and not within the Port District's. Nevertheless, for the reasons just stated, the Port District is optimistic that a final commitment will be obtained shortly through the auspices of Magistrate McCue. In addition, Mr. Anderson has requested, through my office, that representatives of the Port District, Paco and Cyprus (including technical personnel) meet with Regional Board Staff to discuss the progress that has been made and Cyprus' position.

Enclosed are the following materials related to the pilot project: (1) an April 1 letter from Woodward-Clyde Consultants to Mr. R.O. Huch, Manager-Metallurgy Technical Services, Cyprus Metals Company, concerning chemical analysis of two sediment samples delivered to Cyprus during March 1992 in the form ultimately agreed upon by Cyprus and the Port District as the optimum form for the project; and (2) Woodward-Clyde's Project Report for the pilot project, entitled National City Marine Terminal Material Handling Pilot Project Phase I Report (April 15, 1992).

SUMMARY OF PILOT PROJECT

The Port District worked diligently with Cyprus and successfully completed the pilot project on time. Key dates in completing the project were as follows:

February 7, 1992

Signing of Stipulation requested by Cyprus regarding confidentiality of information to be exchanged by Cyprus and the Port District regarding the pilot project;

February 18, 1992

Technical meeting at the Cyprus Sierrita facility among:

Representing Cyprus:

Robert Comstock, Copper Operations Manager, Cyprus Sierrita Corp.

R.O. (Rich) Huch, Manager-Metallurgy, Cyprus Metals Technical Services

B.W. (Doc) Adams, Consultant, Cyprus Metals Company

Mark Kling, Esq., Counsel, Cyprus Minerals Company

Representing the Port District:

Eileen Maher, Environmental Management Dept., Port District

Robert Masterson, Woodward-Clyde Consultants

Jean Nichols, Woodward-Clyde Consultants

The group toured the facility and discussed several options for form and delivery of the sediment. Cyprus requested that the pilot project include shipment of both wet and dry (10% moisture content) sediment, each sieved to two different consistencies as follows:

Wet sediment:	Dry Sediment (10% moisture content):
1. Sieved through 1/4" screen	1. Sieved through 2" screen
2. Sieved through No. 28 mesh screen	2. Sieved through No. 28 mesh screen

March 4, 1992

Pilot project field dredging work conducted under the direction of Woodward-Clyde. The work is more completely described in the Woodward-Clyde Report (enclosed), pages 2-5. In brief, eight 55-gallon drums of sediment were collected, from the North face and four from the West face of the 24th Street Marine Terminal. Sediment from the drums was shoveled into 5-gallon containers to be delivered to several companies described at pages 4-5 of the Woodward-Clyde report for studying dewatering, metal recovery and pumping feasibility, and to Quality Assurance Laboratory in San Diego for chemical analysis, as well as to Cyprus. Cyprus had explicitly requested that it receive only 5-gallon samples.

March 11, 1992

Delivery to Cyprus of two 5-gallon containers of wet sediment, screened to 1/4" (slurry) the form ultimately determined to be the optimum form for the pilot project.

March 23, 1992

Receipt of chemical analysis from Quality Assurance Laboratory of material dredged during pilot project from both the North and West faces of the site.

April 1, 1992

Letter from Woodward-Clyde Consultants to Mr. R.O. Huch summarizing the chemical analysis (copy enclosed).

April 20, 1992

Delivery to Cyprus of dried material (unscreened) from Disposal Control, Inc. of Upland, CA and (screened) from Bio-Nomic Service of Charlotte, NC. Promptly after the March 4 dredging, Woodward-Clyde sent shipments of the dredged sediment to four separate companies that had expressed interest in the drying and screening project. The fastest turnaround was from Disposal Control, which required approximately six weeks to dry (but not screen) the small sample, and from Bio-Nomic Service, which completed drying and sieving through both 2" screen and No. 28 mesh by April 13. The other two companies failed to complete the project. The apparent difficulties and long time frames required to dry the material in these small quantities indicated the significant problems involved in any drying or drying/screening process.

CONCLUSION

The Port District is pleased to report that the pilot project has been concluded on time, and that the pilot project successfully reached its goals of determining the optimum form or constituency in which the sediment should be shipped to Cyprus and the manner and timing of shipment.

The Port District regrets that it has been unable to obtain a final commitment from Cyprus to complete the Mining Company Option by this date. Nevertheless, for the reasons stated above, the Port District is optimistic that such commitment can be obtained shortly through further negotiations under the auspices of Magistrate McCue. In addition, Cyprus has suggested that its representatives, including technical personnel, meet with the Regional Board Staff along with representatives of the Port District and Paco to communicate to the Regional Board Cyprus' optimism that the project will be concluded. The Port District also suggests such a meeting.

Respectfully Submitted,

HILLYER & IRWIN

David B Hopkins

David B. Hopkins
Counsel to San Diego Unified
Port District

DBH:aj
Enclosures
cc: John J. Lormon, Esq. (Paco Counsel)
F. P. Crowell, Esq. (Paco Counsel)
Leighton M. Anderson, Esq. (Cyprus Counsel)
J. Patrick Huston, Esq. (Cyprus Counsel)
Hon. Harry R. McCue, U.S. Magistrate
Settlement Conference Participants (Service List Attached)

PACO TERMINALS, INCORPORATED
SAN DIEGO UNIFIED PORT DISTRICT
COPPER ORE BAY SEDIMENT CLEANUP
NPDES CAO ORDER: 85-91
ENFORCEMENT **FILE: 8** 08/92-11/92
02-0045.05 STATUS: C

F.P. CROWELL (030074)
JAN S. DRISCOLL (065967)
ROBERT W. BROWNLIE (138793)
GRAY, CARY, AMES & FRYE
401 B Street, Suite 1700
San Diego, CA 92101-4297
(619) 699-3665

COPY
KENNETH E. MARTONE
Clerk of the Superior Court
NOV - 6 1992
By: __________ Deputy
BUSINESS

Attorneys for Petitioner
PACO TERMINALS, INC.

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN DIEGO

PACO TERMINALS, INC., a California corporation,

Petitioner,

vs.

STATE WATER RESOURCES CONTROL BOARD OF THE STATE OF CALIFORNIA,

Respondent.

ENVIRONMENTAL HEALTH COALITION and EUGENE SPROFERA,

Real Parties In Interest.

CASE NO. 658082

VERIFIED PETITION FOR PEREMPTORY WRIT OF MANDATE AND APPLICATION FOR STAY

NOV 13 19

Petitioner PACO TERMINALS, INC. ("PACO") hereby petitions this court for a peremptory writ of mandate pursuant to Water Code section 13330 and Code of Civil Procedure section 1094.5 directed to respondent STATE WATER RESOURCES CONTROL BOARD OF THE STATE OF CALIFORNIA ("Respondent") and applies for a stay of the operation of Cleanup and Abatement Order No. 85-91 ("CAO

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85-91") and the addenda thereto and of STATE WATER RESOURCES CONTROL BOARD Order WQ 92-09 pending this court's judgment.

Petitioner alleges:

SUMMARY OF PETITION

1. On December 9, 1991, the Regional Water Quality Control Board, San Diego Region ("Regional Board"), issued to PACO and the San Diego Unified Port District (the "Port District") Addendum No. 7 to CAO 85-91, which contained Order No. 2: "Paco Terminals and the Port District shall reduce the sediment copper concentration in the affected portion of San Diego Bay to a sediment copper concentration less than 4,000 mg/kg (dry weight)." This case involves Respondent's reversal of that order.

2. The Regional Board issued Addendum No. 7 setting the sediment cleanup level at 4,000 mg/kg (dry weight)[1] after reviewing evidence showing, among other things, that the copper in the affected sediment is stable, highly insoluble and thus almost totally unavailable to aquatic life. The Regional Board specifically found that a cleanup level of 4,000 mg/kg (dry weight) or higher will not cause any adverse effect on aquatic life or the beneficial uses of San Diego Bay. There was no competent evidence offered to the contrary.

3. On September 17, 1992, Respondent, after a hearing, reversed Order No. 2 of Addendum No. 7 to impose a 1,000 mg/kg cleanup level, despite the complete lack of evidence

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1 4,000 mg/kg (dry weight) means that in a kilogram of dry sediment, there is 4,000 milligrams of copper, or that 0.4 percent of the sediment is copper. Milligrams per kilogram is sometimes expressed as "parts per million" or "ppm."

that the Regional Board's 4,000 mg/kg cleanup level would cause any adverse effect to aquatic life or to the beneficial uses of San Diego Bay. There is also no evidence that a 1,000 mg/kg cleanup level will provide any material improvement to San Diego Bay's water quality. In reversing the order, Respondent disregarded evidence that the 1,000 mg/kg cleanup level will tremendously increase the cleanup and disposal costs to such an extent that PACO cannot comply with CAO 85-91 -- guaranteeing further delays and litigation.

4. PACO, the Port District and many other entities have been working since June 1991 on a settlement agreement to fund the clean up and disposal of the sediment. Despite admitting that the 4,000 mg/kg cleanup level may be appropriate, Respondent refused to allow any extra time for Paco to provide further data. Respondent ordered that Paco and the Port clean up the affected sediment to the 1,000 mg/kg level on the same schedule that had previously been set for the 4,000 mg/kg level. The net effect of this is to require dredging of an additional 24,500 cubic yards of sediment[2] by February 1, 1993. The increased expense is enormous with no evidence of any increase in benefit to the environment. Respondent's decision is unreasonable and is not supported by adequate findings.

5. PACO therefore petitions for a writ of mandate and requests the court to vacate State Board Order No. WQ 92-09 and to enter a judgment reinstating the 4,000 mg/kg cleanup level to Addendum No. 7 of CAO 85-91.

---

[2] Petitioner is informed of this fact by the San Diego Unified Port District, also a responsible party under CAO 85-91.

THE PARTIES

6. Petitioner PACO is a corporation duly organized and existing under the laws of the State of California. From 1979 through 1986, PACO was doing business in San Diego County. PACO ceased operations in 1986 and has had no income since that time.

7. Respondent is a public agency of the State of California, duly created by the Legislature in Division 1, Chapter 2, Article 3 of the Water Code (Water Code § 174). Respondent's responsibilities include the formulation and adoption of water quality control plans for waters for which water quality standards are required by the Federal Water Pollution Control Act (33 U.S.C. § 1313), as well as compliance with the California Administrative Procedure Act ("APA") (Govt. Code §§ 11340-11356) and the California Environmental Quality Act ("CEQA") (Public Resources Code §§ 2100-21177.)

8. The Environmental Health Coalition ("EHC") is an entity conducting its business in San Diego County.

9. Eugene Sprofera ("Sprofera") is an individual who resides in San Diego County.

VENUE

10. Venue is proper in San Diego County in that CAO 85-91 was issued by the REGIONAL BOARD in San Diego and concerns property located in San Diego County.

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FACTUAL BACKGROUND

11. PACO engaged in copper loading and other stevedore operations at the National City Marine Terminal ("NCMT") from January 1979 through December 1986 under a Lease and Terminal Operator Agreement with the Port District. The NCMT is located on the east side of South San Diego Bay in an area that has been dedicated to shipyard, navigation and other industrial uses for many years. U.S. Navy Piers 1 through 13 are adjacent to NCMT on the north. Several ship repair facilities are nearby. Out-of-state mining companies shipped a type of copper ore concentrate known as chalcopyrite on rail cars to NCMT and hired PACO to unload it, and then re-load it onto ships bound for a smelter in Japan. Chalcopyrite is cupric ferrous sulfide ($CuFeS_2$).

12. There are many sources of pure copper (Cu) in San Diego Bay, including copper that routinely leaches from boat bottoms coated with anti-fouling paints and from surface water run-off through the storm drains. Anti-fouling paints are designed to kill marine organisms by constantly leaching pure copper. In contrast, heavy metal sulfides, such as the cupric ferrous sulfide handled by PACO at NCMT, are well known to chemists as virtually insoluble. Pure copper can only be extracted from cupric ferrous sulfide by the application of extremely high heat (2,000 to 2,500°F) or by adding highly concentrated acids. Ocean water, such as is found in San Diego Bay, is not acidic and has no way of generating extremely high temperatures. Thus, the copper concentrate handled by PACO has virtually no physical propensity to dissolve into the bay water or to harm marine organisms.

THE LEGAL FRAMEWORK

13. Division 7 of the California Water Code (Cal. Water Code section 13000 et. seq.) deals with water quality. The cornerstone of California's policy on water quality attainment is based on what is reasonable under the circumstances:

> "The Legislature finds and declares that the people of the state have a primary interest in the conservation, control, and utilization of the water resources of the state, and that the quality of all of the waters of the state shall be protected for use and enjoyment by the people of the state.
>
> The Legislature further finds and declares that activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is <u>reasonable</u>, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible. . . ." (Water Code § 13000; emphasis added.)

14. The Legislature mandated the implementation of a statewide program for the control of quality of all the waters of the state and found that factors of "precipitation, topography, population, recreation, agriculture, industry, and economic development vary from region to region within the state; and that the statewide program for water quality control can be most effectively administered regionally, within a framework of statewide coordination policy." (Cal. Water Code § 13000.)

15. The state is divided into nine water quality regions. The San Diego region comprises all basins draining into the Pacific ocean between the southern boundary of the Santa Ana region and the California-Mexico boundary. (Cal. Water Code § 13200(f).) Under the statutory scheme, each regional board is

to formulate and adopt water quality control plans for all areas within its region. (Cal. Water Code § 13240.) The water quality control plans are to contain water quality objectives to ensure the <u>reasonable</u> protection of beneficial uses and prevention of nuisance. (Cal. Water Code § 13241) (emphasis added.)) The Water Code specifies:

> "However, it is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses. Factors to be considered by a regional board in establishing water quality objectives shall include, but not necessarily be limited to, all of the following:
>
> (a) Past, present, and probable future beneficial uses of water.
>
> (b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water t reto.
>
> (c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
>
> (d) Economic considerations.
>
> (e) The need for developing housing within the region.
>
> (f) The need to develop and use recycled water."

(Cal. Water Code § 13241.)

16. The regional boards administer the state program for waste discharge requirements ("WDRs") as well as the permits to regulate the discharge of pollutants in dredged or fill material to the navigable waters of the United States under the Federal Water Pollution Control Act (National Pollutant Discharge Elimination or "NPDES permits"). The state law requires that any

person discharging or proposing to discharge waste that could affect the quality of the waters of the state, other than into a sewer system, shall file a report of the discharge with the Regional Board. (Cal. Water Code § 13260.) The Regional Board may then prescribe WDRs. WDRs and NPDES permits are normally issued in the form of an order of the Regional Board.

17. In prescribing requirements for specific WDRs, a regional board is to relate the requirements to the conditions existing from time to time in the disposal or receiving waters upon or into which the discharge is made or proposed. (Cal. Water Code § 13263(a).) In addition, the regional board must "implement relevant water quality control plans, and shall take into consideration the beneficial uses to be protected, the water quality objectives <u>reasonably</u> required for that purpose, other water discharges, the need to prevent nuisance, and the provisions of sections 13241." (Cal. Water Code § 13263(a); emphasis added.) The provisions of section 13241 are set forth above in paragraph 14.

18. The enforcement mechanism used in CAO 85-91 is authorized by Water Code section 13304:

> "Any person who has discharged waste into the waters of this state in violation of any waste discharge requirement . . . or who has caused or permitted . . . any waste to be discharged or deposited where it is . . . discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board clean up such waste <u>or abate the effects thereof</u> or, in the case of threatened pollution or nuisance, take other necessary remedial action."

/////

(Cal. Water Code § 13304(a), emphasis added.) Section 13304 is only triggered if the waste discharge creates or threatens to create a condition of pollution or nuisance. The regional board has the discretion to order that the waste be cleaned up <u>or</u> that the effects of it be abated. Removal is not the only option.

19. The beneficial uses of San Diego Bay have been defined by the Regional Board as:

a. industrial service supply;

b. navigation;

c. water contact recreation;

d. non-contact water recreation;

e. ocean commercial and sport fishing;

f. saline water habitat;

g. preservation of rare and endangered species;

h. marine habitat;

i. fish migration; and

j. shell fish harvesting.

(Exhibit 17, pp. 33.)

20. Water Code section 13307 was recently added to the Water Code to require Respondent to promulgate policies and procedures to oversee and supervise activities of persons who are cleaning up or abating the effects of a discharge of a hazardous substance which creates, or threatens to create, a condition of contamination, pollution, or nuisance. (The evidence does not show that cupric ferrous sulfide in the NCMT sediment is in fact hazardous.) Section 13307 mandates that policies be established for determining reasonable schedules for investigation and cleanup, abatement, or other remedial action at a site and

further mandates "The policies shall recognize the dangers to public health and the waters of the state posed by an unauthorized discharge and the need to mitigate those dangers while at the same time taking into account, to the extent possible, the resources, both financial and technical, available to the person responsible for the discharge." (Cal. Water Code § 13307.) The legislative intent is clear: Regulators enforcing water quality laws must balance the benefit to the environment with the cost of achieving that benefit and the financial resources available to the responsible party.

21. Respondent's action has violated the fundamental principles of the Water Code in that it has reached an unreasonable result which imposes costs on Paco that are punitive in nature without providing any additional benefit to the waters of the state.

22. Respondent must show, with specific findings, a rational connection between the factual evidence supporting the cleanup level and the achievement of specified water quality objectives. (See United States of America v. State Water Resources Control Board, (1986) 182 Cal.App. 82, 113.) Respondent must do more than make the conclusory finding in Order WQ 92-09 that "The cleanup level that will likely comply with the applicable requirements is 1,000 mg/kg (dry weight) copper in the sediment."

PROCEDURAL BACKGROUND

23. On November 26, 1979, the Regional Board adopted Order 79-72 establishing requirements for the waste discharge from PACO to San Diego Bay. Order 79-72 was not a "no discharge"

permit, rather, it contained a Receiving Water Limitation that the discharge shall not cause a violation of any applicable water quality standard for Receiving Waters. Order 79-92 further provided that "neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance as defined in the California Water Code."

24. On November 26, 1984, after PACO had operated at NCMT for five years, the Regional Board adopted Order 84-50, NPDES No. CA0107930, Waste Discharge Requirements for PACO TERMINALS, INC., San Diego County. Order 84-50 renewed the requirements of Order 79-72 and, for the first time, contained the following prohibition: "The deposition of (sic) discharge of copper concentrate ore into San Diego Bay or at any place where it would be eventually transported to San Diego Bay is prohibited." Thus, for the first five of the total seven years of PACO's operation, it did not have a "no discharge" permit.

25. On December 12, 1985, pursuant to Water Code section 13304, the Regional Board issued CAO 85-91 to PACO. CAO 85-91 alleged that PACO's operations resulted in the presence of copper in the sediment beneath San Diego Bay around the NCMT. It also alleged that PACO had caused a "threatened" violation of the Receiving Water Limitations of Orders 79-72 and 84-50. The Receiving Water Limitation was then 5 ug/l[3] based upon a 6-month median. CAO 85-91 required PACO to submit a technical report examining and determining the lateral and vertical extent of the copper in the sediment and the cost, efficiency, and feasibility

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[3] 5 ug/l means 5 micrograms of copper per liter of water which equates to 5 parts per billion or 5 ppb.

of a variety of cleanup strategies. No cleanup level was set. The order proposed three cleanup strategies: (1) remove and/or treat the sediment to attain the same level of concentration of copper that existed in the sediment prior to PACO's operation. (Regional Board staff believed that to be 110 mg/kg. The Order allowed consideration of any other data pertaining to copper concentration levels prior to PACO's operations.); (2) remove and/or treat the copper contaminated sediment to attain certain concentrations of copper in the water column: (a) 5 ug/l 6-Month Median, (b) 20 ug/l Daily Maximum and (c) 50 ug/l Instantaneous Maximum, or (3) a less stringent cleanup alternative than 1) or 2) if it could be shown that the proposed level of concentration -- (a) would not alter the quality of the water to a degree which <u>unreasonably</u> affects the beneficial uses of San Diego Bay (emphasis added); (b) will be consistent with the maximum benefit to the people of the state; and (c) will not result in water quality less than prescribed in the Basin Plan, Ocean Plan or other adopted policies.

26. After PACO submitted the required report, on December 12, 1987, the Regional Board issued Addendum No. 1 to CAO 85-91, which set compliance dates for the various stages of the cleanup and established the original cleanup level for the copper laden sediment of 1,000 mg/kg (dry weight).

27. On November 21, 1988, the Regional Board adopted Addendum No. 2 to CAO 85-91, which found: "Paco Terminals has to date complied with the terms and conditions of Addendum No. 1 to Cleanup and Abatement Order No. 85-91. However, experience indicates that regulatory review and approval has been a lengthy

process resulting in delays beyond the control of Paco Terminals." PACO had originally submitted a cleanup plan on February 4, 1988 that envisioned ocean disposal of the dredged sediments. On August 22, 1988, the Army Corps of Engineers ("ACOE") and the Environmental Protection Agency ("EPA") approved the bioassay plan which was needed for those agencies to approve ocean disposal. However, the EPA withdrew its approval of the bioassay plan on September 12, 1988 and asked for data collection that would make it impossible to comply with the original proposed cleanup schedule. Addendum No. 2 therefore revised the dates for various parts of the cleanup plan so that the EPA requirements could be satisfied.

28. On February 27, 1989, the Regional Board issued Addendum No. 3 to CAO 85-91 naming the Port District as a primarily responsible party under CAO 85-91. Respondent affirmed Addendum No. 3 after review and a hearing in Order No. WQ 89-12.

29. On January 29, 1990, the Regional Board issued Addendum No. 4 to CAO 85-91, which required PACO and the Port to assess the contamination on the land portion of the NCMT and to clean up that site to avoid any future possibility of copper concentrate being washed into San Diego Bay. The land-side cleanup was fully completed at a cost of $1,600,000.

30. On November 5, 1990, the Regional Board adopted Addendum No. 5, which found that the compliance dates set forth in Addendum No. 2 were based on ocean disposal of the contaminated dredged material, and further found that in January 1990, PACO and the Port elected not to pursue ocean disposal due to the EPA's indication that it would not approve ocean disposal.

The Regional Board found it was necessary to modify the tasks and compliance dates in light of that EPA decision. Addendum No. 5 also found that PACO and the Port began negotiating with a mining company in January 1990 to examine the feasibility of removing copper-contaminated sediment and transporting it to a copper production facility for extraction of the copper ore from the sediments. The Regional Board required PACO and the Port to submit a decision on whether the "mining" option was feasible by February 1, 1991. If the "mining" alternative was not to be pursued, PACO and the Port were to submit a plan for cleanup by December 1, 1991. In addition, PACO and the Port were given the option to submit an alternate cleanup strategy by December 1, 1991. The alternative strategy was to comply with certain criteria: (a) The proposed copper concentration to be attained in the contaminated sediment will not alter the water quality of San Diego Bay to a degree which <u>unreasonably</u> affects the beneficial uses of San Diego Bay (emphasis added); (b) the proposed copper concentration to be attained will comply with State Water Resources Control Board Resolution No. 68-16 and the U.S. EPA's antidegradation policy; and (c) the proposed copper concentration to be attained in the sediment will comply with Respondent's "Water Quality Control Policy for the Enclosed Bays and Estuaries of California, May 1974" ("the 1974 EBE Policy") and, upon its adoption by Respondent, the "Water Quality Control Plan for Enclosed Bays and Estuaries of California" ("EBE Plan"). As of November 5, 1990, the 1974 EBE Policy had no numerical limit for the concentration of copper in the water column and the EBE Plan had not yet been adopted. None of these standards has ever contained any numerical limit for the concentration of copper in marine sediments.

31. On January 28, 1991, the Regional Board issued Addendum No. 6 to CAO 85-91, which extended the time schedule set in Addendum 5 and which required PACO and the Port District to prepare a monitoring program designed to identify changes in the location and biological availability of the sediment contaminants. Addendum No. 6 also allowed PACO and the Port District to develop additional technical information to support a less stringent cleanup standard and set August 1, 1991 as the last date to submit the cleanup plan, the time schedule and additional technical information to support a less stringent cleanup level.

32. The Port District commissioned Woodward-Clyde Consultants ("Woodward-Clyde") as technical experts to prepare the cleanup plan and conduct studies to determine if less stringent cleanup levels could achieve the objectives sought by CAO 85-91, i.e., protection of the beneficial uses of the Bay as well as cost, efficiency and feasibility. Woodward-Clyde submitted its report to the Regional Board on August 1, 1991.

THE CHANGING STANDARDS

33. Responding to the CAO 85-91 has been an extremely complicated matter. Although the Regional Board has the authority to order a responsible party to prepare a cleanup plan and assess the cost of various cleanup alternatives, neither the Regional Board nor Respondent issues any of the necessary permits to actually do the work. Instead, the responsible party must

deal with a myriad of public agencies over which the Regional Board and even Respondent have no control. As can be seen from the Regional Board's findings in Addenda 2 and 5, the EPA's reversal of position on ocean disposal first caused a delay in the cleanup process and then totally removed the preferred alternative of ocean disposal as an option.

34. There are currently no published standards for concentrations of copper in marine sediments. The Regional Board, which has worked for many years on the NCMT cleanup, is acutely aware of the long history involved in trying to resolve this matter. Because CAO 85-91 concerns sediments, and there are no standards for sediment, the Regional Board staff continued to recommend that PACO be allowed to pursue various alternatives through the years that always included either removing all sediment containing amounts of copper higher than had been present in the sediments prior to PACO's operation (i.e. "background" level) or removing enough contaminated sediment to achieve then-existing water column numeric standards <u>or</u> any other proposal that protected the beneficial uses of the Bay.

35. Initially, in 1985, the water column standard that the Regional Board staff applied was the allowable concentration of copper in the water column set by the Water Quality Control Plan, Ocean Waters of California. Those limits were 5 ug/l Six-Month Median, 20 ug/l Daily Maximum and 50 ug/l Instantaneous Maximum. At the time of the issuance of CAO 85-91 in 1985, the 1974 EBE Policy did not contain numerical water quality objectives. The EBE Plan, adopted in April 1991, contains narrative water quality objectives, toxicity objectives and

numerical water quality objectives. There are two sets of numerical water quality objectives, one for the protection of saltwater aquatic life and one for the protection of human health. (Exhibit 30, pp. 4 and 5.) Copper is not listed on the Protection of Human Health List[4]. The water quality objective for copper for the protection of saltwater aquatic life is 2.9 ug/l based upon a one hour average. The EBE Plan was intended to set WDRs, not govern cleanups. It contains no numerical standards for sediments. In its 26 pages, its only reference to sediments is in one of the five narrative water quality objectives: "The concentrations of toxic pollutants in the water column, sediments, or biota shall not adversely affect 'beneficial' uses." The word "sediment" also appears in the EBE Plan's definition of "objectionable bottom deposits." If any standard in the EBE Plan should be applied to sediments, it is the narrative standard, not the numerical criteria developed in a completely different context. The great weight of the evidence demonstrates that the NCMT sediment is not adversely affecting the beneficial uses of the Bay. The only relevant standard in the EBE Plan has therefore been satisfied. Respondent clearly recognizes that the EBE Plan does not set numerical standards for sediment because it is currently developing sediment quality objectives for the enclosed bays and estuaries of California. (See Exhibit 32, Workplan for the Development of Sediment Quality Objectives for Enclosed Bays and Estuaries of California, June 1991.)

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[4] Copper is often added to human drinking water to inhibit the growth of algae.

36. State Board Resolution No. 92-49 was adopted in 1992, after the issuance of CAO 85-91 and all its addenda. It contains policies and procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 133304. The part of Resolution 92-49 relied upon by Respondent reads:

> "G. Ensure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of background water quality, or the highest water quality which is <u>reasonable</u> if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible, and any alternative cleanup levels less stringent than background shall:
>
> 1. be consistent with maximum benefit to the people of the State;
>
> 2. not unreasonably affect present and anticipated beneficial use of such waters; 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."

(Exhibit 47, p. 10, emphasis added.)

THE SCIENTIFIC EVIDENCE

37. Paco's consultant concluded in a March, 1986 report that 100% of the area contained in the 1,000 mg/kg copper contaminated area is comprised of a combination of shipyard and navigation channel habitat. The entire area was influenced by pre-existing shipyard operations at the Navy Pier, the Atkinson Shipyard that occupied the area between Navy Pier 13 and the NCMT and normal harbor activities associated with the main navigation channel of San Diego Bay prior to the initiation of Paco's

operation. (Exhibit 17, pp. 34.) This conclusion has never been challenged or disputed. It is also undisputed that the copper contaminated sediment poses no threat to human health or safety. (Exhibit 14; Exhibit 16 pp. ES-3; 3-108.) The Regional Board has not designated which areas of San Diego Bay contain which beneficial uses. However, it is self-evident that not every portion of the bay has every beneficial use. The Regional Board staff in November, 1987 concluded that the benthic community, (i.e., the bottom dwelling aquatic animals) in the area of NCMT was "impoverished" <u>prior to</u> the commencement of PACO's operations and Respondent agreed in Order 92-09. (Exhibit 11, pp. 4.) This has never been disputed.

38. The most recent scientific studies ordered by Addendum 6 established that the cupric ferrous sulfide is <u>not</u> being discharged into the water column. Because of all the other documented ongoing discharges of copper to the water in San Diego Bay, many parts of the Bay exceed the 2.9 ug/l standard and have since before Paco began its operations.

39. Because cupric ferrous sulfide is a unique substance that is markedly different from pure copper, the best scientific method of determining an appropriate cleanup level is to determine whether the material is altering the quality of the water to a degree which unreasonably affects beneficial uses of the water. That was the thrust of Addendum 6 issued by the Regional Board. There are two basic questions to answer: (1) is the cupric ferrous sulfide in the sediment releasing copper to the water column?, and, if so, (2) is it toxic to aquatic life?

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40. Although pure copper can adversely affect aquatic life or the beneficial uses of water, the Woodward-Clyde studies concluded that it is highly unlikely that any copper is being released from the NCMT sediments into the water column above the sediments because of the insolubility of cupric ferrous sulfide. The Woodward-Clyde studies were designed to ascertain whether the NCMT sediments, taken as a whole, were toxic to marine life. This approach was extremely protective of aquatic life because it exposed the test animals to everything that was in the sediment, not just the cupric ferrous sulfide. Therefore, even if the cupric ferrous sulfide by itself is not harmful but might be harmful in combination with other compounds that may be in the sediment, the Woodward-Clyde tests were designed to show whether the sediments, as they actually exist, are toxic to aquatic life. Because the cupric ferrous sulfide is distributed in a "footprint" in which the higher concentrations are closer to the pier face, Woodward-Clyde did toxicity tests from sediments collected from several test stations with different levels of concentration. The tests uniformly found that the NCMT sediment does not adversely affect aquatic life or the beneficial uses of the water in sediment concentrations of copper of up to 18,000 mg/kg, or four and one-half times the 4,000 mg/kg level requested by PACO and the Port District. These tests were done using valid scientifically accepted procedures and test animals, and have been accepted as such by the Regional Board.

41. The 1991 Woodward-Clyde studies also confirmed that the copper concentrate in the sediment at NCMT is not migrating laterally and that it is becoming more deeply buried in

the sediment because it is more dense than the marine sediment. This characteristic decreases the chance of exposure of the animals that live in the top few inches of sediment to the copper concentrate and also reduces the already remote chance of release of copper to the water column. It also places it in an anaerobic (i.e. no oxygen) environment. All of these factors even further reduce the remote possibility that pure copper could be released from the sediment into the water.

THE ISSUANCE OF ADDENDUM NO. 7

42. On November 22, 1991, based on the findings and conclusions in the August 1991 Woodward-Clyde report, the Port District requested the Regional Board to relax the cleanup level from 1,000 mg/kg to 4,000 mg/kg. Although the toxicity test results showed that levels as high as 18,000 mg/kg could safely be left in place, 4,000 mg/kg was requested because: (1) it was well within the range of sediment concentrations that did not adversely affect aquatic life or beneficial uses; (2) a cost effective means of processing sediment containing at least 4,000 mg/kg had been found; and (3) 4,000 mg/kg (dry weight) is approximately 2,500 ppm wet weight, the concentration above which copper is considered a hazardous material. (See Title 22 of the California Code of Regulations.)

43. On December 9, 1991, the Port District's request to relax the cleanup level from 1,000 mg/kg to 4,000 mg/kg came on for hearing before the Regional Board. The Regional Board accepted testimony from the Regional Board staff, the Port District, PACO and the Environmental Health Coalition ("EHC").

(A true and correct copy of the hearing transcript is Exhibit 41.) The Port District presented evidence that the NCMT sediment does not adversely affect aquatic life or beneficial uses with sediment concentrations of copper up to 18,000 mg/kg. Significantly, although the Regional Board staff opposed the request, it did agree that no adverse biological effects would occur at concentration levels of 4,000 mg/kg or higher. (Exhibit 41, p. 57.) The evidence also demonstrated that the cupric ferrous sulfide is <u>not</u> soluble, is <u>not</u> bioavailable and that it is <u>not</u> migrating.

44. At the close of the hearing, the Regional Board issued Addendum No. 7 to CAO 85-91, which relaxed the cleanup level to 4,000 mg/kg. (Addendum No. 7 is Exhibit 10.) The transcript of the hearing shows that, after the close of evidence, the Regional Board members understood that there was no evidence of any adverse impact on the beneficial uses of the Bay at levels as high as 18,000 mg/kg. The Regional Board members recognized that lack of adverse impact is the key to protecting the beneficial uses of the Bay, not some artificial number. (See Exhibit 10, p. 8.) They concluded in their deliberations that, even if the objective for copper in the EBE Plan was exceeded (which PACO and the Port District deny), the exceedence [sic] is causing no adverse impact, thereby making the standard irrelevant. The Regional Board also recognized that if, in the future, there is evidence of an adverse impact, the Regional Board can re-examine the issue. (Exhibit 41.)

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THE EHC PETITION

45. The EHC and Sprofera filed petitions for review with Respondent seeking to rescind Addendum No. 7 and reinstate the 1,000 mg/kg cleanup level. The petitions for review argued that: (1) the 4,000 mg/kg cleanup level would cause San Diego Bay to exceed the 2.9 ug/l standard set in the EBE Plan; (2) the original 1,000 mg/kg cleanup level provided the minimum level necessary to protect the public and the bay; (3) the 4,000 mg/kg cleanup level has no rational basis; and (4) the Regional Board improperly considered economic concerns when authorizing the 4,000 mg/kg cleanup level. PACO and the Port District opposed the petitions.

46. Respondent held a workshop to discuss the petitions on September 2, 1992, and a hearing on September 17, 1992. At the conclusion of the hearing, Respondent granted the petitions for review and reversed Addendum No. 7 by written order served on counsel for PACO on October 9, 1992. Respondent's Order concluded: (1) the cleanup level adopted in Addendum No. 7 to Cleanup and Abatement Order No. 85-91 does not comply with Section 13304 of the Water Code, the EBE Plan, and State Board Resolution 68-16, and (2) the cleanup level that will likely comply with the applicable requirements is 1,000 mg/kg (dry weight) copper in the sediment. (Exhibit 11.)

47. The actions of Respondent in reversing the Regional Board's cleanup level are invalid under California Water Code section 13330 and California Code of Civil Procedure section 1094.5(e) and (f) for the following reasons:

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a. Respondent acted in excess of its jurisdiction and committed prejudicial abuse of discretion by failing to demonstrate that it meaningfully considered the past, present and probable future beneficial uses of the NCMT area of San Diego Bay as is required by Water Code sections 13307 and 13241.

b. Respondent acted in excess of its jurisdiction and committed prejudicial abuse of discretion by failing to demonstrate that it had meaningfully considered the water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area before imposing the 1,000 mg/kg cleanup level.

c. Respondent acted in excess of its jurisdiction and committed prejudicial abuse of discretion by failing to demonstrate that it meaningfully considered economics and the technical and financial resources of the responsible parties in violation of Water Code sections 13241 and 13307.

d. Respondent made factual findings that are contrary to the weight of the evidence and, in some cases, made factual findings totally unsupported by any evidence.

e. Respondent acted in excess of its jurisdiction and committed prejudicial abuse of discretion by establishing a cleanup level based on numerical water quality based standards taken from the EBE Plan. Using the numerical water quality standard is inappropriate and unfair for the following reasons:

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i. Respondent "bootstrapped" a sediment contamination case into an effluent discharge limitation case. There is no competent evidence to support that the sediment is discharging any copper to the water column.

ii. Respondent unreasonably used results from instantaneous grab samples to conclude that PACO was in violation of the 2.9 ug/l hour average numerical water quality objective.

iii. Respondent unreasonably applied the 2.9 ug/l one hour average numerical water quality objective instead of using practical quantification levels ("PQLs").

iv. Respondent unreasonably relied on older, inconclusive scientific data instead of newer reliable data from tests specifically designed to determine whether the NCMT sediment is toxic to aquatic life or harmful to the beneficial uses of the bay.

f. Respondent acted in excess of its jurisdiction and committed prejudicial abuse of discretion by basing the cleanup level on a numerical water quality based objective contained in the EBE Plan, which, for the reasons outlined below, is invalid and unenforceable.

RESPONDENT'S DECISION
IS NOT SUPPORTED BY THE EVIDENCE

48. There is no substantial evidence to support Respondent's order reversing Addendum No. 7 because no competent evidence was presented to show: (1) a 4,000 mg/kg cleanup level for the NCMT sediment would result in copper concentrations in the water above the sediment that exceed 2.9 ug/l; (2) a

4,000 mg/kg cleanup level would not provide the same level of protection for the environment and the public as 1,000 mg/kg; and (3) a cleanup level of 4,000 mg/kg would adversely affect aquatic life or beneficial uses. Because Respondent had no evidence to support any of the grounds of appeal or its order and because there was substantial evidence supporting the 4,000 mg/kg cleanup level, Respondent's order revising Addendum No. 7 is not supported by the evidence, and must be reversed.

ORDER NO. WQ 92-09 MAKES NUMEROUS
FACTUAL FINDINGS THAT ARE
ERRONEOUS AND UNSUPPORTED BY THE EVIDENCE

49. Order No. WQ 92-09 contains a 6½-page narrative factual summary, an 8½-page recitation of "Contentions and Findings," and a 2-paragraph "Summary and Conclusions" to support its order. A partial list of erroneous statements follows:

a. That Order No. 79-72 (PACO's original waste discharge requirements) absolutely prohibited the discharge of copper to San Diego Bay. (Exhibit 11, p. 2, l. 9 through 11.) In fact, Order No. 79-72 only required that any discharge by PACO would not cause a violation of any applicable water quality standards for receiving waters. (Exhibit 1, p. 3.)

b. Respondent relied upon its own Order No. WQ 91-10 as having established that "a major source of copper pollution comes from copper or deposits in the vicinity of Paco Terminal." (Exhibit 11, p. 6, l. 26 through p. 7, l. 1.) PACO was not a party to any of the proceedings that led up to Order No. WQ 91-10. That order concerns the regulation of discharges to San Diego Bay from groundwater de-watering activities arising from construction in another, unrelated case. Order No. WQ 91-10 is currently the subject of a lawsuit filed by the EHC, real party in interest herein, in the Superior Court of the County of San Diego, making Respondent's reliance on findings made in WQ 91-10 questionable. (See Exhibit A to Notice of Lodgment to Request for Taking Judicial Notice.) PACO is not a party to the superior court action either. This "finding" that resulted from administrative proceedings having nothing to do with PACO and at which PACO had no opportunity to be heard, is not binding on PACO as authority for anything.

c. Order No. WQ 92-09 asserts that if PACO were to comply with the 1,000 mg/kg cleanup level, only four to five percent of the material it discharged into the bay would be removed. (Exhibit 11, p. 7, l. 1 through 4.) This is incorrect.[5] This erroneous assertion apparently arose out of PACO's assessment of how much sediment in the area of NCMT has levels of copper in excess of 110 mg/kg compared to how much sediment must be removed to achieve the 1,000 mg/kg cleanup. PACO's March 1986 report prepared in response to CAO 85-91 (Exhibit 17) gave an estimate of the volume of sediment that contained concentrations of copper above 110 mg/kg, above 350 mg/km and above 1,000 mg/km. It was estimated that 575,186 square yards of the Bay sediment contained concentrations of 110 mg/kg or higher. This is relevant to the cost of the cleanup (i.e. the more yardage that must be removed, the more expensive

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5 In fact, Respondent's board members indicated at the hearing that they knew it was incorrect yet the draft of Order No. WQ 92-09 was not changed to reflect that.

the cleanup). It has no relevance to how much copper would be removed at various cleanup levels. The copper concentrate handled by PACO contained an average 27.5% cupric ferrous sulfide by weight. In turn, elemental copper comprises 35% of cupric ferrous sulfide by weight. The technical reports have consistently shown that the highest concentrations of copper in the sediment are located in a "footprint" very close to the pier face. (See Exhibit 25, Table 1.) Removing the sediments with the high concentrations removes the majority of the copper. The recovery of copper per cubic yard of sediment diminishes with the concentration. The 1,000 mg/kg cleanup level would require the removal of an additional 24,500 cubic yards of sediment but would remove very little additional copper. There is no volume discount for disposal of this sediment. The incremental cost is tremendous, yet there is no demonstrable additional benefit to the water quality or beneficial uses. In the face of the scientific evidence showing no toxicity at levels as high as 18,000 mg/kg, there is no logical reason to impose a more stringent cleanup level.

RESPONDENT HAS UNFAIRLY APPLIED STANDARDS AND POLICIES THAT WERE PROMULGATED LONG AFTER THE ISSUANCE OF THE CAO 85-91

50. In addition to the complexities of trying to assess the nature and distribution of the cupric ferrous sulfide in the sediment, PACO has been subjected, ex post facto, to a number of new policies and standards. As the ability of testing laboratories to "detect" increasingly minute quantities of

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chemicals increases, the numerical objectives have become increasingly stringent.

a. The EBE Plan was not adopted until May 1991, (five years after PACO ceased operations) yet the numerical objective of 2.9 ug/l in the water column has been applied to this case.

b. State Board Resolution No. 92-49 was adopted in 1992, (six years after PACO ceased operations) yet Respondent claims that it was properly applied to PACO.

RESPONDENT MISAPPLIED RESOLUTION 92-49 BY
FOCUSING ON BACKGROUND LEVELS OF SEDIMENT RATHER THAN WATER.

51. Water Code section 13304(a) requires the Regional Board to order persons subject to a cleanup and abatement order to clean up the waste or abate the effects thereof. Water Code § 13304(a). Respondent's own policy provides that "dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of background water quality, or the highest water quality which is reasonable if background water quality cannot be restored." State Board Resolution No. 92-49 (emphasis added). A cleanup that promotes the attainment of background water quality satisfies Water Code section 13304. Id. If background water quality cannot be restored, then a cleanup that achieves the highest reasonable water quality will satisfy Water Code section 13304. Id. Thus, unless background water quality is considered, Respondent cannot determine that any cleanup will not comply with Water Code section 13304.

52. Nevertheless, in finding that a 4,000 mg/kg cleanup level would not comply with Water Code section 13304,

Respondent never considered the Bay's background water quality.[6] Because background water quality was not considered, Respondent could not reasonably conclude that a 4,000 mg/kg cleanup level would not achieve background water quality. Moreover, Respondent could not and cannot even determine if the present water quality is any different than background water quality because Respondent failed to make any finding on what background level is despite abundant information in the record. Therefore, Respondent had absolutely no basis or evidence to support its finding that a 4,000 mg/kg cleanup level would not comply with Water Code section 13304.

53. Respondent has unreasonably applied a numerical water column copper objective that was intended to apply to the issuance of WDRs or NPDES permits to a cleanup that involves marine sediment contaminated with copper concentrate. There is no evidence that the sediment is "discharging" copper into the water column in the first instance. In addition, all of the scientific data supports the conclusion that the sediment is not toxic and is not having an adverse impact on the beneficial uses of San Diego Bay. Respondent is using an unattainable objective as a standard despite evidence that concentrations as high as 18,000 mg/kg have no adverse effect on aquatic life and the beneficial uses of San Diego Bay.

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6 Evidence of the Bay's background water quality would include the results of sampling from various locations in the Bay and historic concentrations (i.e., before PACO's activities) around the NCMT. Although the record contains such data, Respondent did not consider any such evidence.

54. The EBE Plan recognizes that it is appropriate in some cases to set site specific objectives rather than relying on theoretical numbers that may be unattainable. The EBE Plan's 2.9 ug/l numerical water column objective for copper is invalid. The EPA, which established the 2.9 ug/l objective in 1986, presently believes it is significantly overly restrictive. (See Ex. 8 to Ex. 59 [Comments on Technical Review Memorandum by the Division of Water Quality to the Office of Chief Counsel on File Nos. A-775 and A-775(a)], pp. 2; Ex. 49 [Technical Review Memorandum by the Division of Water Quality to the Office of Chief Counsel on File Nos. A-775 and A-775(a)] pp. 5.) In fact, the San Francisco Regional Board staff recently recommended that the copper objective for San Francisco Bay be increased to 4.9 ug/l for shallow water discharges and 37 ug/l for deep water discharges. The appropriate copper objective for receiving waters of San Francisco Bay is currently the subject of litigation filed in Santa Clara County, Superior Court, Case No. 724451. (See Exhibit B to Notice of Lodgment re Request for Taking Judicial Notice.) Moreover, in another case in San Diego County, real party in interest EHC contends that the EBE Plan's objectives, including the 2.9 ug/l objective, are invalid for San Diego Bay. (See Exhibit B to Notice of Lodgment re Request for Taking Judicial Notice.) This contention is being pursued by EHC in a Petition for Writ of Mandate that it filed to overturn State Board Order No. WQ 91-10.

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RESPONDENT UNREASONABLY IMPOSED
THE EBE PLAN WATER QUALITY OBJECTIVE

55. Although the EBE Plan sets the state-wide water quality objective at 2.9 ug/l, 2.9 ug/l is well below reliable detection limits. The EBE Plan compensates by establishing Practical Quantification Levels ("PQLs"), which are essentially the reliable detection levels. The EBE Plan provides that when the PQL is greater than the effluent limitation, there is no violation unless the discharge exceeds the PQL. (Exhibit 30, p. 14.) Under the EBE Plan, PQLs are ten times the method detection limit ("MDL"). (Exhibit 30, pp. A1-2 to A1-3.)[7] For example, the State has established PQLs for copper at 60 ug/l to 200 ug/l, depending on the sampling method. 22 CCR §22-66264.801 App. IX.[8] Respondent, however, did not bother to consider the PQL or MDL for copper in this case. Thus, according to the EBE Plan's provisions, Respondent should have applied the much higher PQLs for copper, not the EBE Plan's effluent standard of 2.9 ug/l.

56. Respondent unfairly used instantaneous test results to claim that PACO exceeded the 2.9 ug/l one hour average limit. Water quality standards generally set two different effluent limitations, an instantaneous limitation and an average limitation over a period of time, with instantaneous limitations substantially higher than average limitations. For example, CAO

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[7] PQLs can also be based on laboratory performance data, if available. Id.

[8] These PQLs were established in connection with ground water monitoring requirements for hazardous waste facilities.

85-91 originally required PACO to achieve a six month median concentration level of 5 ug/l, a daily maximum of 20 ug/l and an instantaneous maximum of 50 ug/l. The EBE Plan's limitation for copper is a one hour average of 2.9 ug/l. Yet, Respondent used the results from instantaneous grab samples to extrapolate a hypothetical violation of the one hour average limitation.

RESPONDENT IMPROPERLY USED WATER QUALITY OBJECTIVES IN THE CALIFORNIA BAYS AND ESTUARIES PLAN WHICH IS INVALID AND UNENFORCEABLE.

57. Respondent proceeded in excess of its jurisdiction, and committed prejudicial abuse of discretion, by imposing and affirming a cleanup level supposedly based on water quality objectives contained in the EBE Plan which, for the reasons outlined below, is invalid and unenforceable and thus cannot provide the basis for Respondent's decision.

58. In judicial review proceedings commenced on May 10, 1991, several public and private dischargers in the San Francisco Bay area are seeking review of Respondent's April 11, 1991 adoption of the EBE Plan and the California Inland Surface Water Plan (the "Statewide Plans"). (*See* Verified petition for Writ of Mandate; Complaint for Injunctive and Declaratory Relief, entitled *City of Sunnyvale v. State Water Resources Control Board*, No. 366781, Sacramento County Superior Court (filed May 10, 1991) ("Mandate Petition"), attached to the Notice of Lodgment re Request for Taking Judicial Notice as Exhibit C.) PACO requests the Court to take judicial notice of this proceeding.

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59. As more fully described in Mandate Petition No. 366781, petitioner alleges that Respondent violated the Porter-Cologne Act (Water Code §§ 1300-13953.4) on April 11, 1991 by adopting the Statewide Plans without making specific findings or otherwise demonstrating to the public or a reviewing court:

a. that Respondent considered and balanced all the economic and social, beneficial and detrimental values involved in adoption of the Statewide Plans;

b. that Respondent inquired into whether these specific objectives were reasonably necessary to protect the designated uses of the South [San Francisco] Bay waters; and,

c. that Respondent specifically considered each of the factors enumerated in Section 13241 of the Water Code.

60. The Mandate Petition also alleges that Respondent:

a. improperly delegated to the Regional Board the task of considering the factors mandated by Section 13241; and

b. improperly failed to demonstrate that it considered whether alternatives to the Statewide Plans as adopted could have mitigated the economic and social impacts of the Statewide Plans.

61. Mandate Petition No. 366781 alleges that Respondent's adoption of the statewide plans violated the California Administrative Procedure Act ("APA") (Govt. Code §§ 641, 649) and the California Environmental Quality Act ("CEQA", Public Resources Code §§ 21000-21177).

62. In imposing numerical water quality-based limits as the standard for a sediment cleanup Respondent purported to

implement the water quality objectives contained in the EBE Plan. However, the water quality objectives in the EBE Plan are invalid and unenforceable. The invalidity under state law of the EBE Plan deprives Respondent of a legitimate basis on which to establish the water quality-based cleanup level which it has imposed on PACO.

63. Should the Sacramento Superior Court hold the Statewide Plans to be invalid, under federal law, Respondent will be required to adopt new Statewide Plans for submission to the EPA, the Regional Administrator will have to reapprove the new Plans (40 C.F.R. § 131.5(e) (Administrator of EPA must disapprove any state-developed water quality standards that were adopted in violation of the State's legal procedures governing such adoption)), and that holding by the Sacramento Superior Court Judge will provide this Court with another substantial basis upon which to invalidate Respondent's Order No. WQ 92-09.

RESPONDENT IGNORED THE EVIDENCE OF CURRENT COST PROJECTIONS

64. After the Regional Board issued CAO 85-91 in 1985, PACO sued other responsible parties in the United States District Court for the Southern District of California for, among other things, indemnity and contribution for the cleanup costs. The other responsible parties included the mining companies that shipped and that still own the copper concentrate, and also the manufacturer of a defective clam shell bucket used to load the copper concentrate. PACO also sued its insurers in the San Diego Superior Court for defense costs and indemnity.

65. Over the last three years, the Honorable Harry R. McCue, United States Magistrate Judge for the Southern District of California, conducted numerous working group meetings and settlement conferences between PACO, the Port District, the other responsible parties and PACO's insurers to resolve the state and federal cases concerning CAO 85-91. Without money from its insurers, PACO cannot pay for the cleanup at any level.

66. Respondent asserts that because PACO's original cost estimates ranged as high as $17,000,000 that the increased costs caused by a 1,000 mg/kg cleanup level are of no consequence. (Exhibit 11, p. 14, fn. 13.) This gratuitous but inflammatory assertion ignores the fact that PACO submitted a range of cost estimates for three different cleanup alternatives, including ocean disposal and disposal at a hazardous waste landfill. The Regional Board chose the lowest and, as everyone's knowledge of the nature of the copper concentrate and the cost of removing it has increased over the years, the Regional Board has properly accepted practical and economical solutions to the cleanup.

67. Respondent has admitted that economics should be considered in setting a cleanup standard (Exhibit 11, p. 13, ¶ 2.) and has conceded that this case is appropriate for a relaxed cleanup standard (Exhibit 11, p. 10, ¶ 2) yet it arbitrarily ignored all current evidence of the difference in cost of 1,000 versus 4,000 mg/kg and dismissed the very fundamental fact that, absent the settlement with its insurance carriers, PACO has no funds whatsoever.

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68. Current cost estimates demonstrate that the 4,000 mg/kg cleanup level will cost approximately $5,160,400 and that PACO and the Port District have already spent approximately $1,000,000 on sediment remediation assessment studies and $1,600,000 on landslide remediation. The Port district estimates that the extra cost of a 1,000 mg/kg cleanup is $7,285,910 using the mine disposal option. Under Order WQ 92-09, there is no time to pursue other, perhaps less costly, methods of disposal. There is no evidence that this tremendous additional expense, even if it could be raised, will result in any additional benefits to the environment. Indeed, even Respondent could only say that the cleanup level that will likely comply with the applicable requirements is 1,000 mg/kg.

A WRIT OF MANDATE IS PROPER IN THIS CASE

69. PACO has no plain, speedy, or adequate remedy in the ordinary course of the law. Under Water Code section 13330, PACO's only avenue for relief is through the granting of a petition for writ of mandate.

70. PACO has perfected and exhausted its administrative remedies.

71. Water Code section 13330 mandates that this court exercise its independent judgment on the evidence. Code of Civil Procedure section 1094.5 authorizes this court to set aside Respondent's order and reinstate the original cleanup level of 4,000 mg/kg (dry weight) of Addendum No. 7 to CAO 85-91 without remanding this matter to Respondent for further proceedings.

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A STAY IS NECESSARY

72. PACO will suffer severe irreparable harm if a stay is not entered pending the resolution of this petition. CAO 85-91 and the addenda thereto establish certain compliance dates for PACO and the Port District. PACO's lawful obligations under CAO 85-91 are uncertain as a result of Respondent's factually unsupported decision to revise Addendum No. 7. If PACO is forced to proceed under the unnecessarily stringent cleanup level of 1,000 mg/kg, its costs will be substantially higher than at the cleanup level of 4,000 mg/kg. PACO has no potential source of funding the cleanup other than from the pending lawsuits.

73. The CAO 85-91 and Addendum 7 currently require the dredging necessary to complete the cleanup to be done by February 1, 1993. This date is impossible to achieve unless the cleanup starts immediately. If PACO proceeds with the cleanup at the 1,000 mg/kg level it would be required to spend millions of extra dollars, which it does not have, for no increased benefit to the environment. It is highly unlikely that the permits required to handle the additional volume of sediment could be obtained in time. If PACO does not proceed according to the schedules established in CAO 85-91 and the addenda thereto, PACO may be in violation of the order and subject to fines of up to $25,000 per day. Without a stay, PACO will be denied any benefit that it may derive from this petition for a writ of mandate. Therefore, PACO requests the court to enter a stay of the operation of CAO 85-91 and the addenda thereto and of WQ 92-09 pending this court's decision.

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WHEREFORE, petitioner PACO requests:

1. That an ex parte order pursuant to Code of Civil Procedure section 1094.5 be entered staying the operation of CAO 85-91 and the addenda thereto and WQ 92-09 pending resolution of this petition;

2. That a hearing de novo be held before this court, wholly independent of the hearing and proceedings held before Respondent, and that the issues involved be adjudicated before this court according to its independent judgment;

3. That a judgment vacating Respondent's Order No. 2 of Addendum No. 7 to CAO 85-91 and extending the compliance dates in Order No. 3 of Addendum 7 be entered;

4. Or, in the alternative, that a preemptory writ of mandate be issued directing Respondent to reinstate the Regional Board's Order No. 2 to Addendum 7 to Cleanup and Abatement Order 85-91 and extending the compliance dates in Order No. 3 of Addendum 7;

5. An award of costs of suit and attorneys' fees to the extent permitted by law; and

6. An award of such further relief as the court may deem just and appropriate.

GRAY, CARY, AMES & FRYE

By: ______________________

F.P. CROWELL
JAN S. DRISCOLL
ROBERT W. BROWNLIE
Attorneys for Petitioner
PACO TERMINALS, INC.

VERIFICATION

I, Glenn Howell, declare:

I am Vice President of PACO TERMINALS, INC., petitioner in the above entitled action; I have read the foregoing PETITION FOR PEREMPTORY WRIT OF MANDATE and know the contents thereof. The facts alleged are based upon my own personal knowledge, the records of PACO and the Exhibits referred to in the Petition and I believe the matters alleged in the Petition to be true. I am authorized by PACO TERMINALS, INC. to verify the Petition on its behalf.

I declare under penalty of perjury under the laws of the State of California and the United States of America that the foregoing is true and correct and that this Verification was signed November 6th, 1992 at Providence, Rhode Island.

Glenn G. Howell
GLENN HOWELL

EXHIBIT INDEX

The following exhibits comprise the portion of the administrative record relied on by petitioner, and are filed with this VERIFIED PETITION FOR PEREMPTORY WRIT OF MANDATE AND APPLICATION FOR STAY and incorporated herein by this reference:

Exhibit No.	Date	Description
1	11 26 79	NPDES Permit No. CA0107930, Regional Water Quality Control Board Order No. 79-72.
2	11 26 84	NPDES No. CA0107930, Regional Water Quality Control Board Order No. 84-50.
3	12 12 85	Cleanup and Abatement Order No. 85-91.
4	11 13 87	Addendum No. 1 to Cleanup and Abatement Order No. 85-91.
5	11 21 88	Addendum No. 2 to Cleanup and Abatement Order No. 85-91.
6	02 27 89	Addendum No. 3 to Cleanup and Abatement Order No. 85-91.
7	01 19 90	Addendum No. 4 to Cleanup and Abatement Order No. 85-91.
8	11 05 90	Addendum No. 5 to Cleanup and Abatement Order No. 85-91.
9	01 28 91	Addendum No. 6 to Cleanup and Abatement Order No. 85-91.
10	12 09 91	Addendum No. 7 to Cleanup and Abatement Order No. 85-91.
11	09 17 92	State Water Resources Control Board Order No. WQ 92-09.
12	10 28 68	State Water Resources Control Board Resolution No. 68-16.
13	11 00 78	Copper in the Marine Environment - Part I dated November 1978; Copper in the Marine Environment - Part II dated December 1978.

14	10 29 84	Memorandum from Sanitary Engineering Branch of the Department of Health Services to California Regional Water Quality Control Board, San Diego Region, dated October 29, 1984, subject Paco Terminals, Inc.
15	11 11 84	Copy of article from <u>The Reader</u> re copper to be policed.
16	08 00 85	An Evaluation of Copper in the Marine Environment in the Vicinity of Paco Terminals Inc., San Diego Bay, California, Submitted to Paco Terminals, Inc. by WESTEC Services, Inc.
17	03 00 86	An Evaluation of the Impact of Copper Ore in the Marine Environment in the Vicinity of Paco Terminals, Inc., on the Beneficial Uses of San Diego Bay, prepared in response to Regional Water Quality Control Board Cleanup and Abatement Order No. 85-91, submitted to Paco Terminals, Inc. Submitted by Westec Services, Inc., March 1986.
18	09 25 86	September 25, 1986 letter from William C. Lester to Mr. Greig Peters enclosing proposal to evaluate the copper concentration in interstitial water at Paco Terminals, San Diego Bay.
19	10 00 86	Evaluation of Copper in Interstitial Water From Sediments at Paco Terminals San Diego Bay, Prepared for Paco Terminals, Inc. by WESTEC Services, Inc.
20	03 00 87	Evaluation of Copper in Interstitial Water from Sediment at Paco Terminals, San Diego Bay Phase II, prepared for Paco Terminals, Inc. Prepared by Westec Services, Inc., March 1987.
21	02 04 88	February 4, 1988 Cleanup Plan for Sediments at the 24th Street Marine Terminal.
22	10 17 88	October 17, 1988 letter from William C. Lester to Mr. David Barker enclosing Revision No. 1 to Paco Terminals, Inc. February 4, 1988 Cleanup Plan for Sediments of the 24th Street Marine Terminal.

23	10 20 88	Bioassay on Sediments Collected in the Vicinity of Paco Terminals, Inc. Prepared by WESTEC Services, Inc.
24	04 00 89	Proposal to Conduct a Dredged Material Bioassay at Paco Terminals, Submitted to Paco Terminals, Inc. by ERC Environmental and Energy Services Company.
25	04 28 89	Vertical and Horizontal Location of the 1000 PPM Copper Ore Contour in the Vicinity of Paco Terminals, Inc., San Diego Bay, San Diego, California, Prepared for Paco Terminals, Inc. by ERC Environmental and Energy Services Company.
26	08 17 89	State Water Resources Control Board Order No. WQ 89-12.
27	09 28 90	Decision of the United States Environmental Protection Agency on listings under Section 304(1) of the Clean Water Act regarding the State of California.
28	02 01 91	February 1, 1991 letter from John J. Lormon to Mr. David Barker.
29	03 11 91	March 11, 1991 letter from P.F. Seligman to Mr. Chris Sandall and enclosures thereto.
30	04 11 91	California Enclosed Bays and Estuary Plan, adopted and effective April 11, 1991.
31	05 03 91	May 3, 1991 letter from John J. Lormon to Mr. David Barker.
32	06 00 91	Workplan for the Development of Sediment Quality Objectives for Enclosed Bays and Estuaries of California, June 1991.
33	07 26 91	Final Report, Remedial action alternatives for National City Marine Terminal, prepared for San Diego Unified Port District, prepared by Woodward-Clyde consultants.
34	07 31 91	July 31, 1991 letter from John J. Lormon to Mr. David Barker.
35	09 30 91	September 30, 1991 letter from John J. Lormon to Mr. David Barker.

36	11 04 91	Letter from Ralph T. Hicks to Mr. Arthur Coe, dated November 4, 1991, subject progress report on Paco Cleanup and Abatement Order and inability to meet December 1, 1991 permit deadline.
37	11 20 91	November 20, 1991 letter from Jan Shirley Driscoll to Arthur Coe with enclosures thereto.
38	11 21 91	November 21, 1991 letter to Mr. Art Coe, Executive Officer for the Regional Water Quality Control Board, San Diego Region, from John J. Lormon, Esq.
39	11 22 91	San Diego Unified Port District's written direct testimony for Regional Board hearing on December 9, 1991, regarding cleanup level and adjustment of Addendum No. 6 timelines and exhibits thereto.
40	11 26 91	Letter from Laura Hunter to Charles Badger, dated November 26, 1991.
41	12 09 91	Transcript of Item 8 on the agenda for the December 9, 1991 Regional Water Quality Control Board meeting.
42	12 09 91	Overhead transparencies shown at 12/9/91 hearing.
43	01 06 92	Eugene Sprofera's petition for review.
44	01 08 92	Environmental Health Coalition's petition for review.
45	05 28 92	Paco's response to petitions for review filed by the Environmental Health Coalition and Eugene Sprofera, dated May 28, 1992, and the exhibits thereto.
46	05 29 92	Regional Water Quality Control Board, San Diego Region's response to petition for review.
47	06 00 92	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.
48	06 03 92	San Diego Unified Port District's Written Response Supporting the Regional Board's Addendum No. 7 and the Imposition of 4000 mg/kg Cleanup Level, and the exhibits

		thereto.
49	08 27 92	Division of Water Quality's technical review in the matter of the petitions of the Environmental Health Coalition and Mr. Eugene J. Sprofera to review Cleanup and Abatement Order No. 85-91, Addendum No. 7, of the California Regional Water Quality Control Board, San Diego Region, Office of Chief Counsel File Nos. A-775 and A-775a.
50	08 31 92	August 31, 1992 letter from United States Magistrate Harry R. McCue to Mr. James M. Stubachaer.
51	08 31 92	Letter from David D. Hopkins to Mr. Walt Pettit, Executive Director, state Water Resources Control Board, dated August 31, 1992, regarding request for reconsideration of denial of stay request.
52	08 31 92	August 31, 1992 letter from John J. Lormon to Walt Pettit, Executive Director, State Water Resources Control Board, regarding request for stay of workshop.
53	09 02 92	Environmental Health Coalition's argument re its petition for review.
54	09 02 92	Transcription of tape of hearing on Environmental Health Coalition and Eugene Sprofera's petition before the State Water Resources Control Board on September 2, 1992.
55	09 02 92	Letter from Environmental Health Coalition to Chairman Don Maughan, dated September 2, 1992.
56	09 11 92	Letter from John J. Lormon to Mr. William Atwater, dated September 11, 1992, and the enclosures thereto.
57	09 14 92	Letter from David B. Hopkins to Craig M. Wilson, dated September 14, 1992.
58	09 15 92	Letter from David B. Hopkins to Maureen Marche dated September 15, 1992, and enclosures thereto.
59	09 17 92	San Diego Unified Port District's Supplemental Written Response Supporting the Regional Board's Addendum No. 7, etc., and the documents submitted therewith.

PACO TERMINALS, INCORPORATED
SAN DIEGO UNIFIED PORT DISTRICT
COPPER ORE BAY SEDIMENT CLEANUP
NPDES ORDER: 85-91
ENF. REPORT **FILE: 8** 06/92-06/93
02-0045.06 STATUS: C

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego**
Unified Port District

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and
Eugene J. Sprofera to Review Cleanup and Abatement
Order No. 85-91, Addendum 7, of the
Regional Water Quality Control Board
(San Diego Region)

SAN DIEGO UNIFIED PORT DISTRICT'S
SUPPLEMENTAL WRITTEN RESPONSE SUPPORTING
THE REGIONAL BOARD'S ADDENDUM NO. 7
AND IMPOSITION OF 4,000 mg Cu/kg CLEANUP LEVEL
AND IN OPPOSITION TO STATE BOARD DRAFT ORDER
REIMPOSING 1,000 mg Cu/kg CLEANUP LEVEL

Hearing Date: September 17, 1992

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12.	Declaration of David B. Hopkins (September 15, 1992)
13.	Letter from David B. Hopkins, Counsel for the San Diego Unified Port District, to Walter Pettit, Executive Director, State Water Resources Control Board (August 31, 1992)
14.	Letter from David B. Hopkins, Counsel for the San Diego Unified Port District, to Craig M. Wilson, Esq., Assistant Chief Counsel, State Water Resources Control Board (August 31, 1992)
15.	Letter from U.S. District Court Magistrate Judge Harry R. McCue to Each State Water Resources Control Board Members [letter to W. Don Maughan attached]

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego Unified Port District**

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

SAN DIEGO UNIFIED PORT DISTRICT'S EXECUTIVE SUMMARY OF TESTIMONY AND RECORD SUBMISSIONS TO STATE WATER RESOURCES CONTROL BOARD

Hearing Date: September 17, 1992

The San Diego Unified Port District (the Port District) submits this Executive Summary of its testimony and most record submissions to the State Board on this matter directly to the State Board. The Port District and its consultants have made and are making hundreds of pages of submissions to the State Board record on this matter, concentrating primarily on highly technical issues. The Port District and its consultants are concerned that the State Board has not had an opportunity to review the record or to hear a full discussion of this issues. Therefore, this Executive Summary is being submitted directly to the Board Members.[1]

1. The Toxicity Tests, Sediment Organism Community Diversity Studies, Natural Population Information, and Bioaccumulation Studies Establish That There is No Adverse Biological Impact from the Copper Ore Concentrate in the Sediment off the National City Marine Terminal (NCMT).

Toxicity tests conducted in both 1988 and 1991 showed no toxicity response that can be attributed to the copper in the copper-contaminated sediments under the standardized laboratory toxicity test conditions. It was these test results in combination with the results of other studies that had been

[1]The only technical input going into the draft order is a Staff technical report that states that the author reviewed only one technical document in the record, and not any of the others that have been submitted. At the State Board workshop on this matter, the Port District's request for additional time to address technical issues was denied, based on an explanation from the State Board that the Port District would have an opportunity to present full testimony at the hearing. However, since then the Port District has received a notice from the State Board's General Counsel that no testimony will be accepted at the hearing and that only "brief comments" will be allowed. The Port District has made a due process objection to these procedures and the lack of opportunity to be heard on these issues.

conducted that led the Regional Board Staff to stipulate that there were no adverse biological impacts attributable to copper concentrations at 4,000 ppm <u>and higher</u> at the Regional Board hearing. It is also this data that led the Regional Board, after much greater analysis and study than this Board, to conclude that the 4,000 ppm cleanup level was conservative and would adequately protect the beneficial uses of San Diego Bay.

A summary of the toxicity tests follows:

* Toxicity tests were conducted on NCMT-area copper contaminated sediment using nine different standard toxicity test organisms (including two "bedded sediment" amphipods) and evaluating fourteen response characteristics.

* An array of sediment samples from the pierface in the most contaminated sediments and bayward from the pierface were tested; the samples tested contained copper concentrations as low as 122 mg Cu/kg and as high as more than 18,000 mg Cu/kg, with a number containing intermediate concentrations.

* The most recent toxicity tests were specifically directed to asses potential chronic impacts (those impacts that could result from extended exposure and exposure during critical life stages) to sensitive organisms. Organisms tested with standard short-term chronic testing methods included the Pacific oyster (embryo-larval test) which is recognized by the U.S. EPA to be one of the most sensitive organisms to copper.

* None of the toxicity tests showed any toxicity response to the exposure to the copper-contaminated sediments, with the exception of one response of the <u>Rhepoxynius</u>, one of the two amphipods tested.

* The response noted in the <u>Rhepoxynius</u> test was not related to the concentrations of copper and most likely reflected an effect of sediment grain size on the organisms. Those organisms do not live in San Diego Bay and are known to exhibit response to grain size of sediment. They are recognized to be not reliable for testing San Diego Bay sediments. The other amphipod tested showed no toxicity.

2. There Was No Toxicity Shown at Concentrations of 4,000 ppm Copper and Higher.

There is no basis for the State Board Staff criticism that the toxicity testing did not explicitly test at 4,000 ppm. Tests were conducted at levels much higher than 4,000 ppm, including tests at over 6,000 ppm and over 18,000 ppm. In each of the tests, there was no toxicity shown at the highest levels tested. Therefore, there was no reason to "fine tune" the test results at each intermediate level of copper concentration. The test results at much higher concentrations support that the 4,000 ppm cleanup level is conservative and highly protective of the beneficial uses of San Diego Bay. Conversely, there is no technical support for the proposition that a 1,000 ppm cleanup level is necessary.

3. Aquatic Chemistry Supports the Toxicity Test Results.

The chemistry of chalcopyrite, the form of copper in the copper ore concentrate introduced into the water at the NCMT, in a marine sediment/seawater environment is such that copper would not tend to be released from the sediment. In addition, copper that might be released would be rapidly removed from solution.

4. Elutriate Toxicity Tests are Appropriate.

There is no basis for the State Board Staff criticism that the elutriate toxicity tests are not appropriate for assessing the potential impact of sediment associated copper on beneficial uses. Elutriate tests provide a worst-case exposure situation. In this case, they were conducted using standard critical life stage exposure of copper-sensitive organisms to evaluate potential for chronic toxicity.

5. The Control Water Used in the Elutriate Tests is Standard and is Accepted by the U.S. EPA.

There is no basis for the State Board Staff criticism that the test results should be discounted because the control water was not taken from San Diego Bay. The control water is that normally used by the testing laboratory, which is accepted by the U.S. EPA for flow-through testing to determine, under the "Green Book," whether dredged sediments may be suitable for ocean disposal.

6. Interstitial Waters Were Not and Should Not be Used for Testing.

There is no basis for State Board Staff Member Stephan Loranzato's statement at the workshop that he would have accepted the test results had they been conducted on interstitial water. The U.S. EPA concedes that toxicity tests on interstitial water do not produce results that can be interpreted to assess the impacts of sediment-associated contaminants on beneficial uses of water bodies. One of the problems is that true interstitial water lacks dissolved oxygen; therefore, test organisms cannot survive in interstitial water. Oxygenating the interstitial water would change its chemical characteristics and would thus alter the toxicity test results. The test results would not be representative of or reliable for assessing potential adverse impacts of sediment-associated contaminants on beneficial uses of San Diego Bay.

7. Natural Populations at the Site Support the Conclusion that the Sediments are Not Toxic or Harmful to the Beneficial Uses.

Surveys of the NCMT-area bottom-dwelling community diversity showed that the numbers, types and composition of organisms in the NCMT area are not related to the amount of copper present in the sediments. Significantly, natural populations of the mussel, Mytilus edulis, were found inhabiting the pilings in the areas near the NCMT in which the sediments were most heavily contaminated with copper. Mytilus edulis has been reported by the U.S. EPA to be the most sensitive to copper of all of the marine organisms it evaluated in establishing a water quality criterion for copper. **It was based specifically on the sensitivity of this organism to copper that the numeric criterion value for copper was established at 2.9 ug/L.**

Results of benthic organism population studies also support the conclusion that the sediments are nontoxic. The numbers and types of benthic organisms in the NCMT area sediments (which include copper concentrations several times higher than the proposed cleanup level) are the same as those in other areas of San Diego Bay. The numbers and types of benthic organisms in the vicinity of the NCMT are not related to the concentrations of copper in the sediment.

8. Mussel Watch Data Do Not Support a More Stringent Cleanup Level.

The concentration of copper in mussels planted near the NCMT area are the same as those in mussels in other parts of San Diego Bay.

9. Interstitial Water Copper Concentration Data From the Site Are Inaccurate.

The State Board Staff analysis relies heavily upon interstitial water concentrations determined early in the history of this project by Paco's consultant. The approach he used to try to measure the interstitial water copper concentrations was unreliable and very likely greatly overestimated the true copper concentration. The water quality objectives are not applicable to interstitial waters, but to the water column. There is no relationship between the concentration of contaminants in interstitial water and concentrations in the overlying water column.

10. The Water Quality Objective for Copper Should Not Be Applied in This Case.

The water quality objective should not apply to a cleanup under a CAO; the water quality objectives of the Enclosed Bays and Estuaries Plan applies to discharges from ongoing operations.

The current water quality objective for copper in San Diego Bay was exceeded before Paco's operations.

If the water quality objective were based on soluble copper rather than on total copper (much more biologically defensible), administratively exceeding the copper water quality objective would likely no longer occur in any event.

11. Plume or Sediment Movement is Not a Valid Concern.

Very detailed sediment mapping studies of the site have been performed and analyzed in the Woodward-Clyde Report. The report concludes that there is no evidence that the copper ore concentrate in the sediment is moving laterally. To the extent it is moving, it is moving vertically, deeper into the sediment. Such movement further into the oxygen-free environment of the sediment only increases the unavailability of the copper to marine organisms.

12. Cleaning Up to the 4,000 ppm Level Will Accomplish a Cleanup Much Greater than 4,000 ppm.

The detailed sediment sampling map establishes that removing all copper concentrations above 4,000 ppm will not leave an average concentration in the sediment that approaches 4,000 ppm. Based on 283 data points in that sediment map, removing sediments to satisfy the 4,000 ppm cleanup level will leave an average copper concentration on the west side of the site of 1,046 ppm; on the north side, the average concentration would be 1,873 ppm. Thus, even phrased only in terms of parts per million, there is only a small marginal benefit to be gained from changing the cleanup level to 1,000 ppm, which comes at a very high cost. Moreover, there is no evidence that there is any biological or beneficial use benefit to be gained from changing the cleanup level from 4,000 ppm to 1,000 ppm.

13. The Cleanup Cost Difference Between 1,000 ppm and 4,000 ppm is Estimated to be Between $7 Million and $15 Million.

The cost of the sediment cleanup at the 4,000 ppm cleanup level using the mining company option is estimated to be approximately $5.16 million. Although the costs have not been fine tuned for the 1,000 ppm cleanup level, the added cost is projected to be approximately $7 million if the mining company option remains available for the sediments, which is unlikely.

Under the more likely scenario, the mining company option will not be available for any of the sediments if the cleanup level is changed. In that event, the total sediment cleanup cost (including land disposal and pretreatment) will likely increase by $15 million, to a total of $20 million.

14. If the Cleanup Level is Changed, the Entire Sediment Cleanup Cost Will Be Funded By Public Money.

If the 4,000 ppm cleanup level is changed, the pending settlement of litigation with the insurance carriers and other potentially responsible parties will be nullified. If the settlement is nullified, there will be no funds available for the cleanup from Paco, Paco's insurance carriers, the Port District's insurance carriers, or from any other source. Thus, the entire cleanup would need to be funded by the Port District. (The only means of obtaining additional funding would be for the responsible parties to continue to pursue multiple federal and state court cases on this matter. The cost of pursuing that litigation would also be several million dollars, also to be paid from public money.)

15. There Should Be No Presumption in Favor of a 1,000 ppm Cleanup Level.

The 1,000 ppm cleanup level was set in this matter before the Port District had been added as a responsible party. For this reason, the Port District has lodged a due process objection to any existing presumption in favor of the 1,000 ppm cleanup level. The Port District should not have any burden of proving the validity of the 4,000 ppm cleanup level (as opposed to any other level). The Port District has provided substantial evidence to establish that a much higher cleanup level would be protective of the beneficial uses of the bay. By comparison, there is no credible evidence to support the 1,000 ppm cleanup level.

16. The Port District Violated No NPDES Permits or Waste Discharge Requirements.

At the workshop there appeared to be a misconception that the Port District had itself violated NPDES permits or waste discharge requirements. In fact, the Port District was belatedly named to this CAO only by virtue of its landowner status. The Port District owns (as public trustee) the National City Marine Terminal where Paco's operations were located. When the Regional Board added the Port District to this order (which was affirmed by a 3-2 vote of this Board), it was never understood that Paco would be "off the hook." However, That is exactly what will happen if the cleanup level is reverted to 1,000 ppm. While such a harsh result might be more appropriate for a for-profit landowner in the private sector, it is inappropriate for a public agency that was not operating out of a profit motive, but out of its role as public trustee to provide jobs and commerce to the area it serves.

17. The Cleanup is Achievable Now at 4,000 ppm, But Not at 1,000 ppm.

The negotiations conducted under Magistrate McCue's auspices have succeeded in determining both the financial and the technical means of accomplishing the cleanup, provided the Regional Board's 4,000 ppm cleanup level is not changed. If that cleanup level is changed, there is no available technical means of accomplishing the cleanup. Moreover, any cleanup will be delayed through appeals of this decision and other litigation.

DATED: September 1, 1992

Respectfully submitted,

HILLYER & IRWIN

By ______________________
David B. Hopkins
Attorneys for San Diego
Unified Port District

2

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego Unified Port District**

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

DECLARATION OF KURT F. KLINE, Ph.D.

Hearing Date: September 17, 1992

I, KURT F. KLINE, being duly sworn, state as follows:

1. I have a Ph.D. in Ecology from the University of California, Davis (1978) with emphasis in general ecology, aquatic ecology, fisheries biology and water quality. I am currently the Vice President and Manager of the Bioassay Division of MEC Analytical Systems, Inc. in Tiburon, California, a bioassay and toxicity testing laboratory. In addition, from 1981 to 1987 I was a senior scientist and bioassay laboratory manager at Westec Services, Inc. in San Diego. While at Westec from 1982 through 1987, I directed the bioassay testing for almost all dredging projects in San Diego Bay, including projects for NASSCO, Southwest Marine, and the United States Navy. A copy of my curriculum vitae is attached hereto as Exhibit A.

2. MEC Tiburon was a subcontractor to Woodward-Clyde for the August 1991 report on Remedial Action Alternatives for National City Marine Terminal. Our task was to conduct new bioassay and toxicity tests from the site. The tests were conducted either by me or under my direction. The test formats were designed in consultation with G. Fred Lee & Associates (Drs. G. Fred Lee and Anne Jones-Lee) as well as with Woodward-Clyde, and were standard test protocols, following ASTM guides.

3. The methodology and results of the 1991 tests are set out in Sections 2.2 and 2.3 of the Woodward-Clyde Report. The methodology and results are accurately reported therein.

4. I am informed that the State Board Staff has criticized our bioassay testing methodology for utilizing our usual laboratory water which is 0.45 um filtered UV sterilized

seawater taken from the seawater intake at Tiburon, rather than using water from San Diego Bay. The only basis for such criticism could be a concern that the toxicity testing results could have been different had San Diego Bay water been used or, alternatively stated, that the Tiburon water could have caused a different result. There is absolutely no basis for any such concern. Never before has there been even a suggestion of any concern in using this water. For the past five years, MEC has utilized water from this Tiburon intake in testing contaminated sediments from San Diego, Long Beach, Los Angeles, and San Francisco. The proper test for determining appropriateness of water is the control survival rate, which is excellent utilizing this water. Moreover, the U.S. Environmental Protection Agency accepts this water as flow-through for bioassay testing under the "Green Book" for ocean disposal.

5. I also understand that the tests have been criticized by the State Board Staff supposedly for reporting only the testing on three of five sediment samples tested. In fact, the Woodward-Clyde Report includes results from <u>all</u> sediment samples tested. The testing protocol called for bioassay and toxicity testing on the sediment sample with the lowest and highest copper values against a background reference site. Because no toxicity was shown at either the lowest or the highest copper concentrations against the background site, no biological tests were conducted with the two remaining sediment samples, which were between the two copper concentrations already tested.

No biological test was omitted from the report. This methodology is consistent with normal risk assessment methodology.

6. Finally, I understand that the conclusions of the Woodward-Clyde Report were criticized by the State Board Staff because of mortality in the tests conducted using *Rhepoxynius abronius*. However, it must be noted that the mortality of *Rhepoxynius abronius* in these tests did not appear to be related to copper concentrations. It is my opinion that the mortality rates were attributable to the fact that the sediments from San Diego Bay being tested, which were taken from the site and from a control point near the site, were fine grain sediments. This species is difficult to use in fine grain test material such as those encountered in the sediments at the test sites in south San Diego Bay. The original work by DeWitt, et al. (1988) on grain size effects on this species found high variability in results as the grain size became finer, up to a level of 85% fines. Performance of this species in the MEC laboratory in sediments with finer grain size appears to corroborate this high variability in the test results. It is my opinion that the sediments were generally not suitable for tests using *Rhepoxynius abronius*. It should also be noted that *Rhepoxynius abronius* is not native to and is not found in San Diego Bay, quite possibly because the fine grain sediments there are inimical to that species.

I declare under the laws of the State of California that this declaration is true and correct and that it was executed on September 15, 1992, in Marin County, California.

Kurt F. Kline

Kurt F. Kline

David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego Unified Port District**

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

DECLARATION OF JEAN A. NICHOLS, Ph.D.

Hearing Date: September 17, 1992

I, JEAN A. NICHOLS, being duly sworn, state as follows:

1. I have a Ph.D. in Biological Oceanography from the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution (1975). (My resume was submitted to the Regional Board as Exhibit 14 to the San Diego Unified Port District's Written Direct Testimony for Regional Board Hearing on December 9, 1991.)

2. I have been involved in the study of remedial action alternatives for the marine sediment at the former Paco Terminals site at the San Diego Unified Port District's National City Marine Terminal since the spring of 1991. At that time I was a member of the remedial action alternatives group for Woodward-Clyde Consultants in San Diego. In that capacity I coordinated the preparation of the Woodward-Clyde Report entitled "Remedial Action Alternatives for National City Marine Terminal." After the preparation of the report, I was appointed by Woodward-Clyde as Project Manager for the project. On July 3, 1992 I left Woodward-Clyde to form my own environmental consulting company, but remain involved in this project as a subcontractor under Woodward-Clyde. I have also been retained by the Port District and its outside counsel to assist in the implementation of the cleanup plan consistent with Regional Board Addendum No. 7.

3. The opinions expressed in the Woodward-Clyde Report are based on Woodward-Clyde's analysis and on studies and data collected and analyzed by subcontracting experts and laboratories in various fields, including chemical analysis, bioassays,

bio-toxicity and aquatic chemistry. These subcontracting experts included MEC Analytical Systems, Inc. of Carlsbad, California, for obtaining and chemically analyzing sediment samples; MEC Analytical Systems, Inc. of Tiburon, California for conducting the bioassay and toxicity tests (headed by Kurt F. Kline, Ph.D., Bioassay Division Manager); and G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D. of G. Fred Lee & Associates of El Macero, California, for designing and conducting the risk assessment study based on both new and existing testing from this site and on other literature in relevant fields. In addition, the opinions and conclusions in the report are based on a critical evaluation of several reference sources listed in Section 8 of the Woodward-Clyde Report. The opinions and conclusions stated in the Woodward-Clyde Report are based on the special knowledge, skill, experience, training and education of Woodward-Clyde consultants, the subcontracting consultants, and other references, all of which are of a type that reasonably are relied upon by experts in forming opinions of the type stated in the Woodward-Clyde Report.

4. The primary issue before this board is whether to affirm the Regional Board's 4,000 ppm copper cleanup level set in December 1991. In that regard, it is important to note that dredging all sediments over 4,000 ppm in fact accomplishes a far greater cleanup. Based on the 1989 sediment map, which contains the most data points of any sediment map for this site, removing sediment to satisfy a 4,000 ppm cleanup level will <u>not</u> leave an average concentration of copper in the sediment that approaches

4,000 ppm. (The 1989 ERCE sediment map (Figure 2-2 to the Woodward-Clyde Report) is attached hereto as Exhibit A. Each dot on the map represents a sediment sampling station. Each sampling station actually represents several sampling points, at varying depths below the surface of the sediment. The control location is shown on Figure 2-3 to the Woodward-Clyde Report (Exhibit B hereto), approximately 1,000 feet from the far corner of the 24th Marine Terminal -- approximately three times farther away from the terminal than the outermost sampling point on that side.)

5. Based on those data points, removing sediment to satisfy the 4,000 ppm cleanup level will leave an average copper concentration on the west side of the site of 1,046 ppm; on the north side of the site, the average concentration would be 1,873 ppm. These figures are based on an analysis of 283 sediment collection samples taken at the site which have copper concentrations below 4,000 ppm and which would not need to be dredged to meet the 4,000 ppm cleanup level. In fact, of those 283 sample collection points, only 8 show copper concentrations in excess of 3,000 ppm. And, as stated, the average remaining concentrations are shown to be 1,873 ppm on the north side and 1,046 ppm on the west side. Thus, the 4,000 ppm cleanup level in fact accomplishes a cleanup far greater than 4,000 ppm. Phrased another way, removing all sediment over 4,000 ppm copper requires removal of a great deal of sediment with copper concentrations under 4,000 ppm.

6. Similarly, a 1,000 ppm cleanup level also effectively accomplishes a much greater cleanup level than

1,000 ppm. After removing all sediments exceeding 1,000 ppm, the remaining data points (not needed to be dredged) show an average copper concentration of 318 ppm on the west side of the site and 173 ppm on the north side of the site.

7. Since the Regional Board's adoption of the 4,000 ppm cleanup level I have assisted in the plans to implement the cleanup. In so doing, greater knowledge concerning the actual costs of the project has been gained. The current best estimate of those costs was presented at the workshop in this matter. As shown at the workshop, the total costs expected to be incurred in satisfying the 4,000 ppm sediment cleanup level are now $5,160,450. These costs include the following:

	Dredging, Handling, Loading, etc.	$1,500,000
?	Rail Transport	1,000,000
	Project Management	300,000
	Mining Company Capital Improvements and Overhead	850,000
?	Mining Company Minimum Processing Fee ($28.23/ton, 15,000 ton minimum)	423,450
?	Hazardous Materials Testing (mining company requirement) ($1,790/railcar in testing costs alone)	537,000
	Common Costs (permitting, post-cleanup sampling, etc.)	550,000
TOTAL		**$5,160,450**

It should be noted that these costs do not include the Port District's landside remediation costs or the parties' other consultant fees which were stated at the workshop to total another $2.6 million dollars.

8. The costs marked with a question mark (?) are subject to change and likely to increase. The rail transport

cost is likely to increase because of bottlenecks at both the National City Marine Terminal and at the mining company that require slow loading and off loading of the railroad cars, and require paying significant additional demurrage charges to the railroad not included in the figure above. The mining company minimum processing fee is likely to increase because of the likelihood that more than 15,000 tons will be required to be processed to complete the project. The hazardous material testing fee is likely to increase because the fees shown above include only the test costs and not the labor costs of requiring personnel to take and handle the samples.

9. It should be noted that the costs shown above for the sediment cleanup project are more than double the cost estimates Woodward-Clyde and the Port District provided to the Regional Board in December 1991. The difference is attributable to greater understanding of the actual costs of various elements of the project and to the fact that the December 1991 costs were based on dredging only 5,000 cu. yds. when we now realize that the project will require dredging approximately 10,000 cu. yds.

10. If the cleanup level is changed from 4,000 ppm to 1,000 ppm, the effect on costs is substantial but not precisely known. We have revised costs for the project only at the 4,000 ppm cleanup level, not for any other level. When we prepared the Woodward-Clyde Report, we projected the total project cost at 1,000 ppm at approximately $6.18 million (assuming that ocean disposal would not be available for any portion of the sediment). Based on the fact that the projection for the 4,000 ppm cleanup

level has more than doubled since the Regional Board hearing, it is reasonable to assume that the 1,000 ppm cost estimate of $6.18 million would double as well, making that cost approximately $12.36 million. This estimate assumes that the mining company option remains available for some or all of the sediment. It is doubtful that the mine will accept material required to be dredged if the cleanup level is lowered below 4,000 ppm copper. (See Declaration of David B. Hopkins.) However, even if the mine were able to accept all material subject to a 1,000 ppm cleanup level, the railroad car supply rate would require ten to twelve months to complete the remediation operation, far past the current April 1993 Regional Board deadline.

11. If the cleanup level is changed, I am informed that the mining company option will not be available for any of the sediment. (See Declaration of David B. Hopkins.) In that event, it is likely that the sediment will need to be disposed of off site in landfills. In the Woodward-Clyde Report, the cost of off-site disposal of all sediment over 1,000 ppm (including stabilization of much of the sediment) was estimated at $10.371 million. Again, based on the fact that our knowledge gained since the December Regional Board hearing has caused the 4,000 ppm cost projection to double, this figure could exceed $20 million for off-site disposal.

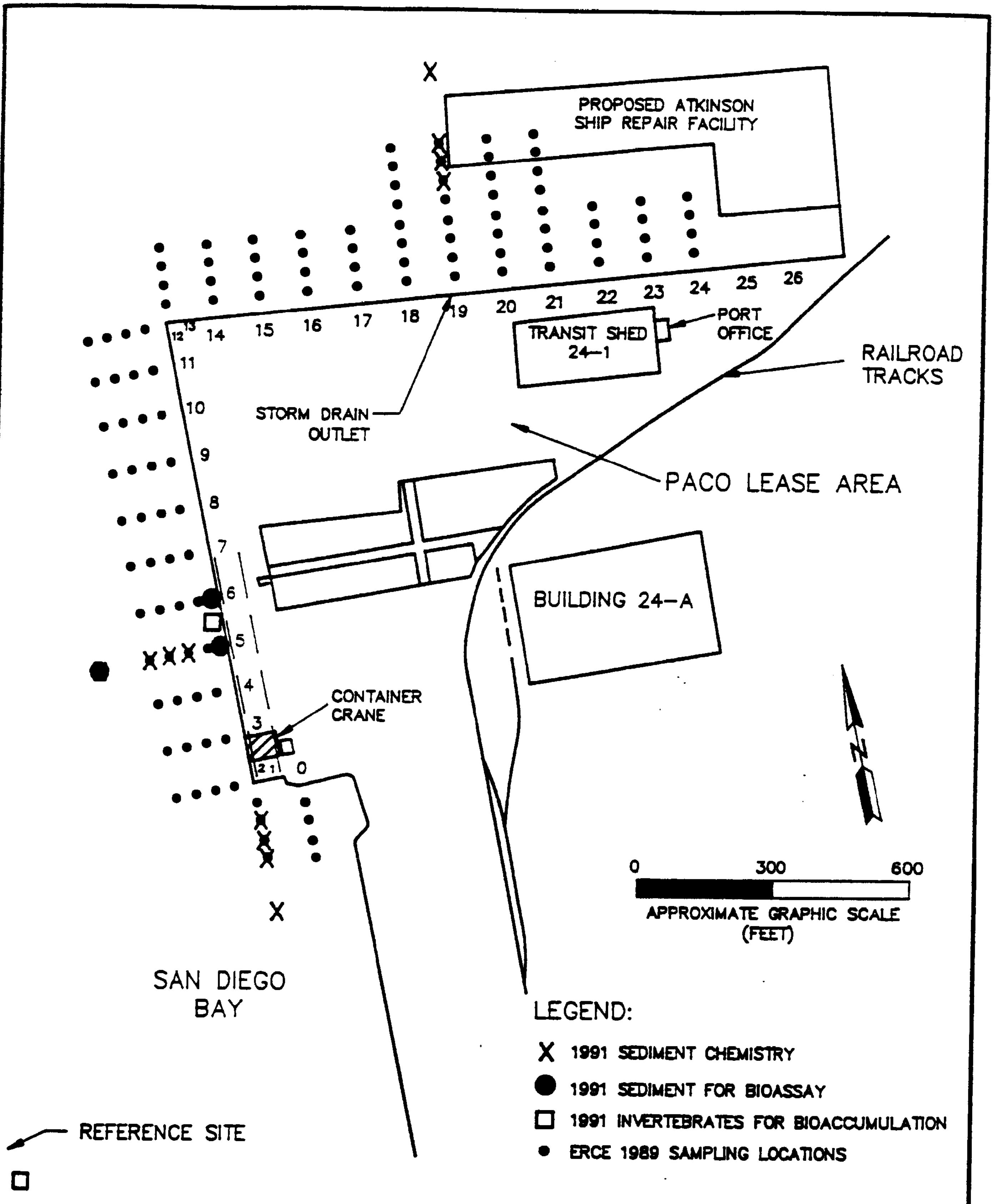
12. Finally, and most importantly, the bioassay and bio-toxicity studies summarized in the Woodward-Clyde Report show that there is no biological advantage to be gained from spending

any additional dollars and jeopardizing timely completion of the cleanup by changing the 4,000 ppm cleanup level.

13. I am informed that the conclusions of the Woodward-Clyde Report have been criticized by the State Board Staff in part because the test results on the species Rhepoxynius abronius showed mortality in lower copper concentrations. It cannot be overemphasized that there is <u>no</u> indication that the copper concentrations are implicated in any way in these test results. The conclusions of the Woodward-Clyde Report and of Dr. Lee, Jones-Lee, and Kline are that mortality of Rhepoxynius abronius is related to its sensitivity to fine grained sediment material such as those found in the sediments at the test sites off the National City Marine Terminal. These conclusions are consistent with other San Diego Bay studies with which I am familiar utilizing Rhepoxynius abronius. These studies have shown that Rhepoxynius abronius actually survives better in higher concentrations of copper. In one test of which I am aware, Rhepoxynius abronius showed a 70% survival rate at one level of copper and a 94% survival rate at four times that copper concentration. While one could conclude that these results show that copper is actually beneficial for Rhepoxynius abronius, it is much more likely, based on other reports concerning this species, that grain size sensitivity is the cause of these different results and that copper is not a statistically significant factor.

I declare under penalty of perjury under the laws of the State of California that this Declaration is true and correct, and that it was executed on September 12, 1992 in San Diego County, California.

Jean A. Nichols

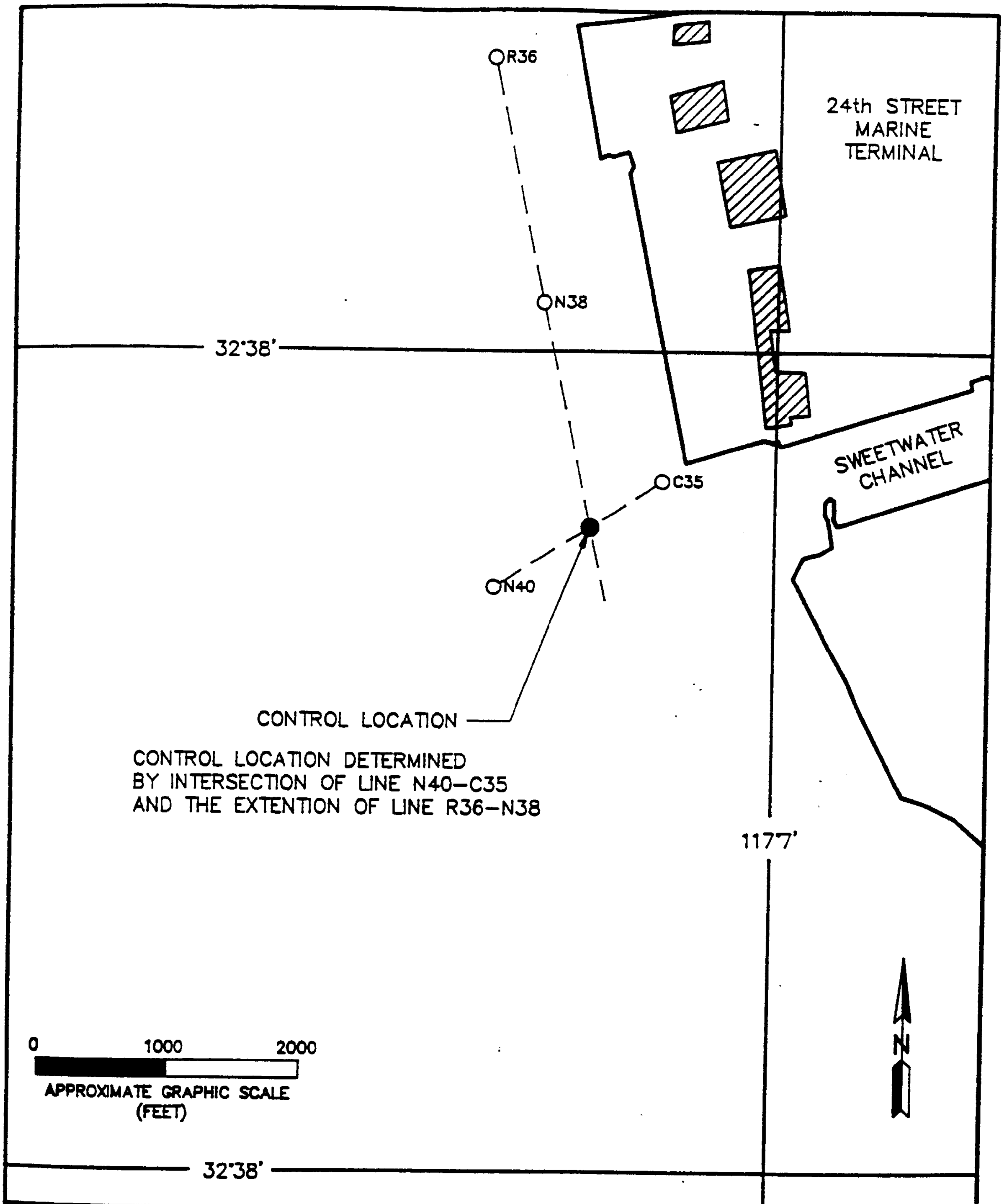


SAMPLING STATIONS
NATIONAL CITY MARINE TERMINAL

FN: NCTM	DRAWN BY: TEB	CHECKED BY:	PROJECT NO.: 9153043P	DATE: 7-2-91	FIGURE NO.: 2-2

WOODWARD-CLYDE CONSULTANTS

Exhibit A



CONTROL SAMPLE LOCATION
NATIONAL CITY MARINE TERMINAL

FN: NCONTROL	DRAWN BY: TEB	CHECKED BY: [illegible]	PROJECT NO.: 9153043P	DATE: 6-26-91	FIGURE NO.: 2-3

WOODWARD–CLYDE CONSULTANTS

Exhibit B

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David B. Hopkins
HILLYER & IRWIN
A Professional Corporation
550 West C Street, Sixteenth Floor
San Diego, California 92101-3540
Telephone: (619) 595-1269
Attorneys for **San Diego
Unified Port District**

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Appeal Nos. A-775 and A-775(a)

Petitions of Environmental Health Coalition and Eugene J. Sprofera to Review Cleanup and Abatement Order No. 85-91, Addendum 7, of the Regional Water Quality Control Board (San Diego Region)

DECLARATION OF G. FRED LEE, Ph.D.

Hearing Date: September 17, 1992

I, G. FRED LEE, being duly sworn, state as follows:

1. I have a Ph.D. in Environmental Engineering and Environmental Science from Harvard University (1960). (A summary of my curriculum vitae was submitted to the Regional Board as Exhibit 6 to the San Diego Unified Port District's Written Direct Testimony for Regional Board Hearing on December 9, 1991.)

2. I am the President of G. Fred Lee & Associates. In the spring of 1991 G. Fred Lee & Associates was retained as a subcontractor to Woodward-Clyde for the study on remedial action alternatives for National City Marine Terminal. All the work on the risk assessment was conducted either by me or under my direction. I was primarily assisted by R. Anne Jones-Lee, Ph.D., Vice President of G. Fred Lee & Associates. (Dr. Jones-Lee's Ph.D. is in Environmental Sciences from the University of Texas at Dallas with areas of specialization in aquatic chemistry, aquatic toxicology-biology and water quality control. A summary of Dr. Jones-Lee's curriculum vitae was submitted to the Regional Board as Exhibit 7 to the San Diego Unified Port District's Written Direct Testimony for Regional Board Hearing on December 9, 1991.) Dr. Jones-Lee and I have been working as a team on these types of issues since the mid-1970s.

3. The risk assessment study was based upon new (1991) toxicity testing and sediment characterization studies from the site, a critical evaluation of historical data from the site, and a critical evaluation of other relevant materials. The 1991 testing was performed on samples taken by MEC Analytical Systems, Inc. (Carlsbad). Metals lab analyses were performed by Quality

Assurance Laboratories (San Diego) (a California certified testing laboratory). Bioassay and toxicity analyses were performed by MEC Analytical Systems, Inc. (Tiburon) (directed by Kurt F. Kline, Ph.D.). The results of the risk assessment are accurately reported in Section 3 of the Woodward-Clyde Report, which was prepared by Woodward-Clyde based upon our risk assessment report to Woodward-Clyde. The opinions and conclusions stated in Section 3 of the Woodward-Clyde Report are based upon our special knowledge, skill, experience, training, and education; upon the laboratory and testing results of the subcontracting consultants; and upon a critical evaluation of other references (listed in Section 8 of the Woodward-Clyde Report), all of which are of a type that reasonably are relied upon by experts in forming opinions of the types stated in Section 3 of the Woodward-Clyde Report. **Based on appropriate studies, our conclusion in the risk assessment is that there is no showing of any increased toxicity or biological risk from copper in the sediments off the National City Marine Terminal up to concentrations over 18,000 ppm (the highest level tested in the risk assessment).**

4. In addition to the preparation of Section 3 of the Woodward-Clyde Report and to our oral testimony at the Regional Board hearing and the State Board workshop and upcoming hearing on this matter, G. Fred Lee & Associates has prepared or supported the preparation of other documents submitted to the State Board and the Regional Board. All of these other documents or portions were prepared by me or at my direction with the

primary assistance of Dr. Anne Jones-Lee. The opinions and conclusions stated in these other papers are based upon our own special knowledge, skill, experience, training, and education and on a critical evaluation of other references, all of which are of a type that reasonably are relied upon by experts in forming opinions of the types stated. These additional submissions include:

San Diego Unified Port District's Written Direct Testimony for Regional Board Hearing on December 9, 1991 Regarding Cleanup and Abatement Order 85-91 [Risk Assessment portions supporting change in cleanup level] (November 22, 1992);

San Diego Unified Port District's Written Response Supporting the Regional Board's Addendum No. 7 and Imposition of 4,000 mg Cu/kg Cleanup Level, submitted to California State Water Resources Control Board on Appeal Nos. A-775 and A-775(a) [portions concerning risk assessment support for changes in cleanup level] (June 3, 1992);

Comments on Environmental Health Coalition Petition for Review by State Water Resources Control Board of Regional Water Quality Control Board, San Diego Region's Adoption of Cleanup and Abatement Order 85-91, Addendum No. 7 (May 28, 1992) submitted as Exhibit 1 to San Diego Unified Port District's Written Response Supporting the Regional Board's Addendum No. 7 and Imposition of 4,000 mg Cu/kg Cleanup Level (June 3, 1992).

Supplemental Testimony of G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D. for the December 9, 1991 Hearing of the California Regional Water Quality Control Board, San Diego Region Regarding NCMT Cleanup and Abatement Order No. 85-91 Regarding Tentative Addendum No. 7, submitted as Exhibit 1, App. B, to San Diego Unified Port District's Written Response Supporting the Regional Board's Addendum No. 7 and Imposition of 4,000 mg Cu/kg. Cleanup Level (June 3, 1992);

Set of seven overheads provided to State Board at the Workshop on File Nos. A-775 and A-775(a) (September 2, 1992);

Comments on State Water Resources Control Board Staff Document Entitled "Preliminary Comments on the Woodward-Clyde Report on Copper Pollution at the

National City Marine Terminal, San Diego Bay" [prepared by Stephan Lorenzato] [faxed August 25, 1992] (September 15, 1992);

Comments on Draft Order WQ-92- for Review of Cleanup and Abatement Order No. 85-91, Addendum No. 7, of the California Regional Water Quality Control Board, San Diego Region [prepared by Frances McChesney, Esq. of Office of General Counsel] [August 20, 1992] (September 15, 1992);

Comments on Technical Review Memorandum by the Division of Water Quality to the Office of Chief Counsel (OCC) on File Nos. A-775 and A-775(a) (August 27, 1992) [prepared by Tom Inouye] [faxed August 31, 1992] (September 15, 1992);

Comments on Environmental Health Coalition's Supplemental Submission to State Water Resources Control Board [in form of State Board Order] [received at State Board Workshop on September 2, 1992] (September 15, 1992);

Comments on Mondal Thesis [submitted by Environmental Health Coalition after State Board Workshop on File Nos. A-775 and A-775(a)] [received by counsel for Port District on 9/9/92] (September 15, 1992).

Responses to Technical Issues Raised at September 2, 1992 Workshop on Sediment Cleanup Objective for National City Marine Terminal (September 15, 1992); and

San Diego Unified Port District's Executive Summary of Testimony and Record Submissions to State Water Resources Control Board [portions concerning risk assessment support for changes in cleanup level] (September 15, 1992).

I declare under the laws of the State of California that this declaration is true and correct and that it was executed on September 15, 1992, in Yolo County, California.

G. Fred Lee

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Comments on

"Draft Order WQ 92- For Review of Cleanup and Abatement Order no. 85-91, Addendum no. 7, of the California Regional Water Quality Control Board, San Diego Region"

Prepared by

G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D.
President Vice-President
G. Fred Lee & Associates
El Macero, CA 95618
(916) 753-9630

September 15, 1992

Many of the technical deficiencies in the information, presumptions, conjecture, and reasoning exhibited in the Draft Order have been addressed in the authors' comments on the "*Preliminary Comments on the Woodward-Clyde Report on Copper Pollution at the National City Marine Terminal, San Diego Bay*" ("Staff Comments") and/or the "Technical Review" dated August 27, 1992.

The Draft Order summarized the Petition submitted by stating,

> *"The Petitioners' primary contention is that the 4,000 mg/kg sediment cleanup level does not comply with the State Water Resources Control Board's (State Water Board's) Water Quality Control Plan for the Enclosed Bays and Estuaries of California ("EBE Plan") and other Board requirements."*

The petitioners have attempted to link a sediment clean-up objective to an exceedance of a water quality objective. The key facts in this matter are:

- The copper concentrations in the watercolumn in the vicinity of the NCMT in San Diego Bay exceeded the April 1991 numeric water quality objective before the PACO Terminal operations that led to the spillage of copper that has accumulated in the NCMT area sediments, took place.

- The concentrations of copper in the watercolumn near the NCMT area after the spillage took place are of the same general magnitude as those found before the spillage took place.

- The copper ore concentrate in the NCMT-area sediments is not the primary cause, and may not be responsible to any measurable extent, to the exceedance of the watercolumn copper objective that exists throughout San Diego Bay.

- Extensive studies of the impact of the copper ore concentrate-contaminated sediments in the NCMT area have determined that the copper in those sediments is not causing a significant adverse impact on the designated beneficial uses of San Diego Bay.

- The 4,000 mg/kg sediment quality objective adopted by the SDWQCB is highly protective of the designated beneficial uses of San Diego Bay. That objective could be significantly raised without impairing those uses.

- The numeric water quality objective for copper in San Diego Bay as implemented is known to be highly overly restrictive for protection of beneficial uses, as the application of that value would be to many other marine bays throughout the US. Exceedance of the numeric copper objective does not represent an impairment of the designated beneficial uses of San Diego Bay waters.

- The State Board staff's review of this matter was stated to have been restricted to only part of the Administrative Record that was available to the it. The State Board staff's review of the matter upon which it has commented and developed this Draft Order has thus not included the technical information submitted to the SDWQCB specifically in refutation of the originally proposed 1,000 mg Cu/kg clean-up objective or in support of a 4,000 mg Cu/kg clean-up objective or the response of the Port of San Diego to the specific issues raised in the Petition.

- The State Board's staff has not raised a single technical issue its Comments or reflected in the Draft Order that had not been addressed in the Administrative Record or that would justify causing the clean-up objective to be established at 1,000 mg/kg rather than the SDWQCB's objective of 4,000 mg/kg. A comparison of the nature and strength of the technical information in support of the 1,000 mg/kg objective with that in support of the 4,000 mg Cu/kg objective shows that the evidence in support of the latter is substantially stronger and more reliable.

- The Environmental Health Coalition's petition was based on faulty analysis of the information available on the potential significance of copper in San Diego Bay sediments on the designated beneficial uses of the Bay waters.

COMMENTS ON THE BACKGROUND

Presented on pages 2 through 7 of the Draft Order is "background" information to the Draft Order. To the extent that the author of the Draft Order relied upon the Staff Comments ("Preliminary Comments on the Woodward-Clyde Report on Copper Pollution at the National City Marine Terminal, San Diego Bay") the "background information" is necessarily incomplete since the Staff stated in its Comments that the portion of the Administrative Record that it reviewed did not include the technical information submitted to the SDWQCB specifically in refutation of the originally proposed 1,000 mg Cu/kg clean-up objective or in support of a 4,000 mg Cu/kg clean-up objective or the response of the Port of San Diego to the specific issues raised in the Petition.

There are several aspects of the technical information presented in the Draft Order that should be brought to the attention of the Water Resources Control Board (WRCB) in its review of the Draft Order. On pages 3 and 4, mention was made of the SDWQCB's adopting a sediment copper clean-up objective of 1,000 mg/kg. As discussed in the Woodward-Clyde report, and further in the materials presented to the SDWQCB and the WRCB by the Port of San Diego (in the Administrative Record), a critical review of the basis for the establishment of that objective shows that it was based on technically unreliable use of inadequate and inaccurate data that purported to present concentrations of soluble copper in interstitial waters (sediment-associated "pore" water) by the SDWQCB staff. There is little doubt, based on the risk assessment studies conducted after proposal of the 1,000 mg Cu/kg clean-up objective, that that clean-up objective would be protective of San Diego Bay water quality. However, that objective was not established based on technical information that would indicate that a higher clean-up objective would not be protective of beneficial uses of the Bay. There is nothing in the technical information available that would identify 1,000 mg Cu/kg as a singularly significant clean-up objective. The fact is, as demonstrated in the risk assessment reported by WCC (1991), that a clean-up objective substantially higher than the 4,000 mg Cu/kg objective adopted by the SDWQCB in Addendum no. 7 could be established for the NCMT-area sediments without adverse impacts to the beneficial uses of San Diego Bay. Comparison of the nature and strength of the technical information in support of the 1,000 mg/kg objective with that in support of the 4,000 mg Cu/kg objective shows that the evidence in support of the latter is substantially stronger and more reliable.

On page 4, first paragraph, the Draft Order stated,

> *"The Board found, however, that data from the State Mussel Watch Program indicated that copper ore contaminated sediment significantly contributes to very elevated copper concentrations found in mussels in the area of Paco Terminals compared to mussels in other areas."*

The quoted statement is an inaccurate expression of the findings from the State Mussel Watch Program; the State Mussel Watch Program data pertinent to the NCMT area were discussed by WCC (1991). Further, as discussed in the Woodward-Clyde report (WCC, 1991) which is part of the Administrative Record on this matter, the risk assessment study conducted by WCC (1991) explicitly addressed the issue of the bioaccumulation (body burden) of copper in benthic and watercolumn mussels specifically in the NCMT area. As reported by WCC (1991), body burdens (accumulation) of copper in watercolumn mussels and benthic (bottom-dwelling) mussels collected from a heavily copper-contaminated area near the NCMT were not different from the body burdens of the same types of mussels collected from historical NPDES reference site in the area. Contrary to the statement quoted from the Draft Order, the mussels in the vicinity of the NCMT area do not contain higher concentrations of copper than do those from other areas of San Diego Bay.

On page 6, paragraph 3, the Draft Order stated,

"Due to high levels of four pollutants, including copper, San Diego Bay is listed in the State Water Board's 1990 Water Quality Assessment as having impaired water quality and has been placed on several Clean Water Act-mandated lists of impaired water bodies. The beneficial uses that are considered impaired include shellfish harvesting and marine habitat."

It is important for the WRCB to understand that the so-called "impairment" of the designated beneficial uses of San Diego Bay referred to in the quoted statement is an "administrative exceedance-impairment," an artifact of how the State of California designates "impaired uses." The so-called "impairment" allegedly associated with the copper-contaminated sediment in the vicinity of the NCMT does not reflect diminution of "shellfish harvesting" or "marine habitat."

This State has adopted a policy that an exceedance of a highly protective (in the case of copper, a highly overly protective) objective, in itself is the same as an "impairment of use." Designated beneficial uses of waterbodies, including as San Diego Bay, focus on the numbers, types, characteristics, and wholesomeness of fish and other aquatic life and contact recreation. It is very clear from the extensive studies that have been done and reported in the Administrative Record, that the copper ore concentrate in the NCMT-area sediments is not adversely affecting the actual designated beneficial uses of San Diego Bay. The "administrative exceedance" is not tantamount to an ecological or public health-related impairment of uses.

Further, since the concentrations of copper in the watercolumn near the NCMT were essentially the same before and after the PACO operations that resulted in the introduction of copper ore into the sediment, it is clear that that copper is certainly not a significant, much less the primary, cause of any exceedance of the numeric water quality objective. Therefore, the so-called exceedance reported in 1986 and the claim that that exceedance constitutes an impairment use is an artifact of administrative policy and does not represent an impairment of actual designated uses of the waterbody; the "administrative exceedance" not manifested as an impairment of beneficial uses is not something that the public or private interests should spend significant amounts of money attempting to eliminate.

The important facts are

- in the face of "exceedances" of the water quality objective, mussels of a type recognized by the US EPA to be the most acutely sensitive to copper and upon which its water quality criterion for copper (and the EBE objective) was based, are living in the areas of the NCMT that are most heavily contaminated by copper ore concentrate;
- the concentrations of copper present in the watercolumn, measured in 1986, that are now termed an exceedance of the current objective, were essentially the same as

those reported for before the PACO operations that introduced the copper ore concentrate into the sediment;

- the contribution to the watercolumn concentrations of copper from the copper ore concentrate in the sediment, if any, begs the issue of the relative appropriateness of the 1,000 mg/kg and the adopted 4,000 mg Cu/kg clean-up objective; and
- an exceedance of the current water quality objective is not, *a priori*, an impairment of designated beneficial uses of the waterbody, but rather is an "administrative exceedance." After careful and detailed investigation, it has been found that the copper-contaminated NCMT-area sediment is not causing an adverse impact on the beneficial uses of San Diego Bay.

From the information available, the administrative exceedance of the water quality objective and associated administrative impairment of use would still be present, and quite likely to essentially the same degree, if the NCMT area sediments contained no copper ore concentrate.

There is no technical justification for the presumption made in the "Finding" for "Contention 1" (page 7),

> *"The revised cleanup level of 4,000 mg/kg does not comply with the requirements applicable to cleanup and abatement orders under Water Code Section 13304 and it is likely to violate the EBE Plan, Resolution No. 68-16, and other requirements."*

The technical flaws in the information, conjecture, and reasoning presented by the EHC in its petition with regard to this "Contention" were discussed in Exhibit 1 of the Port of San Diego's June 3, 1992 submission to the WRCB in response to the EHC appeal of the SDWQCB's adoption of Addendum no. 7, and Appendix B of Exhibit 1 of the Port of San Diego's June 3, 1992 submission to the WRCB in response to the EHC appeal of the SDWQCB's adoption of Addendum no. 7.

All of the technical information available leads to the conclusion that a 4,000 mg Cu/kg clean-up objective would be protective, especially considering that the copper-ore contamination in the vicinity of the NCMT currently present (to levels more than 50,000 mg Cu/kg) is not causing adverse impacts to water quality, and that the most-copper-contaminated NCMT-area sediments tested (containing copper in concentrations greater than 18,000 mg Cu/kg) have been found to be non-toxic to eight test organisms considering 12 response parameters; some of the organisms tested were known to be particularly sensitive to copper and were tested under short-term chronic testing conditions. In fact, the results from the intensive investigation show that a clean-up objective of more than 4,000 mg Cu/kg dry wt. would protect the beneficial uses of the Bay in accord with the Bays and Estuaries Plan as well as State Water Resources Control Board Resolution No. 68-16, 'Statement of Policy with Respect to Maintaining High Quality of Waters in California,' and the U.S. Environmental Protection Agency's Antidegradation Policy.

Under Finding 1, page 8, the Draft Order stated, *"The appropriate cleanup level is 1,000 mg/kg."*

A technical review of the technical foundation of the 1,000 mg Cu/kg clean-up objective was presented in testimony to the SDWQCB at the December 9, 1991 hearing and in Exhibit 1 of the Port of San Diego's June 3, 1992 submission to the WRCB in response to the EHC appeal of the SDWQCB's adoption of Addendum no. 7, and in Appendix B of Exhibit 1 of the Port of San Diego's June 3, 1992 submission to the WRCB in response to the EHC appeal of the SDWQCB's adoption of Addendum no. 7. As discussed in the Administrative Record the 1,000 mg/kg clean-up objective has no intrinsic water quality protection significance or technical foundation. While its adoption would be protective of beneficial uses of the Bay, it is unnecessarily stringent for that purpose.

The Draft Order referred to requirements of Section 13304 of the Water Code that specify that any person who has discharged waste into waters of the state in violation of a waste discharge requirement or other prohibition, is required

"to clean up and abate the effects thereof."

Further, the Draft Order stated,

> *"As stated in Resolution 92-49, 'dischargers are required to cleanup (sic) and abate the effects of discharges in a manner that promotes attainment of background water quality, or the highest water quality which is reasonable if background levels of water quality cannot be restored...'"*

Since the risk assessment studies conducted on behalf of the Port have found that the copper ore concentrate in the NCMT-area sediments is not adversely affecting the designated beneficial uses of San Diego Bay, there are no "effects" to be cleaned-up or abated. As demonstrated by the risk assessment studies, the water quality is at background conditions. Review of watercolumn data prior to PACO's operations and post-PACO toxicity test and biological studies at the site establish that the removal of copper ore concentrate from the NCMT-area sediments will not significantly change the water quality.

On page 9, paragraph 2, the Draft Order stated,

> *"The EBE Plan establishes narrative and numerical water quality objectives to ensure the reasonable protection of beneficial uses and the prevention of nuisance."*

The 4,000 mg/kg cleanup objective provides not only reasonable protection but also extraordinary protection of the designated beneficial uses of San Diego Bay waters from adverse effects of the copper ore concentrate.

On page 9, paragraph 2, the Draft Order stated that the two applicable narrative water quality objectives included in the EBE Plan are, *"(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.'"*

The studies conducted by the Port have clearly demonstrated that the copper ore concentrate and all other contaminants in the copper-contaminated NCMT-area sediments meet these objectives. The NCMT-area sediments are not toxic to a variety of highly sensitive aquatic life, that the differences and similarities between organism assemblages in and near the NCMT area are not related to the amount of copper present in the sediments, that known copper-sensitive mussels live naturally in the most heavily copper-contaminated area of the NCMT, and that watercolumn concentrations of copper were not different when measured in 1986 than they had been prior to the PACO operations at the NCMT. Thus, the narrative standards have been met. There is no technical foundation for the claim that the 1,000 mg Cu/kg clean-up objective would be required to "meet" the narrative objective.

On page 10, paragraph 3, the Draft Order stated,

"With regards to compliance with the EBE Plan, the record indicates that 1,000 mg/kg is the cleanup level that is most likely to attain the numerical standard in the EBE Plan of 2.9 μg/L (1-hour average)."

That statement is inaccurate. There is no technical justification to support the position that achieving a 1,000 mg/kg clean-up objective will significantly affect the frequency and magnitude of exceedances of the watercolumn water quality objective or that attainment of that clean-up level is necessary to achieve the numeric objective. It is important to emphasize that that water quality objective for copper as implemented is widely recognized as being overly restrictive for the protection of beneficial uses. The US EPA has recognized this situation and has proposed to alter the implementation of its water quality criteria so that that objective would no longer be implemented based on total copper concentrations in the watercolumn.

On page 10, paragraph 3, the Draft Order stated,

"Information provided by the Petitioners indicates that several species of marine organisms suffer toxic effects where sediment levels are at or below 390 mg/kg."

Evaluation of the technical foundation for the so-called "information" provided by the Petitioners in this regard demonstrate the technical invalidity of the quoted statement. As discussed at the December 1991 hearing before the SDWQCB, and in detail in Appendix B of Exhibit 1 of the Port of San Diego's June 3, 1992 submission to the WRCB in response to the EHC appeal of the SDWQCB's adoption of Addendum no. 7, the 390 mg Cu/kg value was extracted from the Long and Morgan "co-occurrence" information and misapplied to this site. Contrary to the statement made in the Draft Order quoted above, the value of 390 mg Cu/kg is not a concentration which when present in sediments has been found to cause adverse effects to aquatic life. Long and Morgan did not make "cause-and-effects" determinations. What they reported was that in those sediments on which copper was measured, half of the sediments (50 percentile) that showed toxicity (the cause of which was not assessed) contained copper at that concentration. There was no presumption by Long and Morgan that that concentration of copper, or any other concentration of copper (or of other chemicals measured) was responsible for causing toxicity; they merely listed a number of characteristics of sediments that exhibited some laboratory toxicity. There is a wide variety of other contaminants not considered by Long and Morgan that are much more likely to be the cause of the observed toxicity than copper. Further, some of the ways in which toxicity was assessed (such as the Microtox procedure on sediment extracts) are known to be invalid and unreliable.

As discussed in other materials being submitted to the WRCB providing comments the State Board staff Staff Comments, there is no technical foundation for a claim that any number selected from Long and Morgan's tables of co-occurrence for copper, would or could be expected to cause toxicity. It is well-known that the concentrations of contaminants in sediment are unreliable indicators of potential toxic effects. The petitioners' position that sediment-associated copper causes adverse effects at 390 mg/kg is, which was repeated as fact in the Draft Order, is incorrect and does not properly reflect the technical information or the nature and origin of this value. A review of the numerous toxicity tests on NCMT-area sediment clearly dispels that position.

On page 10, paragraph 3, the Draft Order also stated,

> *"Further, the Regional Water Board concluded in Order No. 85-91 and Addendum No. 1 that data from the State Mussel Watch Program demonstrate that the copper contaminated sediment has affected the marine environment and that the contaminated sediment is continuing to discharge copper to the water column."*

As noted above, that statement does not properly reflect the information available today as presented in the Woodward-Clyde report. It is also based on information developed before the Port District was even a party to this proceeding, and the Port District had no opportunity to address it.

On page 11, paragraph 1, the Draft Order stated,

> *"The Dischargers assert that information from studies performed by their consultants demonstrate that the copper they discharged to the Bay is not toxic to aquatic life because it is stable, highly insoluble, and thus largely unavailable to affect aquatic life. They assert that even at levels as high as 19,800 mg/kg no impacts to aquatic life would occur."*

The quoted statement is an inaccurate and misleading representation of the information provided in this matter by the "Dischargers." First, the conclusion that the sediment-associated copper is largely unavailable to affect aquatic life was not developed simply on the basis of the characteristics of the chalcopyrite (the copper ore), although the nature and behavior of chalcopyrite support the finding. The WCC (1991) report and other information in the Administrative Record, the authors' comments on the Staff Comments, and previous discussion herein discuss the information upon which the assessment was made. Finally, the statement with corrected concentration information, is a misrepresentation of the technical information. It was not an "assertion" regarding levels of copper that did not adversely affect aquatic life. Levels of sediment-associated copper as high as more than 18,000 mg/kg were found to be non-toxic to embryos/larvae of copper-sensitive aquatic life in short-term chronic exposure conditions. Furthermore, mussels known to be copper-sensitive are living naturally in areas of the NCMT sediment that contain some of the highest concentrations of copper there.

On page 12, paragraph 1, the Draft Order stated,

"As noted above, the San Diego Bay is listed in the State Water Board's 1990 Water Quality Assessment as having impaired water quality due, in part, to high levels of copper."

As discussed above, this so-called "impaired water quality" reportedly due to copper is an administrative exceedance impairment, not an ecological or public health-related impairment. Further, the role of copper ore concentrate in contributing to this exceedance is expected, based on the findings of the risk assessment review, to be small and insignificant if any.

The Draft Order also stated on page 12,

"As this Board noted in Order No. WQ 91-10, a 'major source of copper pollution comes from copper ore deposits in the vicinity of Paco Terminals.'"

The results of the studies and review of existing information conducted by the authors do not support that position and, in fact, clearly refute it.

On page 13, the Draft Order stated,

"As noted above, the Dischargers have not provided adequate information to establish that the 4,000 mg/kg level will protect beneficial uses."

That statement is inaccurate. There is substantial information presented in the Administrative Record to support the conclusion of the SDWQCB that the 4,000 mg Cu/kg clean-up level is highly protective of the designated beneficial uses of San Diego Bay. Much higher values could be adopted without impairing these uses.

The Draft Order also stated on page 13,

"Other information in the record indicates that a level of 1,000 mg/kg will comply with the EBE Plan's numerical standard of 2.9 μg/L."

As discussed above and at length in the Administrative Record, there is no technical reason to assert that achieving a 1,000 mg/kg clean-up objective will result in a significant difference in the frequency and magnitude of the exceedances of the 2.9 μg/L water quality objective. While achieving that objective would protect designated beneficial uses of San Diego Bay, its achievement is not necessary to protect beneficial uses; objectives substantially higher than that, indeed higher than the 4,000 mg Cu/kg objective adopted by the SDWQCB, would provide protection of beneficial uses of the Bay. As discussed above, comparison of the nature and strength of the technical information in support of the 1,000 mg/kg objective with that in support of the 4,000 mg Cu/kg objective shows that the evidence in support of the latter is substantially stronger and more reliable.

On page 13, paragraph 2, the Draft Order stated,

"Economic considerations, while relevant to setting cleanup levels, are not the only factors."

The implication of the statement quoted from the Draft Order is that the Port and PACO have only considered economic factors in supporting the 4,000 mg/kg copper clean-up objective. That implication is highly inaccurate. The 4,000 mg Cu/kg was proposed at the authors' suggestion to the Port, based on extensive risk assessment studies that demonstrated that that objective would be highly protective, on its practical implementability within a short time, and on political considerations. The technical information showed that a clean-up objective substantially higher (as high as 18,000 mg Cu/kg - the most contaminated sediments tested in toxicity tests) could be appropriate. At the time that the authors' made this suggestion, they did not know the magnitude of the economic impact of selecting the 4,000 mg Cu/kg clean-up objective. It was subsequently learned that adoption of a 4,000 mg Cu/kg objective would save the Port and public and private interests approximately $4 million out of an approximately $7 million clean-up program. While economic considerations were not the cause of selection of the 4,000 mg Cu/kg objective adopted by the SDWQCB, certainly such an economic factor strongly supports not forcing clean-up just for clean-up's sake but instead adopting the technically valid, cost-effective approach for managing this material in an expedient, efficient manner.

OVERALL CONCLUSION

It is clear that the individual(s) who prepared the Draft Order have chosen to ignore the vast amount of technically sound information in the Administrative Record that supports the SDWQCB's conclusion that the 4,000 mg/kg copper clean-up objective for the NCMT area sediments is protective of the designated beneficial uses of San Diego Bay. In this Draft Order the Board has been provided with a highly biased, technically unreliable assessment of the information available on the impact of the copper-contaminated sediments in the NCMT area on beneficial uses of San Diego Bay.

REFERENCES

WCC (Woodward-Clyde Consultants), "Remedial Action Alternatives for National City Marine Terminal," Final Report, Prepared for San Diego Unified Port District, San Diego, CA, July (1991).

6

Technical Support for

SDWQCB's Adoption of 4,000 mg Cu/kg

Clean-up Objective for

National City Marine Terminal-Area Sediments

San Diego Bay

G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D.

Areas of Expertise:
- Aquatic Biology/Toxicology
- Aquatic Chemistry
- Environmental Engineering
- Public Health

Experience: 32/16 yrs
- Evaluating the Significance of Chemical Contaminants in Sediments
- Teaching Graduate Aquatic Chemistry

Risk Assessment

Chemical Contaminants Exist in Aquatic Systems in a Variety of Forms, Only Some of Which Are Toxic-Available to Adversely Affect Aquatic Life

- Selective, Sequential Testing and Evaluation of
  - **Aquatic Chemistry** (Chemical Nature, Fate and Transport) of Contaminant(s)) of Concern, and
  - Their **Aquatic Toxicology** (Impact) in a
  - Tiered Framework of Increasing Sophistication of Specificity
- Yield Assessment of
  - Adverse Impacts That the Given Situation Has on Designated Beneficial Uses
  - Degree of Contaminant Control Needed to Protect Designated Beneficial Uses
  - Evaluate Improvement in Water Quality That Could Be Achieved as a Result of Implementing Various Contaminant Control Approaches

Summary of Results of Lee & Jones-Lee Risk Assessment Study

- NCMT-Area Sediments Contain Copper to ≈50,000 mg Cu/kg (at 2-3 ft deep)

- Toxicity Tests with NCMT-Area Sediments Containing ≈18,000 mg Cu/kg Did Not Adversely Affect Sensitive Test Organisms

- Overall, 9 Different Types of Organisms Tested
  Considered 14 Response Parameters
  Shrimp, Flat Fish, Sea Urchin Eggs & Embryos, Clams, Worms, 2 Types of Amphipods, Fish Larvae, Pacific Oyster Embryos/Larvae
    - ***Embryos of Pacific Oyster Reported by US EPA to Be One of the Most Sensitive Organisms/Stages to Copper in Salt Water***

- *Mytilus edulis* (mussel) Occurs Naturally in Area of NCMT in Which Sediments Contain Some of Highest Concentrations of Copper Reported
    - ***US EPA Found That Embryos of Mytilus edulis Were the Most Acutely Sensitive to Copper of the Marine Organisms It Evaluated***
    - ***Sensitivity of Mytilus edulis Basis for US EPA Water Quality Criterion for Copper***

Summary of Findings
Dr. G. Fred Lee and Dr. Anne Jones-Lee

Risk Assessment Conclusions

- Copper Ore Concentrate Now in NCMT-Area Sediments Is *Non-Toxic and Not Available*

- Copper in NCMT-Area Sediments Is *Not Having an Adverse Impact* on Beneficial Uses of San Diego Bay

- The 4,000 mg Cu/kg Clean-Up Objective Adopted by Regional Board *Could Be Raised Substantially and Still Protect* Beneficial Uses of San Diego Bay

Summary of Inaccurate Claims - Staff's Draft Order

- (pgs 3&4) The Proposed 1,000 mg/kg Clean-Up Objective Has Technical Support - **NOT TRUE - Based on Inappropriate Interpretation and Use of Unreliable Data**

- (pgs 4&10) Mussel Watch Data Show That the NCMT-Area Sediment Copper Is Causing Elevated Copper in Mussels in San Diego Bay - **NOT TRUE - Mussels in NCMT Area Have Same Copper Concentrations as Mussels from Other Parts of San Diego Bay**

- (pgs 6&12) Copper in NCMT-Area Sediments Is Causing Impairment of Water Quality-Beneficial Uses of San Diego Bay - **NOT TRUE - Determination of "Impairment of Uses" of San Diego Bay Reflects Administrative, Not Ecological Assessment - Based Solely on Alleged "Exceedance" of Overly Protective Water Quality Objective for Copper**

- (pgs 10,12,&13) 1,000 mg/kg Clean Up Objective Is Likely to Cause the Attainment 2.9 μg/L Water Quality Objective **- NO BASIS - Concentrations of Copper in Watercolumn Exceeded Current Numeric Water Quality Objective before Paco Terminal Operation. Would Be Present Even if All Copper Ore Concentrate Were Removed from the Bay. "Exceedance" Due to Other Causes**

(continues)

Summary Continued

- (pg 10) 390 mg/kg Copper Sediment Concentration Proposed by EHC Has Technical Validity - **NOT TRUE - 390 mg/kg Value Developed from Co-occurrence of a Few Chemicals to "Impacts" (NOT CAUSE AND EFFECT). Not Valid Approach to Evaluate Water Quality Impacts of Copper or Other Sediment-Associated Chemicals**

- (pg. 13) There Is Inadequate Justification to Support the 4,000 mg/kg Clean-Up Objective Adopted by the Regional Board - **NOT TRUE - Extensive Data and Information Presented That Justifies the 4,000 mg/kg Clean-Up Objective Adopted by San Diego Regional Board - Protective of Beneficial Uses of San Diego Bay**

- (pg. 13) 4,000 mg/kg Objective Based Only on Economic Considerations - **NOT TRUE - Value Supported by a Proper Technical Evaluation of Beneficial-Use Protection and Political Factors That Impact Clean-Up Requirements**

A Proper Review and Presentation of Information in Administrative Record Demonstrate That the San Diego WQCB's Adoption of 4,000 mg/kg Clean-Up Objective Was Appropriate and Should Be Upheld by the Board.

Conclusion

Staff's Draft Order Does Not Provide Valid Technical Support for Proposed 1,000 mg Cu/kg Clean-Up Objective

Staff's Draft Order Does Not Provide Valid Technical Refutation of Validity of 4,000 mg Cu/kg Clean-Up Objective Adopted by the Regional Board

The Proposed 1,000 mg Cu/kg Clean-Up Objective Overly Conservative for Protection of Water Quality/ Beneficial Uses; Wasteful of Public & Private Funds

Clean-Up Objective Can Be Raised Considerably Above 4,000 mg Cu/kg without Impairment of Beneficial Uses of San Diego Bay

7

Comments on

State WRCB Staff "Preliminary Comments on the Woodward-Clyde Report on Copper Pollution at the National City Marine Terminal, San Diego Bay"

Prepared by

G. Fred Lee, Ph.D. and Anne Jones-Lee, Ph.D.
President Vice-President
G. Fred Lee & Associates
El Macero, CA 95618
(916) 753-9630

September 15, 1992

In December 1991, the San Diego Regional Water Quality Control Board (SDWQCB) adopted Addendum no. 7 to Clean-up and Abatement Order no. 85-91 that prescribed a clean-up objective for copper-contaminated sediments in the vicinity of the National City Marine Terminal in San Diego Bay of 4,000 mg Cu/kg dry wt. While the Regional Board staff had originally recommended a 1,000 mg/kg clean-up objective, after testimony presented by the Port of San Diego and others, the staff stipulated that a 4,000 mg Cu/kg clean-up level or higher would have no adverse biological impacts, and the SDWQCB adopted the 4,000 mg/kg objective. Adoption of that Addendum was appealed to the State Water Resources Control Board (WRCB) by the Environmental Health Coalition (EHC) and E. Sprofera.

The WRCB staff prepared a set of "Preliminary Comments on the Woodward-Clyde Report on Copper Pollution at the National City Marine Terminal, San Diego Bay" ("Staff Comments") which provided the only technical basis upon which a draft WRCB Order was developed to overturn the SDWQCB Order and support the initially recommended clean-up objective of 1,000 mg Cu/kg. Presented below is a critique and discussion of the technical deficiencies in those comments.

Introductory Material
(Staff Comments page 1 and paragraph 1 of page 2)

- The opening statement of the WRCB Staff Comments was:

> *"The following analysis is based on very little review time and is limited to technical issues relevant to the Woodward-Clyde report entitled Final Report, Remedial Action Alternatives for National City Marine Terminal, prepared for the San Diego Unified Port District (no date provided). Other information in the record was not reviewed."*

The authors of these comments (Lee and Jones-Lee) were responsible for developing the risk assessment aspects of the Woodward-Clyde report (WCC, 1991). It is indeed unfortunate that the staff did not thoroughly review WCC (1991) or its backup documents, or the other technical materials that have been submitted to the SDWQCB and that the SDWQCB considered in its decision. The issues of technical concern that the staff raised in its Staff Comments are addressed directly in materials within the Administrative Record; many of them were also addressed in the Woodward-Clyde report (WCC, 1991) that the staff stated it had reviewed.

The fact that the staff was not provided adequate time/support to critically review all of the information in the Administrative Record on this matter should not be used as justification for a recommendation to the WRCB that it overturn the SDWQCB's analysis of the situation and thereby cause the Port of the San Diego (the people in the San Diego region) an additional several million dollars in NCMT sediment cleanup to remove copper from the sediments that is clearly not having a significant adverse impact on the designated beneficial uses of San Diego Bay. As discussed below, a critical review of all of the information in the Administrative Record (as well as this discussion of the issues raised by the WRCB staff in its "Comments" on the Woodward-Clyde report that have not been raised previously) does not support the WRCB staff's position that a 1,000 mg Cu/kg clean-up objective is appropriate for the remediation of the copper-contaminated sediments in the NCMT area. It also seems that the staff did not even review Woodward-Clyde report in any detail or with particular objectivity.

- On page 1, the Staff Comments listed four "provisions" that the preparer indicated "must be considered" in order to support a particular clean-up level of residual copper that is greater than background. The staff stated with regard to those provisions,

> *"The information available must be sufficient to allow for a professional judgement that the remediation alternative complies with the four provisions."*

As discussed further below, a review of the Administrative Record would show that the technical information does not support a 1,000 mg/kg clean-up objective over a 4,000 mg/kg objective. As discussed in the materials submitted to the SDWQCB, the 1,000 mg/kg clean-up objective was based on faulty analysis of inadequate data on the copper concentrations in interstitial waters taken from the sediments in the NCMT area. The technical information in the Administrative Record shows that the 4,000 mg/kg clean-up objective adopted by the SDWQCB is highly conservative in protecting the designated beneficial uses of San Diego Bay. This is supported by the integrated use of a wide variety of technical information and good and experienced professional judgement that shows that a clean-up objective considerably higher than 4,000 mg Cu/kg could be justified and still protect the designated beneficial uses of San Diego Bay.

In the following paragraph on page 1 of the Staff Comments, a summary was presented of the staff's assessment of how well the Woodward-Clyde report addressed the four provisions noted.

- The Staff Comments stated that the Woodward-Clyde report *"adequately addresses provision* *number 2"* which was, *"That the concentration of copper (or other metals associated with the ore) in tissue of organisms at the site not exceed a level hazardous to human health"*.

- The Staff Comments then asserted, however, that the Woodward Clyde report *"provides some, but not adequate information to address provisions 1 and 3"* which were, *"That communities and populations of organisms at the site are not degraded as a result of the residual copper ore,"* and, *"That the concentration of copper in sediment, water or tissue of organisms not result in adverse effects on beneficial uses"*.

  It was the authors' finding as reported in WCC (1991) that considering

  all of the information on communities and populations of aquatic organisms in the NCMT area and elsewhere in San Diego Bay,
  the lack of toxicity of whatever chemicals are present in the copper-contaminated NCMT-area sediments,
  the aquatic chemistry of copper, and
  the technical basis and rationale for the current water quality objective for copper,

  there is substantial technical justification for the conclusion that the copper-contaminated sediments that currently exist in the NCMT area are not adversely affecting the beneficial uses of the area. Thus, it is unlikely that the copper ore remaining after remediation to whatever level is selected would adversely affect beneficial uses of San Diego Bay. These issues are discussed further in subsequent sections of this report.

- The Comments continued on to claim that the Woodward-Clyde report *"provides no technical information to evaluate provision 4"* which was, *"That the residual sediment copper not contribute to exceeding a water concentration of 2.9 ppb* [µg Cu/L] *copper."*, the water quality objective adopted for San Diego Bay in April 1991.

  Had the staff been provided with the time necessary to critically review the information that is in the Administrative Record and that was provided to the SDWQCB in connection with this matter (including the Woodward-Clyde report (WCC, 1991)), they would have found several important aspects of that expressed concern.

  * First, the issue of exceedance of the water quality objective was not raised by the SDWQCB or others until a few weeks before the December 1991 SDWQCB hearing on the proposed clean-up objective. Watercolumn concentrations of copper in the NCMT area were not an issue raised by Addendum no. 6 which provided guidance on the information requested in support of a sediment clean-up objective alternative to the then-proposed 1,000 mg Cu/kg.

  Second, that notwithstanding, the Woodward-Clyde report (WCC, 1991) did provide a discussion of the information available pertinent to concentrations of copper in the watercolumn in the NCMT area. Section 3.4.4 ("Copper in the Watercolumn") of that report (pages 3-18 through 3-25) specifically discussed copper concentrations reported in the literature for San Diego Bay that were pertinent to the evaluation, data that later served as a basis for the allegations that the copper in the NCMT-area sediment was contributing in a significant way to the exceedance of the 2.9 μg Cu/L water quality objective, as well as the implications of the forms and concentrations of copper found in the watercolumn. After four pages of discussion, in the first paragraph of page 3-22 of WCC (1991), it was concluded,

> *"Therefore, the range of dissolved copper concentrations found by WESTEC (1986a) are in accord with what has been found in other parts of the Bay where the sediment concentrations are much lower* [than in the NCMT area]. *This suggests that the higher sediment copper concentrations at NCMT are not significantly affecting water column concentrations."*

Furthermore, WCC (1991) discussed data reported in the literature on the concentrations of copper in the area of the NCMT prior to the PACO operations there. After presenting summary description of the data and findings, WCC (1991) reported on page 3-20, samples collected from the upper 1 m of water at the 32nd Street Naval Shipyard (Navy Pier) (just north of the NCMT - see WCC (1991) Figure 2-1) monthly between July 1978 and June 1979 showed that

> "[t]*he total copper present in the Shelter Island Yacht Basin and Navy Pier waters exceeded the water quality objective adopted by the State Water Resources Control Board in April 1991 of 2.9 μg/L."*

WCC (1991) concluded on pages 3-2 to 3-3,

> *"In previous studies, it was found that concentrations of copper in the watercolumn above NCMT-area sediments contained elevated concentrations of copper higher than the California water quality objective currently applicable to San Diego Bay. Similar situations were found in other parts of San Diego Bay even prior to the initiation of copper ore concentrate transfer operations at the NCMT. In its studies to establish the water quality criterion for copper (recently adopted as the water quality objective by the state Water Resources Control Board), the U.S. EPA found that the embryos of a particular mussel, Mytilus edulis, were the most acutely sensitive to copper of the marine organisms it evaluated. That species of mussel presently occurs naturally in the vicinity of NCMT in an area in which the sediments contain some of the highest concentrations of copper. This indicates that the concentrations of copper reported in the watercolumn near the NCMT sediments. if still present, are not available/toxic to those organisms."*

Thus, contrary to the claim made in the Staff Comments that WCC (1991), *"provides no technical information to evaluate provision 4"*, clearly it did provide and discuss the implications of the technical information with regard to the evidence for the NCMT-area sediment-associated copper to be contributing to an exceedance of the current water quality objective for copper of

2.9 μg/L. Further, as discussed subsequently herein, WCC (1991) provided a detailed technical review of the nature of the forms of copper measured with analytical methods used by various investigators and the implications of the chemical concentration data, as well as toxicity test and other biological data, for adverse impacts on the beneficial uses of San Diego Bay. That technical review included consideration of the technical basis and rationale for the US EPA water quality criterion for copper and the California water quality objective of 2.9 μg Cu/L and their relationship to the findings of the authors' risk assessment as presented by WCC (1991).

Third, when the issue of alleged exceedances of the water quality objective in the NCMT area was raised just prior to the SDWQCB hearing, the authors provided in-depth discussion of the pertinent technical issue to the SDWQCB which caused this Board and its Executive Officer to conclude (see transcript of the December 1991 hearing) that the copper in the sediments of the NCMT area was not having an adverse impact on the designated beneficial uses of San Diego Bay. This conclusion included consideration of the exceedances of the water quality objective for copper that have been established for San Diego Bay.

- After making its overall assessment of how well the Woodward-Clyde report addressed the four "provisions," the Staff Comments stated,

> *"The proposed remediation sediment concentration of 4000 ppm copper (total dry weight) was not specifically evaluated and tests that were conducted utilized sediments substantially above or below this value."*

The study approach developed and followed for the risk assessment portion of the work was a technically sound and conservative in accord with the standard tiered hazard (risk) assessment approach. As discussed by WCC (1991) (in the Risk Assessment section (Section 3) and at various locations including page 2-2), the approach was to test the most contaminated (worst-case) sediments, area sediments containing little if any copper-ore contamination, as well as sediment with intermediate copper concentration. Again, in keeping with standard hazard assessment approaches, the justification for that approach is that if the most copper-contaminated area of the NCMT does not cause toxicity, there would not be toxicity associated with lower levels of contamination by that contaminant. The intermediate and low copper-contamination samples were tested to screen for possible unusual behavior or indications of other contaminants' causing toxicity. Such a testing regime would signal the potential need for higher-tier testing. Further, the fact is that NCMT-area sediments containing copper concentrations above, but close to, the 4,000 mg/kg clean-up objective (6,067 mg Cu/kg) were tested with six different test species evaluating eight response characteristics in previous studies (WESTEC - ERCE, 1988) the results of which were provided in the WCC (1991) Table 2-2. As discussed by WCC (1991), there was no toxicity response in those tests.

After substantial discussion of the pertinent technical aspects, WCC (1991) (page 3-7) concluded,

> *"Therefore, there were significant questions about the need to remove any or all*

relationship that could provide insight into appropriate clean-up levels.

In keeping with principles of technically appropriate hazard assessment, the first tier of toxicity testing focused on the worst-case situation (sediments with the highest concentration of copper), and included toxicity testing of the low-copper sediment and one sediment with intermediate copper concentration. If there was no toxicity associated with the most heavily copper-contaminated NCMT-area sediments, it would be unlikely that there would be toxicity caused by copper associated with area sediments less-contaminated with copper. If, however, there was toxicity with the most heavily copper-contaminated sediments, samples with two additional intermediate copper levels were readily available for toxicity testing to assess whether there was a relationship between the concentration of copper in the NCMT-area sediments and the toxicity caused by the sediments.

With the exception of the tests with *Rhepoxynius*, no toxicity was found in tests of sediments containing the highest concentrations of copper. In the case of the *Rhepoxynius* tests, as discussed further below (as well as in the WCC (1991) report and elsewhere in the Administrative Record), the toxicity response was found to not be related to the concentration of copper in the sediment. Thus, contrary to the claims made in the Staff Comments, ample, technically responsible, provisions were made in the risk assessment study program to investigate the sediment-associated copper as cause of toxicity; the fact is that there was no toxicity in the most heavily contaminated sediments tested.

As noted above, by testing the intact sediment the cumulative impact of all of the sediment-associated contaminants could be determined. Then, if no adverse impacts were found (as was the case for the NCMT-area copper-contaminated sediments) it is logical to conclude that copper in those sediments is not having an adverse impact on the designated beneficial uses of San Diego Bay. It is also important to note that that information was not the only information considered in the assessment of potential impact of the NCMT-area copper-contaminated sediments on water quality. In addition to the finding that the whole sediments were not toxic to eight different sensitive test organisms considering 12 response parameters, it was found that the natural populations of sediment-associated organisms in the vicinity of the NCMT area in which elevated concentrations of copper were present are not significantly different in terms of numbers and types of species than those that are present in other areas of the Bay that do not contain the copper ore concentrate, and that copper-sensitive mussels are found to naturally inhabit areas of the NCMT area in which some of the highest concentrations of copper were found in the sediments. These findings provide a very strong technical foundation for the conclusion that the copper in the NCMT area sediments is non-toxic and unavailable to aquatic organisms in the NCMT area as well as other areas of the Bay.

Third, it is unclear what type of testing the staff had in mind when it faulted the WCC (1991) study for not conducting *"tests that would isolate copper as a contributing factor to the adverse effects investigated."* even if it were appropriate. It is not possible to reliably selectively extract the copper-ore-concentrate-derived copper from the sediment for toxicity testing. The only other approach that the authors can guess the staff had in mind would be "spiked" *of the copper-contaminated sediments from the NCMT area in order to protect beneficial uses of San Diego Bay."*

While the focus of the discussion in the WCC (1991) risk assessment was on whether the originally proposed 1,000 mg Cu/kg clean-up objective would be protective, as discussed therein that value was established without reliable technical foundation. Indeed the risk assessment demonstrated that there was technical justification for a substantially higher clean-up objective. On the basis of those findings, the alternative clean-up objective of 4,000 mg/kg was proposed to the SDWQCB and substantiated with technical information available. Thus, the risk assessment cannot be viewed as deficient for having not specifically evaluated sediments containing 4,000 mg Cu/kg. The technical information and discussion in support a 4,000 mg Cu/kg clean-up objective should not be dismissed simply because the staff did not, by its own admission, review the entire Administrative Record upon which the SDWQCB made its decision in favor of the 4,000 mg Cu/kg clean-up objective.

- The Staff Comments continued by stating,

> *"Generally, the* [WCC, 1991] *report provides some support for a remediation level of 1000 ppm copper, some indication that 2000 ppm copper should be considered, and no support for the proposed 4000 ppm copper remediation level (although a 4000 ppm level cannot be rejected as non-protective on the basis of the information available.)"*

As noted above, in the materials submitted to the SDWQCB and to the State Board by the authors, provided ample evidence to justify a 4,000 mg/kg copper clean-up objective, including the fact that:

- The copper-contaminated sediments in the NCMT area were found to be non-toxic to eight different, sensitive aquatic organisms under extreme exposure conditions most of which were likely worse that what would be found in the NCMT area; and
- Aquatic organisms of a type known to be highly sensitive to copper toxicity are present in large numbers in area near the NCMT that contain the highest concentrations of sediment-associated copper; they are apparently reproducing in the vicinity of the copper-contaminated sediments.

These findings, also noted in WCC (1991) lead to the unequivocal conclusion that the copper present in the NCMT-area sediments is in a form that is non-toxic and unavailable to adversely affect the designated beneficial uses of San Diego Bay waters. While the staff attempts to find flaws in this analysis, the data and discussion analysis provided in the Administrative Record clearly demonstrate the technical validity of it and justification for the conclusion that a 4,000 mg Cu/kg clean-up objective would be protective of the beneficial uses of San Diego Bay.

- The staff stated on the last paragraph of page 1 and the first paragraph of page 2 of the Staff

Comments with reference to the Woodward-Clyde Report,

> *"A failing of the report is that it contains no tests that would isolate copper as a contributing factor to the adverse effects investigated."*

The quoted statement of the staff represents a highly inaccurate assessment of the work that was done. It also does not reflect an understanding of how to proceed to evaluate the potential of a particular contaminant, such as copper, associated with a sediment that could contain a myriad known and unknown chemical contaminants from the copper ore concentrate or other sources to adversely impact the designated beneficial uses of a waterbody, such as San Diego Bay. There are several aspects of the response to that claim of the Staff Comments.

First, Dr. Lee has been involved in work on impacts of contaminants in sediments since the early 1960's; Dr. Jones-Lee, since the mid-1970's. Since the 1970's they have been pioneers in the development and application of the tiered hazard assessment approach for investigating the impacts of chemical contaminants on water quality and for developing and evaluating the expected impacts of control programs on water quality; they are well-published and well-recognized nationally and internationally in this arena.

Second, the authors designed the hazard-risk assessment studies requested by the SDWQCB to screen for adverse impacts of the sediment-associated chemical contaminants in the NCMT area that had elevated concentrations of copper. While the copper in the sediment was the main focus, there was also concern about potential effects of other heavy metals also constituent of the copper ore concentrate. Thus, isolation of the copper from the sediment for testing, were it possible, would not have provided an assessment of the toxicity of the "real world" situation that exists near the NCMT. Had the sediment-associated copper been able to have been isolated for toxicity testing alone in the early-tier hazard assessment, the data would not have been interpretable. It would also not have been advisable to make this isolation because of other contaminants potentially associated with the copper-ore-concentrate-contamination of the sediment.

The study program reported in WCC (1991) was, in fact, established in accord with standard, tiered hazard assessment technique specifically to investigate the role of the sediment-associated copper in causing toxicity. The approach was guided by existing information on the concentrations of copper in the area and the results of previously conducted toxicity tests. Those toxicity tests showed no toxicity to NCMT-area sediments containing as much as about 6,000 mg Cu/kg. However, toxicity tests had not been previously conducted on sediments with the highest copper concentrations. The WCC (1991) study thus focused on collecting sediments from the most heavily copper-contaminated area near the NCMT, from an area of the NCMT with little or no copper contamination, and from three locations with intermediate levels of copper (WCC, 1991, page 2-2). By conducting toxicity tests on area sediments containing various concentrations of copper, it is possible to evaluate whether the copper in the sediments were causing incremental toxicity in the tests and hence to examine the potential role of copper in the sediments in causing observed toxicity, i.e., whether there was a "dose-response" bioassays. Such an approach would yield no useful information pertinent to assessing the potential beneficial use impact of the copper-ore-concentrate-contaminated NCMT-area sediments. Any information developed from such testing could in fact be highly misleading. In comments they submitted to the WRCB (Lee and Jones, 1991), the authors have discussed in detail the severe technical deficiencies in the "spiked bioassay" approach for sediment toxicity assessment. For example, in their discussion of toxicity identification evaluations (TIE's) Ankley *et al.* (1991) also noted these problems in the context of spiking to try to confirm the cause of toxicity in a sediment. They stated, *"There are a number of factors to consider when using spiking as a confirmation tool. For example, spiking may not work well for compounds such as metals, where there is little or no understanding of the speciation reactions that may occur in complex solutions. Because different forms of metals have different toxicities, toxicity of the spiked metal may differ from that of the metal in the original sample. This would make it appear that the identification of the suspect toxicant was wrong when it was in fact correct... A similar type of artifact theoretically also could occur when spiking chemicals with a great affinity to dissolved or particulate organic carbon... Binding to organic carbon can reduce bioavailability (and toxicity) of many nonpolar organic chemicals; however, this process may require a significant equilibration time. Thus, a 'fresh' nonpolar organic spiked into a sample may appear more toxic than a comparable amount of the same nonpolar organic already in the test sample... This would make it appear that the incorrect toxicant had been identified, when in fact there had been a correct identification."*

In general, a chemical "spike" added to a sediment cannot be expected to be present in the sediment in the same forms and same proportions as the chemical in the unspiked sediment; the spike may well not come to equilibrium with the chemical of focus or other constituents in the sediment prior to the bioassay. Thus it cannot be assumed without a major research effort that a chemical "spike" will behave in a manner in any way related to that of that chemical in the unspiked sample. This is well-established in the aquatic and sediment chemistry literature. The authors have found that spiked bioassays may be useful for some chemicals, such as ammonia, whose chemistry in sediments is relatively simple and straightforward. However, such chemicals are few; spiked sediment bioassays are totally unreliable for most of the contaminants of greatest concern (such as heavy metals and many chlorinated hydrocarbons) for their potential for affecting sediment and water quality. Therefore, for most chemical contaminants of concern, it cannot be assumed that the toxicity response to a spike has any relationship to the toxicity associated with the same chemical already present in the sediment. Since the reliability of that assumption is key to the spiked sediment bioassay methodology, the spiked sediment bioassay approach is not, in general, one that can be used to reliably assess the water quality significance of a contaminant or group of contaminants in a sediment.

The spiked bioassay approach is particularly inapplicable to the copper-ore-concentrate-contaminated sediments in the NCMT area owing to the form and nature of the copper. A discussion of key aspects of the chemistry of sediment-associated copper overall, as well as focused on the copper ore concentrate, was provided in WCC (1991) (pages 3-7 to 3-18).

In summary, since no adverse effects can be found for all of the contaminants in the

NCMT area sediments, including copper, why would the staff conclude that there is need to isolate hypothetical "adverse effects" of copper on the designated beneficial uses of San Diego Bay?

- The Staff Comments concluded that because the WCC (1991) report allegedly did not contain tests that would isolate copper as a contributing factor to the adverse effects investigated,

> *"Therefore, when effects are noted, as in the low diversity reported in the benthic analysis or the toxicity found in the amphipod test, one cannot conclude whether copper from the ore is or is not contributing to the effect."*

There are several aspects of that statement that must be addressed.

First, WCC (1991) discussed in detail the issue of the evidence for the NCMT-area copper to have an adverse impact on community diversity in Section 3.5.3 (pages 3-43 to 3-44), and Section 7.1.4.1 (pages 7-5 to 7-8). The discussion in Section 3.5.3 referred to the findings of WESTEC (1986) and stated,

> *"It is clear from the discussion presented in Section 7.1.4.1* [of WCC (1991) pages 7-5 to 7-8], *the previous investigation done by WESTEC (1986a) on the benthic organism community composition, numbers, and diversity at the NCMT area has shown that differences and similarities between organism assemblages in that area are not related to the amount of copper present in the sediments. These findings are consistent with the lack of toxicity of the sediments in the NCMT area to a variety of test organisms."*

The key figure from the cited WESTEC study that summarized the findings of the community character and diversity studies was provided to the members of the Regional Board at the hearing and is thus part of the hearing record.

Section 3.5.3 continued with a discussion of literature pertinent to the potential impacts of copper in San Diego Bay waters on colonizing organisms. There it is stated,

> *"Even though the concentrations of copper were above the water quality objective for the samples collected within the* [Shelter Island] *Yacht Basin* [near the mouth of San Diego Bay], *there was appreciable colonization of the plexiglass sheet substrates as well as of the existing structures. Since Johnston (1989) noted that colonization was largely by larval forms of the organisms, the concentrations of copper that exceeded the water quality objective of 2.9 µg/L were not sufficient to be toxic to the larval and other forms of organisms that colonized the plexiglass sheets and existing structures."*

Section 7.1.4.1 (pages 7-5 to 7-8) presented a detailed review of the WESTEC (1986) infaunal (organisms living within the sediment) community diversity study in the NCMT area and noted the WESTEC finding that the numbers of individuals and the number of species did not appear to be related to the concentrations of copper found in the sediments. In reporting on the WESTEC (1986) study results, WCC (1991) noted on page 7-6 paragraph 4,

> "*Cluster analysis was used to investigate the areal distribution of community structure parameters generated by the 1986 study (WESTEC, 1986). The cluster group characterized by the highest level of faunal* [organism] *density, was concentrated in the* [NCMT] *terminal area; the dominant organism was the small mussel Musculista senhousai, an organism typically found in high abundance in relatively undisturbed areas of south San Diego Bay (WESTEC, 1986). In fact, the highest density of Musculista observed (900/sample) was collected within 275 ft of the pierface at the north end of the terminal.*"

WCC (1991) went on to note with reference to that study (page 7-6, 7-7),

> *Significant relationships or strong trends between the biological variables and copper concentrations were not observed in a single case examined, strongly indicating the lack of effect of the copper ore on the infauna in the area (WESTEC, 1986).*"

Based on the WESTEC (1986) findings and those of other investigators, WCC (1991) concluded,

> "*These observations suggest that the major environmental features controlling biotic distribution in this* [NCMT] *region of San Diego Bay include relatively stronger water movement in the navigation channel, sediment instability, and sediment deposition rates in the bed of the navigation channel. Such impacts have been reported previously for other areas in San Diego Bay and elsewhere...*"

Additional insight into the issue of whether the copper ore in the NCMT-area sediments is contributing to the "effects" was provided by WCC (1991) in Section 3.4.4.3 (pages 3-24 and 3-25). The authors noted (page 3-25, paragraph 2),

> "*According to U.S. EPA (1985), the embryos of the blue mussel (Mytilus edulis) were the most sensitive organism/stage to copper of all the saltwater species for which acute toxicity data were available and considered in the development of its marine water quality criterion. ... It was thus on the basis of that toxicity to Mytilus edulis embryos that the "final chronic value" (criterion value) of 2.9 µg Cu/L was developed. Mytilus edulis live naturally in the NCMT area and in fact were harvested as part of the present study from an area at the pierface of the NCMT at which the highest concentrations of sediment-associated copper in the area have been found. It is therefore apparent that whatever the concentration of available forms of copper in the watercolumn, it is not sufficient to prevent the existence of that* [copper-sensitive] *organism.*"

Second, as discussed in the materials in the Administrative Record, the issue is not whether San Diego Bay sediments show a low diversity based on benthic organism analysis. The issue that should have been addressed is whether the NCMT-area sediments show a low diversity in benthic organisms that can be related in any way to the presence of copper in the sediments, specifically copper from the copper-ore concentrate. The information available in the Administrative Record shows that while there is a reduced diversity of the types of aquatic organisms in San Diego Bay sediments, this reduced diversity is prevalent throughout the Bay and is not in any way related to the presence of copper in the sediments in the NCMT area or elsewhere. Therefore, the staff's assertion that the low diversity is related to copper in NCMT area sediments is a flawed conclusion that is not supported by the data readily available for review.

Third, the quoted statement implied that the apparent toxicity reported for the amphipod test (*Rhepoxynius abronius*) by WCC (1991), can be considered to be an "effect" potentially related to copper in the NCMT-area sediment. WCC (1991) specifically discussed the issue of the toxicity response found in the *Rhepoxynius abronius* toxicity tests conducted as part of the study. The results of those tests were also discussed in materials submitted to the SDWQCB and that are part of the Administrative Record. The results of the *Rhepoxynius abronius* toxicity tests, in particular, conducted as part of the risk assessment were discussed on page 3-29 of WCC (1991). There it was stated,

> *"Table 3-1 summarizes the types of organisms and NCMT-are sediments on which toxicity tests have been conducted and the general findings from each. As indicated in that table, of the nine sensitive organism types tested considering 14 response parameters, only one test type/response resulted in adverse impacts under the laboratory conditions, the survival of the amphipods Rhepoxynius abronius.* ***The mortality of those test organisms was independent of copper concentration in the sediment.*** *Tests with sediments containing 122 mg Cu/kg dry weight showed as much mortality as tests with sediments from the NCMT pierface that contained more than 18,000 mg Cu/kg dry weight, and those with sediments containing 1,174 and 1,372 mg Cu/kg dry weight. While the survival of the Rhepoxynius in all NCMT area sediments tested was statistically lower than that in the control test on sediments from Yaquina Bay, OR, the survival of that amphipod in sediments from the NCMT areas of greater contamination was not statistically different from that in sediments 160 ft from the pierface (containing 122 and 151 mg Cu/kg dry weight).*
>
> *"The reburial behavior of the surviving test Rhepoxynius abronius exposed to the NCMT-area sediments was not significantly different from the control test on sediments from Yaquina Bay. The NCMT area sediments were not toxic to the other amphipod tested, Grandidierella japonica. For the reasons discussed below, the response of Rhepoxynius abronius in the present investigation needs to be interpreted with caution; the results obtained cannot be assumed to indicate that this organism is the 'most sensitive' of those tested."* (emphasis added)

Section 3.5.1.2 of WCC (1991) (pages 3-30 to 3-33) as well as some aspects of Section 3.5.1.3 (pages 3-33 to 3-38) discussed the technical issues pertinent to the use of *Rhepoxynius abronius* as a test organism for San Diego Bay sediments. WCC (1991) (page 3-33) concluded from careful review of the technical information,

> "*It* [is the authors'] *conclusion that, based on the information available, the toxicity response of Rhepoxynius abronius in tests of sediments near the NCMT should not influence decisions on the selection of the remediation objective for the copper ore concentrate-contaminated sediments. The preponderance of evidence from the tests of the eight other organisms, the existing infaunal populations present in the subject area, and the presence of native Mytilus edulis in the 'contaminated' areas near the NCMT, coupled with the response of Rhepoxynius to unknown factors and factors not related to the presence of known contaminants, causes us to conclude that the copper ore in the vicinity of the NCMT is not causing toxicity to aquatic life in the sediments or water of San Diego Bay.*"

While *Rhepoxynius abronius* can be a useful toxicity test organisms in some circumstances, it is not native to San Diego Bay; for some yet-undefined reason it has not been found to occur at any location in San Diego Bay even though it occurs naturally in areas a few hundred miles north of the Bay. It is clear, as discussed in the Woodward-Clyde report, that there are factors in the San Diego Bay sediments that preclude the normal survival of this organism in the toxicity test environment with sediments from San Diego Bay. The US EPA Region IX representative, Pat Cotter (1991) has concluded that *Rhepoxynius abronius* is not an appropriate organism for evaluating toxicity in San Diego Bay sediments.

The Staff Comments regarding "effects" implications of the "amphipod test" ignored the results of the WESTEC toxicity tests on *Grandidierella*, another amphipod which is a more appropriate test organism for San Diego Bay (results reported on and discussed in the Woodward-Clyde report (e.g., sections quoted above)). Those toxicity tests showed 100% survival of *Grandidierella* in tests of NCMT-area sediments containing more than 6,000 mg Cu/kg. The staff's statement indicating that the copper in the NCMT-area sediment is causing an adverse impact on amphipods is not in accord with the data provided in the Woodward-Clyde report, much less was available to the staff in their review of this matter. It is clear that the results of the amphipod tests do not show that the copper-contaminated sediments are adversely affecting anything in the Bay.

- The Staff Comments next asserted,

> "*The* [Woodward-Clyde] *report is distinguished by a lack of evaluation of the effects from any of the proposed remediation levels.*"

This issue was addressed above; the quoted statement was shown to be inaccurate and misleading.

- The Staff Comments continued on to claim,

> *"In general the studies presented* [in WCC, 1991] *were designed to address whether the remediation site is adversely effected (sic), but were not designed to discriminate among various concentrations of copper."*

That quoted statement is inaccurate in several regards. First, the risk assessment presented by WCC (1991) was, in fact, designed to investigate the potential impacts of various concentrations of copper in the NCMT area. As discussed above, the selection of sediment sampling locations was done to obtain a samples with a range of copper concentrations so that if toxicity were found in the toxicity tests, the relationship between the toxicity response and the copper concentration in the sediment could be assessed. The fact was, however, that none of the key toxicity tests (fish larvae survival, fish larvae growth, oyster larvae survival, and oyster larvae incidence of abnormality) showed any toxicity from any of the sediments tested, which included sediments containing as much as more than 18,000 mg Cu/kg. The same was found in the previous studies by WESTEC with six different types of organism with NCMT-area sediments containing two different concentrations of copper (1520 and 6067 mg Cu/kg). While the mortality of the Rhepoxynius was greater in the exposure to NCMT-area sediments than that in the control sediments from the state of Oregon, the toxicity response of that organism was as great in the NCMT-area sediment containing 122 mg Cu/kg as it was in NCMT-area sediments containing more than 18,000 mg Cu/kg. All of this was discussed plainly and at length in the Woodward-Clyde report and was presented to the SDWQCB and is thus in the Administrative Record.

Contrary to the implications of the Staff Comments, the design of the risk assessment studies was such that they provided ample technical foundation to support a clean-up objective of at least 4,000 mg Cu/kg. In fact, from the information available a clean-up objective in excess of 18,000 mg Cu/kg could have been readily justified. This finding was noted in the Woodward-Clyde report (cited and quoted above) as well as in testimony before the SDWQCB included in the Administrative Record. As discussed in the materials provided to the SDWQCB (in the Administrative Record), because of time constraints and political considerations the authors did not recommend an 18,000 mg Cu/kg clean-up objective, but rather a 4,000 mg/kg clean-up objective in order to not surpass the then-DHS (now DTSC) Title 22 levels by which copper-containing materials are classified as "hazardous waste." While in the authors' opinion it would have been possible, with additional study, to demonstrate that a variance from the "hazardous waste" designation could and should be provided to the Port, without adverse impacts to beneficial uses of San Diego Bay, so that a clean-up objective higher than 4,000 mg Cu/kg could be pursued, the time constraints imposed by the SDWQCB for clean-up of the copper-contaminated sediments precluded the possibility of undertaking the necessary studies to obtain the variance.

Therefore the staff's claim that there was inadequate consideration given to the specific role of copper in causing adverse effects on the designated beneficial uses of San Diego Bay and its claim that the Woodward-Clyde report failed to specifically address the clean-up objectives reflect the staff's limited review of the Woodward-Clyde report, and its having admittedly not reviewed the other material in the Administrative Record on the matter.

Provision 1: Community and Population analysis
(Staff Comments page 2)

- In its "more detailed discussion" of the "provisions" noted at the outside of the Staff Comments, the staff stated on page 2, in the first paragraph under the heading of "Provision 1: Community and Population analysis",

  "*The* [WCC, 1991] *report provides a summary of work conducted by WESTEC as part of the initial site evaluation. The report contends that this study shows no effects from the remediation site but acknowledges a lack of species diversity throughout the area. The Westec data is (sic) not provided for review.*"

By that statement, the staff has implied that the handling of this matter by the authors and in the Woodward-Clyde report was inappropriate and seems to suggest that there is some question about the appropriate reporting and analysis of the data from the WESTEC work. However, such implication and suggestion are highly inappropriate and reflect the fact that the staff did not have or take the time to review the materials readily available to it. As discussed previously in this report, with citations to and quotation of, the WCC (1991) report, the Woodward-Clyde report did contain detailed summaries of the pertinent data from the previously conducted WESTEC studies. Key personnel involved in the WESTEC studies contributed substantively to the Woodward-Clyde report. Not only are the WESTEC reports available in the SDWQCB files and well-known to the Regional Board, the summary figure regarding infaunal species diversity study results for the NCMT area from the cited WESTEC report was provided to the SDWQCB as part of hearing submissions and is hence part of the Administrative Record.

- Paragraphs 2 and 3 in the "Provision 1" section on page 2 stated,

  "*The* [WCC, 1991] *report notes that the density of animals seems to be a function of disturbance. This is demonstrated by animals typical of undisturbed areas of the bay present on the shelf areas and animals suited to disturbed habitats in the channel areas (subject to high current, prop wash, dredging). Correlations between population parameters and copper concentrations were not detected.*

  "*This study provides some indication that the copper ore is not exerting extreme effects on the biota. However, the fact that the entire study site appears to have depressed species diversity implies that adverse effects may exist over the entire area. If this is true, copper may be contributing and the adverse effects due to copper may not be* *distinguishable. The study does not contain information that would clarify this point."*

These quoted comments give the appearance of grasping at hypotheticals to cast question on the data available. First, a number of key aspects of the WESTEC study of species diversity in the NCMT area were quoted previously herein. The characterization of the WESTEC study as having provided "some indication that the copper ore is not exerting extreme effects on the biota" is a significant understatement and could suggest predisposition on the part of the author of the Staff Comments. The "low densities and diversities of infaunal organisms" reported by WCC (1991) (based on WESTEC, 1986) throughout the entire area cannot be reliably used to suggest an impact of the copper-contaminated sediment in the NCMT area. Indeed, the technical information strongly indicate otherwise, as was reported by WCC (1991).

WCC (1991) noted (page 7-7) that the absence of certain species from the entire sampling area

> *"is consistent with historical trends noted in samples from the same general vicinity in studies conducted in 1974 and 1977, before operations at PACO Terminal commenced (SDUPD, 1977)."*

WCC (1991) also noted that the distribution of a number of species

> *"supports the hypothesis that disturbance of the sediments is a significant influence on distribution and abundance of some of the major resident infaunal organisms."*

WCC (1991) concluded, as quoted previously from page 7-6 and 7-7,

> *"Significant relationships or strong trends between the biological variables and copper concentrations were not observed in a single case examined, strongly indicating the lack of effect of the copper ore on the infauna in the area (WESTEC, 1986)."*

Second, the Staff Comment statement quoted in the passage above, *"If this is true, copper may be contributing and the adverse effects due to copper may not be distinguishable."* is obtuse. It is not clear what is meant by, "effects due to copper may not be distinguishable." The quoted statement seems to suggest the argument that the hypothetical "effects" could be contributed to by copper in the NCMT-area sediment but that that contribution to the effects is too subtle to be seen over the factors that are primarily responsible for controlling the populations. The studies indicate (WCC, 1991 page 7-8) that the major environmental features controlling biotic distribution in the NCMT area are factors that are not controllable (e.g., strength of water movement, sediment instability, sediment deposition rates) such as have been reported elsewhere. If the effects from copper-contaminated sediments, some of which currently contain on the order of 23,000 mg Cu/kg, are too subtle to be seen, this would not provide technical justification for remediation of the copper. It is certainly inappropriate for the Staff

Comments to suggest that that situation provides any support for the need for a 1,000 mg Cu/kg clean-up objective or for the insufficiency of the 4,000 mg Cu/kg clean-up objective adopted by the SDWQCB.

Provision 2: Protection of Human Health
(Staff Comments page 2)

Staff Comments on Provision 2 stated,

> *"The information in the report appears to adequately support the contention that exposure to copper at the site will not result in bioaccumulation that will create a threat to human health."*

Provision 3: Protection of Beneficial Uses
(Staff Comments pages 2 to 5)

- Paragraph 1 in the "Provision 3: Protection of Beneficial Uses" section on page 2 stated,

> *"The evaluation of this provision primarily uses toxicity testing and sediment chemistry data to evaluate effects in the water and sediment."*

That quoted assessment is incomplete and hence somewhat misleading. The results of toxicity tests contributed to the assessment of the existing sediment-contamination conditions on beneficial uses. The sediment composition/copper concentration information (the so-called "chemistry" data) does not provide, and was not used to make, an assessment or indication of the potential impacts of sediment-associated copper on the beneficial uses of the Bay, or on potential toxicity in the water or sediment. This point and its technical basis was made clear in the risk assessment section of the WCC (1991) report and elsewhere in the Administrative Record. For the risk assessment of potential impacts of the existing condition on beneficial uses of the Bay, the determinations of concentrations of copper in NCMT-area sediment were used only to guide the selection of sampling locations so that highly copper-contaminated areas, areas essentially uncontaminated by copper, and areas with intermediate copper-contamination could be sampled. As discussed earlier, by selection of such sampling sites for toxicity testing, if toxicity were found, its relationship to the concentrations of copper in the sediment could be evaluated.

In addition to the toxicity test information, the results of previous studies on numbers, types, and distribution of organisms in the NCMT area; the results of observations of copper-sensitive mussels living in the most heavily copper-contaminated areas near the NCMT; results of other studies reported in the literature; the authors' understanding of the nature, behavior, and water quality impacts of various forms of copper; and the senior author's 30 years, and the junior author's 18 years, of professional expertise and experience in evaluating the impacts of sediment-associated contaminants on water quality, all contributed to the "evaluation" provided in the Woodward-Clyde risk assessment. This information was all clearly presented and thoroughly discussed in the Woodward-Clyde report.

- The "Provision 3" section in the Staff Comments continued on to state,

> *"Most of these species were tested using elutriate tests which utilize a 4:1 ratio of water to sediment."*
>
> * * *
>
> "[The elutriate test] *cannot be used to interpret the toxicity of bedded sediments. A number of technical details can influence the interpretation of elutriate test results. For the most part these details are not discussed, so the summaries must be taken at face value."*

As noted previously, the senior author has been involved in the assessment of the behavior and water quality implications of sediment-associated contaminants for the past 30 years; Dr. Jones-Lee for the past 18 years. The authors are thoroughly familiar with the development, intent, appropriate use, and limitations of the elutriate test. In the 1970's, the senior author was responsible for helping to develop and evaluate the reliability of the elutriate test that was adopted by the US EPA and US Army Corps of Engineers as a standard test procedure. He conducted more than $1-million in research on the development of the elutriate test, definition and accommodation of factors affecting elutriate test results, and evaluation of the reliability, results interpretation, and applicability of the elutriate test procedure. It was the senior author and his graduate students (including the junior author) who developed the toxicity testing component of the elutriate test and promoted its use in dredged sediment evaluation; that fundamental procedure is widely used today as a truly effects-based evaluation procedure to evaluate sediment toxicity. While the elutriate test was developed for the purpose of evaluating the potential worst-case effects of open water disposal of hydraulically dredged sediments, the approach has substantially wider applicability when applied and evaluated properly. The admonishment of the Staff Comments in this regard is misplaced.

- In the second paragraph of page 3, the Staff Comments stated,

> *"The* [WCC, 1991] *report states that five stations were tested and chemical data sheets in the appendix support this assertion. However, toxicity data is (sic) only supplied for 3 sites. Omission of the toxicity data for 40% of the sites tested is a significant problem."*

The Staff Comment's presumption that 40% of the toxicity test data were "omitted" from the report is incorrect. As stated on page 2-2 of WCC (1991) under the heading, "Sediment

Collection" (emphasis added),

> *"Based on copper concentrations reported in ERCE (1989), five sampling locations were selected for the assessment scheme. These were: (1) Transect 5, 0 feet from the pier, 0 to 2 feet deep in the sediment - the area containing the historically highest concentrations of copper ore concentrate (on the order of 40,000 mg/kg dry weight); (2) Transect 6, 160 feet from the pier, 0 to 1 feet deep - an area in close proximity to the terminal containing very low levels of copper; (3) Transect 1, 80 feet from the pier, 0 to 1 feet deep - an area containing copper concentration of approximately 1,000 mg/kg dry weight; (4) Transect 5, 80 feet from the pier, 0 to 1 feet deep, an area containing about 10,000 mg/kg dry weight copper; and (5) Transect 4, 40 feet from the pier, 1 to 2 feet deep - an area containing about 20,000 mg/kg dry weight copper."*

There was no statement that each of the samples was used in toxicity tests. As discussed above, this sampling scheme was developed to meet the needs of the tiered hazard/risk assessment for worst-case, low/no contamination, and intermediate copper concentrations. In keeping with the tiered hazard assessment approach described above, the first tier of testing involved toxicity tests of the worst case, low/no contamination, and one intermediate-concentration sediments. Hence toxicity tests were conducted on sediment samples from three (not five) sites.

While all of the chemical composition data for samples from those five locations specified were presented in the report appendix, the fact that only some of the sediment samples collected were used in toxicity tests should have been clarified by the subsequent statements in the WCC (1991) report (page 2-6),

> *"The results of the sediment chemical analyses for the sediment samples tested are presented in Table 2-3. ..."*

The text proceeded to describe those data and Table 2-3 clearly showed the results of the sediment analysis of duplicate samples from <u>three</u> (3) locations on two sampling dates. The text noted which set of samples was used for the various toxicity tests. Further, the risk assessment section of the report stated in introduction to the use of the toxicity test results (pages 3-28 and 3-29),

> *"Three species were tested during the present study considering sediments having concentrations of copper as great as 18,750 mg Cu/kg dry weight; the remainder had been tested by WESTEC (1988) considering sediments having copper concentrations as high as 6,067 mg Cu/kg dry weight (see Table 2-2* [results of WESTEC toxicity tests], *2-3* [chemical composition of the sediments from the three locations on which toxicity tests were conducted], *2-5, 2-7, and 2-9* [results of the WCC (1991) toxicity tests]."

While the WCC (1991) could have further belabored the point of which samples were used for toxicity tests, the manner in which the data were presented and handled was sufficiently clear. Raising the specter of impropriety in accusing Woodward-Clyde or others of "omitting" data from a report of this type was totally unjustified. If the staff believed that it identified a discrepancy in the information presented, it should have stated just that, without making statements of "fact" that data were omitted; the Staff Comments made not one, but three, references (the third being on page 4 of the Staff Comments) to staff's supposed knowledge (presumption) that data were "omitted." In the opinion of the authors, the Staff Comments' repeated presumption of impropriety in this regard was unnecessary, unprofessional, and raises question about the objectivity of those who prepared the Staff Comments.

- In the paragraphs 2 and 3 under Provision 3, the Staff Comments asserted that the conclusion that the copper-ore concentrate in the NCMT-area sediments is not having a significant adverse impact on the designated beneficial uses of San Diego Bay waters is not supported by the data presented. It stated,

> *"On the basis of these* [toxicity test] *results ... and the summaries, it can be concluded that significant toxic effects would not be likely during a large scale disturbance. However, the report contends that these data indicate no impairment can be associated with the range of sediment copper concentrations found at the site.*
>
> *"This conclusion is unsupported for the following reasons."*
>
> *"First, as stated, these data do not reflect the bedded sediment conditions."*

but rather the results of elutriate testing. First, the staff's statement with respect to the toxicity data being based solely on elutriate testing is incorrect. As was clearly discussed by WCC (1991) (and above in this report), toxicity tests were performed on NCMT-area sediments with two different amphipods. Those tests involved exposure of those benthic organisms under standard US EPA- and Corps of Engineer-specified conditions designed to simulate bedded sediment conditions. These agencies use these same tests to evaluate whether there would be expected adverse effects on organisms that live within the sediments. The nature and results of those tests were discussed in detail by WCC (1991) in Section 2 "Biological Studies" (e.g., pages 2-2, 2-4, 2-7, 2-8; Tables 2-4 and 2-5), and in Section 3 "Risk Assessment" (e.g., pages 3-2, 3-28 to 3-33; Table 3-1).

As discussed by WCC (1991) and as recounted above with citation and quotations from WCC (1991) (e.g., pages 3-29 to 3-33, and portions of pages 3-33 to 3-38), the tests conducted by WESTEC (1988) on sediment containing sediments containing 1,520 and 6,067 mg Cu/kg using the amphipod *Grandidierella japonica* showed no toxicity for either the survival or reburial response. The apparent "toxicity effect" exhibited in the toxicity tests with the amphipod, *Rhepoxynius abronius*, was found to not be related to copper; it appeared to have been related to physical or other unknown factors which are present throughout San Diego Bay which apparently preclude the native existence of that organism in the Bay even though it is found as a resident species several hundred miles north of the Bay. As was discussed above and in materials in the Administrative Record, ***Rhepoxynius abronius*** cannot be considered a suitable organism for toxicity testing in San Diego Bay. This was an ancillary finding of the risk assessment supported by subsequent discussions with those involved in use of this organism. Had its unsuitability been understood at the outset of the risk assessment study, another amphipod or organism would have been selected for inclusion in the WCC (1991) study.

As discussed in the Woodward-Clyde report and the supplemental materials submitted to the SDWQCB (in the Administrative Record), and as recounted, cited, and quoted previously in this report, the results of the toxicity testing that was done for the risk assessment of the NCMT-area copper-contaminated sediments are supported by the field survey data of the numbers and types of organisms present in the NCMT area with the highest copper concentrations versus other areas of the Bay. The numbers and types of infaunal (sediment-dwelling) organisms in the regions of the NCMT area with the highest sediment-copper concentrations were similar to those found in regions of the NCMT area in which the sediments contained much lower copper-ore concentrations. There is no evidence that the native species found in the bedded sediments that are in contact with the high concentrations of copper ore concentrate are adversely affected by the copper ore concentrate. Further, and most importantly, the finding that the mussel *Mytilus edulis* inhabit the pilings in areas of the NCMT in which the sediments contain some of the highest concentrations of copper provides additional strong evidence that the copper ore concentrate in those sediments is not adversely affecting the designated beneficial uses of San Diego Bay. It is important to remember that the embryo form of that species was found by the US EPA to be most sensitive to copper of all organisms tested. Its sensitivity to copper was used as the basis upon which the US EPA developed its water quality criterion for copper, which, in turn, now serves at the California water quality objective applicable to San Diego Bay waters.

It is important to note that standard toxicity tests of "bedded sediments" such as the amphipod tests (which were conducted on the NCMT-area sediments as discussed by WCC (1991) and further in this report) incorporate substantial alteration of the "bedded sediment" condition. Furthermore, the results of such tests are designed to be interpreted relative to some reference sediment. Thus while the results of the test are highly dependent on the nature of the "reference" site selected, the issues of the impact of sediment-associated contaminants on water quality have nothing whatever to do with what may or may not happen at the reference site. Therefore, what may ostensibly appear to be a more direct or appropriate tests to assess of the impacts of contaminants associated with bedded sediments, can in fact be highly unreliable.

As discussed below, properly developed and executed elutriate test bioassays, such as those included in the WCC (1991) risk assessment, can provide considerable and reliable information on potential impacts of contaminants associated with bedded sediments.

- In furtherance of its claim that elutriate test bioassays do not provide useful information in support of the finding of no adverse impacts associated with the NCMT-area copper-contaminated sediment, the staff stated in paragraph 3 on page 3 of the Staff Comments,

> *"Copper has been demonstrated to exhibit reductions in toxicity with increases in total suspended solids (Hansen, 1992). One explanation for this is that the particulate phase scavenges free copper from the water column thereby reducing dissolved copper concentrations. The elutriate technique maximizes suspended solids."*

That analysis is misleading in its application from several points of view.

First, it should be understood that the elutriate test bioassay provides for the test organisms a more severe exposure than would watercolumn organisms would be expected to experience in the field in relation to bedded sediments. As was clearly described in the Woodward-Clyde report (Section 2.2.2 Test Methods), the 4:1 initial water:sediment ratio for elutriate preparation was not maintained during the tests, but rather the supernatant from the settled elutriate system was used. The test organisms (larval and embryo stages) were tested in a chronic exposure estimation assessment test; watercolumn organisms in San Diego Bay would not be expected to receive a chronic exposure (lifetime or extended critical life-stage exposure) to the limited area of the NCMT-area sediments in which the greatest sediment-copper contamination exists. Thus, the elutriate test bioassays that were conducted were conservative in their indication of potential impact of the contaminants associated with the copper-contaminated sediment in the NCMT area. Even with the comparatively more severe exposure conditions of the elutriate tests bioassays, the most heavily copper-contaminated NCMT area sediments tested (containing more than 18,000 mg Cu/kg) did not cause adverse impacts to the embryo and larval forms tested.

Second, the issue of availability of the various forms of copper pertinent to the issue of the PACO-operation-derived chalcopyrite form of copper in the NCMT area sediments and its potential impact on beneficial uses of San Diego Bay was discussed in detail in WCC (1991) (e.g., pages 3-7 to 3-28). As discussed by WCC (1991) and additionally below, one of the reasons that sediment-associated copper, when suspended into the watercolumn, is non-toxic is the ferric hydroxide scavenging. It would appear to be the position of the Staff Comments that all particulates should have been removed from the elutriate test bioassay system. However, that would not have been indicative of how ambient water organisms would be exposed and such an approach could have been criticized for not incorporating potential continued release of copper and other sediment-associated contaminants over the period of the toxicity test.

The risk assessment testing scenario was not developed lightly or without the substantial understanding of the authors of the nature and behavior of sediment-associated contaminants relative to beneficial uses of water; the authors have had many years research, experience, and publication in this area which has earned them substantial stature in the field.

Third, contrary to the Staff Comments statement, it is inappropriate to characterize the elutriate test bioassay as an approach that "maximizes suspended solids." It does not.