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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN THE MATTER OF TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001 (SHIPYARD SEDIMENT CLEANUP)	**NATIONAL STEEL AND SHIPBUILDING COMPANY'S HEARING BRIEF** Date: November 9, 14, 15, 16, 2011

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I. INTRODUCTION

The Tentative Order would require the parties to spend $60-72 million on the largest environmental dredging project in San Diego Bay history, purportedly to protect beneficial uses of water within the security-boomed areas leased to NASSCO and BAE. Using extremely conservative assumptions that have no basis in reality and are inconsistent with agency guidance, the Tentative Order finds that dredging will ameliorate some *theoretical* risk to aquatic life, aquatic-dependent wildlife, and human health. In fact, using conservative but realistic assumptions, there are no *predicted* impacts to beneficial uses. More importantly, site-specific analyses demonstrate the lack of any *actual* impairment.

Under these circumstances, massive dredging at the Site would do more harm than good, particularly where most of the contamination is safely buried deep in the sediment. The theoretical benefits do not outweigh the significant economic, social, and environmental impacts associated with such a massive dredging project, including potential job loss, noise, traffic, air emissions, re-suspension of contaminants, and the destruction of a thriving ecosystem.

Human Health: The human health impairment finding is driven by theoretical assumptions that over the course of 30-70 years, anglers will only fish at the Site (nowhere else), will only eat fish and shellfish caught at the Site, will only eat the most contaminated fish, will eat a large amount of fish and shellfish per day, and will always eat the entire fish (guts, skin, bones, organs, and all, for subsistence anglers). These assumptions are facially unreasonable, particularly where military security measures at the NASSCO leasehold prohibit public access and fishing, making it impossible for anglers to obtain any of their diet from the Site. Moreover, even if fishing were allowed at will at NASSCO, changing any one of these assumptions to a more reasonable, but still conservative approach (such as assuming that anglers occasionally eat fish caught elsewhere in the bay) results in no significant human health risk. Indeed, EPA categorizes the levels of mercury found in fish at NASSCO as “low levels of mercury” within the range recommended for consumption, and chemicals of concern in fish at NASSCO, including PCBs, are not at levels significantly different than background conditions. Deposition of Tom Alo (“Alo Depo”), at 115:13-115:21, 116:8 – 116:20.

Aquatic Wildlife: Similarly, the aquatic-dependent wildlife impairment finding is driven by unreasonable assumptions, such as assuming birds, turtles, and sea lions in San Diego Bay get 100% of their diet from the Site and not from anywhere else in San Diego Bay or any other water body, including the Pacific Ocean. This assumption is wholly unrealistic, given the size of each species' known home range and the level of activity at the Site. Even if it *is* assumed that these species forage only within the shipyards, Board staff concludes in the Draft Technical Report ("DTR") that *not a single species will exceed the level of exposure beyond which regulatory guidance indicates adverse effects are likely to occur*.

Aquatic Life: The aquatic life analysis assumes that all sediments have at least a "low" likelihood of negatively impacting sediment-dwelling creatures and fish, even where sampled and found to be identical to background reference conditions. Staff's analysis places undue weight on the concentrations of contaminants in sediment, contrary to applicable regulatory guidance. As a result, the DTR's impairment finding is primarily driven by theoretical *predictions* about the likelihood of biological effects based on the sediment chemical concentrations, rather than site-specific data documenting the absence of *actual* effects on the sediment-dwelling creatures and fish at the Site. Even under this skewed framework, the DTR concludes that ***only one*** area at NASSCO (polygon NA19) is "likely" impaired.

Natural Attenuation: By 1960, when NASSCO began operating at the shipyard, discharges from the City sewer had created a large sludge bed at the site that was devoid of life. DTR, at 10-9. Forty years later, when sampling was conducted in 2001-02, conditions had already naturally improved to the point that mature benthic communities were thriving in the sediment. In 2003, Exponent concluded that Monitored Natural Attenuation ("MNA") was the appropriate remedy for the Site. Studies conducted in 2009-10 confirm that sediment chemical concentrations are continuing to decline due to natural processes. Board staff does not, and cannot, dispute that natural attenuation is occurring and is a reasonable remedy, particularly in light of (i) the absence of significant risk; (ii) NASSCO's lease through 2040 (sufficient time for natural attenuation to occur); (iii) NASSCO's status as a "zero discharge" facility for

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stormwater; and (iv) long-term monitoring requirements that can detect an issue and trigger further action, if needed.

Thus, the Board should order the parties to monitor whether conditions naturally continue to improve over time. If they do, then dredging should not be necessary. If not, or if the shipyard changes to a more sensitive use (such as a fishing pier), the Board can consider whether to order the parties to dredge at that time. This result protects beneficial uses, while avoiding the significant impacts to the parties, community, and environment attributable to massive dredging.[1]

II. WHAT WE KNOW AFTER MORE THAN A DECADE OF INVESTIGATION

At the outset of these proceedings, it was alleged that the Site was a "dead zone" due to elevated sediment chemical concentrations, and that wide-spread dredging would be necessary. After a decade of study, we now know that conditions are much better than previously assumed.

In 2001, the Board concluded that it was not appropriate to establish cleanup levels based solely on sediment chemistry. The Board directed Exponent, one of the premier sediment and environmental consulting firms in the nation, to perform an unprecedented multi-million dollar investigation under the supervision and direction of Board staff. The investigation gathered data for multiple lines of evidence—including chemistry (the concentration of chemicals of concern in the sediment), toxicity (measuring whether observed chemical concentrations harm sediment-dwelling organisms in lab tests), and benthic community assessment (counting whether sediment-dwelling organisms exist at the site in the same numbers and diversity that would be expected in a healthy community)—to determine the extent and potential environmental impacts of contamination at the site, and identify sediment cleanup alternatives.

The sediment investigation has been described by staff as "the most extensive sediment investigation ever conducted for a site in San Diego Bay." Deposition of David Barker ("Barker Depo"), at 83:5-12. It gathered chemistry data for all 66 stations within the NASSCO and BAE

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[1] The evidence cited herein is representative of the evidence in the administrative record supporting each point, but is not intended to be an exhaustive summary of all evidence supporting each point. This brief incorporates by reference NASSCO's May 26, 2011 TCAO and DTR comments, and June 23, 2011 rebuttal, as well as NASSCO's August 1, 2011 comments on the Draft Environmental Impact Report ("EIR"), and Final EIR comments, submitted concurrently.

leaseholds (31 within NASSCO), and gathered toxicity and benthic community data for 30 stations (15 within NASSCO), resulting in a comprehensive data set. NASSCO and Southwest Marine Detailed Sediment Investigation ("Shipyard Report"), at Tables 2-2, 2-3. These data were compared to data from reference stations selected by the Board from locations least likely to be impacted by contaminants in San Diego Bay. DTR, at 17-1; Shipyard Report, at 3-7.

In 2003, Exponent issued its Shipyard Report, which reveals a healthy, mature benthic community inhabiting the Site, and concludes that Site conditions are protective of aquatic life, aquatic-dependent wildlife, and human health beneficial uses. Shipyard Report, at 10–42-43, 11-20. For these reasons, and because dredging would not produce any long-term improvement in beneficial uses relative to current conditions, the Shipyard Report selects MNA as the preferred remedy, noting that "monitored natural recovery, is the only alternative that provides acceptable effects on beneficial uses and is technically and economically feasible." *Id.* at 19–12-13.

III. THE ORDER IS BASED ON EXCESSIVELY CONSERVATIVE, UNREALISTIC ASSUMPTIONS THAT SKEW ITS FINDINGS OF IMPAIRMENT

The Tentative Order ("TCAO") and DTR rely almost entirely on the same data used in the Shipyard Report. TCAO, at ¶ 13; DTR, at 13–1-4. Contrary to the Shipyard Report, however, the TCAO and DTR conclude that human health, aquatic-dependent wildlife, and aquatic life beneficial uses are significantly impaired, and select extensive dredging as the remedy. These findings are skewed by a series of unrealistic, excessively conservative assumptions, which compound on one another resulting in absurd conclusions.

A. There Is No Significant Risk To Human Health (TCAO, ¶ 25)

Technical guidance indicates that a two-tiered risk assessment to evaluate potential risks to human health is appropriate. Tier I represents a screening analysis, where conservative assumptions are used to determine whether there is a theoretical possibility of impairment. DTR, at 26-1. If Tier I indicates theoretical impairment, then regulators should conduct a more complex, Tier II analysis, replacing conservative assumptions with real-world, site-specific data to determine whether there is an actual risk. The DTR finds that human health beneficial uses

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for San Diego Bay are impaired by relying on a number of unrealistic, inappropriate assumptions for its Tier II analysis, which, when removed, demonstrate no significant risk to human health.

First, contrary to EPA guidance to employ realistic catch estimates, the DTR assumes that San Diego Bay recreational and subsistence anglers will catch all the fish and shellfish they eat every day for a 30 to 70 year period from the NASSCO leasehold. Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site ("Ginn Report"), at 81, 88; DTR, at 28-12, 28-13, Table 28-7; Alo Depo, at 93:12-18, 94:19-95:11, 101:3-23. This is highly unrealistic. NASSCO is a militarily-secured facility with no public access, where fishing is not allowed. Moreover, there is no evidence that the NASSCO leasehold (43 acres in size) could supply all the fish and shellfish San Diego Bay recreational and subsistence anglers catch daily for 30 to 70 years. Expert Opinion Letter Regarding Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 ("Finley Report"), at 17; Alo Depo, at 144:9-144:14.

Second, the DTR assumes subsistence anglers always consume the entire fish or shellfish (including the skin, guts, liver, and other organs), and not just the fillet or edible portion, which substantially increases risk because internal organs typically contain higher chemical concentrations. DTR, at 28-17. To assume that *all* subsistence anglers *always* consume the entire fish is excessively conservative and unrealistic. Alo Depo, at 121:18-25. In fact, the Santa Monica Bay angler study—which formed the basis for the consumption rates used in the DTR—found that only *one percent* of surveyed anglers consumed the whole fish. Ginn Report, at 89. Thus, rather than blindly assuming that all subsistence anglers always consume the entire fish or shellfish, it would have been more reasonable to assume consumption based on site-specific data.

Third, the DTR assumes that subsistence anglers consume *only* spotted sand bass or lobster, but neglect other species caught by anglers, thereby overestimating exposure to chemicals. For example, a significant portion of the typical sport catch includes topsmelt and jacksmelt, which have much lower maximum PCB concentrations than spotted sand bass. Ginn Report, at 88. Accordingly, by assuming that anglers *always* consume *only* the species of fish with the highest maximum chemical concentrations, the DTR overestimates exposure. *Id*.

Fourth, the DTR assumes that the maximum measured chemical concentrations in spotted sand bass and lobster are representative of typical exposure for recreational and subsistence anglers, despite the fact that multiple samples were collected at each sampling station. DTR, at 28-17. This simplistic approach "gives no insight as to the potential variability in the risk estimates as a function of the range and frequency of measured contaminant levels. In essence, each of the risk estimates presented by the [DTR] relies on a single measured (in this case, maximum) value, which can yield a highly biased risk estimate, particularly if the underlying data set is skewed." Finley Report, at 14. Furthermore, the 1989 EPA guidance the DTR relies on was superseded in 2005. *Id.* The DTR should have based risk estimates on measures of central tendency (such as means, averages, and/or distributions of the underlying measured concentrations), instead of selecting maximum measurements as the typical exposure.

Finally, the DTR assumes the highest possible value of inorganic arsenic observed in literature reviews, instead of collecting and analyzing actual fish tissue from the Site for inorganic arsenic. Because Staff uses the highest estimate, not real-world data, the DTR's conclusion that inorganic arsenic in seafood theoretically harvested at the NASSCO site "poses a theoretical increased" cancer risk compared to reference areas is invalid. Ginn Report, at 87.

In sum, the human health risk finding is driven by excessively conservative, unrealistic assumptions that are inappropriate in a Tier II analysis. Correcting the DTR's errors, Dr. Finley, a board-certified toxicologist with over 20 years of experience conducting and managing human health risk assessments, found that fish and shellfish caught at NASSCO do not pose a significant risk to human health. Finley Report, at 23-28. Accordingly, the DTR and TCAO should be revised to incorporate Dr. Finley's analysis and conclusions.

B. There Is No Significant Risk To Aquatic-Dependent Wildlife (TCAO, ¶ 21)

The DTR erroneously concludes that aquatic-dependent wildlife uses are impaired, based on theoretical exposure models that are replete with excessively conservative and unrealistic assumptions that do not follow regulatory guidance, and bias the results towards finding risk.

The DTR modeled the dietary exposure of six representative species—the California least tern, California brown pelican, Western grebe, Surf scoter, and East Pacific green turtle—to predict whether these species are likely to be affected by the concentrations of chemicals observed in the fish, shellfish, and eelgrass at the Site. The DTR then compared these predicted exposures to risk thresholds and chemical exposure levels of species foraging in reference areas. At least two of the DTR's unrealistic assumptions in the Tier II risk analysis make it unreliable.

First, the DTR assumes that each species obtains *all* of its food from the Site, greatly inflating the predicted degree of risk to each species. DTR, at 24-10, Table 24-6 (Area Use Factor set to 1). This is plainly unrealistic since all six species have home ranges substantially larger than the 43 acre NASSCO leasehold (an active heavy industrial zone, unattractive to most wildlife). Ginn Report, at 61, Table 6; Alo Depo, at 331:16-19, 334:3-15, 335:8-336:3, 339:5-9, 346:10-13. It also disregards regulatory guidance, which require consideration of site-specific information regarding available habitat, and the foraging preferences and behavior of target species. *Id.* at 59. Using conservative, realistic use factors that assume species obtain a portion of their diet from the Site shows no significant risks to aquatic-dependent wildlife. *Id.* at 60.

Second, it is generally accepted that the point where adverse effects from dietary exposure to a given chemical occurs lies somewhere *between* the established "no-observed-adverse-effect-level" ("NOAEL") (a level of exposure that is believed to have no adverse effects on receptors of concern) and the "lowest-observed-adverse-effect-level" ("LOAEL") (the lowest level of exposure shown to have *any* adverse effects on receptors of concern). Alo Depo, at 357:2-358:1. Accordingly, when a creature is exposed to a chemical above the LOAEL, it is likely that adverse effects will be observed; however, there is no evidence that adverse effects will be observed for exposure above the NOAEL but below the LOAEL. DTR, at 24-12.

The DTR finds aquatic-dependent wildlife impairment only by setting the risk threshold at the no-effects level (NOAEL), even though the true point where adverse effects will occur is somewhere *above* the NOAEL. DTR, at 24-12; Alo Depo, at 360:11-361:7. This approach is inconsistent with agency guidance. Ginn Report, at 67, 70-71; Alo Depo, at 357:2-358:1. Significantly, even assuming that *all* species obtained *all* of their food from the shipyard, *not a single species exceeded the lowest-effects level (LOAEL) for any chemical*. DTR, at 24-6, Table

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24-3. Without these unrealistic assumptions, the adverse aquatic-dependent wildlife finding is unsupportable.

C. There Is No Significant Risk To Aquatic Life (TCAO, ¶ 14)

1. Framework For Assessing Aquatic Life

The aquatic life impairment analysis is based on a "weight of the evidence" approach that examines "multiple lines of evidence" to determine whether sediment-dwelling creatures are adversely affected by sediment chemicals. DTR, at § 18. The three lines of evidence—which form the sediment "triad"—include sediment chemistry, sediment toxicity, and benthic community data. For each line of evidence, the DTR determines whether sediment poses a "low," "moderate," or "high" likelihood of adverse impacts to sediment-dwelling creatures. *Id.* The DTR then assigns an "impairment category" of either "unlikely," "possibly," or "likely" impacts to each station, based on whether the combined lines of evidence indicate "low," "moderate," or "high" likelihood of effects. *Id.* As demonstrated below, the framework is biased towards finding "likely" impacts, even where impacts do not exist.

2. The DTR Is Biased Because It Assumes All Sediment Will Have At Least A "Low" Likelihood of Adverse Effects On Aquatic Life

The framework is biased towards finding adverse effects because it does not allow the possibility of "no" likelihood of impacts. DTR, at 18–26-27. Instead, it assumes that all sediment will impact sediment-dwelling creatures to some degree. Even pristine sediment would be characterized as having a "low" likelihood of impacts, and would be categorized as "unlikely" to be impaired (instead of definitively "unimpaired"). Alo Depo, at 232:13-22, 299:8-300:17. This framework (developed by Staff and the environmental community without industry stakeholders), conflicts with the State Board's Sediment Quality Objectives, which allow for "unimpacted" or "inconclusive" findings. DTR, at 15–2-3; Alo Depo, at 289:7-290:6.

3. The DTR Places Undue Weight On Sediment Chemistry

Sediment chemistry is a poor diagnostic tool when used in isolation. Ginn Report, at 13, 52-54. Indeed, that is why the Board required the Exponent triad investigation in 2001. Furthermore, staff recognize that "high" chemistry does not necessarily indicate biological impacts. DTR, at 15-1 ("[S]ediment chemistry . . . provides inadequate information to predict biological impact"); Deposition of David Gibson ("Gibson Depo"), at 143:7-13 ("Q: [S]hould . . . evidence of toxicity be given more weight than chemistry? A. . . . yes because the reaction of the organism itself is a better indicator of true risk than the chemistry alone; but they do have to both be considered together."); Alo Depo, at 227:10-18, 228:22-229:3.

Yet the framework erroneously places undue emphasis on sediment chemistry. For example, whenever sediment chemistry is "high"—even where little or no toxicity or adverse effects on sediment-dwelling creatures is observed—the conclusion must be "likely" or "possibly" impacted, contrary to the State Sediment Quality Objectives. DTR, at 18-26, Table 18-14.

Over-emphasis on sediment chemistry is especially disturbing considering how that line of evidence is assessed. The DTR classifies sediment chemistry as presenting a "low," "medium," or "high" likelihood of adversely affecting sediment-dwelling creatures based on whether chemical concentrations exceed certain benchmarks set forth in generic sediment quality guidelines ("SQGs"). This approach, however, ignores the fact that SQGs are guidelines, used to *predict* whether adverse effects will be found in field studies measuring toxicity and benthic communities, not whether a chemical *actually is* causing ill effects. Alo Depo, at 225:13-226:16. This means the framework relies more on a predictive tool, uncalibrated to the Site, than on the direct measures of how sediment-dwelling creatures at the Site are actually responding.

4. <u>Sediment-Dwelling Creatures At Most Stations At NASSCO Are As Healthy As They Are At Reference Stations in San Diego Bay</u>

The condition of actual sediment-dwelling creatures at the five NASSCO polygons slated for remediation is nearly indistinguishable from creatures at San Diego Bay reference stations. Three NASSCO remedial areas (NA06, NA15, NA17) are equivalent to reference conditions along all seven biological metrics examined, including three sediment toxicity tests (amphipod survival; sea urchin fertilization; bivalve development) and four benthic community metrics (BRI; abundance; number of taxa; Shannon-Wiener diversity). DTR, Tables 18-8, 18-12; Figure F-1, Toxicity and Benthic Community Results for NASSCO Stations Within The Remedial

Footprint (Alo Depo, Ex. 1123). Two other polygons (NA09, NA19) are equivalent to reference under all metrics except the bivalve larvae test (an experimental test ultimately plagued by extreme variability, even at reference stations). Alo Depo, at 255:18-25, 262:6-267:16.

These results strongly suggest that chemicals in Site sediments have limited bioavailability (a measure of the potential for a chemical to enter into ecological or human receptors). Bioavailability recognizes that the *form* of a chemical substance often dictates whether organisms will be affected. For example, a fish may be unaffected by the addition of a copper wire to its tank, whereas the addition of copper sulfate is likely to be lethal. Importance of Bioavailability for Risk Assessment of Sediment Contaminants at the NASSCO Site—San Diego Bay ("Allen Report"), at ii; Barker Depo, at 91:16-92:29; Alo Depo, at 225:24-226:16.

Despite the framework's bias towards finding adverse effects by overemphasizing sediment chemistry and failing to adequately assess bioavailability, only NA19 is designated as "likely" impaired. NA09 and NA17 are designated "possibly" impaired, and NA06 and NA15 are "unlikely" to be impaired. Figure F-2, NASSCO Remedial Stations by Triad Designation; DTR, at Table 18-1. Viewing all of the direct lines of evidence -- toxicity and benthic community analyses -- for all NASSCO stations demonstrates that there is minimal impairment to aquatic life at the Site. See Figure 3; Alo Depo, Exs. 1124-1125. It simply does not make sense to spend tens of millions of dollars "remediating" these polygons based on the DTR's improper emphasis on sediment chemistry.

IV. MONITORED NATURAL ATTENUATION ("MNA") IS LEGALLY REQUIRED, SCIENTIFICALLY SUPPORTED, AND ECONOMICALLY JUSTIFIED

Not only is MNA scientifically supported and economically justified, but it is also legally sanctioned. As discussed below, the Board is constrained by legal principles, including the Water Code, State Board Resolution 92-49, and principles of fundamental fairness and due process, which prohibit dredging from being selected as the preferred remedy in the TCAO.

A. Massive Dredging In The Order Is Contrary To Law Because It Is Neither Scientifically Justified Nor Economically Feasible

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1. <u>The Order Treats NASSCO Differently Than Similarly Situated Dischargers In Violation of Resolution No. 92-49, And Principles Of Due Process And Equal Protection</u>

Resolution 92-49, promulgated as a regulation, provides that the "Regional Water Board shall: . . . [p]rescribe cleanup levels which are *consistent* with appropriate levels set by the Regional Water Board for analogous discharges that involve similar wastes, site characteristics, and water quality considerations." *Id.* at II.A.9 (emphasis added); Barker Depo, at 345:12-17 (Resolution 92-49 ensures that Regional Boards treat similar sites similarly). Principles of due process and equal protection also require fundamental fairness, and similar treatment under the law. U.S. Const. amend. XIV, §1; Cal. Const. art. I, §§ 7, 15.

Over the past decade, the Board has prescribed cleanup levels for sediments at shipyard and boatyard locations on San Diego Bay with nearly identical discharges and beneficial uses. *See, e.g.,* Barker Depo, at 362:15-365:5; Barker Depo, Exs. 1209, 1210 at Exhibit A, 1211-1219. Despite substantial similarities between these sites and NASSCO, however, the TCAO would impose radically more stringent cleanup levels upon NASSCO. This departure from precedent violates Resolution 92-49's consistency rule, and due process and equal protection principles. TCAO, at ¶ 32, DTR, at 32-1.

For example, Staff calculated cleanup levels for the Campbell Shipyard using an apparent effects approach, but used the *lowest* apparent effects threshold (with an additional 40% "safety" buffer to further reduce the cleanup levels) to reach exceptionally low cleanup levels at NASSCO compared to other sites in the Bay, and nationwide. Barker Depo, 373:14-374:22; 944:18-949:21. The requirement that similar sites be treated similarly is rendered meaningless if a site like the Campbell *Shipyard*—located less than a mile from the NASSCO *Shipyard*, operating during similar time-frames, discharging the same types of pollutants to the same water body, and subject to the same beneficial uses—is not considered a "similar site."

2. <u>The Proposed Dredging Is Not Economically Feasible Within The Meaning of Resolution No. 92-49</u>

The Water Code recognizes competing demands on San Diego Bay, including marine industrial uses. For this reason, the Water Code and Resolution 92-49 explicitly require

Regional Boards to "consider[] all demands being made and to be made on [the Bay] and the total values involved," and to ensure that recommended cleanups are economically feasible and cost-effective. Cal. Water Code § 13000; Resolution 92-49, at III.G. The Board must objectively "balanc[e] . . . the incremental benefit of attaining further reduction in the concentrations of primary [contaminants of concern] [against] the incremental cost of achieving those reductions." DTR, at 31-1.

By this standard, the incremental benefits of dredging, if any, do not justify the increased cost when compared to MNA. First, the TCAO recommends dredging expected to cost $60 to $72 million. Yet experts agree that human health, aquatic-dependent wildlife, and aquatic life beneficial uses are not impaired when assessed using conservative, real-world assumptions. Dredging will reduce chemical concentrations in sediment faster than MNA, but will offer no long-term improvement to beneficial uses because they *already* meet reference conditions at NASSCO. It is not economically feasible or cost-effective to spend tens of millions for little to no improvement in beneficial uses, especially when the same result can be achieved through MNA at substantially less cost, with substantially less community and environmental impacts.

Second, the DTR's economic feasibility analysis confirms that the TCAO violates Resolution 92-49's cost-effectiveness requirement, even when the "benefits" of cleanup are assessed using the DTR's flawed, excessively conservative, unrealistic impairment analyses. DTR, at 31-4. The DTR indicates that any cleanup beyond $24 million is not economically feasible because "[t]he highest net benefit per remedial dollar spent occurs for the first $24 million (12 polygons) [but] [b]eyond $24 million . . . exposure reduction drops consistently as the cost of remediation increases." *Id.* When Site polygons are ranked on a "worst-first" basis, only NA06 and NA17 fall among the 12 "worst" polygons for which dredging is economically feasible. Accordingly, the TCAO illegally requires dredging of NA09, NA15, and NA19, even though the DTR's excessively conservative, unrealistic analysis clearly shows that the additional benefits to be gained by dredging those polygons, if any, are not justified. DTR, Table A-31-4.

B. Monitored Natural Attenuation Must Be Adopted Because It Is Substantially Likely To Achieve Cleanup Goals Within A Reasonable Time

Under Water Code Section 13360, the Board may not specify the particular manner by which dischargers cleanup or abate the effects of their wastes, and a person subject to an order under Water Code Section 13304 may comply with it in any lawful manner. "To ensure that dischargers have the opportunity to select cost-effective methods for cleaning up and abating their discharges, the . . . Board must concur with any cleanup and abatement proposal which the dischargers have demonstrated has a substantial likelihood of achieving compliance with cleanup goals and objectives within a reasonable timeframe." Response To Comments Report, at 1-26 (emphasis omitted).

MNA is a recognized, scientifically-sound remedy that has been used by the Board, and comports with both the Water Code and Resolution 92-49. Barker Depo, 262:23-263:21, Ex. 1226; Gibson Depo, at 149:9-20. For example, Water Code Section 13304, which requires a discharger to "cleanup *or abate the effects* of the waste," makes clear that wastes need not be actively dredged if the effects can be abated. *Id.* (emphasis added). Likewise, Resolution 92-49 supports the use of MNA, provided there is evidence that the requisite cleanup levels will be attained "within a reasonable time frame" after site closure. *Id.* at III.A.

The dischargers have long proposed MNA because the record demonstrates that MNA has a substantial likelihood of achieving compliance with cleanup goals within a reasonable timeframe. *See* Resolution 92-49; Cal. Water Code § 13304; Barker Depo, Exs. 1212-1218, 1225-1228; Gibson Depo, Ex. 1304. Accordingly, the Board is legally obligated to concur.

C. Monitored Natural Attenuation Has Been The Preferred Remedy Since 2003

Sediment experts have recommended MNA as the best remedy for the Site since 2003. Shipyard Report, at 19-13. This is because dredging will provide minimal, if any, incremental benefit, at a very high cost, will also destroy the Site's healthy, mature benthic communities, and risk altering the habitat in ways that can affect the health or type of community to be established after dredging (e.g., altering habitat in ways that prevent re-colonization, or create potential for re-colonization by invasive species). *Id.* at 15-10. By contrast, MNA risks no negative impacts and, once off-site sources are controlled, the "natural recovery of benthic macroinvertebrate communities would be expected to occur within a 3-5 year period." *Id.* at 15-3.

D. Site-Specific Conditions Strongly Support Monitored Natural Attenuation

NASSCO meets the criteria defined in the DTR to identify when a site is "particularly conducive" to MNA. *See* DTR, at 30-2. First, the Site contaminants have limited bioavailability, and toxicity to benthic organisms is extremely low.

Second, recent testing in 2009 (by Exponent) and 2010 (by AMEC for BAE) provide evidence that natural attenuation is already occurring. The "dead zone" that existed pre-1960 has rebounded to support mature benthic communities, according to both Sediment Profile Imaging (more than one hundred photographs taken of benthic conditions) and benthic community analyses. Further, Surface-Weighted Area Concentrations ("SWACs") for each of the five primary contaminants of concern have decreased substantially since 2001-02, and in many cases, are only slightly higher than the post-remedial SWACS prescribed by the TCAO. Barker Depo, Ex. 1228. This suggests that the TCAO's cleanup goals can be achieved in a reasonable time through MNA. In fact, for the locations sampled in 2009 (which were selected to be representative of site-wide conditions), three of the five SWACs for primary contaminants of concern *have already attained the post-remedial SWACs that would be required by the TCAO*, and SWACs for the remaining two are only slightly higher than would be required by the TCAO. Barker Depo, at 280:9-19, 336:11-337:13, Ex. 1228.

Finally, NASSCO's strict access controls will prevent public exposure to sediments during the recovery period. NASSCO is a secure military industrial facility that does not permit fishing, swimming, or recreational uses, and will remain so until at least 2040 under the terms of its current lease. This time period is more than sufficient to allow natural attenuation to occur.

E. Dredging Cannot Control Site Recontamination From Chollas Creek

The DTR notes that MNA is not recommended because "[c]omplete control of site sources has not been fully demonstrated to a level that would assure adequate rates of recovery." DTR, at 30-3. Board staff testified logically, however, that re-contamination from off-site sources, such as Chollas Creek, would affect *all* potential remedies. Barker Depo, at 276:9-279:2. Thus, lack of source control is not a basis to reject MNA as a remedy.

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In fact, the lack of Chollas Creek source control favors MNA, as it makes little sense to spend tens of millions to dredge to unprecedented cleanup levels when ongoing Chollas Creek discharges continue to impact the Site, and are not expected to be controlled for at least 20 years. It is axiomatic that source control be achieved prior to dredging, and common sense dictates that it is a waste of resources to dredge a site at risk of recontamination. It is also technologically infeasible to require compliance with the exceptionally stringent cleanup levels proposed in the TCAO while the Site continues to be impacted by uncontrolled Chollas Creek discharges.

V. CONCLUSION

When excessively conservative, unrealistic assumptions throughout the Draft Technical Report are replaced by conservative but real-world assumptions and actual evidence collected at the Site, the support for the Tentative Order's findings of impairment to human health, aquatic-dependent wildlife, and aquatic life beneficial uses falls away. Furthermore, the minimal benefit to be gained by achieving the Tentative Order's cleanup goals a few years earlier by dredging pales in comparison to the $60-72 million cost (which can be expressed as more than a 1,000 blue collar San Diego jobs), the destruction of the Site's mature and thriving benthic community, and associated community and environmental impacts.

Water Code Section 13360, State Board Resolution 92-49, and principles of due process and equal protection shape the Board's discretion to adopt a Cleanup and Abatement Order. When scientific and economic considerations are weighed appropriately, the most appropriate remedy is Monitored Natural Attenuation, which will ensure that Site conditions remain protective of beneficial uses while sediment chemical concentrations attenuate. NASSCO submits that the remedy selected in the Tentative Order must be amended accordingly.

Dated: October 19, 2011

LATHAM & WATKINS LLP

By ______________________
Kelly E. Richardson
Attorneys for Designated Party
NATIONAL STEEL AND
SHIPBUILDING COMPANY

PROOF OF SERVICE

I am employed in the County of San Diego, State of California. I am over the age of 18 years and not a party to this action. My business address is Latham & Watkins LLP, 600 West Broadway, Suite 1800, San Diego, CA 92101-3375.

On **October 19, 2011**, I served the following document described as:

NATIONAL STEEL AND SHIPBUILDING COMPANY'S HEARING BRIEF

by serving a true copy of the above-described document in the following manner:

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I am familiar with the office practice of Latham & Watkins LLP for collecting and processing documents for hand delivery by a messenger courier service or a registered process server. Under that practice, documents are deposited to the Latham & Watkins LLP personnel responsible for dispatching a messenger courier service or registered process server for the delivery of documents by hand in accordance with the instructions provided to the messenger courier service or registered process server; such documents are delivered to a messenger courier service or registered process server on that same day in the ordinary course of business. I caused a sealed envelope or package containing the above-described document and addressed as set forth below in accordance with the office practice of Latham & Watkins LLP for collecting and processing documents for hand delivery by a messenger courier service or a registered process server.

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Catherine Hagan
California Regional Water Quality Control Board, San Diego Region
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San Diego, CA 92123-4340
fmelbourn@waterboards.ca.gov
chagan@waterboards.ca.gov
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BY ELECTRONIC MAIL

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I declare that I am employed in the office of a member of the Bar of, or permitted to practice before, this Court at whose direction the service was made and declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed on **October 19, 2011**, at San Diego, California.

Andrea Rasco

Certification of Authenticity of Electronic Submittal

I, Kelly E. Richardson, declare:

I am a partner at Latham & Watkins LLP, counsel of record for National Steel and Shipbuilding Company ("NASSCO") in the Matter of Tentative Cleanup and Abatement Order R9-2011-0001 before the San Diego Regional Water Quality Control Board ("Water Board"). I am licensed to practice law in the State of California and make this declaration as an authorized representative for NASSCO. I declare under penalty of perjury under the laws of the State of California that the electronic version of National Steel and Shipbuilding Company's Hearing Brief, submitted to the "Water Board" and served on the Designated Parties by e-mail on October 19, 2011, is a true and accurate copy of the submitted signed original. Executed this 19th day of October 2011, in San Diego, California.

Kelly E. Richardson

FIGURES

FIGURES

FIGURE F-1

Toxicity and Benthic Community Results for NASSCO Stations Within the Remedial Footprint

NA06

Station	Toxicity[1]			Benthic Community[2]			
	Amphipod Survival	Urchin Fertilization	Bivalve Development	BRI	Abundance	# Taxa	S-W Diversity
Reference	73% (95% LPL)	42% (95% LPL)	37% (95% LPL)	57.7 (95% UPL)	239 (95% LPL)	22 (95% LPL)	1.8 (95% LPL)
NA06	78%	103%	74%	54.4	611	37	2.7
As Protective As Reference/Background?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[1] Data from Table 18-8, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

[2] Data from Table 18-12, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

Toxicity and Benthic Community Results for NASSCO Stations Within the Remedial Footprint

NA09

Station	Toxicity[1]			Benthic Community[2]			
	Amphipod Survival	Urchin Fertilization	Bivalve Development	BRI	Abundance	# Taxa	S-W Diversity
Reference	73% (95% LPL)	42% (95% LPL)	37% (95% LPL)	57.7 (95% UPL)	239 (95% LPL)	22 (95% LPL)	1.8 (95% LPL)
NA09	88%	99%	1%	51.1	862	44	2.6
As Protective As Reference/Background?	Yes	Yes	No	Yes	Yes	Yes	Yes

[1] Data from Table 18-8, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

[2] Data from Table 18-12, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

B

Toxicity and Benthic Community Results for NASSCO Stations Within the Remedial Footprint

NA15

Station	Toxicity[1]			Benthic Community[2]			
	Amphipod Survival	Urchin Fertilization	Bivalve Development	BRI	Abundance	# Taxa	S-W Diversity
Reference	73% (95% LPL)	42% (95% LPL)	37% (95% LPL)	57.7 (95% UPL)	239 (95% LPL)	22 (95% LPL)	1.8 (95% LPL)
NA15	97	88	93	51.0	306	26	2.3
As Protective As Reference/Background?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[1] Data from Table 18-8, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

[2] Data from Table 18-12, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

C

Toxicity and Benthic Community Results for NASSCO Stations Within the Remedial Footprint

NA17

Station	Toxicity[1]			Benthic Community[2]			
	Amphipod Survival	Urchin Fertilization	Bivalve Development	BRI	Abundance	# Taxa	S-W Diversity
Reference	73% (95% LPL)	42% (95% LPL)	37% (95% LPL)	57.7 (95% UPL)	239 (95% LPL)	22 (95% LPL)	1.8 (95% LPL)
NA17	95%	88%	80%	55.3	418	33	2.7
As Protective As Reference/Background?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

[1] Data from Table 18-8, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

[2] Data from Table 18-12, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

SD\776809.1

Toxicity and Benthic Community Results for NASSCO Stations Within the Remedial Footprint

NA19

Station	Toxicity[1]			Benthic Community[2]			
	Amphipod Survival	Urchin Fertilization	Bivalve Development	BRI	Abundance	# Taxa	S-W Diversity
Reference	73% (95% LPL)	42% (95% LPL)	37% (95% LPL)	57.7 (95% UPL)	239 (95% LPL)	22 (95% LPL)	1.8 (95% LPL)
NA19	89	72	2	46.7	828	43	2.7
As Protective As Reference/Background?	Yes	Yes	No	Yes	Yes	Yes	Yes

[1] Data from Table 18-8, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

[2] Data from Table 18-12, Draft Technical Report for Tentative Cleanup and Abatement Order R9-2011-01

SD\776809.1

FIGURE F-2

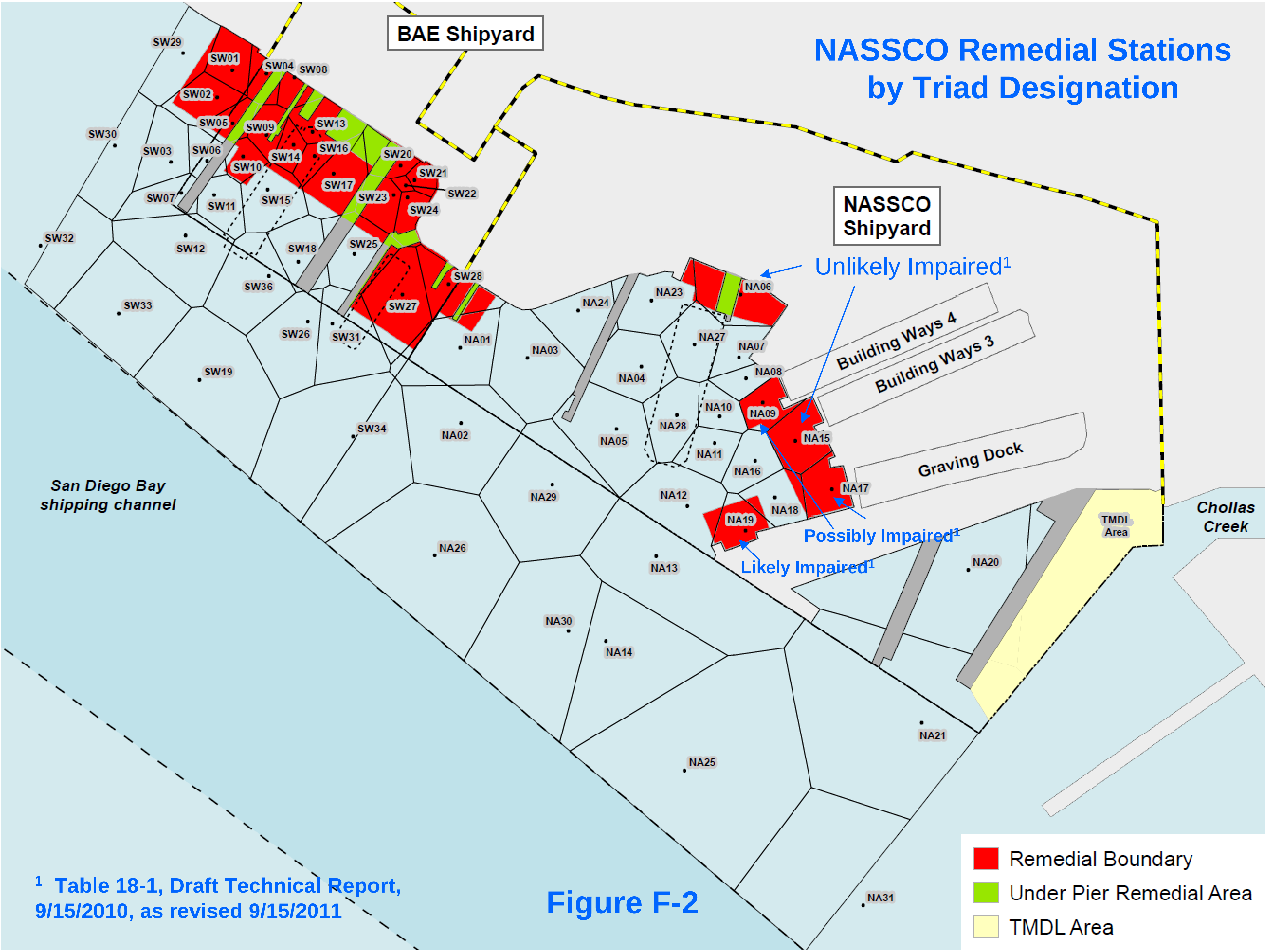
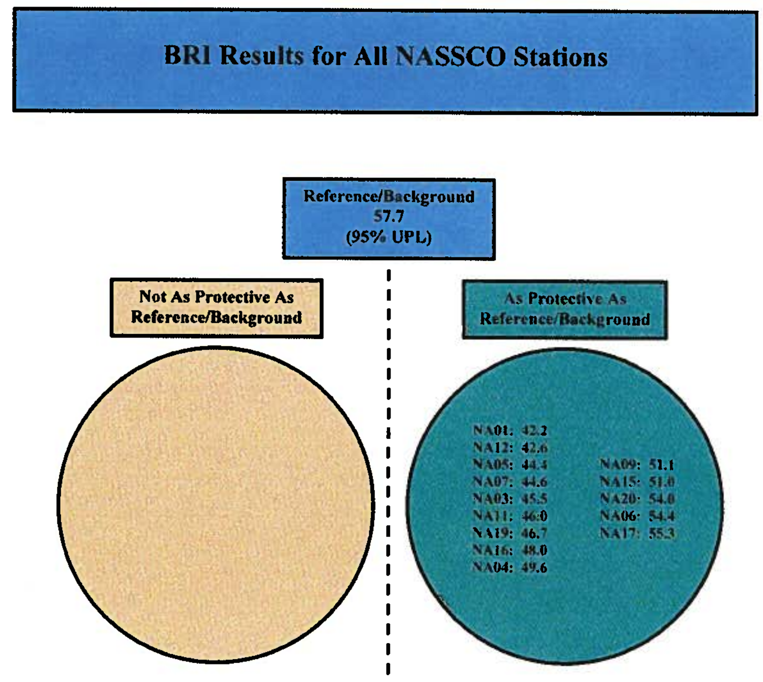

NASSCO Remedial Stations
by Triad Designation
BAE Shipyard
NASSCO
Shipyard
Unlikely Impaired[1]
Possibly Impaired[1]
Likely Impaired[1]
Building Ways 4
Building Ways 3
Graving Dock
San Diego Bay
shipping channel
Chollas
Creek
TMDL
Area
SW01
SW02
SW03
SW04
SW05
SW06
SW07
SW08
SW09
SW10
SW11
SW12
SW13
SW14
SW15
SW16
SW17
SW18
SW19
SW20
SW21
SW22
SW23
SW24
SW25
SW26
SW27
SW28
SW29
SW30
SW31
SW32
SW33
SW34
SW36
NA01
NA02
NA03
NA04
NA05
NA06
NA07
NA08
NA09
NA10
NA11
NA12
NA13
NA14
NA15
NA16
NA17
NA18
NA19
NA20
NA21
NA23
NA24
NA25
NA26
NA27
NA28
NA29
NA30
NA31
Remedial Boundary
Under Pier Remedial Area
TMDL Area
[1] Table 18-1, Draft Technical Report,
9/15/2010, as revised 9/15/2011

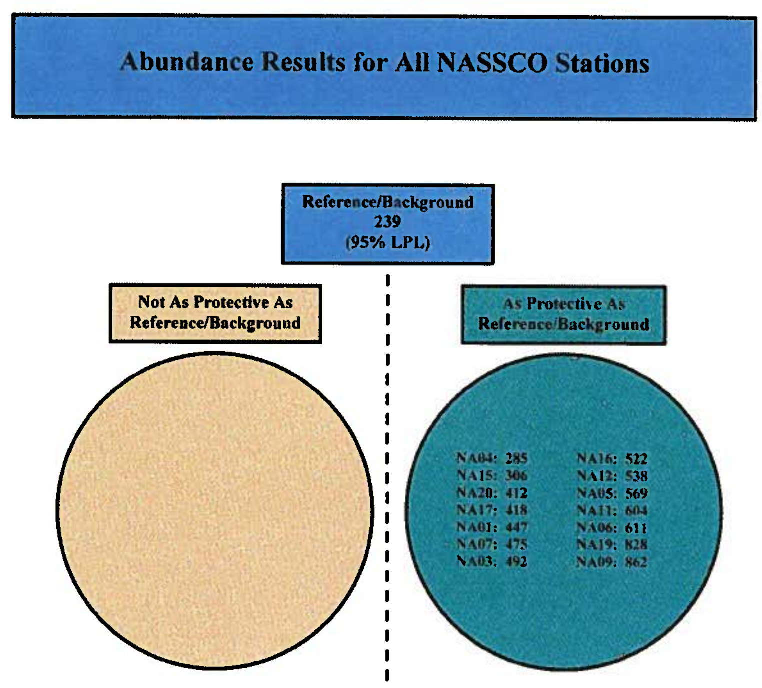
Figure F-2

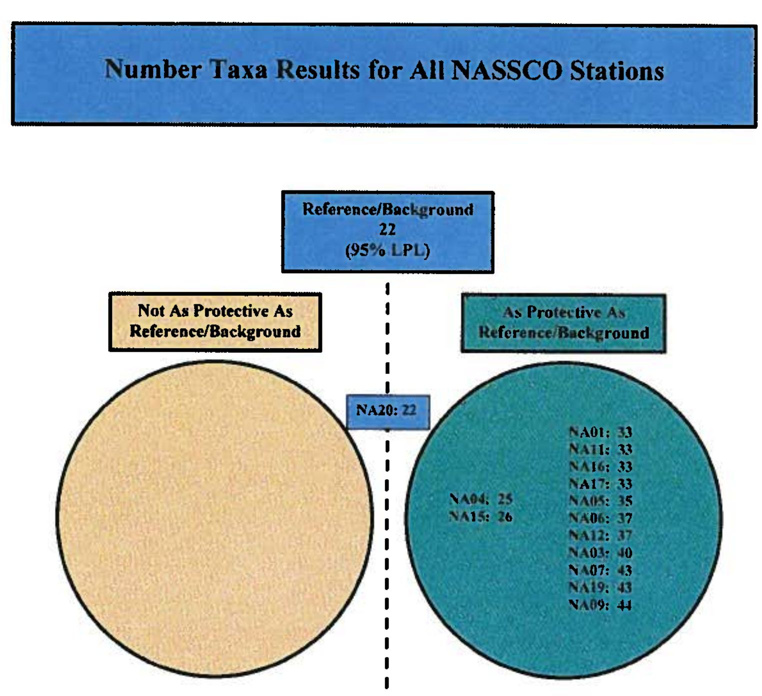
FIGURE F-3

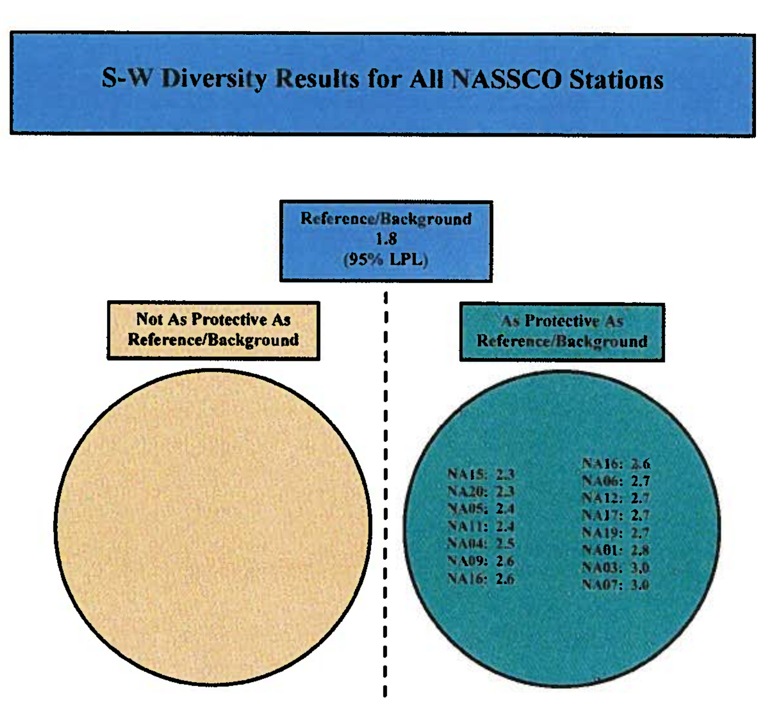
FIGURE F-3

Benthic Community



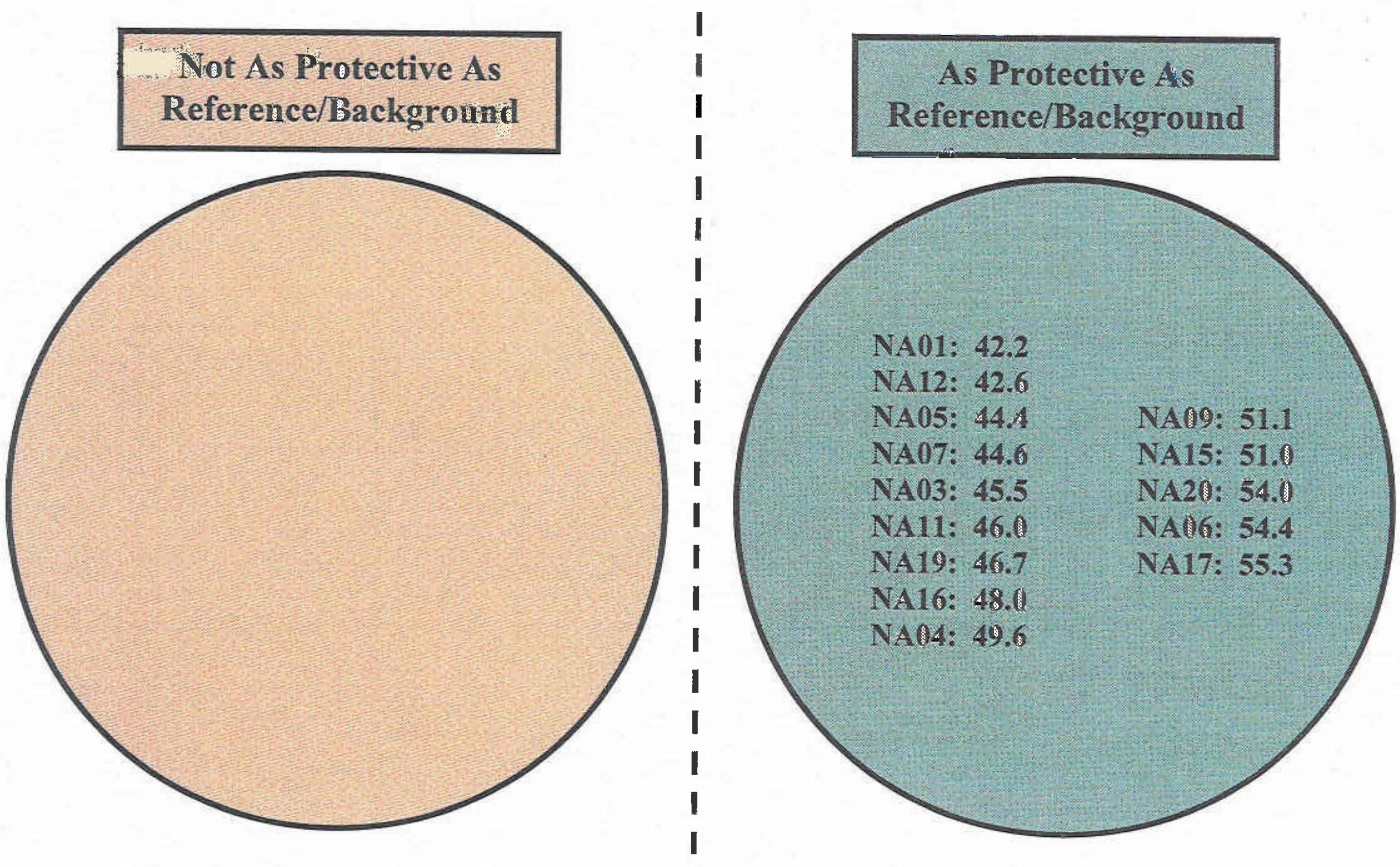




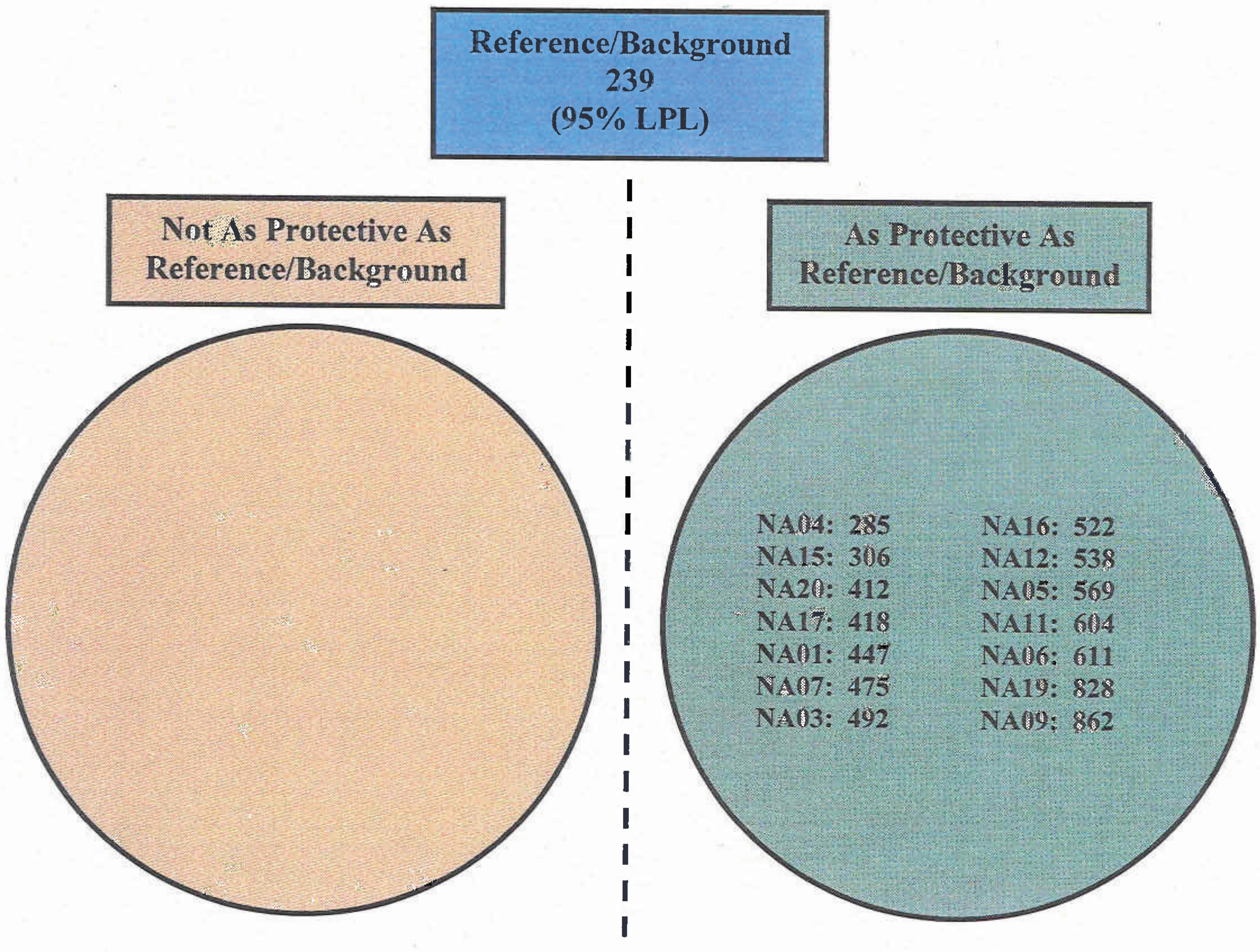


BRI Results for All NASSCO Stations

Reference/Background
57.7
(95% UPL)

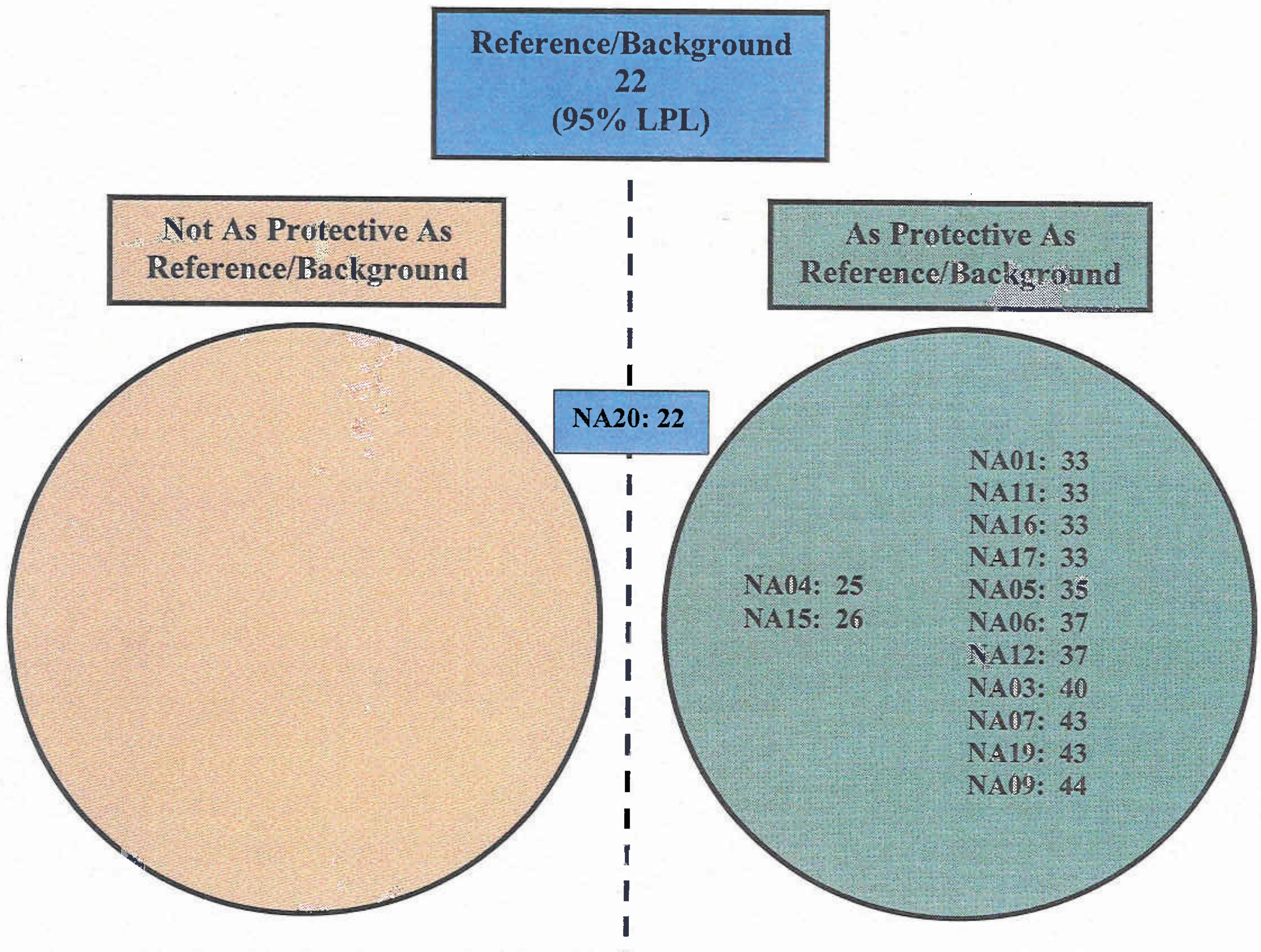


Abundance Results for All NASSCO Stations



4

Number Taxa Results for All NASSCO Stations



B

S-W Diversity Results for All NASSCO Stations

Reference/Background
1.8
(95% LPL)

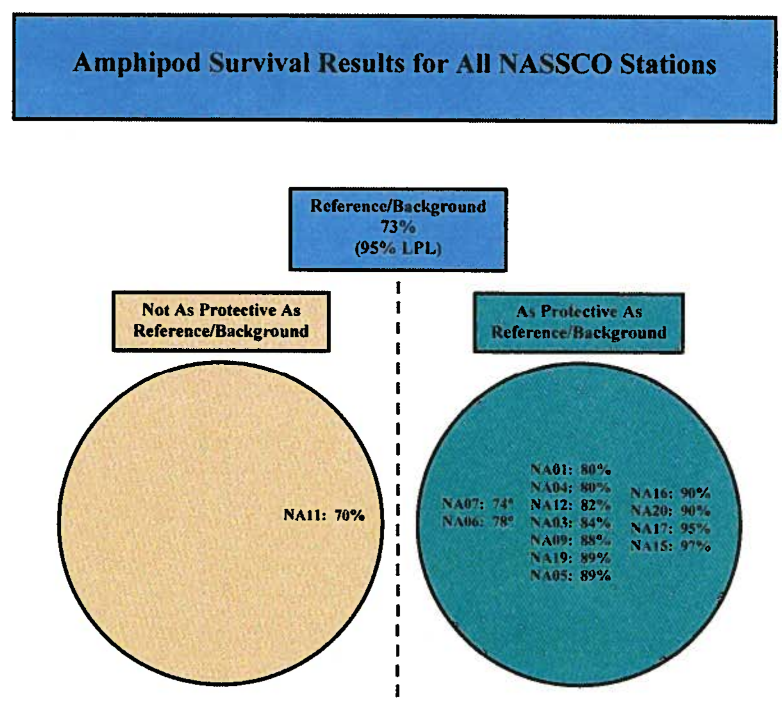
Not As Protective As Reference/Background

As Protective As Reference/Background

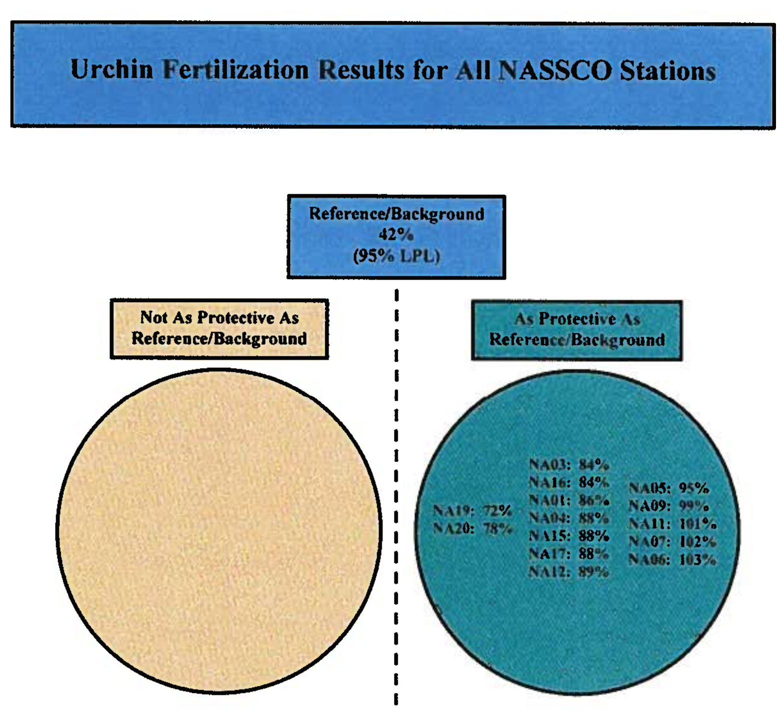
NA15: 2.3
NA20: 2.3
NA05: 2.4
NA11: 2.4
NA04: 2.5
NA09: 2.6
NA16: 2.6

NA16: 2.6
NA06: 2.7
NA12: 2.7
NA17: 2.7
NA19: 2.7
NA01: 2.8
NA03: 3.0
NA07: 3.0

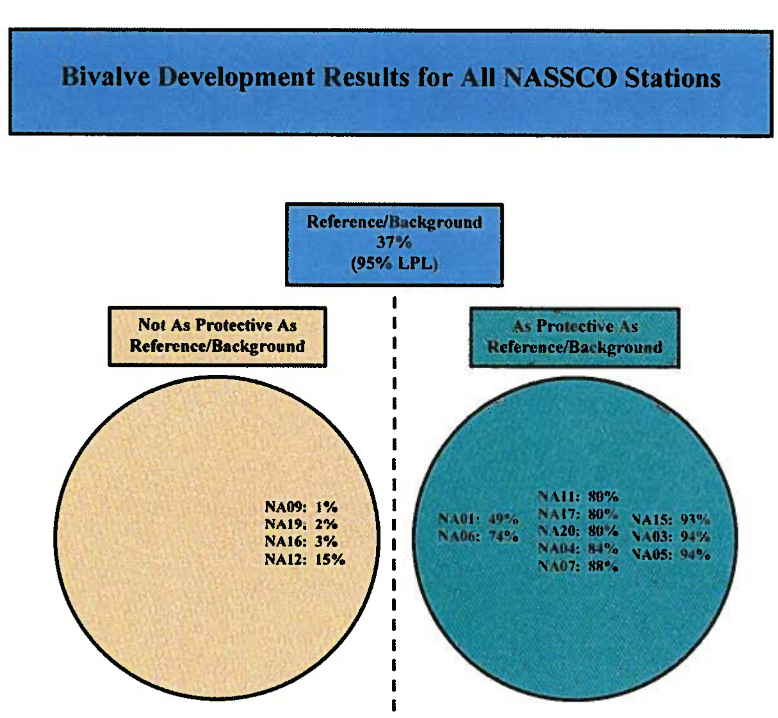
Toxicity



Amphipod Survival Results for All NASSCO Stations
Reference/Background 73% (95% LPL)
Not As Protective As Reference/Background
NA11: 70%
As Protective As Reference/Background
NA07: 74%
NA06: 78%
NA01: 80%
NA04: 80%
NA12: 82%
NA03: 84%
NA09: 88%
NA19: 89%
NA05: 89%
NA16: 90%
NA20: 90%
NA17: 95%
NA15: 97%

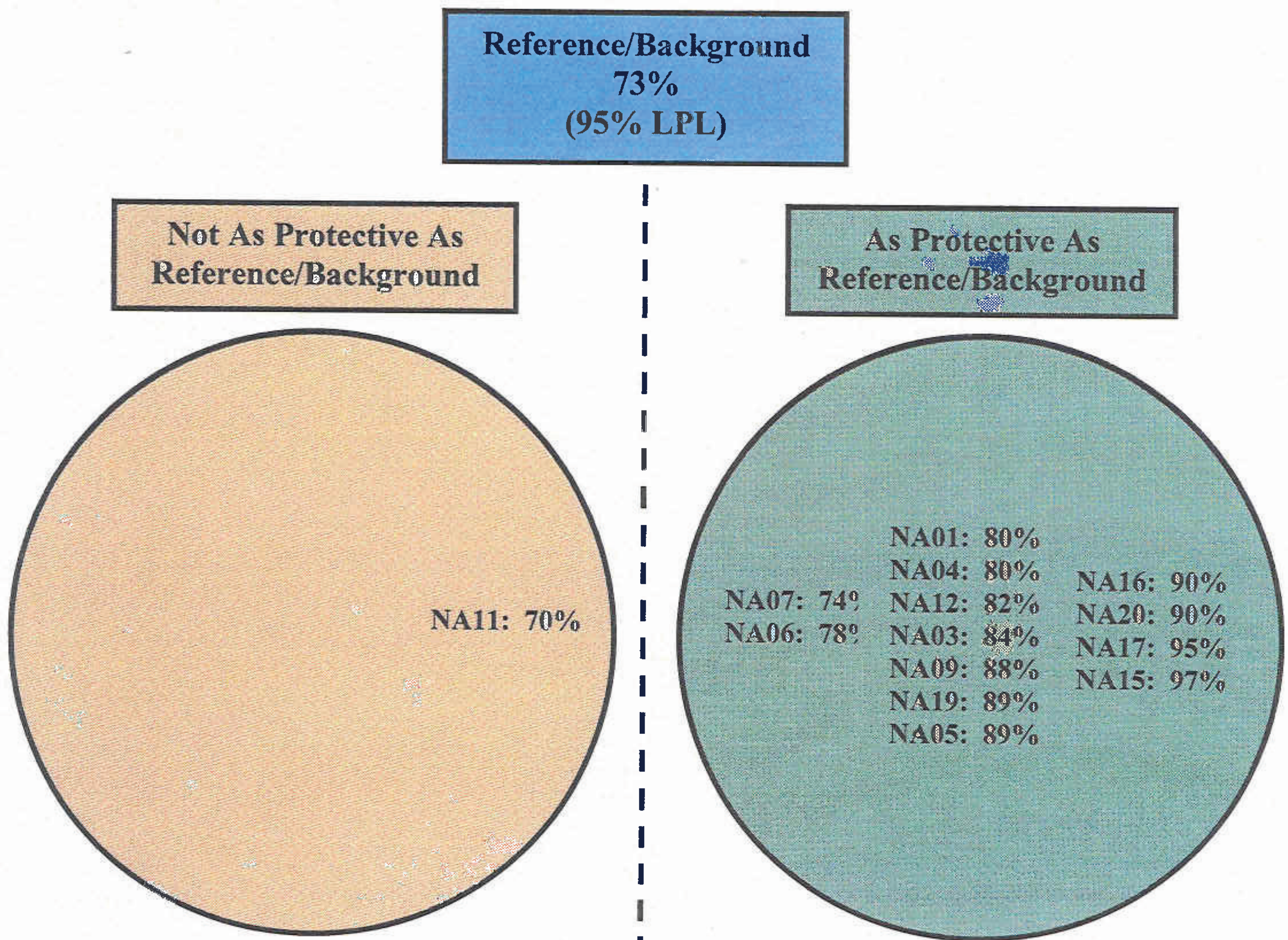


Urchin Fertilization Results for All NASSCO Stations
Reference/Background 42% (95% LPL)
Not As Protective As Reference/Background
As Protective As Reference/Background
NA19: 72%
NA20: 78%
NA03: 84%
NA16: 84%
NA01: 86%
NA04: 88%
NA15: 88%
NA17: 88%
NA12: 89%
NA05: 95%
NA09: 99%
NA11: 101%
NA07: 102%
NA06: 103%



Bivalve Development Results for All NASSCO Stations
Reference/Background 37% (95% LPL)
Not As Protective As Reference/Background
NA09: 1%
NA19: 2%
NA16: 3%
NA12: 15%
As Protective As Reference/Background
NA01: 49%
NA06: 74%
NA11: 80%
NA17: 80%
NA20: 80%
NA04: 84%
NA07: 88%
NA15: 93%
NA03: 94%
NA05: 94%

Amphipod Survival Results for All NASSCO Stations



Urchin Fertilization Results for All NASSCO Stations

Reference/Background
42%
(95% LPL)

Not As Protective As Reference/Background

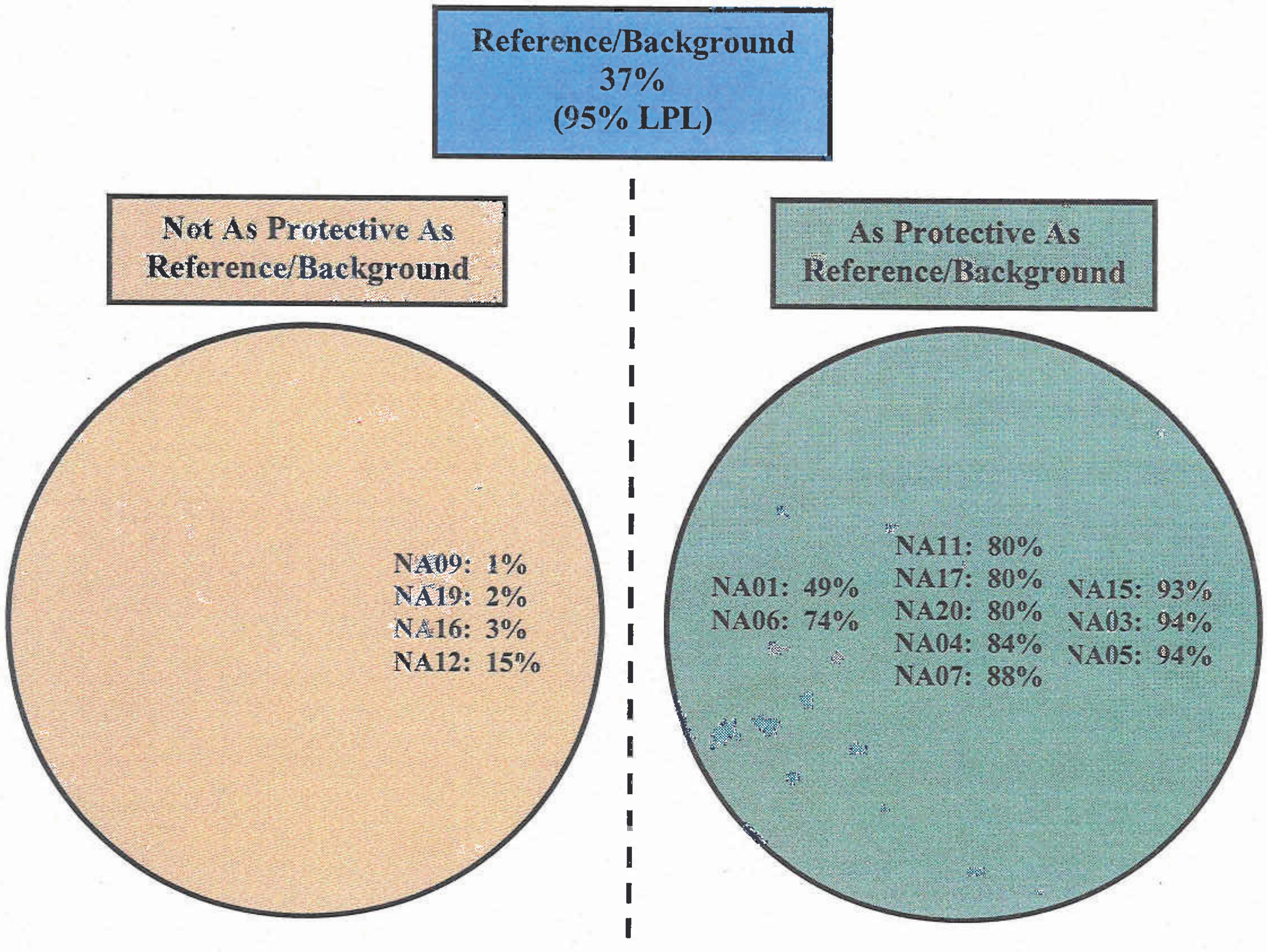
As Protective As Reference/Background

NA19: 72%
NA20: 78%

NA03: 84%
NA16: 84%
NA01: 86%
NA04: 88%
NA15: 88%
NA17: 88%
NA12: 89%

NA05: 95%
NA09: 99%
NA11: 101%
NA07: 102%
NA06: 103%

Bivalve Development Results for All NASSCO Stations



REFERENCES

REFERENCES

Hearing Brief Section	Reference Description	Pages
I	Deposition of Tom Alo, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on February 16-17, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-4
	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-7
II	Deposition of David Barker, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on March 1, 2, 3, and 10, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-9
	Exponent, NASSCO and Southwest Marine Detailed Sediment Investigation (October 10, 2003) [SAR105417-SAR106742].	R-11
	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-22
III	California Regional Water Quality Control Board, San Diego Region, Tentative Cleanup and Abatement Order No. R9-2011-0001 (September 15, 2010 [SAR382474-382519], as amended on September 15, 2011).	R-24
	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-26
III-A	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-31
	Ginn, Thomas Ph.D., Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site (March 11, 2011).	R-36
	Deposition of Tom Alo, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on February 16-17, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-42
	Finley, Brent Ph.D., Expert Opinion Letter Regarding Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 (March 11, 2011).	R-49

III-B	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-59
	Ginn, Thomas Ph.D., Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site (March 11, 2011).	R-63
	Deposition of Tom Alo, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on February 16-17, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-71
III-C	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-82
	Deposition of Tom Alo, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on February 16-17, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-114
	Ginn, Thomas Ph.D., Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site (March 11, 2011).	R-139
	Deposition of David Gibson taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on March 11, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-145
	Allen, Herbert Ph.D., Importance of Bioavailability for Risk Assessment of Sediment Contaminants at the NASSCO Site—San Diego Bay (March 11, 2011).	R-147
	Deposition of David Barker, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on March 1, 2, 3, and 10, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-149
IV	State Water Resources Control Board, Resolution 92-49 (as Amended on April 21, 1994 and October 2, 1996), Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304 [SAR286333-286353]	R-152
	Deposition of David Barker, taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on March 1, 2, 3, and 10, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-157
	California Regional Water Quality Control Board, San Diego Region, Tentative Cleanup and Abatement Order No. R9-2011-0001 (September 15, 2010 [SAR382474-382519], as amended on September 15, 2011).	R-214

	California Regional Water Quality Control Board, San Diego Region, Draft Technical Report (September 15, 2010 [SAR382520-SAR384585], as amended on September 15, 2011).	R-218
	California Regional Water Quality Control Board, San Diego Region, Response to Comments Report, Tentative Cleanup and Abatement Order No. R9-2011-0001 and Draft Technical Report for the Shipyard Sediment Site, San Diego Bay (August 23, 2011).	R-230
	Deposition of David Gibson taken In the Matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 on March 11, 2011, and Exhibits thereto (submitted to the administrative record on May 26, 2011).	R-232
	Exponent, NASSCO and Southwest Marine Detailed Sediment Investigation (October 10, 2003) [SAR105417-SAR106742].	R-236

I. INTRODUCTION

Certified Copy

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN THE MATTER OF:	)	Order No.
TENTATIVE CLEANUP AND ABATEMENT	)	R9-2011-001

DEPOSITION OF TOM ALO

VOLUME I, PAGES 1 THROUGH 210

FEBRUARY 16, 2011

SAN DIEGO, CALIFORNIA

REPORTED BY: JULIE A. MCKAY, CSR NO. 9059

Peterson Reporting

Truth and Technology, Transcribed.

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619 260 1069 tel
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page 28-19 of the DTR.
Do you see that table?
A. Yes, I do.
Q. Mr. Alo, what was the concentration of mercury in spotted sand bass in the reference areas?
A. According to Table 28-9 of the DTR, the mercury -- total mercury concentration in spotted sand bass collected at reference was 0.19 milligrams per kilogram.
Q. And what was the result for mercury in spotted sand bass within the NASSCO leasehold?
A. 0.12 milligrams per kilogram.
Q. So do you agree that mercury in fish captured within the NASSCO leasehold was lower than reference conditions?
MR. CARRIGAN: Document speaks for itself.
THE WITNESS: Yes, according to Table 28-9.
BY MR. RICHARDSON:
Q. Is there any reason to believe that Table 28-9 is incorrect?
A. No.
Q. Mr. Alo, the concentration of fish inside the NASSCO leasehold that you've described as 0.12 -- strike that.
Mr. Alo, on page 28-18, the DTR cites U.S. EPA

advisory levels and recommends eating fish listed as having lower levels of mercury.

Do you see that on Section 28.3?

A. Which paragraph?

Q. Paragraph beginning the "2004 U.S. EPA Advisory" --

A. Okay. Yes.

Q. Mr. Alo, if I understand this paragraph correctly, EPA recommends eating lower levels of mercury -- fish with lower levels of mercury such as light canned tuna with concentrations of .12 milligrams per kilogram; is that correct?

A. Yes.

Q. Mr. Alo, isn't that precisely the data for the fish fillets within the NASSCO leasehold?

A. Yes.

Q. So wouldn't you agree that mercury -- that fish within the leasehold are not impacted for mercury at unsafe levels?

A. Yes. However, based on the results for the Tier 2 risk assessment, the chemicals posing theoretical increased cancer risk include mercury.

Q. Okay, Mr. Alo, we'll come back to that.

A. Okay.

Q. If you look at Table 28-9 again, Mr. Alo, for

VOLUME I

DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA
Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

oil consisted of various waste petroleum, oils, and lubricants. In addition, containers of electrical insulating oils were stored at the site during the 1970s. Some of the containers reportedly leaked but no estimated quantities are available. The storage yard was paved with asphalt in 1975 and is currently used for parking and boat storage. Potential pollutant pathways to Paleta Creek and San Diego Bay during the storage yard's years of operation would have included surface water runoff and pollutant movement through the highly to moderately permeable (10^{-2} to 10^{-3} cm/sec) fill material underlying the site. Part of the storage yard was located adjacent to Paleta Creek along its southern edge, which flows into San Diego Bay approximately 1400 feet west of the storage yard site. Chemical constituents identified at the Salvage Yard Site in the U.S. Navy's 1990s IR Program site investigations have included petroleum, PCBs, and metals.

10.4.1.5. City of San Diego Sewage Treatment Plant

Between the years 1943 through 1963 the City of San Diego owned and operated its main sewage treatment plant at a location in NBSD bounded on the east by Harbor Drive, on the south by Vesta Street, and on the north by Knowlton Williams Road. During its initial years of operation from 1943 to 1950, the 14 million gallon per day (MGD) capacity plant was known as the 32nd Street Sewage Treatment Plant. In 1950 the plant capacity was expanded to 40 MGD capacity to accommodate increasing sewage flows resulting from San Diego's rapidly increasing population. The plant was renamed the Bayside Treatment Plant and was also sometimes referred to as the Harbor Drive Treatment Plant. The sewage treatment plant facilities consisted of maintenance and administration buildings, anaerobic digesters, clarifiers, elutriation tanks, sludge handling facilities, and other associated facilities. Effluent from the sewage treatment plant was discharged into an outfall pipeline and conveyed into San Diego Bay at a point 35 feet below the water line near present day Pier 5, approximately 0.9 miles south of the Shipyard Sediment Site. The Bayside Treatment Plant discharge would typically have included pollutants such as biochemical oxygen demand, suspended solids, grease and oils, metals, bacteria, and pathogens.

San Diego Bay water quality conditions drastically deteriorated during the years 1951-1963 due to the pollution effects caused by Bayside Treatment Plant discharge and other sewage, sludge, and industrial waste discharges entering the bay from various sources (Fairey et al 1996). Dissolved oxygen concentrations in the Bay declined to about half normal levels and turbidity in the water resulted in a visibility of less than 1 meter. Bait and game fish had virtually disappeared from the Bay. Coliform bacteria were routinely isolated from the Bay at significant levels. In 1955, the State Board of Public Health and the San Diego Department of Public Health declared much of the Bay contaminated, and posted quarantine and warning signs along 10 miles of shoreline. By 1963, sludge deposits from the treatment plant outfall were two meters deep, extended 200 meters seaward, and along 9000 meters of the shoreline. In 1960 the U.S. Navy began to complain that the Bayside Treatment Plant discharge was causing advanced corrosion to the hulls of naval ships while in port and that the sewage plant should be moved.[70] (Jamieson, 2002)

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[70] The ship hull corrosion was reportedly caused by electrolysis of the very high levels of organic matter present in San Diego Bay waters at the time. The U.S. Navy estimated at the time that the excessive corrosion was costing $1.5 million dollars a year in repairs.

II. Unprecedented Investigation

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

IN RE THE MATTER OF	)
	)
TENTATIVE CLEANUP AND ABATEMENT	)
ORDER NO. R9-2011-0001	)
	)
	)
______________________________	)

VIDEOTAPED DEPOSITION OF DAVID BARKER

Volume I, Pages 1 - 208

San Diego, California

March 1, 2011

Reported By: Anne M. Zarkos, RPR, CRR,
CSR No. 13095

BY MR. RICHARDSON: 11:30:38

Q. Did the board staff approve of the quality assurance reports? 11:30:38 11:30:40

A. Yes. 11:30:42

Q. The CAO calls the investigation detailed. It sounds like you agree; correct? 11:30:45 11:30:48

A. Yes. 11:30:50

Q. Would you also agree that this sediment investigation conducted at the shipyards is the most extensive sediment investigation ever conducted for a site in San Diego Bay? 11:30:55 11:30:58 11:31:01 11:31:04

A. Yes. 11:31:05

Q. Anywhere else in the state that you're aware of where a more extensive study was conducted for a site? 11:31:08 11:31:10

A. I am not aware of it. 11:31:14

Q. Was the public involved in the development of the study? 11:31:16 11:31:18

A. Very much so, yes. 11:31:20

Q. So the board staff sought -- considered substantial public input from a variety of stakeholders; correct? 11:31:27 11:31:29 11:31:36

MR. CARRIGAN: Vague. 11:31:37

THE WITNESS: Yes. 11:31:37

BY MR. RICHARDSON: 11:31:38

Q. This is referred to in Exhibit 2, Master 11:31:38

Exponent®

NASSCO and Southwest Marine Detailed Sediment Investigation

Volume I

Prepared for

NASSCO and Southwest Marine
San Diego, California

Bight '98 Stations 2241, 2256, and 2257 are all included in the final reference pool, and all of these stations are located in the same area of San Diego Bay (south of the shipyards, on the other side of the channel). Bight '98 Station 2258 is also located in this area of the bay, but is not included in the final reference pool.

The inconsistencies in the data selected for the final reference pool clearly indicate that those data were not selected by identifying appropriate reference locations on the basis of proximity to the shipyards, physical conditions, and absence of local sources. Because Regional Board staff have not provided any specific and detailed rationale for the selections, the method by which the final reference pool data were selected is unknown. However, by comparing the final reference pool samples with other data from the same locations, it is apparent that the final reference pool was selected by choosing data points with the lowest available chemistry concentrations, and the lowest available levels of biological responses. As a result, the final reference pool is biased toward the cleanest conditions available anywhere in San Diego Bay, and is not appropriate as a set of site-specific reference stations for the shipyard investigation.

3.2.4 Use of Reference Data for the Shipyard Investigation

Notwithstanding the inappropriateness of the final reference pool, these data have been used to evaluate shipyard conditions, following the direction of Regional Board staff. Because of the bias in the final reference pool, the results of evaluations using those data are biased toward overestimation of potential adverse effects at the shipyards.

The final reference pool is composed predominantly of Bight '98 stations, and there are some technical issues related to use of those data. Several groups of chemicals that were included in the shipyard investigation were not included in the Bight '98 study (and some were also not included in the Navy study). These chemicals include the butyltins, PCB Aroclors®, PCTs, and petroleum hydrocarbons. For these chemicals, reference conditions were characterized by only the Phase 1 data points that were included in the final reference pool. The Bight '98 study had elevated detection limits for PCBs (only selected congeners were measured) and PAHs, and these chemicals were ordinarily undetected. The Bight '98 study reported nondetected values at using several of the more potent Aroclors®, specifically 1248 or 1254. To the extent that less potent Aroclors® constitute a significant proportion of the total PCB content, such as in the case of forage fish and spotted sand bass where Aroclor® 1260 was detected in all samples, this approach represents a conservative estimate of the potential toxicity resulting from exposure of receptors to PCBs.

10.8.3.3 Polycyclic Aromatic Hydrocarbons

The availability of toxicity data on individual PAHs, particularly with regard to effects on ecologically relevant endpoints such as reproduction, is extremely limited. Therefore, exposure to PAHs was quantified based upon total PAH concentrations. Total PAH was computed as the sum of the concentrations of the following compounds: 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[ghi]perylene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene. Total PAH concentrations were compared to TRVs developed from studies where animals were only exposed to benzo[a]pyrene. Because benzo[a]pyrene is among the more potent PAHs, comparison of total PAH concentrations to a compound-specific TRV represents a conservative estimate of the potential toxicity resulting from exposure of receptors to PAHs.

10.9 Interpretation of Ecological Significance

Aquatic-dependent wildlife was modeled using conservative, ecologically relevant exposure assumptions to develop representative estimates of risk to receptors foraging near the shipyards. Exposure models indicate that no exposure estimates, for any chemical, exceed either no-effect (i.e., NOAEL-based) or lowest effects (i.e., LOAEL-based) TRVs for any receptor at any of the assessment units. Even under hypothetical, but ecologically unlikely, scenarios that maximize exposure by assuming receptors forage exclusively within an assessment unit, the likelihood of adverse effects is minimal, especially when considering uncertainty associated with exposure estimates and effects thresholds used in the exposure models. Overall, the results of this risk evaluation indicate that chemical concentrations measured in prey and sediment of the

NASSCO and Southwest Marine leaseholds are very unlikely to constitute an unacceptable risk to populations of aquatic-dependent wildlife potentially foraging at these locations. Therefore, the current conditions at the shipyards are protective of beneficial uses associated with aquatic-dependent wildlife.

exceeds the percentage of inorganic arsenic found in fish and shellfish reported in all but a few studies.

11.6 Summary and Conclusions

Chemical concentrations in fish and lobster tissue were screened against TRGs protective for human consumption. Two chemicals, PCBs in both fish and lobster, and mercury in lobster only, exceeded screening TRGs. Concentrations of these two chemicals were further screened against chemical concentrations in fish and lobster from reference areas. Within the NASSCO leasehold, maximum concentrations of mercury in lobster exceeded reference concentrations. Within the Southwest Marine leasehold, maximum concentrations of PCBs in fish and lobster exceeded reference concentrations. Outside the Southwest Marine leasehold, maximum concentrations of PCBs in fish exceeded reference concentrations. These chemicals were selected for evaluation in the human health risk assessment.

Estimated cancer risks associated with PCB exposure were:

- **Inside Southwest Marine Leasehold—**2×10^{-6} for fish consumption and 1×10^{-7} for lobster consumption
- **Outside Southwest Marine Leasehold—**6×10^{-8} for lobster consumption.

The estimated hazard index associated with mercury exposure was:

- **Inside NASSCO Leasehold—**0.05 for lobster consumption

In no case do risks exceed target risk levels. The existing conditions at the shipyards are protective of beneficial uses associated with human health. Therefore, it is unnecessary to derive cleanup levels for protection of human health at the site.

19.3.3 Effects on Recreational and Commercial Uses of Aquatic Resources

Alternative C is the only remedial alternative that is expected to have an effect on sport or commercial angling, shellfish harvesting, or recreational uses. Remedial activities associated with all other alternatives occur only within the leasehold boundaries where these uses are all prohibited. The dredging and barging activities performed outside the leasehold boundaries under Alternative C will interrupt these activities but is not expected to have a significant effect because of the short duration of active remedial operations in this area (estimated at approximately 5–6 months) and the ability of these users to avoid these remediation operations.

Ranking scores for the alternatives with respect to effects on recreational and commercial uses of aquatic resources are 0 for Alternatives A, B1, and B2 and −1 for Alternative C.

19.3.4 Summary of Economic Feasibility Rankings

A summary of the ranking scores for each of the alternatives under the economic feasibility evaluation criteria is presented in the table below.

Comparative summary of economic feasibility

	Alternative A	Alternative B1	Alternative B2	Alternative C
Shipyards and shipyard customers	0	−3[a]	−3[a]	−5[a]
Local quality-of-life effects on businesses and residents	0	−2	−1	−5
Recreational and commercial users of aquatic resources	0	0	0	−1

[a] Estimated economic effects on shipyard and shipyard customers s for Alternatives B1, B2, and C are provided for comparative purposes only. These evaluations are based on the unrealistic assumptions that cost and schedule implications can be ignored in favor of minimizing conflicts with shipyard operations.

19.4 Feasibility Study Summary

The results of the feasibility study show that Alternative A, monitored natural recovery, is the only alternative that provides acceptable effects on beneficial uses and is technically and economically feasible. Overall, aquatic life, aquatic-dependent wildlife, and human health beneficial uses are at approximately 95 percent of ideal conditions, and active remedial alternatives will result in improvements that are minimal—on the order of only a percent or so. Thus, Alternatives B1 (offsite disposal) and B2 (onsite CDF disposal), which involve removal of sediments to the site-specific LAET criteria, provide little or no incremental benefit over baseline conditions but impose significant impacts on shipyard operations and on the local community, and do so at a high cost. Alternative C, remediation to final reference pool chemical conditions, similarly provides little long-term benefit and imposes even more severe impacts on shipyard operations and on the local community; this alternative is consequently technically and economically infeasible to implement. Because there are uncontrolled contaminant sources nearby (Chollas Creek and municipal storm drains), and because physical sediment disturbance associated with shipyard operations will continue indefinitely, sediment conditions are likely to return to current conditions even if extensive dredging were to be conducted. Monitored natural recovery is therefore the most technically and economically feasible approach to addressing current sediment conditions at the shipyards.

Table 2-2. Summary of analyses by station

			Phase 1			Phase 2			
	Coordinates[a]								
Station	Latitude	Longitude	Triad Analyses[b]	Additional Surface Sediment	Bioaccum-ulation	Core for Chemical Analysis	Pore Water	Additional Surface Sediment	Core for Engineering Properties
NASSCO									
NA01	3616867.150000	486618.000000	X			X			
NA02	3616775.020000	486619.220000		X		X			
NA03	3616854.678703	486700.993722	X						
NA04	3616843.990000	486840.440000	X			X	X	X[c]	
NA05	3616767.512513	486809.931465	X						
NA06	3616932.510000	486961.610000	X		X	X	X		X
NA07	3616855.259861	486959.722777	X[d]						
NA08	3616829.389691	486968.273321		X					
NA09	3616800.390000	486988.960000	X			X			X
NA10	3616783.096101	486936.176432		X					
NA11	3616750.797778	486930.303333	X		X			X[c]	
NA12	3616672.986217	486896.831631	X		X				
NA13	3616611.410000	486858.480000		X		X	X		X
NA14	3616508.047784	486797.087827		X					
NA15	3616753.183215	487028.646327	X						
NA16	3616728.900000	486979.600000	X			X	X		
NA17	3616693.610000	487073.710000	X			X	X		X
NA18	3616684.027819	487004.073697		X					
NA19	3616643.220000	486967.900000	X			X			
NA20	3616594.920000	487240.400000	X		X	X			
NA21	3616407.690000	487183.990000		X		X			
NA22	3616582.832500	487379.712500	X					X[c]	
NA23	3616925.030000	486852.600000				X		X	
NA24	3616912.580000	486762.720000				X		X	X
NA25	3616349.260000	486892.940000				X		X	
NA26	3616612.940000	486587.140000				X		X	
NA27	3616871.251559	486905.328588						X	
NA28	3616784.712792	486883.693896						X	
NA29	3616699.320000	486731.150000				X		X	
NA30	3616520.060000	486751.000000				X		X	
NA31	3616184.210000	487111.930000				X		X	

Table 2-2. (cont.)

Station	Coordinates[a] Latitude	Coordinates[a] Longitude	Phase 1 Triad Analyses[b]	Phase 1 Additional Surface Sediment	Phase 1 Bioaccum-ulation	Phase 2 Core for Chemical Analysis	Phase 2 Pore Water	Phase 2 Additional Surface Sediment	Phase 2 Core for Engineering Properties
Southwest Marine									
SW01	3617206.990000	486339.470000		X		X	X		X
SW02	3617173.880000	486320.790000	X			X	X		
SW03	3617095.051914	486264.049842	X						
SW04	3617202.830000	486380.920000	X[d]		X	X	X	X[c]	
SW05	3617141.991289	486339.873319		X					
SW06	3617096.656107	486308.430201		X					
SW07	3617056.615892	486276.873082		X					
SW08	3617198.370000	486415.190000	X		X	X	X		
SW09	3617128.147179	486381.270040	X						
SW10	3617101.970000	486352.020000		X		X			X
SW11	3617054.405921	486317.050697	X						
SW12	3617004.710000	486281.940000		X		X	X		
SW13	3617131.839371	486437.518825	X		X				
SW14	3617115.959411	486413.953396		X					
SW15	3617061.139224	486382.842764	X						
SW16	3617102.528070	486440.262208		X					
SW17	3617080.840000	486463.100000	X			X			X
SW18	3616972.897179	486420.053694	X						
SW19	3616827.460000	486299.010000		X		X			
SW20	3617090.190000	486545.510000		X		X			
SW21	3617072.473283	486562.393409	X		X				
SW22	3617065.955876	486551.644511	X						
SW23	3617054.105245	486537.339936	X						
SW24	3617050.990000	486553.400000		X		X	X		X
SW25	3616981.930000	486488.740000	X			X	X		
SW26	3616899.257878	486431.954162		X					
SW27	3616932.220000	486547.400000	X			X			
SW28	3616945.190000	486604.420000		X	X	X	X		
SW29	3617228.400000	486278.860000				X		X	
SW30	3617114.480000	486195.450000				X		X	X
SW31	3616896.510000	486461.560000				X		X	X
SW32	3616992.440000	486104.400000				X		X	
SW33	3616909.220000	486200.080000				X		X	
SW34	3616758.500000	486487.120000				X		X	
SW36	3616955.330000	486384.480000				X		X	

Table 2-2. (cont.)

	Coordinates[a]		Phase 1			Phase 2			
Station	Latitude	Longitude	Triad Analyses[b]	Additional Surface Sediment	Bioaccum-ulation	Core for Chemical Analysis	Pore Water	Additional Surface Sediment	Core for Engineering Properties
Reference									
2229	3619035.560536	483501.910215						X	
2230	3618324.650116	483255.473513						X	
2231	3617448.642000	485325.876000	X		X		X	X	
2240	3614441.124194	485552.428884						X	
2241	3614741.868181	487203.077910						X	
2243	3614105.548000	486625.544000	X		X		X	X	
2244	3613571.802548	487639.180461						X	
2265	3616251.802897	486847.215393						X	
2433	3620528.253988	480397.853986	X		X		X	X	
2435	3619330.202811	479108.531823						X	
2440	3620092.082000	483620.208000	X		X		X	X	
2441	3617113.053991	477860.015961	X		X		X	X	

Note: PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
TBT - tributyltin

[a] Universal Transverse Mercator Zone 18, North American Datum 1983.

[b] Surface sediment chemistry; amphipod, echinoderm, and bivalve toxicity tests; and benthic macroinvertebrates.

[c] Organophosphate pesticide analysis only.

[d] Includes serial dilution toxicity test.

Table 2-3. Relative effort of sediment investigations

			Number of Stations										
Geographic Location	Acres	Study	Amphipod Bioassay	Sediment Chemistry	Benthic Community	Echinoderm Bioassay	Bivalve Bioassay	Bioaccum-ulation Test	Lobster Tissue Chemistry	Mussel Tissue Chemistry	Fish Tissue Chemistry	Fish Histo-pathology	Fish Bile
NASSCO and Southwest Marine[a]	143	Exponent	30	66	30	30	30	10	2	2	4	4	4
Chollas and Paleta Creeks TMDL[b]		Navy 2001	17	31	31	17							
San Diego Bay	11,231	Bight '98	46	46	46								
San Diego Bay	11,231	BPTCP		158	22								
Ventura Harbor	154	Bight '98	1	1									
Channel Islands Harbor	148	Bight '98	4	4									
Marina del Rey	417	Bight '98	7	7									
San Pedro Bay	12,444	Bight '98											
Anaheim Bay	604	Bight '98	3	3									
Newport Bay	1,202	Bight '98	11	11									
Mission Bay	2,315	Bight '98	3	3									
Mission Bay	2,315	BPTCP			3								
Dana Point Harbor	170	Bight '98	3	3									
Los Angeles Harbor	7,000	Bight '98	36	36									

Note: BPTCP - Bay Protection and Toxic Cleanup Program
TMDL - total maximum daily load

[a] Includes areas out to the ship channel; counts of samples do not include reference areas.

VOLUME II

DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

R-22

SAR382893

17. Finding 17: Reference Sediment Quality Conditions

Finding 17 of CAO No. R9-2011-0001 states:

The San Diego Water Board selected a group of reference stations from three independent sediment quality investigations to contrast pollution conditions at the Shipyard Sediment Site with conditions found in other relatively cleaner areas of San Diego Bay not affected by the Shipyard Sediment Site: (1) Southern California Bight 1998 Regional Monitoring Program (Bight 98), (2) 2001 Mouth of Chollas Creek and Mouth of Paleta Creek TMDL studies, and (3) 2001 NASSCO and BAE Systems Detailed Sediment Investigation. Stations from these studies were selected to represent selected physical, chemical, and biological characteristics of San Diego Bay. Criteria for selecting acceptable reference stations included low levels of anthropogenic pollutant concentrations, locations remote from pollution sources, similar biological habitat to the Shipyard Sediment Site, sediment total organic carbon (TOC) and grain size profiles similar to the Shipyard Sediment Site, adequate sample size for statistical analysis, and sediment quality data comparability. The reference stations selected for the Reference Sediment Quality Conditions are identified below.

Reference Stations Used To Establish Reference Sediment Quality Conditions

2001 Chollas/Paleta Reference Station Identification Number	2001 NASSCO/BAE Systems Reference Station Identification Number	1998 Bight'98 Reference Station Identification Number
2231	2231	2235
2243	2243	2241
2433	2433	2242
2441	2441	2243
2238		2256
		2257
		2258
		2260
		2265

III. SITE UNIMPAIRED

TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

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

NATIONAL STEEL AND SHIPBUILDING COMPANY

BAE SYSTEMS SAN DIEGO SHIP REPAIR, INC.

CITY OF SAN DIEGO

STAR & CRESCENT BOAT COMPANY

CAMPBELL INDUSTRIES

SAN DIEGO GAS AND ELECTRIC

UNITED STATES NAVY

SAN DIEGO UNIFIED PORT DISTRICT

SHIPYARD SEDIMENT SITE

SAN DIEGO BAY

SAN DIEGO, CALIFORNIA

Daily Load program) is the appropriate regulatory tool to use for correcting the impairment at the Shipyard Sediment Site.

13. **SEDIMENT QUALITY INVESTIGATION.** NASSCO and BAE Systems conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003 (Shipyard Report, Exponent 2003*). Unless otherwise explicitly stated, the San Diego Water Board's finding and conclusions in this CAO are based on the data and other technical information contained in the Shipyard Report prepared by NASSCO's and BAE Systems' consultant, Exponent.

    The Shipyard Sediment Site is exempt from the Phase I Sediment Quality Objectives promulgated by the State Water ~~Resources Control~~ Board ~~(State Water Board)~~ because a site assessment (the Shipyard Report) was completed and submitted to the San Diego Water Board on October 15, 2003. See State Water Board, *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*, II.B.2 (August 25, 2009).

IMPAIRMENT OF AQUATIC LIFE BENEFICIAL USES

14. **AQUATIC LIFE IMPAIRMENT**. Aquatic life beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Aquatic life beneficial uses include: Estuarine Habitat (EST), Marine Habitat (MAR), and Migration of Aquatic Organisms (MIGR). This finding is based on the considerations described below in this *Impairment of Aquatic Life Beneficial Uses* section of the CAO.

15. **WEIGHT-OF-EVIDENCE APPROACH**. The San Diego Water Board used a weight-of-evidence approach based upon multiple lines of evidence to evaluate the potential risks to aquatic life beneficial uses from pollutants at the Shipyard Sediment Site. The approach focused on measuring and evaluating exposure and adverse effects to the benthic macroinvertebrate community and to fish using data from multiple lines of evidence and best professional judgment. Pollutant exposure and adverse effects to the benthic macroinvertebrate community were evaluated using sediment quality triad measurements, and bioaccumulation analyses, and interstitial water (i.e., pore water) analyses. The San Diego Water Board evaluated pollutant exposure and adverse effects to fish using fish histopathology analyses and analyses of PAH breakdown products in fish bile.

16. **SEDIMENT QUALITY TRIAD MEASURES**. The San Diego Water Board used lines of evidence organized into a sediment quality triad, to evaluate potential risks to the benthic community from pollutants present in the Shipyard Sediment Site. The sediment quality triad provides a "weight-of-evidence" approach to sediment quality assessment by integrating synoptic measures of sediment chemistry, toxicity, and benthic community composition. All three measures provide a framework of complementary evidence for assessing the degree of pollutant-induced degradation in the benthic community.

VOLUME II






DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

13. Finding 13: Sediment Quality Investigation

Finding 13 of CAO No. R9-2011-0001 states:

NASSCO and BAE Systems conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003 (Shipyard Report, Exponent 2003)*. Unless otherwise explicitly stated, the San Diego Water Board's finding and conclusions in this CAO are based on the data and other technical information contained in the Shipyard Report prepared by NASSCO's and BAE Systems' consultant, Exponent.

The Shipyard Sediment Site is exempt from the Phase I Sediment Quality Objectives promulgated by the State Water ~~Resources Control~~ Board ~~(State Water Board)~~ because a site assessment (the Shipyard Report) was completed and submitted to the San Diego Water Board on October 15, 2003. See State Water Board, *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*, II.B.2 (August 25, 2009).

13.1. NASSCO and Southwest Marine Detailed Sediment Investigation

On February 21, 2001, the San Diego Water Board adopted Resolution Nos. 2001-02 and -03 directing the Executive Officer to issue ~~CWC~~ Water Code section 13267 letters to NASSCO and BAE Systems requiring the submission of a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives.

On June 1, 2001, the San Diego Water Board Executive Officer directed, under the authority provided in ~~CWC~~ Water Code section 13267, NASSCO and BAE Systems to conduct a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives. The study was conducted in accordance with the San Diego Water Board document, *Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards, June 1, 2001*.

As a first step, NASSCO and BAE Systems developed and submitted to the San Diego Water Board a Work Plan (Exponent, 2001a) and time schedule for performance of a site assessment and development of sediment cleanup levels, sediment cleanup alternatives, and cleanup costs. Following San Diego Water Board concurrence with the work plan NASSCO and BAE Systems conducted the two phase sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. The results of the investigation are provided in the Shipyard Report.

13.2. Data Quality

The Work Plan for the Detailed Sediment Investigation included a field sampling plan (FSP) (Appendix A, Exponent, 2001a). The FSP presented the sampling methods that would be used during the investigation, including field sampling locations and procedures, the use of quality control samples, field data reporting and field custody procedures, and sample packaging and shipping requirements.

The Work Plan also included a quality assurance project plan (QAPP) (Appendix B, Exponent, 2001a) to ensure that the quality of the data was sufficiently high to support its intended use of determining the nature and extent of contamination, determining biological effects, assessing ecological and human health risks, and establishing remediation measures for the Shipyard Sediment Site. The QAPP described the procedures for field collection of samples, sample handling and custody (including preservation and holding time requirements), analytical methods, field and laboratory quality control, instrument maintenance and calibration, data validation methods, and data management. Data validation methods were provided for field procedures, chemical analyses, toxicity tests and laboratory bioaccumulation, and benthic macroinvertebrate identification.

The Shipyard Report presented a Quality Assurance Report for Chemistry Data that provided a data quality review (data validation and data quality assessment) of the data collected during the Detailed Sediment Investigation. The review verified that quality assurance and quality control (QA/QC) procedures were completed and documented as required by the QAPP. The data quality of chemistry data was determined by Exponent to be sufficiently high and no data were rejected. (Appendix F, Exponent, 2003)

Quality Assurance Reports were also provided for Toxicity Tests (Amphipod Toxicity, Echinoderm Toxicity, Sediment-Water Interface Toxicity, and Dilution Series Toxicity), Bioaccumulation Tests, and Benthic Macroinvertebrate Identification. The quality assurance reviews identified whether results met applicable performance standards, whether any deviations or inconsistencies with the specifications of the statement of work (with each contracted laboratory) occurred and then assessed whether there were any resulting affects on the quality of the data. Exponent determined that the data generated from the Detailed Sediment Investigation were acceptable for their intended use. (Appendices H, J, and L, Exponent, 2003)

13.3. Stakeholder Involvement

The San Diego Water Board conducted a series of stakeholder meetings and public workshops during the course of NASSCO's and BAE Systems' sediment investigation and received valuable input, which was factored into the investigation. At the meetings and workshops, experts, and interested parties representing the shipyards and a diverse group of stakeholders had the opportunity to provide critical input and share knowledge on various aspects of the Shipyard Sediment Site investigation, including review of the work plan. The stakeholder group included representatives from the Audubon Society; California Department of Fish and Game (DFG); City of San Diego, Environmental Health Coalition; National Oceanic and Atmospheric Administration (NOAA); San Diego Baykeeper; SDUPD; Sierra Club; Southern California

Coastal Water Research Project (SCCWRP); Surfrider Foundation; University of California, Davis, Marine Pollution Studies Laboratory; U.S. Fish and Wildlife (U.S. FWS); and U.S. Navy.

A summary of the meetings, workshops, and significant documents for the Shipyard Sediment Site investigation are listed in the Table 13-1 below.

Table 13-1 List of Meetings, Workshops, and Significant Documents

	Item or Event	Date
1	Adopt Resolution Nos. 2001-002 and 2001-003	2/21/2001
2	Issue CWC section 13267 letters to NASSCO and BAE Systems	6/01/2001
3	Issue Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and BAE Systems Shipyards.	6/01/2001
4	Public Workshop #1	8/03/2001
5	Stakeholder Meeting #1	10/12/2001
6	Stakeholder Meeting #2	1/29 - 30/2002
7	Stakeholder Meeting #3	3/28 - 29/2002
8	Public Workshop #2	6/18/2002
9	Stakeholder Meeting #4	8/22/2002
10	Technical Meeting #1	12/12/2002
11	Technical Meeting #2	1/22 - 23/2003
12	San Diego Water Board Meeting – Status Report #1	9/10/2003
13	NASSCO and BAE Systems Detailed Sediment Investigation released for review.	10/10/2003
14	San Diego Water Board Meeting – Status Report #2	11/12/2003
15	Public Workshop #3	11/14/2003
16	Release Tentative CAO R9-2005-0126	5/1/2005
17	Public Workshop #4	6/29/2005
18	San Diego Water Board Meeting – Status Report #3	8/10/2005
19	Pre-Hearing Conference #1	8/26/2005
20	Pre-Hearing Conference #2	12/06/2005
21	Advisory Team / Cleanup Team public meeting	12/12/2005

It is anticipated that the San Diego Water Board will conduct additional prehearing conferences and workshops and at least one San Diego Water Board public hearing in considering the issuance of a final Cleanup and Abatement Order.

13.4. Conclusion

The San Diego Water Board's findings in the Tentative Cleanup and Abatement Order and conclusions in this Technical Report are based primarily on the data and other technical information provided in the Shipyard Report. The San Diego Water Board has reviewed the Quality Assurance Reports and found that the data reported in the Shipyard Report are found to be of sufficient quality to be used to develop the San Diego Water Board's findings and conclusions.

The San Diego Water Board's Technical Report identifies those instances where other data and technical information, in addition to that provided in the Shipyard Report, are used to support the Findings in the tentative Cleanup and Abatement Order and for the San Diego Water Board's management decisions.

III-A. HUMAN HEALTH RISK

VOLUME II






DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA
Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

R-31
SAR382893

26. Finding 26: Risk Assessment Approach for Human Health

Finding 26 of CAO No. R9-2011-0001 states:

The San Diego Water Board evaluated potential risks to human health from chemical pollutants present in the sediment at the Shipyard Sediment Site based on a two-tier approach. The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using ASTM protocols. The Tier II baseline comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. Two types of receptors (i.e., members of the population or individuals at risk) were evaluated:

a. Recreational Anglers – Persons who eat the fish and/or shellfish they catch recreationally; and

b. Subsistence Anglers – Persons who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in their diet.

26.1. Human Health Risk Assessment Approach

A two-tiered approach was used to evaluate potential risks to human health from chemical pollutants present at the Shipyard Sediment Site. The Tier I screening level risk assessment used conservative exposure and effects assumptions to support risk management decisions. The Tier II comprehensive risk assessment (i.e., baseline risk assessment) more accurately characterized potential risk to receptors of concern primarily by replacing the conservative assumptions required by Tier I with site-specific exposure parameters.

The approach used in Tiers I and II was conducted in accordance with U.S. EPA's "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)" (U.S. EPA, 1989b). The approach consists of the following key elements:

- Identification of Chemicals of Potential Concern;
- Exposure Assessment;
- Toxicity Assessment;
- Risk Characterization;
- Risk Management; and
- Uncertainties Related to Risk Estimates.

These elements are discussed in more detail in Section 27 – Tier I Screening Level Risk Assessment for Human Health and Section 28 – Tier II Baseline Risk Assessment for Human Health of this Technical Report.

- **Spiny Lobsters (*Panulirus interruptusi*)** – Chemical concentrations in edible tissue (all soft tissue, including hepatopancreas) and the entire organism, including the shell, were used to estimate exposure to chemicals in food for the recreational angler and subsistence angler, respectively.

Human exposure to contaminants in fish and shellfish collected at the Shipyard Sediment Site was estimated using the following simple exposure model consistent with U.S. EPA (1998b) guidance (Exponent, 2003):

$$\text{Intake (in mg/kg - day)} = \frac{(C * CR * FI * ED * EF)}{(BW * AT * CF)}$$

where:

C	=	tissue chemical concentration in spotted sand bass and spiny lobster (µg/kg-wet weight)
CR	=	fish consumption rate (kg/day)
FI	=	fraction ingested from the site (unitless)
ED	=	exposure duration (years)
EF	=	exposure frequency (days/year)
BW	=	body weight (kg)
AT	=	averaging time (days) - non-carcinogens: exposure duration x 365 days - carcinogens: 70-year lifetime x 365 days
CF	=	conversion factor (1,000 µg/mg)

According to U.S. EPA guidance, exposures should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future conditions at the site. The RME is defined as the highest exposure that is reasonably expected to occur at a site. The assumptions used by the San Diego Water Board to estimate the RME at the Shipyard Sediment Site are shown below in Table 28-7 and the exposure estimate calculations using these assumptions are provided in the Appendix for Section 28.

Table 28-7 Reasonable Maximum Exposure (RME) Assumptions for Recreational and Subsistence Anglers

Parameter		Units	Recreational Angler	Subsistence Angler
Tissue Chemical Concentration	C	μg/kg-wet wt	Maximum	Maximum
Fish or Shellfish Consumption Rate	CR	kg/day	0.021[1]	0.161[2]
Body Weight	BW	kg	70	70
Exposure Duration	ED	years	30	30
Exposure Frequency	EF	days/year	365	365
Fraction Ingested from Site or Reference	FI	unitless	1	1
Averaging Time for Carcinogens	AT_c	days	25,550	25,550
Averaging Time for Noncarcinogens	AT_n	days	10,950	10,950
Conversion Factor	CF	μg/mg	1,000	1,000

1. OEHHA 2001
2. SCCWRP and MBC 1994

28.2.3. Toxicity Assessment

The toxicity assessment identifies toxicity values for each chemical pollutant of concern and discusses their potential adverse effects to humans (U.S. EPA, 1989b). Two types of toxicity values are evaluated: CSFs for carcinogenic chemicals and RfDs for non-carcinogenic chemicals.

CSFs and RfDs from U.S. EPA's Integrated Risk Information System (IRIS) were used in the baseline risk assessment (U.S. EPA, 2003a). The CSFs and RfDs for the CoPCs identified in Section 28.2.1 are listed in Table 28-8 below.

Table 28-8 Cancer Slope Factors and Reference Doses for Chemicals of Potential Concern

Chemical	CSF $(mg/kg\text{-}day)^{-1}$	RfD (mg/kg-day)	Source
Metals			
Arsenic, inorganic	1.5	0.0003	U.S. EPA (2003a)
Cadmium	NA	0.0005	U.S. EPA (2003a)
Copper	NA	0.037	U.S. EPA (2003a)
Mercury, total	NA	0.0001	U.S. EPA (2003a)
Polychlorinated Biphenyls			
Total PCBs	2	NA	U.S. EPA (2003a)
Total PCBs (as Aroclor 1254)	NA	0.00002	U.S. EPA (2003a)

28.2.6. Uncertainties Related to Risk Estimates

The process of evaluating human health cancer risk and non-cancer hazard indices involves multiple steps. Inherent in each step of the risk assessment process are uncertainties that ultimately affect the risk estimates. Uncertainties may exist in numerous areas such as estimation of potential site exposures and derivation of toxicity values. The most significant uncertainties in the Tier II risk analysis for the Shipyard Sediment Site are discussed below.

Fractional Intake. Exponent (2003) used the following fractional intake assumptions for the human health risk assessment: Inside NASSCO = 0.034 (or 3.4 percent), Outside NASSCO = 0.005 (or 0.5 percent), Inside BAE Systems = 0.023 (or 2.3 percent), and Outside BAE Systems = 0.002 (or 0.2 percent). In contrast, the San Diego Water Board initially used a conservative fractional intake of 1 based on the assumption that 100% of the fish and shellfish caught and consumed by recreational and subsistence anglers is from the Shipyard Sediment Site. Since it is likely that anglers catch at least a portion of their seafood from other locations in San Diego Bay and/or the fish caught from the Shipyard Sediment Site comes from elsewhere, the actual site fractional intake is likely to be less than 100 percent.

Exposure Concentration. U.S. EPA guidance recommends that the tissue chemical concentrations used in the intake equation be either the 95 percent upper confidence limit (UCL) on the arithmetic average concentration or the maximum concentration, whichever is lesser (U.S. EPA, 1989b). In order to simplify the risk calculations, the San Diego Water Board only used the maximum concentration observed in spotted sand bass (fillet and whole body) and lobster (edible tissue and whole body) to estimate risks at each of the four assessment units and at the two reference areas. This may result in an under- or overestimation of risks at the Shipyard Sediment Site.

Spotted Sand Bass Home Range. Spotted sand bass were collected in four discrete assessment units at the Shipyard Sediment Site: inside NASSCO leasehold, outside NASSCO leasehold, inside BAE Systems leasehold, and outside BAE Systems leasehold. It is assumed that the assessment units bound the home range for these spotted sand bass and that the observed tissue chemical concentrations are based exclusively from exposure within these areas. This may, however, not be indicative of their actual exposures because these fish may feed beyond the assessment unit boundaries. Therefore, the estimated risk to the recreational and subsistence anglers ingesting the fish is considered conservative and does not characterize actual exposures to the Shipyard Sediment Site.

PCB Cooking Losses. Numerous studies have evaluated the loss of PCBs from fish during preparation and cooking (Exponent, 2003). Reductions of PCBs ranged from 26 to 90 percent using cooking methods such as microwaving, boiling, and frying. For this assessment, a 50 percent reduction factor for PCBs in spotted sand bass fillets was used to assess potential risks to recreational anglers (Brodberg, 2004). A PCB cooking loss factor was not applied to spotted sand bass whole bodies because of the various preparation and cooking methods (such as boiling the entire fish to make a soup) and other related habits (such as consuming pan drippings from frying) potentially used by subsistence anglers. These cooking loss factor assumptions may underestimate or overestimate PCB cancer risks and PCB non-cancer hazards.

Exponent®

Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site

Expert Report of Thomas C. Ginn, Ph.D.

Exponent®

Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site

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March 11, 2011

Unrealistic Exposure Assumptions in the Risk Assessment

As indicated previously, the overly-conservative assumptions used in the Tier II baseline risk assessment result in a meaningless and implausible assessment that is constructed under the guise of being "conservative." These overly-conservative and unsubstantiated assumptions have a dramatic effect on the resultant risk calculations. In effect, the DTR is combining a series of extreme assumptions, which result in a multiplicative effect on the final risk calculations:

1. All of the fish or shellfish tissue consumed each day comes from the shipyard site (i.e., FI = 1.0)
2. Four percent of the arsenic in seafood is in the inorganic form
3. Risks for subsistence anglers are unrealistic
    a. The only species consumed are spotted sand bass and spiny lobster.
    b. The theoretical subsistence angler consumes only the whole-bodies of the fish and invertebrate species
4. Anglers have complete access to the highly-restricted shipyard site.

By using these assumptions, the Staff has constructed a highly-conservative, screening-level assessment of risk that bears no resemblance to a Tier II baseline risk assessment, which would incorporate some more realistic, but nonetheless conservative, assumptions. The following sections of my report discuss each of these unrealistically conservative assumptions and how they bias the results of the DTR risk assessment.

Fractional Intake (FI) is 1.0

The most unrealistic assumption used in the DTR Tier II assessment is the FI. FI represents the portion of the seafood diet that an angler would receive directly from the assessment area. In the DTR, FI is set to 100 percent, the same value used in the Tier I screening-level assessment. In other words, the baseline risk assessment (and determination of need for remediation) is entirely concentration of 44 μg/g wet weight. It is recognized that demersal crustaceans such as crabs and lobsters may have higher levels of inorganic arsenic in tissue because of potentially ingesting these forms of arsenic in the diet (e.g., algae, small invertebrates and associated sediments). In a study of lobster, prawns, and crab, Edmonds and Francesconi (1993) reported that the percentage of inorganic arsenic in muscle tissue ranged from 0.6 to 1.7. In the Sloth et al. (2005) survey, the highest inorganic arsenic concentrations in lobster were measured in meat from the head and thorax (0.037 μg/g wet weight), but this represented only 0.2 percent of the total arsenic in that tissue (22 μg/g wet weight).

The above studies show that the use of the assumption of 4 percent inorganic arsenic in fish fillets and edible lobster is most likely overly conservative, and the actual percentage of inorganic arsenic may be substantially less than this value. Moreover, as was demonstrated in a previous section of my report, there is no significant difference between the arsenic concentrations measured in edible lobster at NASSCO and the reference area, or between sand bass fillets from outside the NASSCO leasehold and the reference area. For the Staff to conclude in the DTR (Table 28-1) that arsenic risks are higher for recreational anglers consuming sand bass fillets from outside the NASSCO leasehold, compared to reference, is especially disingenuous given that the mean arsenic concentrations for those two areas are 0.42 and 0.36 mg/kg, respectively.

In summary, the DTR's conclusion that inorganic arsenic in seafood theoretically harvested at the NASSCO site "poses a theoretical increased" cancer risk when compared to reference areas is not valid, and does not form the basis for concluding that beneficial uses are impaired or that any active remediation of sediments would be required to reduce arsenic exposure.

Risks for Subsistence Anglers

The DTR includes risk calculations for so-called "subsistence anglers;" however, the definition of these kinds of anglers is neither specified nor otherwise justified in the DTR. In Table 28-7 of the DTR, the exposure assumptions are provided and indicate that the only difference between recreational anglers and subsistence anglers is that the latter group has a consumption rate of 161 g/day versus 21 g/day. The other significant difference between recreational and subsistence anglers, as assessed in the DTR, is that subsistence anglers are always assumed to eat the entire organism, either sand bass or lobster. The DTR provides no justification for this important assumption.

First, there is no basis for assuming that all anglers of this theoretical category would consume only whole-body organisms for the entire 30-year period. I would agree that certain ethnic groups (primarily Asians) may use whole bodies of harvested fish or invertebrates in soups or stews. The staff should have assumed that a certain proportion of harvested seafood was prepared in this manner. For the proportion of the diet that was assumed to be consumed as a whole body, the DTR should have apportioned the species according to expected catch rates. For example, the DSI included the sampling of smaller species of fish for use in the aquatic-dependent wildlife risk assessment. These species (e.g., topsmelt, *Atherinops affinis*) contained significantly lower concentrations of PCBs in whole bodies when compared with spotted sand bass. The maximum PCB concentrations in whole-body topsmelt inside the NASSCO area were less than 20 percent of the corresponding maximum concentrations of PCBs in spotted sand bass. Moreover, the maximum PCB concentration in topsmelt collected inside NASSCO was only about 40 percent higher than the reference concentration. This is an important consideration because:

1. Topsmelt and the closely related jacksmelt (*Atherinops californiensis*) are among the most abundant fishes available to shore and pier anglers in southern California and they make up a large proportion of the sport catch in such areas (CA DFG 2001)

2. Because of their abundance and ease of catch, topsmelt and jacksmelt would be much more available to shore or near-shore anglers than the larger sand bass. If “subsistence” anglers actually could operate at the shipyard site, these *Atherinops* species would most likely constitute a significant part of the catch.

Therefore, by using only spotted sand bass data, the DTR has substantially overestimated the concentrations of PCBs that may occur in fish species harvested in San Diego Bay.

Another significant error in the DTR assessment results from the assumption that all subsistence anglers consume the entire body of harvested fish. Whole body analyses were conducted in the DSI for use in the wildlife risk assessment because predators such as sea lions and birds consume the entire fish. The consumption of entire fish by humans, including guts, kidneys, and livers, is relatively rare. Even if whole fish are added to soups or stews, the fish is typically gutted, thereby removing the liver and other soft internal organs. For example, in the Santa Monica Bay seafood consumption study (SCCWRP and MBC 1994), which was the basis for the DTR consumption rates, only 1 percent of surveyed anglers consumed whole fish that were not gutted. Even among Hispanic and Asian anglers, only about 1 percent consumed whole fish that were not gutted. Alternatively, about 33 percent of anglers consumed whole fish that had been gutted. This is an important distinction because it is well-established that the liver and other fatty internal organs in fishes contain much higher concentrations of hydrophilic substances such as PCBs than muscle tissue (OEHHA 2010). Finley (2011) also criticizes the use of whole-body tissue concentrations for all subsistence anglers and indicates that the DTR could have assumed a fixed percentage of anglers that consume the entire fish.

Finally, there is simply no basis for the DTR assumption that subsistence anglers could harvest sufficient lobsters from the shipyard site to maintain a 30-year daily consumption rate of 161 g/day and that all of these lobsters would be eaten whole (i.e., shell, internal organs, and meat). I have discussed previously the problems associated with DTR exposure assessment for so-called “subsistence anglers.” In the case of lobsters for which the DTR claims significant risks from arsenic for recreational anglers but not for subsistence anglers) the exposure assumptions are overestimated because of the Staff’s failure to consider the degree to which lobsters could actually be harvested in San Diego Bay. As noted previously, the DTR assumes that recreational and subsistence anglers would consume 21 and 161 g/day, respectively, of lobster tissue every year for a lifetime. However, it is important to note that the lobster fishery in California is highly regulated as to size, numbers, and seasons during which lobsters can be harvested. The current regulations (CA DFG 2010) specify that lobsters can be harvested only from October 2, 2010 to March 16, 2011. The same season length occurred in 2009/2010. Thus, lobsters can be harvested for less than half of the year in California, further invalidating the overly-conservative exposure assumptions used in the DTR.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN THE MATTER OF:	)	
	)	Order No.
TENTATIVE CLEANUP AND ABATEMENT	)	R9-2011-001

DEPOSITION OF TOM ALO

VOLUME I, PAGES 1 THROUGH 210

FEBRUARY 16, 2011

SAN DIEGO, CALIFORNIA

REPORTED BY: JULIE A. MCKAY, CSR NO. 9059

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BY MR. RICHARDSON:

Q. Are you aware of any agency inspection reports that indicate someone is fishing at NASSCO?

A. No, I'm not aware of it.

Q. Mr. Alo, in light of your prior testimony that the administrative record is voluminous and that you are not aware of any CAO proceeding with a larger record, and because there is no evidence in this voluminous record that anyone has fished at the NASSCO site, and in light of the security measures that we just reviewed and the photographs that you saw and the discussion on page 28-10, wouldn't you agree that it's an unrealistic assumption to assume that someone fishes at the shipyard for 30 years and eats only fish caught at the shipyard?

MR. CARRIGAN: I'm going to object as vague.

But you can answer, if you understood the question.

THE WITNESS: I agree. However, the third bullet on page 28-11 of the DTR states that "It's the Water Board's statutory responsibility to protect the current and reasonably anticipated beneficial uses designated for the Bay. The beneficial uses pertaining to human health are commercial and sportfishing and shellfish harvesting. Common shell are to be protected at all times regardless of the current site access measures that prevent the uses from occurring."

And, also, the first bullet, "Although NASSCO and BAE Systems have long-term leases, it is possible they may not occupy the site in the future and future site usage may allow for fishing," which, you know, this scenario has recently occurred at the former shipyard, Campbell Shipyards, located in the Bay just north of the Shipyard Sediment Site.

BY MR. RICHARDSON:

Q. Great. Thank you for that clarification.

Mr. Alo, if I refer you to page 28-17 of the DTR. Give you a moment to refresh your memory on this page. I'm sorry, Mr. Alo. Under the "Fractional intake" paragraph.

A. Sorry.

(Witness reviews document.)

Q. Have you reviewed that paragraph?

A. Yes, I have.

Q. So don't you agree that even the DTR indicates that the actual site fractional intake for NASSCO is less than a hundred percent?

MR. CARRIGAN: Document speaks for itself.

You can answer.

THE WITNESS: Yes.

BY MR. RICHARDSON:

Q. And wouldn't you agree that that's at least an extremely conservative assumption?

A. Yes.

Q. And why, in your view, is that conservative?

A. As stated in the DTR, page 28-17, it's likely that anglers catch at least a portion of their seafood from other locations in the Bay and/or fish caught from the Shipyard Sediment Site comes from elsewhere. The actual site fractional intake is less -- likely to be less than a hundred percent.

Q. Great. Thank you.

We recently discussed Exhibit 1104, EPA's Risk Assessment Guidance for Superfund Sites, which suggest that site-specific factors should be used in the Tier 2 risk assessment, correct?

A. Correct.

Q. Isn't the fractional intake a site-specific factor?

MR. CARRIGAN: Incomplete hypothetical. Vague.

THE WITNESS: Repeat the question.

BY MR. RICHARDSON:

Q. Isn't the fractional intake a site-specific factor?

A. Yes.

THE WITNESS: I don't know.

BY MR. RICHARDSON:

Q. Do you believe it would be reasonable to assume that there are subsistence anglers of NASSCO employees at the shipyard?

MR. CARRIGAN: Same objection.

THE WITNESS: I don't know. There may be.

BY MR. RICHARDSON:

Q. That is, you don't know?

A. I don't know.

Q. Navy personnel?

MR. CARRIGAN: Same objections.

THE WITNESS: There is a potential. There could be a potential.

BY MR. RICHARDSON:

Q. Okay. I'll ask a clearer question. I want to make sure the record is clear on this.

A. Okay.

Q. Is it reasonable to assume under current site uses that there is a subsistence angler that fishes for 30 years within the NASSCO leasehold?

MR. CARRIGAN: Incomplete hypothetical.

THE WITNESS: Probably not.

BY MR. RICHARDSON:

Q. You previously testified that there may be suggesting that these numbers are not accurate?

A. Repeat the question, please.

MR. RICHARDSON: Could you repeat the question.

(Record read.)

THE WITNESS: The numbers appear to be accurate. However, we used a different consumption rate in our Tier 2 baseline risk assessment.

BY MR. RICHARDSON:

Q. Okay. And what consumption rate did you use for your Tier 2 assessment?

A. We used for recreational angler would be -- conversion would be 21 grams per day. And for subsistence angler, we used 161 grams per day.

Q. Would you agree, Mr. Alo, that those are significantly higher numbers than those stated in Table 10-52?

A. Yes.

Q. Do you have any site-specific data suggesting that an angler would consume a whole fish or whole lobster at NASSCO?

A. No.

Q. Do you have any site-specific data that they would consume a whole fish and a whole lobster daily for 30 years?

A. No.

MR. CARRIGAN: Document speaks for itself.
THE WITNESS: Yes.
BY MR. RICHARDSON:
Q. And that only six percent of the total anglers fish on a daily basis?
MR. CARRIGAN: Same objection.
THE WITNESS: I see that.
BY MR. RICHARDSON:
Q. So with this site-specific study on San Diego Bay, is it unrealistic or overly conservative to assume that someone fishes every day at the shipyard for 30 years?
MR. CARRIGAN: Incomplete hypothetical.
THE WITNESS: Yes.
BY MR. RICHARDSON:
Q. The County survey also provided some data on the number of anglers expected to eat the whole body of the fish. Refer you to page 417, the very first paragraph. I'll give you a moment to review the paragraph.
A. Which paragraph again?
Q. The very top paragraph on page 417 that begins "Parts of fish consumed."
A. (Witness reviews document.)
Okay.

Expert Report of
Brent L. Finley, Ph.D., DABT

Prepared in Regards to the California Regional Water Quality Control Board's Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 (San Diego Bay)

Prepared for

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the range of measured concentrations. Instead, the RWQCB selected the highest measured concentrations and presented the subsequent risk estimates as plausible and representative.

This was an arbitrary assumption with no scientific or regulatory support. No discussion is offered in the RWQCB assessment as to why use of the maximum, and only the maximum measured levels, is appropriate in this case. Reliance on a single point estimate of chemical concentration also gives no insight as to the potential variability in the risk estimates as a function of the range and frequency of measured contaminant levels. In essence, each of the risk estimates presented by the RWQCB relies on a single measured (in this case, maximum) value, which can yield a highly biased risk estimate, particularly if the underlying data set is skewed.

I will quote again from recent (2005) EPA risk assessment guidance:

> …significant risk management decisions will often benefit from a more comprehensive assessment…such assessments *should provide central estimates of potential risks in conjunction with lower and upper bounds (e.g., confidence limits)* and a clear statement of the uncertainty associated with these estimates" ((USEPA 2005); p. 1-9 – 1-10). [emphasis added]

At the very least, if the RWQCB wished to include a point risk estimate based on maximum concentrations they should have also presented risk estimates based on: 1) measures of central tendency (e.g., means or averages) and/or 2) distributions of the underlying measured concentrations. Indeed, in the SDCDHS Health Risk Study, risk estimates were presented based on maximum and average chemical concentrations (County of San Diego, 1990). Presenting risk estimates associated with each of these values would allow the reader to understand the relative impact of the concentrations used in the risk calculations.

c) Considering the lack of access and industrial nature of the shipyard leasehold, the use of unmodified fish consumption rates from the Santa Monica Bay Study, which was conducted in a highly accessible recreational area, is inappropriate and inconsistent with EPA guidance

In the United States, the primary sources of fish consumption information include the following: 1) per capita estimates for fishery products (disappearance into the commercial marketing system); 2) national consumption surveys (which can be on a per capita basis, or focus exclusively on fish consumers); and 3) creel-angler surveys (which can include recreational or subsistence fishers, or both) (USEPA 1997b; OEHHA 2001).

Results from one survey may not be applicable in a different setting. The most relevant sources of fish consumption data for a specific setting (e.g., San Diego Bay) are creel/angler surveys, wherein the catch/consumption habits of local anglers are assessed via interviews. These studies vary in many respects, including methodology, the target population evaluated, whether fishing occurs in fresh or marine waters, and whether consumption of commercially purchased products are included in the consumption estimates, to name a few. Obviously, a daily consumption rate determined for an angler catching/consuming pike in Lake Michigan may not be an accurate barriers such as buildings or 8-foot fences with razor wire), permanent obstructions in the water prevent boaters from accessing the leasehold. As mentioned previously, these measures are enforced in a number of ways, including video surveillance, requirements for identification for anyone entering or exiting the premises, alarm systems, and the use of security personnel (NASSCO 2006).

In analyzing site security, I reviewed the security footage overlooking the NASSCO facility from several months in late 2007. The footage provided 24 hour surveillance, seven days a week. The video revealed that approximately half of the security cameras view the shipyard docks and surrounding water, while half view the perimeter, entrance gates and facility property. Cameras are placed at main entrances and exits and in areas with high risk and/or high value cargo. They have the capability to monitor all perimeter barriers, water line, perimeter security boom/buoy early warning system, and numerous locations throughout the facility (NASSCO 2006).

The security cameras are functional in high and low light situations and have the ability to pan, tilt, zoom and focus manually for increased surveillance in specific areas. Increased surveillance and manual focusing were observed when activity occurred in the camera view. Throughout the viewed footage, employees were seen performing work on vessels within the facility as well as entering and exiting the perimeter. No unauthorized vessels were seen attempting to gain access to the facility waters. Additionally, no fishing or attempted fishing was observed in or around the facility. The cameras view the entire shoreline and surrounding waters and would certainly have captured fishing attempts.

Full details of how entry was made as well as accounts of why the individual was present are taken and recorded. Security remains especially strict because of NASSCO’s work with naval vessels. Due to this fact, during times of threat, measures are in place to increase security and limit facility access (NASSCO 2002). Additionally, security measures are reviewed through audits and revised to remain up to date with current issues (NASSCO 2007).

The Santa Monica Bay study assessed anglers in an area where fishing is freely allowed via party or private boats, numerous piers and/or jetties, and the beach. Given the severe access restrictions of the NASSCO shipyard from land (the shore or from piers/jetties) and water (anglers on boats), it is obvious that fish consumption rates in the NASSCO leasehold are not comparable to those in Santa Monica Bay.

Finally, and perhaps most importantly, I will note that it is well understood that, like all short-term creel/angler surveys of highly populated areas, the Santa Monica Bay angler data have a significant source of bias that must be accounted for before the data can properly be used to estimate angler consumption rates for risk assessment purposes. The bias is known as “avidity bias,” which refers to the fact that that repeat anglers, who are more likely to be interviewed, have higher consumption rates than those who visit the area less frequently. In short-term surveys where anglers are interviewed on multiple occasions (such as the Santa Monica Bay, a 28-day study), probability factors are typically applied to counter this bias. The Santa Monica Bay data were not adjusted for this bias before they were published, and proper adjustment for avidity bias will result in daily consumption rates far lower than those presented in the Santa Monica Bay report.

EPA clearly states that high-end exposure assumptions are intended to be plausible estimates that characterize a definable, high-end segment of the exposed population (usually above the 90th percentile) (USEPA 1992; USEPA 1995). From a purely statistical perspective, combination of multiple high-end exposure factor values (e.g., 90th or 95th percentiles) can often produce results that are more extreme than any one of the individual values. As noted by EPA ((EPA 1992); p. 27):

> "The term 'worst case exposure' has historically meant the maximum possible exposure, or where everything that can plausibly happen to maximize exposure, happens. While in actuality, this worst case exposure may fall on the uppermost point of the population distribution, in most cases, it will be somewhat higher than the individual in the population with the highest exposure. The worst case represents a hypothetical individual and an extreme set of conditions; *this will usually not be observed in the actual population*." [emphasis added]

As I've noted throughout this opinion, the impacts of the various assumptions made by RWQCB are not well characterized or discussed. The RWQCB did not conduct any sort of quantitative uncertainty analysis, nor did they provide a comparison of risk estimates derived using different point estimates (e.g., mean vs. upper bound) in a deterministic risk assessment. As noted previously, the use of probabilistic techniques is an ideal method for quantifying the uncertainty associated with each of the parameters used in risk calculations, which can then be used to determine the contribution of uncertainty associated with each parameter to the overall risk estimate. In general, sources of uncertainty include measurement errors, sampling errors, variability, and the use of generic or surrogate data ((EPA 1992); p. 93). Either approach can provide a way to quantitatively understand the impact of using one value verses another.

d) A refined yet conservative risk assessment indicates that consumption of fish and shellfish from the NASSCO leasehold is not associated with an increased risk of cancer or non-cancer health effects.

Above I have given a few examples of the degree to which the RWQCB risk estimates change by simply substituting one of their highly conservative and implausible assumptions with a more reasonable assumption (i.e., a semi-quantitative sensitivity analysis). Below I present my own estimates of risk by incorporating specific refined assumptions (Tables 1-3). The purpose of this exercise is to 1) demonstrate how much uncertainty and conservatism is actually present in the RWQCB risk estimates, and 2) provide a more scientifically valid and plausible estimate of potential angler risk. This analysis is representative of the "comprehensive" assessment that the RWQCB claimed to have conducted (but did not). Specific changes include the following:

- **Use of mean and 95% upper confidence limit (UCL) fish and shellfish tissue concentrations instead of maximum values**. Risk assessments are commonly performed using a central tendency estimate (arithmetic mean), as well as the 95% upper confidence limit (UCL) of the arithmetic mean. The 95% UCL is the value that when calculated for a random data set equals or exceeds the true mean 95% of the time. Both values are often used in risk assessment because of the uncertainties that may be associated with estimating the arithmetic mean. This approach is consistent with EPA guidance for non-screening level assessments and provides a far more informed estimate of the distribution of chemical contaminants among the local fish and shellfish populations of interest.

- **Use of fish consumption rates that reflect the lack of access and industrial nature of the NASSCO shipyard.** As noted previously, the importance of representative data is clearly described in several EPA documents, as well as OEHHA's 2001 report regarding fish consumption in California. Based on my experience and as described in several recent publications, characterizing angling and fish consumption patterns in highly urbanized areas with relatively little public access can be useful in conducting risk assessments in similar settings. The fish consumption rates of 0.42 g/day (estimate of central tendency) and 1.8 g/day (95th percentile) reported in a study of anglers in a highly industrialized waterway with limited access were used in risk calculations for recreational anglers (the 95th percentile was used as an upper bound estimate) for both fish and shellfish (Ray, Craven et al. 2007a).

- **Assume that anglers would only consume the edible portions of any fish or shellfish.** Consistent with EPA guidance, edible tissue data were used for both the recreational and upper bound scenarios.

- **Utilization of a reference dose for dietary ingestion in estimating risk from cadmium.** There is no basis for the RWQCB's use of a drinking water reference dose for cadmium considering there is a reference dose for cadmium based on ingestion. In my updated assessment, I utilized the EPA recommended reference dose for cadmium consistent with dietary ingestion.

- **Use of an exposure duration of 9 years**. I used the central estimate of 9 years for the amount of time that potential exposure could occur, as recommended by EPA guidance ((USEPA 1989b); p. 6-22).

- **Use of a cooking loss factor for PCBs.** Cooking results in a reduction in total PCBs because they accumulate in the fat. Because the reductions vary by cooking method (e.g., pan-frying, steaming, deep-frying), a weighted average of the median fish fractional loss was used for the deterministic analysis, while a distribution was used for the probabilistic analysis (Wilson, Shear et al. 1998). The fish fractional cooking loss was weighted by the probability of using each method and cooking methods were grouped according to their cooking loss distributions. For shellfish, the mean shellfish cooking loss value was calculated from averaging PCB cooking losses from steaming and boiling (with and without hepatopancreas) whole blue crab (Zabik, Harte et al. 1992).

- **Incorporation of a probabilistic risk assessment for cancer risk for PCBs (Aroclor 1260) and arsenic.** The purpose of this assessment was to quantify uncertainty associated with the exposure parameters, as well as provide as more accurate estimation of the true cancer risk using a more refined technique (i.e., Monte Carlo analysis).

I performed two sets of risk calculations. First, I used the same equations described in the RWQCB's draft technical report, but with refined assumptions (CRWQCB 2010a). This approach was used to evaluate cancer and non-cancer risks for the chemicals identified by the RWQCB.

Second, I performed a probabilistic risk assessment ("Monte Carlo analysis") to evaluate cancer risk for a subset of chemicals (arsenic and PCBs). As mentioned previously, the Monte Carlo technique can be used to derive an estimate of the distribution of exposures or doses in a population. I also used this technique to perform a quantitative uncertainty analysis.

Tissue concentration data for the contaminants of concern (sand bass and lobster) were obtained from Exponent, and were the same tissue data upon which the RWQCB's risk assessment is based. Cancer and non-cancer risk was calculated separately for inside the NASSCO leasehold, outside the NASSCO leasehold, and for the reference locations 2230 and 2240. The specific calculations and exposure assumptions are described in greater detail in Appendix A.

Results for cancer risk using a refined deterministic model are summarized in Appendix A, Tables 4 and 5. Risk estimates using mean tissue concentrations (fish or shellfish) ranged from 1.67×10^{-8} to 1.62×10^{-6} for inorganic arsenic and from 1.17×10^{-8} to 1.62×10^{-7} for PCBs. Using the 95% UCL tissue concentrations, risk estimates ranged from 1.85×10^{-8} to 2.58×10^{-6} for inorganic arsenic and from 1.17×10^{-8} to 2.08×10^{-7} for PCBs.

As a point of comparison, if one uses my exposure assumptions but employs the method used by Exponent, wherein the more conservative fish consumption rates used by the RWQCB are used (21 g/day and 161 g/day for recreational and subsistence anglers, respectively) but a fractional intake factor is applied to account for the fact that only a 3.4% of the total shoreline of the San Diego Bay is occupied by the NASSCO shipyard, cancer risks for inorganic arsenic ranged from 2.17×10^{-7} to 7.48×10^{-6} when mean tissue concentrations were used (fish or shellfish), while cancer risk for PCBs ranged from 1.99×10^{-8} to 6.33×10^{-7}.

Furthermore, if only the fractional intake is adjusted to account for the fact that 3.4% of the total shoreline is occupied by NASSCO, all risks from all chemicals in edible tissue fall significantly below regulatory concern. Using either approach, the cancer risk estimates derived using more reasonable exposure assumptions are orders of magnitude less than those reported by the RWQCB.

Based on more realistic and appropriate exposure assumptions, risk estimates for both consumption of lobster and sea bass were well below the *de minimus* risk levels of 1 in 100,000 (1×10^{-5}) defined by CalEPA (OEHHA 2006). More recently, in June, 2008, OEHHA published a report titled "Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish: Chlordane, DDTs, Dieldrin, Methylmercury, PCBs, Selenium, and Toxaphene." This report addresses the general concept that "the advisory process should be expanded beyond a simple risk paradigm, as is used in criteria development, in order to best promote the overall health of the fish consumer" (p.2). In this report, OEHHA specifically states that $1x10^{-4}$ is an acceptable risk level when developing fish consumption advisories (OEHHA also cites several EPA regulatory criteria that rely on this same value). In fact, this report goes as far as to state that "setting the risk level at $1x10^{-5}$ or $1x10^{-6}$ would restrict fish consumption to the extent that it could largely deny fishers the numerous health benefits that can be accrued through fish consumption" (p. 55).

Results for non-cancer risk are summarized in Appendix A, Tables 6-10. The hazard indices for all contaminants at both consumption levels were well below 1, indicating that using more realistic and appropriate exposure assumptions results in estimated daily exposures below the levels that are considered safe by the U.S. and California Environmental Protection Agencies. Even using the 95% UCL tissue concentrations for upper bound consumers, the hazard indices did not exceed 0.013, 0.012, 0.04 0.004, and 0.0004 for inorganic arsenic, total PCBs, mercury, copper, and cadmium, respectively.

The risk assessment described above mirrors the deterministic analysis performed by the RWQCB, the only difference being the values used in the exposure assumptions. As noted previously, there are additional techniques available that provide more statistically robust and informative risk estimates. Thus, for purposes of comparison, I also performed a probabilistic analysis of the cancer risk associated with consumption of fish and shellfish caught in the NASSCO leasehold.

The probabilistic assessment addressed Aroclor 1260 and arsenic, which were the primary drivers of cancer risk in the RWQCB assessment. It should be noted that Aroclor 1260 was the only PCB mixture that had detectible concentrations. The distributions associated with each of the exposure parameters are summarized in Table 11. These were generally derived from the same sources as my refined, deterministic calculations, although the Monte Carlo analysis also included a range of values for the percent of inorganic arsenic (0-4%) and the cancer slope factor associated with Aroclor 1260 (0.07, 0.4, and 2 per mg/kg-day). Regarding the loss of PCBs through cooking, the distribution of percent losses for fish and shellfish were based on prior empirical studies and vary by cooking method (Zabik, Harte et al. 1992; Wilson, Shear et al. 1998).

The cancer risk estimates based on this analysis are presented in Table 12. Cancer risks were within the same order of magnitude across all locations considered (inside NASSCO vs. outside NASSCO vs. reference), which is consistent with my observation that there is not a statistically significant difference in fish tissue concentrations between the shipyard and the general background in the bay (described in more detail in the next opinion).

Based on the probabilistic assessment, cancer risks for Aroclor 1260 ranged from 4.69×10^{-13} to 2.17×10^{-12} (50^{th} percentile). Risks for the extreme upper bound of the population (99^{th} percentile) were still well below what is considered *de minimus* risk (8.55×10^{-8} to 4.82×10^{-7} for fish and shellfish, across all locations). For inorganic arsenic, risks for the 50^{th} percentile were in the 10^{-11} to 10^{-12} range, while at the uppermost portion of the population (99^{th} percentile), risks ranged from 4×10^{-6} to 3×10^{-7} for fish and shellfish.

In addition to preparation of additional risk estimates, the Monte Carlo technique also allows one to quantify the uncertainty associated with parameters used in the risk calculations. I will note that there was no difference in parameter sensitivity between the various locations considered (inside NASSCO, outside NASSCO, reference). For Aroclor 1260 cancer risk, fish or shellfish ingestion rate contributed from 86.3 to 87.4% of the total variance of the risk estimates.

Exposure duration and the Aroclor 1260 cancer slope factor (CSF) contributed to total variance with exposure duration having contributions from 4.7 to 5.2% and CSF having contributions of 7.0 to 7.6%. Adult body weight and cooking method both contributed less than 0.1% to the total variance for Aroclor and arsenic cancer risks. For arsenic cancer risk, fish and shellfish ingestion contributed about 90% to the total variance with exposure duration contributing between 4.6 to 5.1% and fraction of inorganic arsenic contributing about 2.6%.

Taken together, the uncertainty analysis highlights the importance of the fish consumption rate in the overall risk assessment, and as I have described in considerable detail above, use of the most appropriate fish consumption rate (i.e., reflective of the complete lack of access to the NASSCO leasehold) is *critical* in properly characterizing risk.

Risk Characterization

I will note that my risk estimates presented above, although reasonable, are still very conservative. They are based on the following assumptions:

1. An individual will gain access to the NASSCO leasehold and catch and consume fish and shellfish tissue for 9 years,
2. The filter organs (hepatopancreas) of the lobster will always be consumed along with the edible tissue,
3. NASSCO sediments are the source of all of the chemicals in the fish/lobster, and
4. 4% of the arsenic in the fish/lobster tissue is inorganic.

Any one of these assumptions is arguably implausible. Yet even if this individual consumes fish/shellfish tissues at the highest rate (1.8 g/day) and only eats tissues containing the upper-bound (95^{th} UCL) chemical concentrations, the risks are below levels that typically warrant regulatory concern. Finally, I will mention that PCBs are not even considered by the USEPA to be known human carcinogens (USEPA 2010).

Additionally, I will note that the risk estimates published by the County of San Diego in their Health Risk Study (the SDCDHS study) were also generally below levels of regulatory concern, particularly when more refined assumptions (e.g., average contaminant concentration values, average fish consumption rate, species-specific fish consumption rate) were used in the risk calculations. In their report, the County of San Diego concluded that "the estimated excess lifetime cancer risk resulting from a typical consumption of fish from San Diego Bay falls between the estimated risks resulting from the consumption of four tablespoons of peanut butter per day (5.6×10^{-4}) and from the average saccharin consumption in the U.S. or drinking one pint of milk per day (both at 1.4×10^{-4}) ((County of San Diego, 1990); p. xxv).

Like my refined assessment, the San Diego Bay Health Risk Study notes that a degree of conservatism remains even in their refined risk estimates: "Due to the conservative nature of quantitative risk assessments, the actual risk may be several orders or magnitude lower or could even be zero" ((County of San Diego, 1990); p. xx).

Another common risk characterization technique involves comparisons of the estimated doses to "background" doses of the chemicals of interest. This type of analysis was clearly described in Wilson et al. (2001), wherein pharmacokinetic models were used to estimate the daily uptake of PCBs based on concentrations measured in the blood and adipose tissue. A back-calculation was performed in order to determine the amount of PCBs that would have to be consumed in the diet to correspond to levels measured in the blood and/or tissues of the American general population, which were reported to be 5 µg/kg in blood serum and 0.82 mg/kg in adipose tissue (Wilson, Price et al. 2001).

Assuming a half-life of seven years, one would need to consume 44 ng/kg-d of PCBs in order to achieve and maintain 6 µg/kg in the blood serum. As a point of comparison, the mean estimated lifetime average daily dose for recreational anglers consuming fish from the NASSCO leasehold was 0.0251 ng/kg-d, while the upper end estimate was 0.108 ng/kg-d. These doses are equivalent to 0.06% and 0.25% of the background doses received from dietary sources.

e) **The RWQCB's risk assessment and the Tentative Order fail to acknowledge that the fish/shellfish contaminant levels measured in the NASSCO leasehold are 1) statistically indistinguishable from those measured outside the leasehold**, *including the background reference locations specifically selected by the RWQCB***,** **and 2) for PCBs, no different from background levels that have been measured around the U.S. Clearly, such findings are inconsistent with the assertions that NASSCO operations are a "chemical source" or that remediation of NASSCO sediments will reduce human health risk.**

It is important to note that all of the chemicals of interest in the San Diego Bay risk assessments are ubiquitous and are typically present at measurable levels in sediments and fish tissues. This is obviously true for the metals, all of which occur naturally, but is also true for PCBs, which bioaccumulate easily and do not degrade quickly in the environment. Accordingly, the mere presence of metals or Aroclor 1260 in NASSCO fish tissues does not indicate that NASSCO is the source of these chemicals; I believe these chemicals would be present at measurable levels even if NASSCO had never conducted operations in the leasehold.

A statistical comparison of the mean chemical concentrations measured in edible fish and lobster tissues collected inside the NASSCO leasehold vs. those measured at reference locations indicates no significant difference (Tables 13 and 14). By definition, a chemical "source" results in levels of environmental contaminants that are higher than regional and/or national background levels. However, the fish tissue data collected from the NASSCO leasehold are no different from tissue concentrations collected in the selected reference station, which strongly suggests that the discharges from the leasehold do not appear to have influenced fish tissue concentrations.

I will note that the reference locations were specifically chosen by the RWQCB to represent "background." Further, the mean chemical concentrations measured in the edible fish tissues

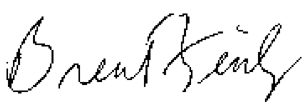
Again, it should be emphasized that the similarity across sampling locations for PCBs is consistent with what has been reported in the past in other surveys (County of San Diego, 1990; Table IV-I). With respect to #3, Tables 4-10 summarize the risks I have calculated for the reference, "inside NASSCO," and "outside NASSCO" locations. The risks calculated for locations outside the NASSCO leasehold (reference and "outside NASSCO" locations) are always a significant fraction of the "inside NASSCO" risks and in fact in many cases (e.g., for Arcolor 1260) the risks *always* exceed those in the leasehold.

Clearly, these findings are inconsistent with the RWQCB's apparent belief that remediation of sediments in the NASSCO leasehold will yield meaningful reduction in potential health risks associated with consumption of fish from the San Diego Bay. .

V. CLOSING COMMENTS

I submit these opinions and am prepared to support them in both deposition and/or courtroom testimony. I may supplement this report if additional information becomes available or I am asked to address other issues.

Respectfully,



March 11, 2011

Brent L. Finley Date
Ph.D., DABT
Principal Health Scientist

III-B. AQUATIC-DEPENDENT WILDLIFE RISK

VOLUME II






DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA
Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

Table 24-3 Summary of Tier II Risk Assessment Hazard Quotients (continued)

Receptor Location	Benzo[a]pyrene		PCBs		TBT	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Brown Pelican						
Inside NASSCO	0.24	0.024	**3.3**	0.23	0.0094	0.00015
Outside NASSCO	0.2	0.02	**1.5**	0.11	0.018	0.00028
Inside SWM	0.35	0.035	**3.5**	0.25	0.015	0.00024
Outside SWM	0.2	0.02	**2.1**	0.15	0.014	0.00022
Reference	0.18	0.018	**1.2**	0.088	0.0044	0.00007
Green Turtle						
Inside NASSCO	0.029	0.0029	0.0033	0.00023	0.00007	1.1E-06
Inside SWM	0.09	0.009	0.0092	0.00065	0.00024	3.7E-06
Reference	0.014	0.0014	0.002	0.00014	0.000017	2.8E-07
Least Tern						
Inside NASSCO	0.29	0.029	**2**	0.14	0.0052	0.000082
Outside NASSCO	0.29	0.029	**2.4**	0.17	0.0069	0.00011
Inside SWM	0.52	0.052	**3**	0.21	0.012	0.00019
Outside SWM	0.32	0.032	**2.3**	0.16	0.02	0.00032
Reference	0.22	0.022	**1.3**	0.093	0.0052	0.000082
Sea Lion						
Inside NASSCO	0.0066	0.00026	0.22	0.061	0.0071	0.00012
Outside NASSCO	0.0055	0.00022	0.098	0.028	0.013	0.00022
Inside SWM	0.0099	0.00039	0.23	0.065	0.011	0.00019
Outside SWM	0.0057	0.00023	0.14	0.039	0.01	0.00017
Reference	0.0049	0.0002	0.081	0.023	0.0034	0.000056
Surf Scoter						
Inside NASSCO	0.75	0.075	0.37	0.026	0.032	0.00051
Inside SWM	**2.1**	0.21	0.57	0.04	0.04	0.00063
Reference	0.3	0.03	0.44	0.031	0.011	0.00017
Western Grebe						
Inside NASSCO	0.17	0.017	0.062	0.88	0.000043	0.0027
Outside NASSCO	0.15	0.015	**1.0**	0.074	0.0032	0.000051
Inside SWM	0.38	0.038	**1.4**	0.096	0.0064	0.0001
Outside SWM	0.16	0.016	**1.0**	0.073	0.0088	0.00014
Reference	0.1	0.01	0.57	0.041	0.0023	0.000036

Note: Reference HQs are based on samples collected in the vicinity of Station 2240.

Table 24-6 Exposure Parameters for Tier II Baseline Risk Assessment

Receptor	Prey Tissue Concentration (mg/kg dry wt)	Sediment Chemical Concentration (mg/kg dry wt)	Body Weight[1] (kg)	Food Ingestion Rate[1] (kg/day dry wt)	Sediment Ingestion Rate[1] (kg/day dry wt)	Area Use Factor	Absorption Efficiency
California brown pelican	Mean Detected Value	Mean Detected Value	3.174	0.25	0.005	1	1
California least tern	Mean Detected Value	Mean Detected Value	0.045	0.0053	0.00011	1	1
Western grebe	Mean Detected Value	Mean Detected Value	1.2	0.062	0.0031	1	1
Surf scoter	Mean Detected Value	Mean Detected Value	1.05	0.056	0.0028	1	1
California sea lion	Mean Detected Value	Mean Detected Value	75	1.54	0.0308	1	1
East Pacific green turtle	Mean Detected Value	Mean Detected Value	95	0.35	0.0186	1	1

1. Exponent, 2003

24.2.3. Effects Characterization

Characterizing potential adverse effects to the receptors of concern requires a comparison of the receptor-specific exposure estimates to an appropriate toxicity reference value (TRV). As recommended by the Natural Resource Trustee Agencies, exposure estimates for the baseline risk assessment were compared to TRVs developed by BTAG (DTSC, 2000). The BTAG TRVs were developed jointly by the U.S. Navy, Navy consultants, and regulatory agencies, including the U.S. EPA, DTSC – Human and Ecological Risk Division, San Diego Water Board, NOAA, U.S. FWS, Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA), and DFG. The U.S. EPA, DTSC, and the other agencies endorse and recommend the use of the BTAG TRVs for ecological risk assessments conducted in California and in U.S. EPA Region 9.

The BTAG TRVs are presented as an upper and lower estimate of effects thresholds. The low-TRV is based on no-adverse-effects-levels (NOAELs) and represents a threshold below which no adverse effects are expected. The high-TRV is based on an approximate midpoint of the range of effects levels and represents a threshold above which adverse effects are likely to occur. The BTAG low and high TRVs for birds and mammals (site CoPCs only) are shown in Table 24-7 below. Because BTAG TRVs are not available for BAP for birds and chromium for birds and mammals, the NOAELs and low-adverse-effects-levels (LOAELs) identified by Exponent (2003) were used (Table 24-8). It should be noted that suitable reptilian TRVs were not found in the literature (Exponent, 2003). Therefore, avian TRVs were used to estimate potential adverse effects to the East Pacific green turtle.

HQ	=	hazard quotient (unitless)
$IR_{chemical}$	=	total ingestion rate of the chemical (mg/kg body weight-day)
TRV	=	BTAG low or high toxicity reference value (mg/kg body weight-day)

An HQ value less than 1.0 indicates that the chemical is unlikely to exceed the TRV for the receptor of concern. An HQ value greater than 1.0 indicates that the receptor's exposure to the chemical pollutant is predicted to exceeded the TRV, which could indicate that there is a potential that some fraction of the population may experience an adverse effect (Exponent, 2003). The significance of any HQ greater than 1.0 depends in large part on the relevance of the TRV. In this assessment, HQs were calculated for two risk thresholds. The TRV_{low} is a no-effect level (i.e., a level at which no effects are predicted). The TRV_{high} is a demonstrated effect level. The actual threshold of adverse effects is predicted to lie somewhere between these two thresholds. The HQ calculations and risk characterization results for each receptor of concern at each assessment unit are provided in the Appendix for Section 24 and summarized in Table 24-3.

In addition to characterizing the risks at the Shipyard Sediment Site, risks were also characterized at a reference area to determine whether or not the site poses a greater risk to the receptors of concern than reference conditions in San Diego Bay. The reference area, located in the vicinity of Reference Station 2240, is located across the bay from the Shipyard Sediment Site (Exponent, 2003). Spotted sand bass, topsmelt, anchovies, benthic mussels, and eelgrass were collected from this reference area and the chemical concentrations from these prey items were used to estimate exposure to the receptors of concern. Risks at the reference area were calculated using the same CoPCs, exposure assumptions, and TRVs as those identified above for the Shipyard Sediment Site. The HQ calculations and risk characterization results for the reference area are provided in the Appendix for Section 24.

24.2.5. Risk Management

The San Diego Water Board identified two risk management decisions: (1) Current site conditions pose acceptable risks and no further action is warranted, and (2) Current site conditions pose unacceptable risks that require remedial action. These two management decisions are based on the risk characterization results at the Shipyard Sediment Site and at the reference area. A flow diagram showing how each management decision is triggered is shown below in Figure 24-1.

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Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site

Expert Report of Thomas C. Ginn, Ph.D.

Exponent®

Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site

Prepared for

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March 11, 2011

Failure to Consider Actual Habitat Use

One of the primary risk-driving assumptions made by the Staff in their exposure assessment is selection of an area use factor (AUF) of 1.0 for all receptors. In other words, for purposes of risk evaluation, it is assumed by the Staff that all modeled receptors obtain 100 percent of their diet from within the confines of the NASSCO leasehold, and that prey items sampled at NASSCO stations are therefore representative of the entire diet for each receptor. This assumption is clearly unrealistic, and the resulting conclusions based on this model are an inaccurate representation of actual wildlife exposure and risk.

As described in the DSI (Exponent 2003), the NASSCO leasehold is far too small to serve as the sole foraging habitat of any of the modeled receptor species. Based on an examination of the habitat present throughout San Diego Bay and the best available scientific literature on the foraging preferences and behavior of the modeled species, the tern, pelican, grebe, scoter, and sea lion are all estimated to obtain at most 0.4 percent of their diet from the area of the NASSCO leasehold. The green turtle is estimated to obtain no more than 1.1 percent of its diet from the NASSCO leasehold (Exponent 2003). These estimates should actually be considered as maximum area use estimates because it is assumed in their derivation that the shipyard would be as attractive to these species as the rest of San Diego Bay. In fact, the heavy industrial activities at the shipyard would most likely deter birds and other species from foraging at the shipyard, thus reducing their actual area uses below these conservative (i.e., protective) estimates.

The Staff acknowledges the uncertainties associated with wildlife area use in the DTR (Section 24.2.6). Yet they make no attempt to estimate realistic area use values for incorporation into their exposure and risk estimates. Rather than estimating AUF based on scientific evidence, as is standard practice in ERA, the Staff assumes a theoretical maximum exposure of 100 percent. No justification for this extreme assumption is provided.

In effect, the Staff is asserting an arbitrary policy that site-specific habitat usage by wildlife is irrelevant to exposure assessment, and by extension to the decision on sediment cleanup requirements at NASSCO. This policy is neither typical of standard ERA practice at other sites, nor is it justified in the CAO.

As demonstrated in the 2003 DSI, use of realistic AUFs in food web models for all representative receptors results in a finding of insignificant risk from dietary exposure, because the habitat quality within the NASSCO leasehold is low for all representative species (Table 6). If habitat usage is low, then exposure to sediment contaminants and resultant risk are correspondingly low. Were the Staff to incorporate realistic habitat usage values into their assessment, they would conclude that there are not any impaired beneficial uses for aquatic-dependent wildlife resulting from sediment contamination in the NASSCO leasehold. The entire assertion of impairment by the Staff for this LOE is therefore driven by a single policy decision that is not scientifically based and is contrary to regulatory guidance. This policy also deviates from technical decisions approved by the Staff during the sediment investigation. The use of an AUF derived for the shipyards was established in the 2001 sediment investigation work plan (Exponent 2001a), in the work plan revisions issued at the request of Staff later that year (Exponent 2001b), and again in the 2002 technical memorandum that described receptor species and receptor parameters for the ERA (Exponent 2002), all of which were reviewed and approved by the Staff. The Staff has not published any justification for eliminating consideration of actual habitat use prior to the CAO. As discussed in the following section, this unrealistic and scientifically unsupportable policy decision is also contrary to relevant ERA guidance and standards of practice.

Table 6. Dependence of hazard quotient on habitat usage

Receptor	San Diego Bay Habitat (acres)	Maximum NASSCO AUF[a]	Maximum Hazard Quotient for Receptor	
			DTR AUF = 1.0[b]	Maximum NASSCO AUF[c]
East Pacific green turtle	3,734	0.011	6.8	0.07
California least tern	13,374	0.003	25	0.08
California brown pelican	11,219	0.004	20	0.07
Western grebe	11,219	0.004	25	0.09
Surf scoter	11,375	0.004	50	0.18
California sea lion	10,396	0.004	1.0	0.0039

Note: AUF - area use factor
DTR - Detailed Technical Report (RWQCB 2010)

[a] Assumes that entire forage range is limited to habitat in San Diego Bay. Area of aquatic habitat within NASSCO leasehold is 43 acres.

[b] Value from DTR.

[c] All parameters from DTR, except AUF.

Regulatory Guidance and Standards for AUF Application

Federal Guidance on AUFs

The most comprehensive regulatory guidance for ecological risk assessment is the EPA Ecological Risk Assessment Guidance for Superfund (ERAGS, U.S. EPA 1997). This multi-volume manual, which is widely cited and followed in jurisdictions throughout the U.S., includes detailed guidance for every aspect of ERA, from preliminary site assessment and screening to final risk characterization. As noted above, the CAO ERA is stated to be ERAGS-compliant. ERAGS describes the use of dietary exposure modeling in detail, including application of AUFs. A clear distinction is made between AUF application in Tier I screening assessment and Tier II comprehensive risk assessment. ERAGS states:

> For the screening level exposure estimate for terrestrial animals, assume that the home range of one or more animals is entirely within the contaminated area, and thus the animals are exposed 100 percent of the time. This is a conservative assumption and, as an assumption, is only applicable to the screening-level phase of the risk assessment. Species- and site-specific home range information would be needed later, in Step 6, to estimate more accurately the percentage of time an animal would use a contaminated area. Also evaluate the possibility that some species might actually focus their activities in contaminated areas of the site. For example, if contamination has reduced emergent vegetation in a pond, the pond

> the shipyard site had a value less than 1.0 (Table 32-8), indicating that the COCs are unlikely to cause adverse ecological effects and that the post-remedial sediment chemistry conditions are protective of aquatic-dependent wildlife and their associated beneficial uses. (RWQCB 2010, p. 32-15)

Based on the Tier II risk assessment decision tree shown in Figure 24-1, any hazard quotient (presumably low or high) greater than 1.0 results in a requirement for remedial action if the modeled exposure is also higher than the reference exposure. The rationale behind such a decision framework is not explained in the DTR, and is directly contradictory to the interpretation of high and low TRVs provided in the discussion of alternative cleanup levels, which clearly states that the protective threshold is some exposure level above the NOAEL. The biased risk characterization approach of the Tier II ERA is neither justified nor explained in the CAO, nor is it typical of ERA practice or regulatory guidance.

The exposure threshold used in the DTR to justify the alternative cleanup levels is the geometric mean of the NOAEL/low and LOAEL/high TRVs:

> The toxicity reference values (TRVs) presented in Table 32-7 are based on the geometric mean of the TRVs (BTAG, NOAELs, and LOAELs) presented in Tables 24-7 and 24-8 of Section 24. The geometric mean addresses the region of uncertainty between the NOAEL and LOAEL. At the NOAEL, no effects are observed. At the LOAEL, effects are observed. Between these two values there is often a significant range over which the effects are uncertain because the data do not exist. The uncertainty is handled by taking an intermediate value that is biased toward the NOAEL by using the geometric mean. (RWQCB 2010, p. 32-15).

While the geometric mean TRV is an arbitrary selection within the NOAEL-LOAEL range, it is protectively biased, in the sense that it is lower than the midpoint of the range, and it has been recommended as a reasonable preliminary remediation goal by leading ecological risk assessors at U.S. EPA (Charters and Greenberg 2004, Greenberg and Charters 2005). Had the Staff used a geometric mean TRV in the Tier II wildlife risk assessment, as they did in the post-remedial protectiveness evaluation, their conclusions would have been quite different (Table 7). In fact, the only evaluated chemical for which any hazard quotient for any receptor exceeded 1.0 would have been lead. Based on this change alone, copper, mercury, HPAHs, PCBs, and TBT would have been eliminated as risk drivers. This conclusion would have been reached notwithstanding the highly conservative assumption of an AUF = 1.0.

Furthermore, the lead geometric mean hazard quotient would have exceeded 1.0 only for least tern inside SWM, and for surf scoter inside NASSCO and inside SWM. Had this more reasonable approach been employed in the Tier II risk level, the conclusions in the CAO about potential beneficial use impairment would have been quite different, even if no other risk-driving assumptions were modified. It should also be noted that lead was not selected as a primary COC for the shipyard site and no alternative cleanup level for lead is proposed in the DTR.

Regulatory Guidance on Risk Characterization

The federal ERAGS describes the risk characterization process as follows:

> Risk characterization integrates the results of the exposure profile and exposure-response analyses, and is the final phase of the risk assessment process. It consists of risk estimation and risk description, which together provide information to help judge the ecological significance of risk estimates in the absence of remedial activities. The risk description also identifies a threshold for effects on the assessment endpoint as a range between contamination levels identified as posing no ecological risk and the lowest contamination levels identified as likely to produce adverse ecological effects. To ensure that the risk characterization is transparent, clear, and reasonable, information regarding the strengths and limitations of the assessment must be identified and described (U.S. EPA 1997).

The approach taken in the DTR fails to fully comply with the regulatory standard for risk estimation. Risk description, as described by federal ERA guidance, is completely missing from the Staff's approach. California guidance for risk characterization is similar: "[r]isk characterization would include comparison of the estimated exposure via all pathways with the selected toxicity criteria. In general, this would include an estimate of the range of uncertainty and the probability of adverse effects at the calculated exposure level" (DTSC 1996). The DTR Tier II ERA is completely lacking any consideration of probability of adverse effects.

Federal ERA guidance recommends consideration of highly conservative assumptions and NOAEL effect thresholds only when considered in conjunction with more realistic exposure and effect scenarios.

> Key outputs of the risk characterization step are contaminant concentrations in each environmental medium that bound the threshold for estimated adverse ecological effects given the uncertainty inherent in the data and models used. The lower bound of the threshold would be based on consistent conservative assumptions and NOAEL toxicity values. The upper bound would be based on observed impacts or predictions that ecological impacts could occur. This upper bound would be developed using consistent assumptions, site-specific data, LOAEL toxicity values, or an impact evaluation (U.S. EPA 1997).

Similarly, California ERA guidance recommends consideration of a range of hazard quotients with different TRV thresholds and exposure assumptions to properly characterize risk and make risk management decisions (DTSC 1999). One consistent aspect of state and federal regulatory guidance on ecological risk characterization is the need for critical examination of predicted risk, including consideration of alternative exposure and adverse effect threshold assumptions: "[w]ell-balanced risk characterizations present risk conclusions and information regarding the strengths and limitations of the assessment for other risk assessors, EPA decision-makers, and the public" U.S. EPA 1995). The DTR approach fails to comply with this basic requirement.

Risk from Lead

As noted above, the highest hazard quotients in the Tier II wildlife risk assessment, and the only hazard quotients that would exceed 1.0 using a geometric mean TRV, are those based on the lead NOAEL for birds (also used to assess risk to green turtle). Lead was the only evaluated chemical for which a NOAEL TRV was exceeded by a factor greater than 10 in the flawed DTR assessment. This finding is a result of the use by the RWQCB of an inappropriate and ecologically irrelevant TRV.

The NOAEL TRV for lead used by the RWQCB (0.014 mg/kg-day) is based on a 10 percent reduction in egg laying in Japanese quail, as reported by Edens et al. (1976). Extrapolation of such an endpoint to wild bird species is highly questionable, given that quail have been selectively bred to have unnaturally high egg production rates. The quail in which egg laying was judged to be "impacted" in this study were laying 5.4 eggs per week, as opposed to 6 eggs per week in controls. No wild bird species approaches this rate of continuous egg production,

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN THE MATTER OF: TENTATIVE CLEANUP AND ABATEMENT	Order No. R9-2011-001

VIDEOTAPED

DEPOSITION OF TOM ALO

VOLUME II PAGES 211 THROUGH 410

FEBRUARY 17, 2011

SAN DIEGO, CALIFORNIA

REPORTED BY: JULIE A. MCKAY, CSR NO. 9059

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A. Correct. 13:53
Q. And so, to be clear, that means that the assumption is a hundred percent of the prey items for each of the these species were caught and consumed by these receptors from the shipyard? 13:53
A. Correct.
Q. Why was a hundred percent used?
A. To ensure beneficial use protection. It was a risk management decision on our end.
Q. And who made that risk management policy decision? 13:54
A. That would be the members of the Cleanup Team.
Q. Did any one individual Cleanup Team member make that policy decision?
A. That would be David Barker. 13:54
Q. The assumption that a hundred percent of the prey comes from the shipyard for all these species is very conservative. Would you agree?
A. I would agree.
Q. Is it likely that there is a pet brown pelican at the shipyards that spends all of its time there? 13:54
MR. CARRIGAN: Vague. Incomplete hypothetical.
THE WITNESS: Yeah, I don't know.
MR. CARRIGAN: Wouldn't it be shot by the Navy? Strike that. 13:54

100-percent AUF for Tier 2 assessment. Correct? 13:58
A. Correct.
Q. So on this same page it says that, the sentence above it: "It's possible that these receptors could catch their prey from other locations in San Diego Bay, 13:58 thus reducing their area use factor."
Do you see that?
A. I see that.
Q. Do you agree with this statement?
A. Yes. 13:59
Q. Why is that?
A. Because as written, I agree with it as written.
Q. Okay. So it's possible that species could eat prey outside of the shipyards?
A. Correct. 13:59
Q. Would you agree it's actually probable that they eat some amount of their diet outside of the shipyard?
A. Yes.
Q. Are you aware of any support for the notion 13:59 that a bird species would choose to spend all of its time, its foraging time, in an area the size of the shipyard site?
MR. CARRIGAN: Overbroad. Calls for speculation. 14:00

THE WITNESS: I don't know. 14:00

BY MR. RICHARDSON:

Q. Okay. Same question for all the other receptors. Is there any reason to believe that they would spend a hundred percent of their foraging time within the shipyard? 14:00

A. I don't know.

Q. Are any of the species used in the aquatic dependent wildlife risk assessment migratory?

A. Yes. 14:00

Q. In other words, they are not permanent residents of San Diego Bay. Correct?

A. Correct.

Q. So the least terns nest in the bay and are present only during the breeding season. Correct? 14:00

A. Correct.

Q. For the brown pelicans, surf scoters, Western grebes, they are all winter residents of the bay but migrate away to breed. Correct?

A. I believe so. 14:01

Q. Finally, sea lions breed away from San Diego Bay in offshore work areas. Correct?

A. I believe so.

Q. That being the case, they could not possibly have 100 percent of their diet from the shipyard site. 14:01

Correct? 14:01
MR. CARRIGAN: Incomplete hypothetical.
THE WITNESS: Correct. But got to remember
that we're using these receptors as representative of
other receptors that, say, for the brown pelican, 14:01
representative marine birds that may feed on small to
medium-size fish.
BY MR. RICHARDSON:
Q. And so do any of those other potential receptor
species feed entirely within the Shipyard Sediment Site? 14:01
A. I don't know.
Q. Isn't it the policy of EPA and the State of
California to use site-specific area use factors in
connection with Tier 2 aquatic dependent wildlife risk
assessments? 14:02
A. Repeat the question.
MR. RICHARDSON: Can you read it back.
(Record read.)
MR. CARRIGAN: Calls for a legal conclusion.
THE WITNESS: I would have to look at the 14:02
guidance documents for OEHHA or the EPA guidance manual.
MR. RICHARDSON: Okay. Then let's do that.
I'll introduce as Exhibit 1127 this document.
Counsel, for you.
(Exhibit 1127 marked for identification.) 10:21

foundation. 14:06

You can answer if you know.

THE WITNESS: Sure.

BY MR. RICHARDSON:

Q. Are you aware of any EPA ecological risk risk assessment guidance in any context, superfund or otherwise, where they suggest using an area use factor of a hundred percent even in Tier 2 risk assessment? 14:06

A. Not that I'm aware of.

MR. RICHARDSON: Would you mark this as Exhibit 1128. 14:06

(Exhibit 1128 marked for identification.)

BY MR. RICHARDSON:

Q. Mr. Alo, I've handed you a document from the California Department of Toxic Substances Control, Human and Ecological Risk Division, entitled HERD Ecological risk assessment Note dated December 8, 2000. 14:07

Do you see that?

A. Yes, I do.

Q. If I can draw your attention to Page 9, Paragraph C, of the document and Paragraph D of the document. After you've had a chance to review both of those, let me know. 14:07

A. Okay.

Q. Mr. Alo, the equation in Paragraph D is vaguely 14:08

Q. By approximately a hundredfold. Correct? 14:16
A. (Witness nods head.)
Q. I'm sorry?
A. Yes.
Q. The reporter can't take down a head nod. 14:16
That difference can be significant, right? I mean, it could be the difference between triggering a threshold and not triggering a threshold?
A. That's correct.
Q. Did the Cleanup Team conduct any study of the actual use of these receptors or other receptors at the shipyard? 14:16
A. No, we did not.
Q. Did the Cleanup Team calculate any site-specific area use factors for any species at the shipyard? 14:16
A. No, we did not.
Q. You just used the default assumption of a hundred percent?
A. Correct, for protection of beneficial uses. 14:17
Q. You're reading my notes. I said to be conservative. Right?
A. I can see that far.
Q. So these are based on very conservative theoretical assumptions, not based on the site-specific 14:17

BY MR. RICHARDSON: 14:50

Q. The lowest observed adverse effects threshold is that concentration that you would expect to see an adverse effect. Correct?

A. Correct. 14:51

Q. So wouldn't that be an appropriate measure to use for determining if there is potential risk at the site?

A. Yes. And also there could be adverse effects above the NOAELs between. 14:51

Q. Less than the LOAEL.

A. Yeah, between the NOAELs and the LOAELs.

Q. Are you aware of any agency guidance document or agency policy that indicates that a no adverse effects threshold should be used for making any cleanup decisions as part ecological risk assessment? 14:51

A. Not that I'm aware of.

Q. Are you aware of any agency guidance document that indicates that an exceedance of a NOAEL or TRV represents an unacceptable risk in the Tier 2 risk assessment? 14:51

A. Not that I'm aware of.

Q. So you would agree that the actual threshold for adverse effects always occurs at an exposure level greater than the no adverse effects level. Correct? 14:52

A. Correct. 14:52

Q. I want to discuss the toxicity reference values developed by the Navy and the EPA Biological Technical Assistance Group. I understand that's frequently referred to as BTAG. Is that correct? 14:52

A. That's correct.

Q. Just one more acronym for us to use today.

A. I warned her it was coming.

Q. Let's look at DTR Page 24-10.

What is a TRV high exceedance? 14:52

A. The high TRV?

Q. Yes.

A. That would be equivalent to a LOAEL.

Q. And what about a TRV low exceedance?

A. That would be equivalent to a NOAEL. 14:53

Q. Who selected the TRVs that were used in this analysis?

A. That would be based on consultation with the resource agencies.

Q. Do you recall who in particular at the resource 14:53 agencies were involved in that decision making?

A. No, I don't. It was group effort.

Q. I'm sorry?

A. It was the group.

Q. Did you evaluate independently whether those 14:53

THE WITNESS: We used it, if it exceeded the NOAEL or if it even exceeded a LOAEL, we concluded that there is a potential risk to the receptors of concern based on the Tier 2 analysis. 14:55

BY MR. RICHARDSON: 14:56

Q. So do you agree that an exceedance of a NOAEL where there's not an exceedance of a LOAEL does not mean that there's necessarily an impact on aquatic dependent wildlife?

A. Correct. But there is a potential. 14:56

Q. Has the Cleanup Team made a policy decision to find impairment to aquatic dependent wildlife even where there are no exceedances to the LOAEL?

A. Made it a -- Cleanup Team made it a policy?

Q. Do you want her to read back the question? 14:56

A. Yeah, read back the question. Sorry.

(Record read.)

THE WITNESS: Yes, we made a decision.

BY MR. RICHARDSON:

Q. Would you agree that that decision is extremely conservative and protective? 14:57

MR. CARRIGAN: Vague.

You can answer.

THE WITNESS: Protective.

BY MR. RICHARDSON: 14:57

Q. So you agree it is conservative and protective?

A. It provides protection of beneficial uses.

Q. But it's conservative because it's less than the lowest concentration that there has been an observed 14:57 effect. Correct?

A. Correct.

Q. In evaluating the post-remedial conditions related to aquatic dependent wildlife, did the DTR use the geometric mean between the NOAEL and LOAEL to 14:57 evaluate risks for selected receptors?

MR. CARRIGAN: This is beyond this witness's topic as a designated expert as it deals with the alternative cleanup levels.

So we'll ask this of Mr. Alo -- 14:57

MR. RICHARDSON: I will ask Mr. Alo --

MR. CARRIGAN: -- based on his expertise?

BY MR. RICHARDSON:

Q. Yeah, based on your expertise.

A. Based on my expertise, did we use the geometric 14:58 mean between the NOAEL and the LOAEL?

Q. In evaluating post-remedial conditions.

A. Yes, we did.

Q. And I'll bring that back around to the aquatic dependent wildlife analysis. 14:58

III-C. AQUATIC LIFE RISK

VOLUME II

DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA
Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

15. Finding 15: Multiple Lines of Evidence Weight-of-Evidence Approach

Finding 15 of CAO No. R9-2011-0001 states:

The San Diego Water Board used a weight-of-evidence approach based upon multiple lines of evidence to evaluate the potential risks to aquatic life beneficial uses from pollutants at the Shipyard Sediment Site. The approach focused on measuring and evaluating exposure and adverse effects to the benthic macroinvertebrate community and to fish using data from multiple lines of evidence and best professional judgment. Pollutant exposure and adverse effects to the benthic macroinvertebrate community were evaluated using sediment quality triad measurements, and bioaccumulation analyses, and interstitial water (i.e., pore water) analyses. The San Diego Water Board evaluated pollutant exposure and adverse effects to fish using fish histopathology analyses and analyses of PAH breakdown products in fish bile.

15.1. No Single Method Can Measure the Effects of Contaminated Sediment

Pollutants in sediment can cause adverse effects either through direct toxicity to benthic organisms or through bioaccumulation and food chain transfer to human and wildlife consumers of fish and shellfish. As noted by U.S. EPA (1992a), there is no single method that will measure all contaminated sediment effects at all times and to all biological organisms. For example, sediment chemistry provides unambiguous measurements of pollutant levels in marine sediment, but provides inadequate information to predict biological impact. Benthic communities can provide a direct measurement of community impacts, but are subject to disturbances that are not necessarily caused by pollutant driven sediment toxicity (e.g. low dissolved oxygen). Measurements of sediment toxicity directly measure biological impacts and integrate the effect(s) of various pollutant mixtures, but are subject to test imprecision and lack of consistent correlations with biological community effects. In addition, the toxicity test organisms may not adequately reflect the sensitivity of the full range of species comprising the benthic community. Reliance on any one of these measurement endpoints (chemistry, benthic communities and toxicity) to evaluate exposure and effects is problematic for characterizing risk from sediment pollutants. In contrast, a weight of evidence assessment using all three measurement endpoints gives the assessor much more information to reach conclusions.

15.2. Weight-Of-Evidence Approach

Based on these considerations, the assessment of potential adverse effects from contaminated sediment is best performed using a “weight-of-evidence approach.” The central tenet of a weight-of-evidence approach is that “multiple lines of evidence” should support decision-making. The corollary is that no single line of evidence should drive decision-making (unless a single line of evidence gives all the information necessary, and decision makers are willing to accept the outcome). The weight-of-evidence approach is commonly defined in the literature as a determination related to possible ecological impacts based upon multiple lines of evidence, which contribute to an overall evaluation and conclusion. This determination incorporates judgments referred to as "best professional judgment" (BPJ) concerning the quality, extent, and congruence of the data contained in the different lines of evidence. BPJ comprises the use of expert opinion and judgment based on available data and site-situation specific conditions to determine, for example, environmental status or risk. BPJ can be initiated in cases where there are extensive data but few uncertainties and in cases where there are few data and many uncertainties.

15.3. San Diego Water Board Approach

The San Diego Water Board applied the weight-of-evidence approach principles to evaluate potential risks to aquatic life beneficial uses from the existing levels of pollutants at the Shipyard Sediment Site. The approach focused on evaluating the exposure and adverse impacts to the benthic macroinvertebrate community and to fish using multiple lines of evidence including sediment and pore water chemistry, laboratory studies of toxicity and bioaccumulation, benthic community evaluation, fish histopathology analyses and analyses of PAH breakdown products in fish bile. The details regarding pore water, fish histopathology, and fish bile analyses can be found in the Appendix for Section 15. The data used to establish these lines of evidence are contained in the NASSCO and BAE Systems' report (Exponent, 2003) referenced in Section 13 of this Technical Report. The San Diego Water Board's evaluation of these data and multiple lines of evidence are discussed in Sections 16 through 19 of this Technical Report.

15.4. State Water Resources Control Board's Sediment Quality Objectives

The State Water Board's *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1. Sediment Quality* was effective on August 25, 2009 (SWRCB, 2009).

This plan contains sediment quality objectives (SQOs) for direct (benthic communities) and indirect (human health) effects, and a plan of implementation for direct effects. The SQOs are designed to provide the State and Regional Water Boards, stakeholders, and interested parties with a process to differentiate sediments impacted by toxic pollutants from those that are not. To protect benthic communities in bays and estuaries of California, the SQO describes a multiple lines of evidence (MLOE) approach that integrates sediment toxicity, sediment chemistry, and benthic community analysis into a station level assessment.

The State Water Board's MLOE approach, sometimes referred to as the Triad approach, is similar to the San Diego Water Board's approach identified in Section 15.3 above. Both methodologies evaluate the potential for the pollutants in the sediment to impact benthic communities by integrating sediment toxicity, sediment chemistry, and benthic community data.

The results of the station level MLOE assessment classify the impacts to the benthic communities into one of the following 6 categories:

a. Unimpacted;
b. Likely Unimpacted;
c. Possibly Impacted;
d. Likely Impacted;
e. Clearly Impacted; or
f. Inconclusive.

The SQO recommends a dividing line between "Likely Unimpacted" and "Possibly Impacted." Protected sediments are defined by the categories "Unimpacted" and "Likely Unimpacted." All other categories would be considered as not representing the protective condition.

The Principal Scientist on the project was Mr. Steve Bay, with SCCWRP. Mr. Bay evaluated a number of stations within San Diego Bay utilizing the MLOE approach in the SQO. This evaluation included 27 stations at the Shipyard Sediment Site, (Bay, 2007). The results are presented in Table 32-17 in Section 32.5.1 Analysis for Aquatic Life at Triad Stations.

The Shipyard Sediment Site is exempt from the Phase I Sediment Quality Objectives promulgated by the State Water Resources Control Board (State Water Board) because a site assessment (the Shipyard Report) was completed and submitted to the San Diego *Water Board on October 15, 2003. See State Water Board, Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*, II.B.2 (August 25, 2009).

18. Finding 18: Sediment Quality Triad Results

Finding 18 of CAO No. R9-2011-0001 states:

The San Diego Water Board categorized 6 of 30 sediment quality triad sampling stations at the Shipyard Sediment Site as having sediment pollutant levels "Likely" to adversely affect the health of the benthic community. The remaining triad stations were classified as "Possible" (13) and "Unlikely" (11). These results are based on the synoptic measures of sediment chemistry, toxicity, and benthic community structure at the Shipyard Sediment Site.

18.1. Sediment Quality Triad Results

Based on the results of the Triad lines of evidence, 6 of 30 stations sampled at the Shipyard Sediment Site are categorized as "Likely" impacted, which means it is likely that the CoPCs are adversely impacting the health of the benthic community (Table 18-1). The process used to assign the "Low," "Moderate," and "High" classifications to each line of evidence, and the "Unlikely," "Possible," and "Likely" categories for the weight-of-evidence conclusions are described below.

The results presented in Table 18-1 are based on a comparative analysis using a set of reference stations that characterize the Reference Sediment Quality Conditions described in Section 17 of this Technical Report. This reference condition can be used to represent contemporary background chemical and biological characteristics of San Diego Bay and is reflective of conditions that would exist in the marine sediment in the absence of the Shipyard Sediment Site discharges. This condition reflects the presence of existing background anthropogenic levels of pollutants from non-shipyard related discharges (e.g., urban watershed loading in San Diego Bay), as well as natural variability in marine sediment toxicity and benthic community condition. A description of the Reference Sediment Quality Conditions, including a list of the reference stations, is provided in Section 17 of this Technical Report.

Table 18-1 Results of the Sediment Quality Triad Lines-of-Evidence

Site	Station	Sediment Chemistry[1]	Toxicity[2]	Benthic Community[3]	Weight-of-Evidence Category[4]
NASSCO	NA01	Moderate	Low	Low	Unlikely
	NA03	Moderate	Low	Low	Unlikely
	NA04	Moderate	Low	Low	Unlikely
	NA05	Moderate	Low	Low	Unlikely
	NA06	Moderate	Low	Low	Unlikely
	NA07	Moderate	Low	Low	Unlikely
	NA09	Moderate	Moderate	Low	Possible

Site	Station	Sediment Chemistry[1]	Toxicity[2]	Benthic Community[3]	Weight-of-Evidence Category[4]
	NA11	Moderate	Moderate	Low	Possible
	NA12	Moderate	Moderate	Low	Possible
	NA15	Moderate	Low	Low	Unlikely
	NA16	Moderate	Moderate	Low	Possible
	NA17	High	Low	Low	Possible
	NA19	High	Moderate	Low	Likely
	NA20	Low	Low	Moderate	Unlikely
	NA22[5]	Moderate	Moderate	Moderate	Likely
BAE Systems	SW02	High	Low	Low	Possible
	SW03	Moderate	Low	Low	Unlikely
	SW04	High	Low	Moderate	Likely
	SW08	High	Low	Low	Possible
	SW09	High	Low	Low	Possible
	SW11	Moderate	Low	Low	Unlikely
	SW13	High	Moderate	Low	Likely
	SW15	Moderate	Moderate	Low	Possible
	SW17	Moderate	Moderate	Low	Possible
	SW18	Moderate	Low	Low	Unlikely
	SW21	High	Low	Low	Possible
	SW22	High	Moderate	Low	Likely
	SW23	High	Moderate	Low	Likely
	SW25	Moderate	Moderate	Low	Possible
	SW27	Moderate	Moderate	Low	Possible

1. Relative likelihood that the chemicals present in the sediment is adversely impacting organisms living in or on the sediment (i.e., benthic community).
2. Relative likelihood of toxic effects based on the combined toxic response from three tests: amphipod survival, sea urchin fertilization, and bivalve development.
3. Relative likelihood of benthic community degradation based on four metrics: total abundance, total number of species, Shannon-Wiener Diversity Index, and the Benthic Response Index.
4. Relative likelihood (Likely, Possible, or Unlikely) that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.
5. NA22 was omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

18.2. Sediment Chemistry Ranking Criteria

The low, moderate, and high classifications assigned to the sediment chemistry line-of-evidence are determined by comparing the bulk sediment chemical concentrations from each site station to sediment quality guidelines (SQGs) and to Reference Condition as follows:

- **Sediment Quality Guidelines** – Sediment quality guidelines (SQGs) are reference values above which sediment pollutant concentrations could pose a significant threat to aquatic life and can be used to evaluate sediment chemistry data. SQGs are considered one of the most effective methods for attempting to relate sediment chemistry to observed toxic effects and determine whether contaminants are present in amounts that could cause or contribute to adverse effects (Long et al., 1995; Long et al., 1998). SQGs have been used by regulatory agencies, research institutions, and environmental organizations throughout the United States to identify contamination hot spots, characterize the suitability of dredge material for disposal, and establish goals for sediment cleanup and source control (Vidal and Bay, 2005). SQGs are often used as a tool to interpret chemical data from analyses of sediment, identify data gaps, and screen CoPCs. SQGs are helpful in determining whether marine sediment contaminants warrant further assessment or are at a level that requires no further evaluation.

  Several different approaches, based on empirical or causal correlative methodologies, have been developed for deriving SQG screening levels. Each of these approaches attempts to predict pollutant concentration levels that could result in adverse effects to benthic species, which are extrapolated to represent the entire aquatic community. Examples of empirical SQGs include the ERL and ERM values, which are concentrations corresponding to the 10th and 50th percentiles of the distribution observed in toxic samples, respectively (Vidal and Bay, 2005). Examples of causal SQGs include the equilibrium partitioning (EqP) approach which uses partitioning theory to relate the dry-weight sediment concentration of a particular chemical that causes an adverse biological effect to the equivalent free chemical concentration in pore water and to the concentration sorbed to sediment organic carbon or bound to sulfide. The theoretical causal resolution of chemical bioavailability in relation to chemical toxicity in different sediments differentiates equilibrium partitioning approaches from purely empirical correlative assessment methods (U.S. EPA 1998d). Causal SQGs have a greater ability relative to empirical SQGs to determine the specific contaminants responsible for toxicity. However causal SQGs require more extensive data sets and published values are not available for many contaminants relative to empirical SQGs. By comparison, empirical SQGs can be calculated for a large number of contaminants and only require routine chemical analyses (Vidal and Bay, 2005).

It is important to note that SQGs are not promulgated as regulatory sediment quality criteria or standards in California nor are they intended as cleanup or remediation targets (Buchman, 1999). The SQGs used to classify the Shipyard Sediment Site stations include:

- ERM for metals (Long et al., 1998),
- Consensus midrange effects concentration for PAHs and PCBs (Swartz, 1999; MacDonald et al., 2000), and
- Sediment Quality Guideline Quotient (SQGQ) for chemical mixtures (Fairey et al., 2001).

- **Reference Sediment Quality Conditions** – A key step to evaluating each line-of-evidence comprising the Triad of data is to determine if there are statistically significant differences between a contaminated marine sediment site and reference station sites. To accomplish this it is necessary to specify the appropriate statistical procedure to estimate the level of confidence obtained when differentiating between reference and the contaminated marine sediment site conditions. The statistical procedure used by the San Diego Water Board in the Shipyard Sediment Site investigation to identify stations where conditions are significantly different from the Reference Sediment Quality Conditions consisted of identifying station sample values outside boundaries established by the 95% upper predictive limit reference pool of data for each contaminant of concern. The 95% upper predictive limit allows a one-to-one comparison to be performed between a single Shipyard Sediment Site station and the pool of reference stations used to establish "Reference Sediment Quality Conditions" for the Shipyard Sediment Site (Reference Pool). Although multiple comparisons are made to the Reference Pool prediction limits, the San Diego Water Board made a decision to not correct for multiple comparisons so that the Shipyard Site/Reference comparisons would remain conservative and more protective. Metals characteristics and summary statistics for the Reference Pool are shown in Table 18-2. The 95% upper predictive limit for metals was dependent on the fines content at each station to help identify concentrations of metals that were enriched at the Shipyard Sediment Site (Table 18-3). In general, this means that stations with higher fines content will have a higher 95% upper predictive limit. For example, the 95% upper predictive limit for copper ranged from 85.9 mg/kg for a fines content of 25% to 159.5 mg/kg for a fines content of 75%. Summary statistics and the 95% upper predictive limits for organic contaminants and the SQGQ1 for the Reference Pool are shown in Tables 18-4 and 18-5, respectively.

- **Tributyltin (TBT) Considerations** - TBT is not specifically considered in the sediment chemistry line of evidence (LOE) analysis because 1) it is not incorporated in the combination of chemicals used in the SQGQ1 calculation and 2) there are no published empirical SQGs or consensus MEC values for TBT effects on benthic community health. The SQGQ1 metric, documented in Fairey et. al., (2001) and used in the analysis, is a central tendency indicator of the potential for adverse biological effects from chemical mixtures in a complex sediment matrix. Under the Fairey et. al., (2001) methodology, the SQGQ1 value for a sediment is calculated by dividing concentrations of cadmium, copper, lead, silver, zinc, total chlordane, dieldrin, total PAHs (normalized by sediment organic carbon content), and total PCBs (sum of 18 congeners) in sediment by each chemical's empirical SQG and subsequently averaging the individual quotients. The combination of chemicals used in the SQGQ1 calculation, which does not include TBT, are assumed to be representative of, or the surrogates of, the toxicologically significant chemical mixture regardless of which chemicals were quantified in the sediment chemistry analyses. This is not only a well-accepted, but also a reasonable approach given the seemingly infinite number of chemicals present in marine sediment and for this reason it is not at all uncommon to exclude a specific chemical(s), such as TBT, in the chemistry LOE analysis for determining the likelihood of benthic community impairment.

Table 18-2 Individual Station Characteristics and Summary Statistics for Physical Properties (%) and Metals (mg/kg) in the Reference Pool

Station	% Fines	%TOC	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
CP 2231	41.2	1.0	0.288	7.78	0.025	46.6	71.1	0.364	11.5	40.3	129
CP 2238	69.0	1.0	0.510	7.8	0.133	59.2	71.0	0.262	16.5	28.8	214
CP 2243	30.3	0.6	0.651	5.94	0.143	40.2	56.4	0.332	10.2	30.7	125
CP 2433	38.4	0.5	0.385	5.55	0.288	42.2	43.3	0.251	11.2	23.3	115
CP 2441	82.8	1.8	0.388	8.82	0.411	54.0	78.4	0.238	17.5	26.7	143
SY 2231	45.0	1.3	0.260	8.3	0.100	37.0	82.0	0.430	10.0	42.0	120
SY 2243	28.0	0.5	0.560	4.3	0.120	23.0	47.0	0.250	5.6	21.0	93.0
SY 2433	41.0	0.7	0.390	4.6	0.290	24.0	40.0	0.210	7.4	19.0	92.0
SY 2441	41.0	1.1	0.240	5.4	0.290	22.0	37.0	0.160	9.9	13.0	80.0
2235	45.0	0.6	0.476	6.4	0.095	37.5	58.2	0.239	10.7	21.3	136
2241	18.0	0.5	0.538	4.53	0.088	27.5	59.2	0.213	7.3	26.3	104
2242	31.0	0.7	0.493	4.27	0.096	25.4	42.0	0.300	6.8	17.8	89.8
2243	35.0	0.5	0.504	3.66	0.101	20.8	38.8	0.239	5.1	19.9	81.2
2256	67.0	1.3	1.29	7.47	0.200	54.3	128	0.632	14.3	54.1	197
2257	77.0	1.6	1.25	9.08	0.175	66.7	157	0.511	18.7	64.1	233
2258	71.0	1.4	0.954	7.75	0.161	60.0	143	0.664	16.4	53.0	211
2260	27.0	0.5	0.452	4.06	0.092	23.9	50.8	0.216	7.1	20.4	87.5
2265	13.0	0.4	0.192	2.48	0.069		18.0	0.065	1.5	12.0	43.2
N	18	18	18	18	18	18	18	18	18	18	18
Minimum	13.0	0.4	0.192	2.48	0.025	20.8	18.0	0.065	1.5	12	43.2
Maximum	82.8	1.8	1.29	9.08	0.411	66.7	157	0.664	18.7	64.1	233
Mean	44.5	0.9	0.546	6.01	0.160	39.1	67.8	0.310	10.4	29.6	127.4
Std Dev	20.5	0.4	0.315	1.98	0.100	15.4	38.3	0.158	4.7	15.0	53.4
RSD	46.1%	49.6%	57.8%	33.0%	62.5%	39.4%	56.4%	50.9%	45.5%	50.6%	41.9%
ERM	NA	NA	3.7	70	9.6	370	270	0.71	51.6	218	410

SCCWRP and U.S. Navy, 2005b

Table 18-3 Metal Threshold Values (mg/kg) Derived from the Fines-Metals Regression as a Function of Percent Fines for the Reference Pool

% Fines	Ag[1]	As[1]	Cd[1]	Cr[1]	Cu[1]	Hg[1]	Ni[1]	Pb[1]	Zn[1]
0	0.73	3.4	0.23	25.2	54.4	0.36	4.4	31.7	87.6
5	0.76	3.8	0.24	28.1	60.4	0.38	5.4	33.6	97.3
10	0.79	4.2	0.25	31.1	66.6	0.39	6.4	35.5	107.2
15	0.82	4.6	0.26	34.1	72.9	0.41	7.4	37.5	117.2
20	0.85	5	0.27	37.1	79.4	0.43	8.4	39.6	127.4
25	0.89	5.4	0.28	40.2	85.9	0.45	9.5	41.7	137.7
30	0.92	5.8	0.29	43.4	92.6	0.47	10.5	43.9	148.2
35	0.96	6.2	0.3	46.6	99.5	0.5	11.6	46.1	158.8
40	1	6.6	0.31	49.8	106.5	0.52	12.6	48.4	169.6
45	1.04	7.1	0.32	53.2	113.6	0.54	13.7	50.8	180.6
50	1.08	7.5	0.33	56.5	120.9	0.57	14.8	53.2	191.8
55	1.13	7.9	0.35	60	128.3	0.59	15.9	55.8	203.1
60	1.17	8.3	0.36	63.5	135.9	0.62	17	58.3	214.6
65	1.22	8.8	0.37	67	143.6	0.64	18.1	61	226.2
70	1.27	9.2	0.39	70.6	151.5	0.67	19.2	63.7	238.1
75	1.32	9.7	0.4	74.3	159.5	0.7	20.3	66.5	250
80	1.37	10.1	0.42	78	167.6	0.72	21.5	69.3	262.1
85	1.42	10.6	0.43	81.7	175.9	0.75	22.6	72.2	274.4
90	1.48	11	0.45	85.5	184.2	0.78	23.8	75.1	286.8
95	1.53	11.5	0.46	89.3	192.7	0.81	24.9	78.1	299.3
100	1.59	11.9	0.48	93.2	201.2	0.84	26.1	81.1	311.9

SCCWRP and U.S. Navy, 2005b

1. Sediment metal concentrations exceeding these thresholds are considered enriched.

Table 18-4 Individual Station Characteristics, Summary Statistics, and 95% Upper Predictive Limits for Organic Contaminants in the Reference Pool

Station	PP-PAHs[1] µg/kg	PCBs[2] µg/kg	HPAHs[3] µg/kg	TBT[4] µg/kg
CP 2231	1,063	42.7	536.0	
CP 2238	199	11.4	199.0	
CP 2243	267	20.7	118.0	
CP 2433	780	27.1	415.0	
CP 2441	2,143	33.5	1,210.0	
SY 2231	687	77.1	235.0	15.0
SY 2243	204	22.4	56.0	2.6
SY 2433	486	20.8	169.5	3.3
SY 2441	343	10.5	117.2	3.7
2235	234	49.8	76.5	
2241	234	49.8	76.5	
2242	359	49.8	126.8	
2243	234	49.8	76.5	
2256	424	49.8	174.4	
2257	505	50.9	215.9	
2258	463	49.8	197.9	
2260	234	49.8	76.5	
2265	234	49.8	76.5	
N	18	9	18	4
Minimum	199	10.5	56	2.60
Maximum	2,143	77.1	1,210	15.00
Mean	505	29.6	231	6.15
Std Dev	471	20.5	275	5.92
RSD	93%	69%	119%	96%
95% PL[5]	**1,264**	**84**	**663**	**21.7**

1. PP-PAHs = Priority Pollutant Polynuclear Aromatic Hydrocarbons, sum of 16 PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, indeno[123-cd]pyrene, dibenz[ah]anthracene, and benzo[ghi]perylene.
2. PCBs = Polychlorinated Biphenyls. "PCBs" is the sum of 41 congeners unless otherwise stated: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.
3. HPAHs = High Molecular Weight Polynuclear Aromatic Hydrocarbons, sum of 6 PAHs: Fluoranthene, Perylene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, and Dibenzo(a,h)anthracene.
4. TBT = Tributyltin

5. The 95% upper predictive limits are calculated using the same methodology described in SCCWRP and U.S. Navy, 2005b. The supporting calculations are provided in the Appendix for Section 18.

Table 18-5 Calculated SQGQ1, Summary Statistics and 95% Upper Predictive Limit for the Reference Pool

Station	SQGQ1[1]
CP 2231	0.18
CP 2238	0.20
CP 2243	0.18
CP 2433	0.15
CP 2441	0.19
SY 2231	0.21
SY 2243	0.15
SY 2433	0.13
SY 2441	0.10
2235	0.16
2241	0.16
2242	0.13
2243	0.13
2256	0.33
2257	0.37
2258	0.31
2260	0.14
2265	0.07
N	18
Minimum	0.07
Maximum	0.37
Mean	0.18
Std Dev	0.08
RSD	42%
95% PL[2]	**0.35**

1. SQGQ1 = Sediment Quality Guideline Quotient 1. The SQGQ1 value for a sediment is calculated by dividing concentrations of cadmium, copper, lead, silver, zinc, total chlordane, dieldrin, total PAHs (normalized by sediment organic carbon content), and total PCBs (sum of 18 congeners) in sediment by each chemical's empirical SQG and subsequently averaging the individual quotients. Individual quotients for total chlordane and dieldrin quotients are excluded in the SQGQ1 supporting calculations because these constituents were not included in the list of minimum analytes required to assess exposure at the Shipyard Sediment Site.

2. The 95% upper predictive limit is calculated using the same methodology described in SCCWRP and U.S. Navy, 2005b. The supporting calculations are provided in the Appendix for Section 18.

The relative potential for adverse effects attributable to sediment chemistry is classified as low, moderate, or high based on comparisons made to published sediment quality guidelines where increasing weight is given by the number and magnitude of chemicals exceeding a threshold, similar to the method used by Long et al. (1998). The breakpoints in the ranking levels are established using best professional judgment (BPJ) and followed Long et al. (1998) and Fairey et al., (2001). The San Diego Water Board's decision process for sediment chemistry evaluation is outlined in Figure 18-1 and the supporting calculations are provided in the Appendix for Section 18. The sediment chemistry line-of-evidence results for each Shipyard Sediment Site stations are shown in Table 18-6 and the supporting calculations are provided in the Appendix for Section 18.

Figure 18-1 Flow Diagram for the Sediment Chemistry Ranking Criteria (Low, Moderate, and High)

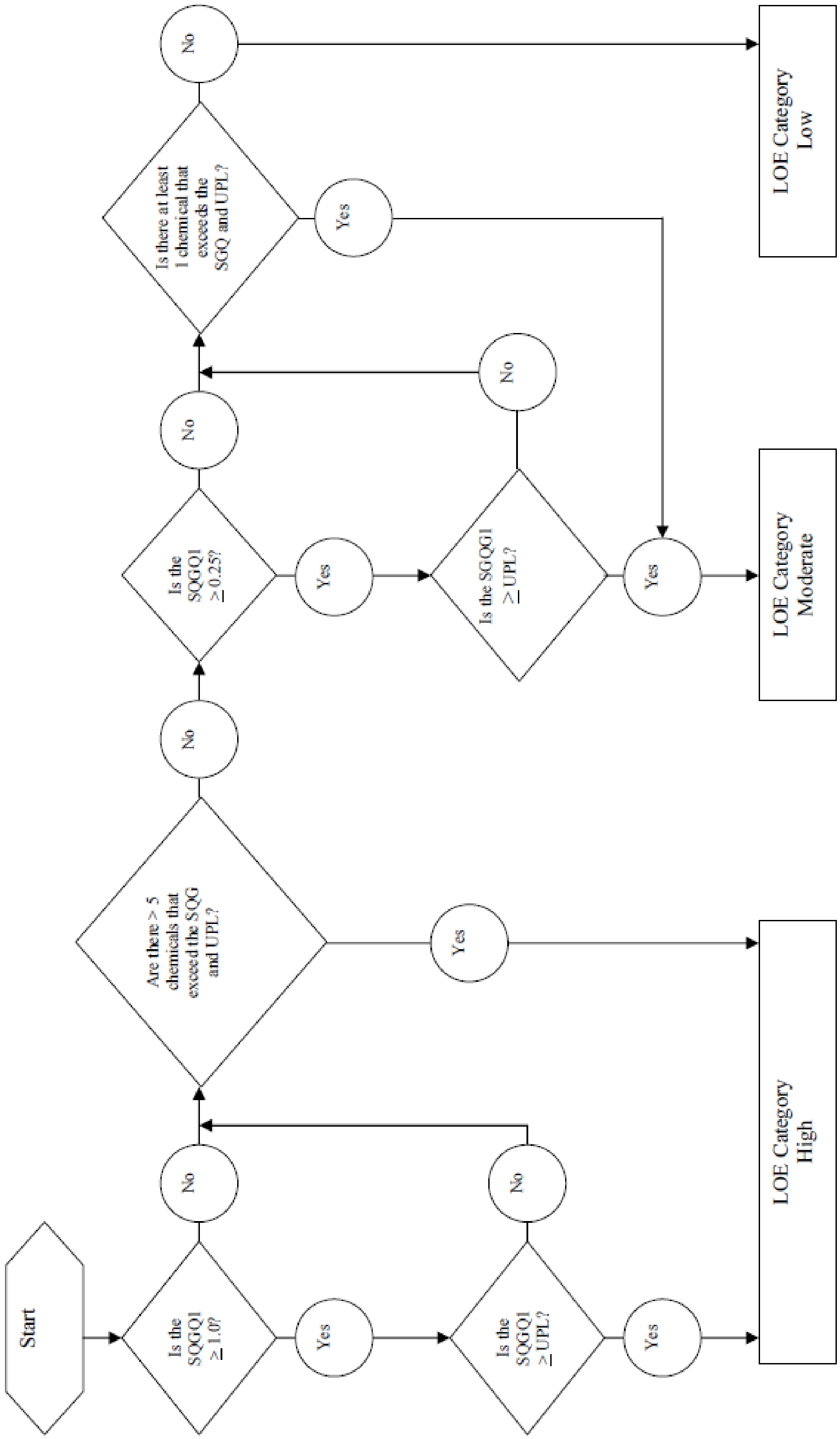

Table 18-6 Sediment Chemistry Line-of-Evidence Results

Site	Station	SQGQ1[1]			SQGQ1 ≥ UPL	# Chemicals > SQG and UPL	LOE Category[2]
		< 0.25	0.25 to 1.0	≥1.0			
NASSCO	NA01		X		Yes	2	**Moderate**
	NA03		X		Yes	2	**Moderate**
	NA04		X		Yes	1	**Moderate**
	NA05		X		Yes	0	**Moderate**
	NA06		X		Yes	3	**Moderate**
	NA07		X		Yes	2	**Moderate**
	NA09		X		Yes	2	**Moderate**
	NA11		X		Yes	1	**Moderate**
	NA12		X		Yes	0	**Moderate**
	NA15		X		Yes	2	**Moderate**
	NA16		X		Yes	2	**Moderate**
	NA17			X	Yes	4	**High**
	NA19			X	Yes	4	**High**
	NA20		X		No	0	**Low**
	NA22[3]		X		Yes	0	**Moderate**
BAE Systems	SW02			X	Yes	6	**High**
	SW03		X		Yes	2	**Moderate**
	SW04			X	Yes	6	**High**
	SW08			X	Yes	5	**High**
	SW09			X	Yes	5	**High**
	SW11		X		Yes	1	**Moderate**
	SW13			X	Yes	4	**High**
	SW15		X		Yes	2	**Moderate**
	SW17		X		Yes	3	**Moderate**
	SW18		X		Yes	2	**Moderate**
	SW21			X	Yes	2	**High**
	SW22			X	Yes	2	**High**
	SW23			X	Yes	3	**High**
	SW25		X		Yes	2	**Moderate**
	SW27		X		Yes	0	**Moderate**

1. SQGQ1 = Sediment Quality Guideline Quotient 1 (Fairey et al., 2001)
2. The supporting calculations are provided in the Appendix for Section 18.
3. NA22 was omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

The sediment chemistry ranking criteria was originally developed for the sediment quality site assessment work for the mouth of Chollas Creek and Paleta Creek TMDLs (SCCWRP and U.S. Navy, 2005b). The criteria were developed by SCCWRP, U.S. Navy, and the San Diego Water

Board with input from DFG, U.S. FWS, DTSC, and NOAA; collectively referred to as the Natural Resource Trustee Agencies (NRTAs), non governmental environmental groups, SDUPD, and the City of San Diego (City).

The low, moderate, and high sediment chemistry ranking criteria are based on the following two key assumptions (SCCWRP and U.S. Navy, 2005b):

1. A Shipyard Sediment Site sample station is ranked as having a low likelihood of impact from sediment CoPCs when all chemicals at a station are less than relatively low SQGs and less than the established Reference Condition; and

2. A Shipyard Sediment Site sample station is ranked as having a high likelihood of impact from sediment CoPCs when many of the chemicals at a station exceed a relatively high SQG, and exceed the Reference Condition sediment chemistry levels.

The specific sediment chemistry line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 18-1of this report. The same sediment chemistry ranking criteria from the SCCWRP and U.S. Navy (2005b) report is used to evaluate the sediment chemistry data to the Shipyard Sediment Site sample stations.

Low Potential for Adverse Effects: The mean SQGQ1 is less than 0.25 or all chemicals were less than the 95% predictive limit calculated from the Reference Pool. Additionally, there must not be any single chemical that exceeded either its SQG or Reference Pool predictive limit value whichever was higher. To meet this category, all chemicals present at the site station, either individually or when summed, must be lower than a relatively low SQG and below the Reference Condition.

Moderate Potential for Adverse Effects: The mean SQGQ1 is between 0.25 and 1.0 and greater than the 95% predictive limit calculated from the Reference Pool. Additionally, a station is classified under this category if there are five or less individual chemicals that exceed their respective SQG and Reference Pool predictive limit. To meet this category, some (five or less) chemicals either individually or when summed exceed a moderate level SQG and/or the Reference Condition.

High Potential for Adverse Effects: The mean SQGQ1 for all chemicals is greater than or equal to 1.0 and is greater than the 95% predictive limit calculated from the Reference Pool. This category is also assigned if more than five chemicals exceed their individual SQG or the Reference Condition, whichever is higher. To meet this category, the Reference Condition as well as a relatively high SQG is exceeded when chemicals are considered as a group, or there are at least six individual chemicals exceeding a SQG or Reference Condition.

To determine the likelihood of impairment (Likely, Possible, or Unlikely) in the overall weight of evidence, each line of evidence ranking (Low, Moderate, or High) is put into the Weight-of-Evidence Analysis framework described in Section 18.5 below.

18.3. Toxicity Ranking Criteria

The low, moderate, and high classifications assigned to the toxicity line-of-evidence are determined by comparing the results of the three toxicity tests to their negative controls[10] and to the Reference Pool described in Section 17 of this Technical Report:

- **Negative Controls –** The first key step in the toxicity line-of-evidence is to determine whether there are statistically significant differences between toxicity observed at the Shipyard Sediment Site and toxicity observed in the laboratory control condition. Three types of sediment toxicity tests were conducted at each Shipyard Site station: (1) 10-day amphipod survival test using *Eohaustorius estuarius* exposed to whole sediment, (2) 48-hour bivalve larva development test using the mussel *Mytilus galloprovincialis* exposed to whole sediment at the sediment-water interface, and (3) 40-minute echinoderm egg fertilization test using the purple sea urchin *Strongylocentrotus purpuratus* exposed to sediment pore water. The results of these toxicity tests were compared statistically to their respective negative controls using a one-tailed Student t-test ($\alpha = 0.05$). The supporting calculations are provided in the Appendix for Section 18.

- **Reference Sediment Quality Conditions** – The second key step in the toxicity line-of-evidence is to determine whether there are statistically significant differences between toxicity observed at the Shipyard Site and toxicity observed at the Reference Pool. The statistical procedure used to identify these differences consisted of the 95% lower predictive limit. The 95% lower predictive limit allows a one-to-one comparison to be performed between a single Shipyard Site station and the Reference Pool. The 95% lower predictive limit computes a single threshold value for each toxicity test in the Reference Pool (e.g., amphipod survival) from which each Shipyard Site station toxicity result is compared. Although multiple comparisons are made to the Reference Pool prediction limits, the San Diego Water Board made a decision to not correct for multiple comparisons so that the Shipyard Site/reference comparisons would be more conservative and protective. The 95% lower predictive limits for the three toxicity tests are shown in Table 18-7.

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[10] The term "controls" refers to a treatment in a toxicity test that duplicates all of the conditions of the exposure treatments but contains no test material. The control is used to determine the absence of toxicity of basic test conditions (e.g. health of test organisms, quality of dilution water). "Control sediment" is sediment that is (1) essentially free of contaminants, (2) used routinely to assess the acceptability of a test, and (3) not necessarily collected near the site of concern. Control sediment provides a measure of test acceptability, evidence of test organism health, and a basis for interpreting data obtained from test sediments. "Negative Control" is a type of control used to determine the inherent background effects in the toxicity test, such as effects related to the health of the test organisms and the quality of the dilution water. It provides a baseline and a point of correction for interpreting the sediment toxicity test results.

Table 18-7 Individual Station Characteristics, Summary Statistics, and 95% Lower Predictive Limits for Control Adjusted Amphipod Survival (%), Bivalve Development (% Normal), and Urchin Fertilization (%) in the Reference Pool

Station	Amphipod Survival	Bivalve Development[1]	Urchin Fertilization
CP 2231	76		66
CP 2238	90		36
CP 2243	84		97
CP 2433	84		100
CP 2441	82		102
SY 2231	84	93	99
SY 2243	92	66	92
SY 2433	96	101	79
SY 2441	95	70	90
2235	71		
2241	98		
2242	92		
2243	96		
2256	100		
2257	91		
2258	92		
2260	73		
2265	85		
N	18	4	9
Minimum	71	66	36
Maximum	100	101	102
Mean	88	82.5	85
Std Dev	8.4	17.1	22
RSD	10%	21%	26%
95% PL	72.9	37.4	41.9

SCCWRP and U.S. Navy, 2005b

1. The 95% lower predictive limit for bivalve development is calculated using the same methodology described in SCCWRP and U.S. Navy, 2005b. The supporting calculation is provided in the Appendix to Section 18.

Similar to the chemistry line-of-evidence, the sediment toxicity ranking method employed a semi-quantitative assessment of the data that reflected both the presence and magnitude of toxicity. The category ranking criteria for sediment toxicity are summarized below and depicted in Figure 18-2. A comparison of the toxicity test results at each Shipyard Sediment Site station to the Reference Pool 95% lower prediction limits is shown in Table 18-8.

Figure 18-2 Toxicity Lines of Evidence

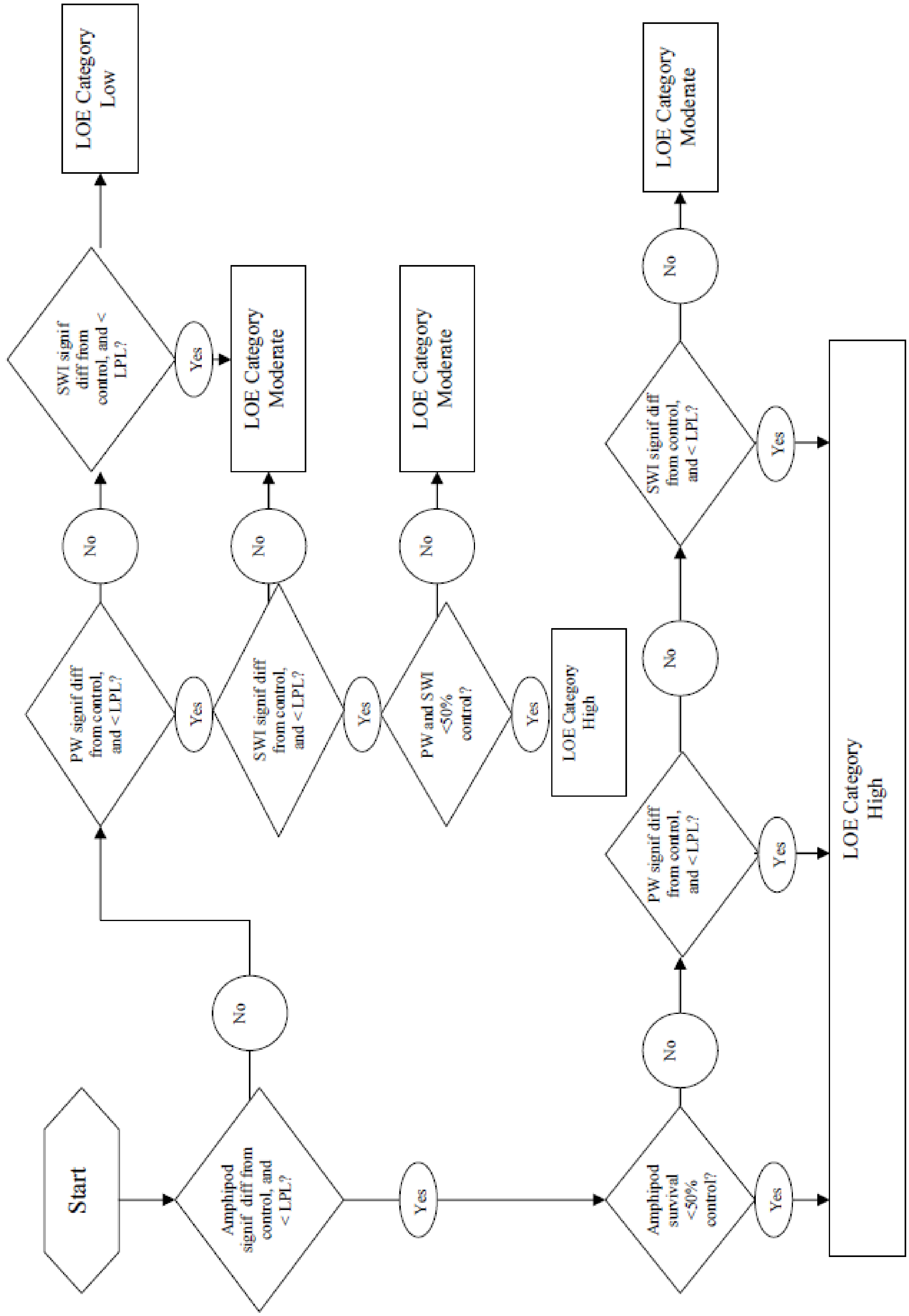

Table 18-8 Comparison of the Toxicity Data from the Shipyard Sediment Site Stations to the Reference Pool 95% Lower Predictive Limit

Site	Station	Amphipod Survival (95% LPL = 73%)[1]	Urchin Fertilization (95% LPL = 42%)	Bivalve Development (95% LPL = 37%)[1]
NASSCO	NA01	80	86	49
	NA03	84	84	94
	NA04	80	88	84
	NA05	89	95	94
	NA06	78	103	74
	NA07	74	102	88
	NA09	88	99	**1**
	NA11	**70**	101	80
	NA12	82	89	**15**
	NA15	97	88	93
	NA16	90	84	**3**
	NA17	95	88	80
	NA19	89	72	**2**
	NA20	90	78	80
	NA22[2]	95	111	**2**
BAE Systems	SW02	88	103	85
	SW03	92	103	88
	SW04	94	108	63
	SW08	91	103	93
	SW09	88	100	85
	SW11	77	89	83
	SW13	92	99	**28**
	SW15	92	103	**9**
	SW17	95	96	**16**
	SW18	74	83	64
	SW21	91	102	67
	SW22	90	104	**1**
	SW23	91	107	**16**
	SW25	86	103	**10**
	SW27	73	91	**22**

1. Toxicity values less than the 95% lower prediction limit values are bold faced and shaded.
2. NA22 was omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

The toxicity ranking criteria was originally developed for the sediment quality site assessment work for the mouth of Chollas Creek and Paleta Creek TMDLs (SCCWRP and U.S. Navy, 2005b). The criteria were developed by SCCWRP, U.S. Navy, and the San Diego Water Board; with input from NRTAs, non-governmental environmental groups, Port, and the City of San Diego.

The low, moderate, and high toxicity ranking criteria are based on the following five key assumptions (SCCWRP and U.S. Navy, 2005b):

1. Toxic effects at Shipyard Sediment Site sample stations are classified as low or none when the results of all three toxicity tests were not significantly different from their controls or they had a statistically lower level of toxicity than observed at the Reference Condition sample stations;

2. The presence of significant toxicity in any one test was sufficient to classify a Shipyard Sediment Site sample station as moderately toxic. The three toxicity tests were given equal weight for classifying a sample station as moderately toxic;

3. If amphipod survival is less than 50 percent and significantly different from the control and Reference, a high rank of sediment toxicity was justified;

4. Toxic effects at Shipyard Sediment Site sample stations are classified as high when both of the sublethal toxicity tests measured a greater level of toxicity than the Reference Condition sample stations; and

5. The amphipod toxicity test result is given greater weight for the high toxicity category because the acute survival endpoint of this test was assumed to have a higher degree of association with ecological impacts than either the urchin fertilization or bivalve development tests. The sea urchin fertilization and bivalve embryo development test results are given less weight because these are sublethal critical life stage tests that are more susceptible to confounding factors, and their association with ecological impacts is less certain.

The toxicity line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 18-2. The same toxicity ranking criteria from the SCCWRP and U.S. Navy (2005b) report were used to evaluate the sediment toxicity data from the Shipyard Sediment Site investigation. The toxicity line-of-evidence results for each Shipyard Sediment Site station are depicted in Table 18-9.

Low Toxicity: Toxic effects are classified as low or none when results of all three bioassays were not significantly different from their controls or they have a statistically lower level of toxicity than observed at the Reference Condition sample stations.

Moderate Toxicity: Toxic effects are classified as moderately toxic if any one of the bioassay results is statistically different from its control and was less than the Reference Condition. Additionally, it is required for amphipod survival to have been greater than 50 percent, regardless of the result relative to controls or the Reference Condition.

High Toxicity: Toxic effects are classified as highly toxic when any one of the following criteria is met:

1. If survival of amphipods at a station is less than 50 percent and is statistically different than controls and statistically less than the Reference Condition sample stations.

2. If the amphipod test together with any one of the other bioassays both has a result that is statistically different from control and is statistically less than the Reference Condition sample stations.

3. If both the pore water and sediment-water interface test results are less than 50 percent of the control values and are statistically less than the controls and the Reference Condition sample stations.

To determine the likelihood of impairment (Likely, Possible, or Unlikely) in the overall weight of evidence, each line of evidence ranking (Low, Moderate, or High) is put into the Weight-of-Evidence Analysis framework described in Section 18.5 below.

Table 18-9 Toxicity Line-of-Evidence Results

Station	Amphipod Survival			Urchin Fertilization			Bivalve Development			LOE Category
	Different from Control	< 95% LPL	< 50% Control	Different from Control	< 95% LPL	< 50% Control	Different from Control	< 95% LPL	< 50% Control	
NA01	Yes	No	No	Yes	No	No	Yes	No	No	**Low**
NA03	No	No	No	Yes	No	No	No	No	No	**Low**
NA04	Yes	No	No	Yes	No	No	Yes	No	No	**Low**
NA05	Yes	No	No	No	No	No	No	No	No	**Low**
NA06	Yes	No	No	No	No	No	No	No	No	**Low**
NA07	Yes	No	No	No	No	No	No	No	No	**Low**
NA09	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
NA11	Yes	Yes	No	No	No	No	No	No	No	**Moderate**
NA12	Yes	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
NA15	No	No	No	Yes	No	No	No	No	No	**Low**
NA16	Yes	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
NA17	No	No	No	Yes	No	No	Yes	No	No	**Low**
NA19	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
NA20	Yes	No	No	Yes	No	No	Yes	No	No	**Low**
NA22[1]	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
SW02	Yes	No	No	No	No	No	No	No	No	**Low**
SW03	No	No	No	No	No	No	Yes	No	No	**Low**
SW04	No	No	No	Yes	No	No	Yes	No	No	**Low**
SW08	Yes	No	No	No	No	No	Yes	No	No	**Low**
SW09	No	No	No	No	No	No	Yes	No	No	**Low**
SW11	Yes	No	No	Yes	No	No	No	No	No	**Low**
SW13	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW15	No	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW17	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**

Station	Amphipod Survival			Urchin Fertilization			Bivalve Development			LOE Category
	Different from Control	< 95% LPL	< 50% Control	Different from Control	< 95% LPL	< 50% Control	Different from Control	< 95% LPL	< 50% Control	
SW18	No	No	No	Yes	No	No	Yes	No	No	**Low**
SW21	Yes	No	No	No	No	No	No	No	No	**Low**
SW22	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW23	No	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**
SW25	Yes	No	No	No	No	No	Yes	Yes	Yes	**Moderate**
SW27	Yes	No	No	Yes	No	No	Yes	Yes	Yes	**Moderate**

1. NA22 was omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

18.4. Benthic Community Ranking Criteria

The low, moderate, and high potential for benthic community degradation classifications used in the benthic community line-of-evidence were determined by comparing the benthic community structure indices at each Shipyard Sediment Site station to the thresholds developed for the Bight ’98 Benthic Response Index for Embayments (BRI-E) (Ranasinghe et al., 2003) and to the Reference Pool described in Section 17 of this Technical Report:

- Benthic Response Index for Embayments – The BRI-E was developed by SCCWRP as a screening tool to discriminate between disturbed and undisturbed benthic communities in Southern California embayments, such as San Diego Bay. In order to give BRI-E values an ecological context and facilitate their interpretation and use for evaluation of benthic community condition, a reference threshold and four thresholds of response were defined by SCCWRP (Table 18-10). The reference threshold is defined as a value toward the upper end of the range of index values of samples taken at sites that had minimal known anthropogenic influence. The other four thresholds (Response Levels 1, 2, 3 and 4) involved defining levels of deviation from the reference condition. These thresholds are based upon a determination of the index values, above which species, or groups of species, no longer occurred along the pollution gradient.

Table 18-10 Characterization, Definition and BRI-E Thresholds for Levels of Benthic Community Condition

Level	Definition for Bays	BRI-E Threshold
Reference		< 31
Response Level 1	> 5% of reference species absent	31 to 42
Response Level 2	> 25% of reference species absent	42 to 53
Response Level 3	> 50% of reference species absent	53 to 73
Response Level 4	> 80% of reference species absent	> 73

(Ranasinghe et al., 2003)

- **Reference Sediment Quality Conditions** – Four metrics were used to assess the benthic community structure: (1) Total abundance – the total number of individuals identified in each replicate sample, (2) Total taxa richness – the total number of distinct taxa identified in each replicate, (3) Shannon-Weiner Diversity Index – a measure of both the number of species and the distribution of individuals among species; higher values indicate that more species are present or that individuals are more evenly distributed among species, and (4) BRI-E – a quantitative index that measures the condition of marine and estuarine benthic communities by reducing complex biological data to single values. A key step in the benthic community line-of-evidence is to determine whether there are statistically significant differences between the benthic community structures observed at the site and the benthic community structure observed at the Reference Pool using the four metrics described above. The statistical procedure used in the Shipyard Sediment Site investigation to identify these differences consisted of the 95% lower predictive limit for total abundance, # of Taxa, and Shannon-Weiner Diversity index. A 95% upper predictive limit was used for the BRI-E. The 95% predictive limit computes a single threshold value for each benthic community metric in the Reference Pool (e.g., total abundance) from which each site station metric result is compared. Although multiple comparisons are made to the Reference Pool, the San Diego Water Board made a decision to not correct for multiple comparisons so that the Shipyard Site/Reference comparisons would be more conservative and protective. The 95% lower predictive limits for the four benthic community metrics and 95% upper predictive limit for BRI-E are shown in Table 18-11.

Table 18-11 Individual Station Characteristics, Summary Statistics, and 95% Lower Predictive Limits for Abundance, Number of Taxa, Shannon-Weiner Diversity Index and BRI-E in the Reference Pool

Station	Abundance	# Taxa	S-W Diversity	BRI-E	BRI-E Level
CP 2231					
CP 2238	419	32	2.6	60.3	III
CP 2243	691	41	2.3	55.1	III
CP 2433	421	57	2.8	22.8	Reference
CP 2441	476	66	2.9	30.0	Reference
SY 2231					
SY 2243	989	78	2.5	45.1	II
SY 2433	441	77	2.6	16.8	Reference
SY 2441	506	108	2.8	19.9	Reference
2235	551	29	2.1	42.1	II
2241	1526	44	2.3	34.7	I
2242	1117	28	1.8	36.6	I
2243	966	47	2.7	36.4	I
2256	237	28	2.7	37.9	I

Station	Abundance	# Taxa	S-W Diversity	BRI-E	BRI-E Level
2257	503	37	2.3	38.1	I
2258	826	36	2.3	43.2	II
2260	2263	49	1.8	39.1	I
2265	1543	48	2.4	26.7	Reference
N	16	16	16	16	
Minimum	237	28	1.8	17	
Maximum	2263	108	2.9	60	
Mean	842	50	2.4	37	
Std dev	544	22	0.3	12	
RSD	65%	44%	14%	32%	
95% PL	239	22	1.8	57.7	

SCCWRP and U.S. Navy, 2005b

The benthic community ranking criteria was originally developed for the sediment quality site assessment work for the mouth of Chollas Creek and Paleta Creek TMDLs (SCCWRP and U.S. Navy, 2005b). SCCWRP, U.S. Navy, and the San Diego Water Board developed the criteria with input from NRTAs, non-governmental environmental groups, the Port, and the City of San Diego.

The BRI-E threshold scores evidence are weighed higher because: (1) they are a comprehensive measure of benthic community health developed specifically for bays and harbors in Southern California, (2) the indices remove much of the subjectivity associated with interpreting the benthic community structure data, and (3) the indices provide a simple means of communicating complex benthic community structure data to the public and regulatory managers. The category ranking criteria for benthic community composition is depicted in Figure 18-3. A comparison of the benthic community metrics at each Shipyard Sediment Site station to the Reference Pool 95% prediction limits is shown in Table 18-12. The benthic community line-of-evidence results for each Shipyard Sediment Site station using the Reference Pool comparison are shown in Table 18-13 and the supporting calculations are provided in the Appendix for Section 18.

Figure 18-3 Benthic Community Lines of Evidence Characteristics

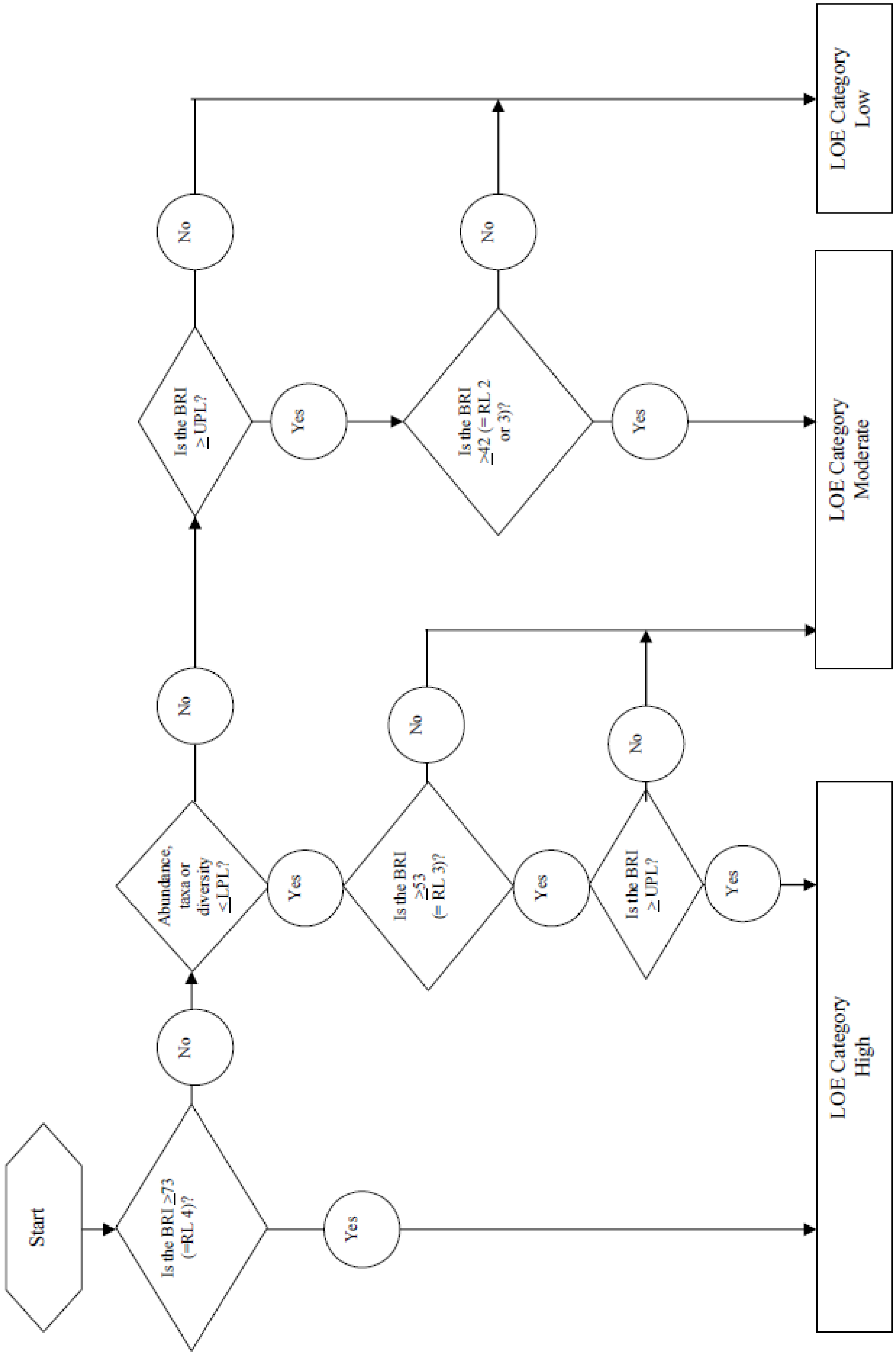

Table 18-12 Comparison of the Benthic Community Metrics Data from the Shipyard Sediment Site Stations to the Reference Pool 95% Predictive Limits

Site	Station	BRI (95% UPL = 57.7)	Abundance[1] (95% LPL = 239)	# Taxa[1] (95% LPL = 22)	S-W Diversity[1] (95% LPL = 1.8)
NASSCO	NA01	42.2	447	33	2.8
	NA03	45.5	492	40	3.0
	NA04	49.6	285	25	2.5
	NA05	44.4	569	35	2.4
	NA06	54.4	611	37	2.7
	NA07	44.6	475	43	3.0
	NA09	51.1	862	44	2.6
	NA11	46.0	604	33	2.4
	NA12	42.6	538	37	2.7
	NA15	51.0	306	26	2.3
	NA16	48.0	522	33	2.6
	NA17	55.3	418	33	2.7
	NA19	46.7	828	43	2.7
	NA20	54.0	412	**22**	2.3
	NA22[2]	51.6	**107**	**15**	2.2
BAE Systems	SW02	52.1	976	39	2.4
	SW03	49.9	361	31	2.8
	SW04	41.1	3,175	36	**1.6**
	SW08	41.5	2,457	41	2.4
	SW09	53.2	572	39	2.7
	SW11	42.4	777	44	2.9
	SW13	43.6	742	53	3.2
	SW15	37.8	806	59	3.1
	SW17	45.7	621	30	2.4
	SW18	39.5	829	42	2.8
	SW21	53.2	315	24	2.4
	SW22	55.1	363	26	2.4
	SW23	50.0	316	27	2.6
	SW25	41.3	611	40	2.8
	SW27	42.9	927	48	2.9

1. For the BRI-E, index scores greater than the 95% upper prediction limit are bold faced and shaded. For the abundance, # taxa, and S-W diversity metrics, metric scores less than or equal to their respective 95% lower prediction limits are bold faced and shaded.
2. NA22 was omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

Table 18-13 Benthic Community Line-of-Evidence Results

Station	Benthic Response Index				Abundance	# Taxa	S-W Diversity	LOE Category
	≥ 73	≥ 53	≥ 42	≥ 95% UPL	≤ 95% LPL	≤ 95% LPL	≤ 95% LPL	
NA01	No	No	Yes	No	No	No	No	**Low**
NA03	No	No	Yes	No	No	No	No	**Low**
NA04	No	No	Yes	No	No	No	No	**Low**
NA05	No	No	Yes	No	No	No	No	**Low**
NA06	No	Yes	Yes	No	No	No	No	**Low**
NA07	No	No	Yes	No	No	No	No	**Low**
NA09	No	No	Yes	No	No	No	No	**Low**
NA11	No	No	Yes	No	No	No	No	**Low**
NA12	No	No	Yes	No	No	No	No	**Low**
NA15	No	Yes	Yes	No	No	No	No	**Low**
NA16	No	No	Yes	No	No	No	No	**Low**
NA17	No	No	Yes	No	No	No	No	**Low**
NA19	No	No	No	No	No	No	No	**Low**
NA20	No	No	Yes	No	No	Yes	No	**Moderate**
NA22[1]	No	No	Yes	No	Yes	Yes	No	**Moderate**
SW02	No	No	Yes	No	No	No	No	**Low**
SW03	No	No	No	No	No	No	No	**Low**
SW04	No	Yes	Yes	No	No	No	Yes	**Moderate**
SW08	No	No	Yes	No	No	No	No	**Low**
SW09	No	No	Yes	No	No	No	No	**Low**
SW11	No	No	No	No	No	No	No	**Low**
SW13	No	No	Yes	No	No	No	No	**Low**
SW15	No	No	No	No	No	No	No	**Low**
SW17	No	No	No	No	No	No	No	**Low**
SW18	No	No	No	No	No	No	No	**Low**
SW21	No	No	Yes	No	No	No	No	**Low**
SW22	No	No	Yes	No	No	No	No	**Low**
SW23	No	No	Yes	No	No	No	No	**Low**
SW25	No	No	Yes	No	No	No	No	**Low**
SW27	No	No	Yes	No	No	No	No	**Low**

1. NA22 was omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

The low, moderate, and high ranking benthic community health classification criteria are based on the following two key assumptions (SCCWRP and U.S. Navy, 2005b):

- The assumption is made that no, or a low degree of benthic community degradation is present when the station BRI is Response Level 1 (< RL 2) or is statistically similar to the Reference Condition; and

- A high degree of benthic community degradation at a station is assumed to be present at BRI Response Levels (RLs) greater than 3 or when other indicators also show benthic community structure impacts.

The benthic community structure line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 18-3 of this report. The same ranking criteria from the SCCWRP and U.S. Navy (2005b) report are used to evaluate the benthic community indices from the Shipyard Sediment Site investigation.

Low Degree of Benthic Community Degradation: Benthic community degradation at each station is classified as none or a low if the BRI RL is less than 2 and when abundance, number of taxa, and the Shannon-Weiner Diversity Index are all statistically similar to the Reference Condition.

Moderate Degree of Benthic Community Degradation: The benthic community is classified as moderately degraded at stations exhibiting a BRI RL 2 or 3 and is statistically greater degradation than the Reference Condition, or, if any one of the other benthic community metrics is below the 95% PL established by the Reference Condition.

High Degree of Benthic Community Degradation: The benthic community is classified as highly degraded at stations with a BRI greater than RL 3. The benthic community is also classified as highly degraded at stations with BRI RL 2, the results are statistically greater than Reference Condition, and at least one of the other benthic community metrics is below the 95 percent PL established by the Reference Condition.

To determine the likelihood of benthic community impairment (Likely, Possible, or Unlikely), each line of evidence ranking (Low, Moderate, or High) is put into the Weight-of-Evidence Analysis framework described in Section 18 below.

18.5. Weight-of-Evidence Criteria

The ~~classification results for the~~ three line~~s~~ of evidence (LOE) assessments for sediment chemistry, toxicity, and benthic community described in DTR Sections 18.2, 18.3 and 18.4, respectively, ~~comprising the Triad of data are~~ were integrated into an overall weight-of-evidence (WOE) ~~evaluation~~ assessment ~~that focuses on identifying~~ to identify the likelihood that ~~the health of~~ the benthic community is adversely impacted at a given Shipyard Sediment Site station due to the presence of CoPCs in the sediment. This ~~evaluation~~ WOE assessment follows the general principles of the "Sediment Quality Triad Approach" described in a U.S. EPA compendium of "scientifically valid and accepted methods" used to assess sediment quality (U.S. EPA, 1992a). Potential combinations of the rankings for individual LOE were assessed and assigned a relative overall likelihood of benthic community impairment using three categories "Unlikely", "Possible" and "Likely" similar to the WOE approach described in "Sediment Assessment Study for the Mouth of Chollas and Paleta Creek, Phase 1 Final Report, May 2005" (SCCWRP and U.S. Navy, 2005b).

~~Three categories are used to describe the overall likelihood of impairment at each Shipyard Sediment Site station: "Unlikely," "Possible," and "Likely." These categories are assigned to each Shipyard Sediment Site station based on the potential combinations of the low, moderate, and high classifications of impairment for each previously described line-of-evidence in this section. For example, a station with a "High" classification for sediment chemistry, toxicity, and benthic community would indicate that it is "Likely" that the benthic community is adversely impacted. The framework used to interpret the various combinations is shown in Table 18-14 below, and is based on the consideration of four key elements as described in "*Sediment Assessment Study for the Mouth of Chollas and Paleta Creek, Phase 1 Final Report, May 2005*" (SCCWRP and U.S. Navy, 2005b).~~

The WOE framework used to interpret the various combinations is shown in Table 18-14, and is based on the consideration of four key elements:

- Level of confidence or weight given to the individual line of evidence
- Whether the line of evidence indicates there is an effect
- Magnitude or consistency of the effect
- Concurrence among the various lines of evidence.

The three categories of impairment are described below:

Unlikely - A station was classified as "Unlikely" if the individual LOE provided no evidence of biological effects due to elevated CoPCs (relative to the reference condition) at the site. This category was assigned to all stations with a "Low" chemistry LOE ranking, regardless of the presence of biological effects, because there was no evidence that effects were related to site-specific contamination. Similarly, stations having a "Moderate" ranking for chemistry and a "Low" ranking for biological effects were also classified as "Unlikely." The category of "Unlikely" does not mean that there was no impairment, but that the impairment was not clearly linked to site related chemical exposure.

Possible - A station was classified as "Possible" when there was a lack of concurrence among the LOE, which indicates less confidence in the interpretation of the results. This category was assigned to stations with moderate chemistry and a lack of concurrence among the biological effects LOE (i.e., effects present in only one of two LOE). Intermediate chemistry rankings have less certainty for predicting biological effects. The lack of concurrence between the toxicity and benthic community measures indicates a lower degree of confidence that the biological effects observed were due to CoPCs at the site; and that these effects could have been caused by other factors (e.g., physical disturbance or natural variations in sediment characteristics). The category of "Possible" represents situations where impairment was indicated, but there was less confidence in the reliability of the results. Of the three categories listed, stations in this group would be more likely to change their category as a result of natural variability, changes in the composition of the reference stations used for comparison, or to differences in the criteria used to classify each LOE.

Likely - A station was classified as "Likely" if there was a high level of agreement between observed biological effects and elevated CoPCs at the site. Concurrence among the three LOE (i.e., the presence of moderate or high rankings for chemistry, toxicity, and benthic community) always resulted in a classification of likely impairment. This classification was also assigned when the chemistry LOE was "High" and biological effects were present in either the toxicity or benthic community LOE.

For example, a station with a "High" ranking for chemistry, toxicity and benthic community would indicate a "High" likelihood of site-specific aquatic life impairment because each LOE indicates an effect, the magnitude of the effect is consistently high, and there is clear concurrence among the LOE. Alternatively, a station with a "Low" ranking for chemistry, and moderate or high rankings for toxicity and benthic community would indicate unlikely site-specific aquatic life impairment from site CoPCs, because there is no concurrence with site CoPCs. This does not mean that there is no impairment, but that the impairment is not clearly linked to site related chemical exposure.

The WOE framework in Table 18 -14 was used to interpret the MLOE results and is consistent with other published WOE frameworks. The results of the WOE ~~weight of of evidence results~~ assessment for each Shipyard Sediment Site station are presented in Table 18-1 ~~above~~.

Table 18-14 Weight-of-Evidence Analysis Framework for the Aquatic Life Impairment Assessment

Sediment Chemistry[1]	Toxicity[2]	Benthic Community[3]	Relative Likelihood of Benthic Community Impairment[4]
High	High	High	Likely
High	High	Moderate	
High	Moderate	High	
Moderate	High	High	
High	High	Low	
High	Low	High	
High	Moderate	Moderate	
Moderate	High	Moderate	
Moderate	Moderate	High	
Moderate	Moderate	Moderate	
High	Moderate	Low	
High	Low	Moderate	
Moderate	High	Low	
Moderate	Low	High	
Moderate	Moderate	Low	Possible
Moderate	Low	Moderate	
High	Low	Low	
Low	High	High	Unlikely
Low	High	Moderate	
Low	Moderate	High	
Low	Moderate	Moderate	
Low	Low	High	
Low	High	Low	
Low	Low	Moderate	
Low	Moderate	Low	
Moderate	Low	Low	
Low	Low	Low	

1. Relative likelihood that the contaminants present in the sediment is adversely impacting organisms living in or on the sediment (i.e., benthic community).
2. Relative likelihood of toxic effects based on the combined toxic response from three tests: amphipod survival, sea urchin fertilization, and bivalve development.
3. Relative likelihood of benthic community degradation based on four metrics: total abundance, total number of species, Shannon-Wiener Diversity Index, and the Benthic Response Index.
4. Relative likelihood that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.

Item No. 6 - Supporting Document 10a
Volume 5

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN THE MATTER OF:	)	
TENTATIVE CLEANUP AND ABATEMENT	)	Order No. R9-2011-001

VIDEOTAPED

DEPOSITION OF TOM ALO

VOLUME II PAGES 211 THROUGH 410

FEBRUARY 17, 2011

SAN DIEGO, CALIFORNIA

REPORTED BY: JULIE A. MCKAY, CSR NO. 9059 the process to evaluate each leg of the triad, there is a -- the first step is comparing to sort of a threshold. And the threshold that we used for the sediment quality guidelines for the sediment chemistry leg were ERM for metals, consensus midrange effects concentrations for PAHs and PCBs and the sediment quality guideline quotient for the chemical mixtures. 09:14 09:14

Q. At the end of the first paragraph, the bold beginning sediment quality guidelines, do you see the final sentence of that paragraph beginning "SQGs are helpful"? 09:15

A. I'm sorry. I see it. Okay.

Q. So SQGs are helpful in determining whether marine sediment contaminants warrant further assessment or at a level that requires no further evaluation. 09:15

Do you agree with that statement?

A. Yes.

Q. So in order to screen sediment chemistry and try to determine whether some type of further analysis was warranted at those stations, you looked at the SQGs and compared NASSCO station data to those numbers. 09:15

Correct?

A. Correct.

Q. So the presence of a chemical concern by itself may indicate impairment of aquatic life but does not 09:16

necessarily mean that there is impairment. Correct? 09:16
A. Correct.
Q. A professor explained this to me once as the copper wire test. So, if you have a fish tank and you put a copper wire in, the fish may swim around it like 09:16 any other structure in the fish tank. But if you put a different type of copper in, like copper sulfate, all the fish may die. So he explained to me the form of the substance is very important in determining the aquatic life impairment. Is that correct? 09:16
A. Correct.
Q. So the purpose of this sediment chemistry analysis is to determine whether there's that potential effect, it's more like the copper sulfate or it's more like the copper wire? 09:16
A. Right.
Q. So, if I understand the triad process correctly, once we have triggered our further analysis, we then move on to the other two legs of the triad. We look at the toxicity and the benthic community analysis 09:17 to determine whether those chemicals of concern are actually causing aquatic impairment. Correct?
A. Correct. But you don't necessarily have to start with sediment chemistry, stepwise. You can start with toxicity. It doesn't matter because at the end you 09:17

combine the three legs of the triad. 09:17

Q. For the triad approach, do you agree that the
biologically based lines of evidence are the most
important since they measure the actual direct impacts
on what we're trying to protect? 09:17

MR. CARRIGAN: Vague.

MR. RICHARDSON: I'll rephrase it.

MR. CARRIGAN: Okay.

BY MR. RICHARDSON:

Q. Do you agree, Mr. Alo, that the biologically 09:18
based lines of evidence are the most important in the
triad analysis since they are the direct measures of
what is being protected?

A. Yes, I agree that the biological information is
one of the most important. But, again, the triad 09:18
analysis considers all three legs combined to make a
decision and not just, you know, focusing in on
toxicity, focusing in on the benthic community results.

MR. RICHARDSON: Okay. Court Reporter, ask you
to mark this as Exhibit 1121. 09:18

(Exhibit 1121 marked for identification.)

BY MR. RICHARDSON:

Q. Mr. Alo, I'm handing you an article from the
Journal of Human and Ecological Risk Assessment, dated
2002, titled "Weight of Evidence Framework for Assessing 09:19

Sediment or Other Contamination." 09:19

Do you see that?

A. Yes, I do.

Q. Mr. Alo, I refer you to Page 1685 of the document, the very last paragraph. 09:19

Can you read that paragraph and let me know when you are ready to discuss it.

A. You said the last paragraph?

Q. The last paragraph on Page 1685.

A. Okay. 09:19

Q. Mr. Alo, are you familiar with the authors of this article from Wright State University, Miami University, Virginia Tech, and others?

A. I'm familiar with Peter Chapman from EVS Environmental Consultants if it's the same Peter Chapman 09:20 that I know.

Q. Okay. And do you recognize Peter Chapman as -- strike that.

Do you know who developed the multiple lines of evidence approach for aquatic life impairment? 09:20

A. No, I don't.

Q. Mr. Alo, in reading this last paragraph, "The biologically based line of evidence are the most important since they are direct measures of what is being protected," as the authors of this study and in 09:21

your own expertise as a sediment toxicologist, would you agree with the authors in that statement?

A. Yes, I would agree with them.

Q. Mr. Alo, looking at Page 18-3 of the DTR, for the sediment chemistry analysis you compared sediment chemical concentrations for each station at the NASSCO site to the reference conditions. Correct?

A. Correct.

Q. And then determined the relative potential for adverse effects as being low, moderate, or high.

Is that correct?

A. That's correct.

Q. Why are there only three possible results for this category?

A. In the -- as stated in DTR is that we worked with multiple stakeholders on this; namely, SCCWRP, the Navy, Spawar. We also worked with the natural resource trustee agencies. That would be NOAA, Fish and Wildlife, Fish and Game. And it was a decision based on the entire group that it was reasonable to use the three classifications of low, moderate, and high.

Q. Okay. Mr. Alo, let's go to that development of these lines of evidence. On Page 18-11 of the DTR, the very last sentence refers to how these criteria were developed. And I believe you mentioned that they were and it would still be deemed to have low impairment? 09:25

MR. CARRIGAN: Misstates the document.

BY MR. RICHARDSON:

Q. Is that correct?

MR. CARRIGAN: I'm sorry. Misstates the document. Misstates the witness's testimony. 09:25

You can answer.

THE WITNESS: Again, the flowchart will, as you -- as you move through the diamonds within the flowchart and the decisions that are made within that flowchart, you will either come up with a high, a low, or a moderate. 09:25

BY MR. RICHARDSON:

Q. Okay. Mr. Alo, I'm not trying to be a tricky question here. It's a very simple question. 09:25

If we have a sediment chemistry result at the shipyard and we compare that to reference and they're identical, would there be no impairment compared to reference or would there be low impairment compared to reference under this methodology? 09:26

A. Under this methodology, you would get a low impairment.

Q. Great. Thank you.

Mr. Alo, what's the justification for that?

A. I'd have to refer back to this flow diagram. 09:26

whenever I refer to NASSCO site, I'll refer to NASSCO 10:00
site except for the NA22 site. Do you understand?
A. Yes, I do.
Q. Was there significant variability in the data
for the bivalve development test at the shipyard site? 10:00
A. I don't recall. I'd have to look at the
replicates for toxicity test to see if there was
variability.
Q. Was there significant variability in the
bivalve test at reference? 10:01
A. Again, I would have to go back into the data to
see if there was any variance with the replicates.
Q. Would you agree that a test that has
significant variability, both at reference and at a site
being studied, would be suspect? 10:01
MR. CARRIGAN: Incomplete hypothetical. Vague.
THE WITNESS: Potentially, yes.
BY MR. RICHARDSON:
Q. Isn't the bivalve test more susceptible to
confounding factors than the other tests -- than the -- 10:01
strike that. I'm sorry. Let me start over.
Isn't the bivalve test more susceptible to
confounding factors and its association with ecological
receptors less certain than the amphipod survival test?
A. I would agree with that. 10:02

BY MR. RICHARDSON: 10:27

Q. I have added the row below the double line as protected as reference background question mark.

Do you see that?

A. I see that. 10:27

Q. Mr. Alo, what I've tried to do is analyze for all the seven direct lines of evidence for NA06 how the station compares to reference conditions.

Do you see that?

A. Yes. 10:27

Q. I have the LPLs and the UPLs for each of the relevant multiple lines of evidence for toxicity and benthic community described here.

Do you see that?

A. Yes, I do. 10:27

Q. Do you agree, Mr. Alo, that for each of these tests, based on all the seven lines of evidence, none are different than the background reference conditions? Correct?

A. Correct. 10:28

Q. Would you agree that, based on these seven direct tests, that there is no impairment to aquatic life at NA06?

A. No. I would have to take a look at the sediment chemistry leg and again go through the 10:28

flowchart to determine aquatic life impairment. 10:28
Q. I understand. What I'm asking you, though, is
a very different question. I'm asking you: Looking
exclusively as these seven lines of evidence, these
seven direct lines of toxicity and benthic community 10:28
evidence related to NA06, is there any difference
compared to reference?
A. No.
Q. Mr. Alo, would you -- this may make it easier
for us to go through these -- if you would label on the 10:29
bottom right A, B, C, D, and E.
A. Just right here?
Q. Yes, just -- oh, yeah.
I'm sorry. You're double-sided. Yeah, on the
back of the double side put "B." 10:29
A. Okay.
Q. Easier to refer to which document we're looking
at. So the next one should be labeled "B" now, and it's
the Station NA09.
Do you see that? 10:29
A. Yes, I do.
Q. Mr. Alo, would you agree that six of the seven
lines of evidence indicate that NA09 is not
significantly different than the background reference
conditions? 10:30

A. Yes.

Q. Do you agree that the only test that's different than background reference conditions is the bivalve development?

A. Yes.

Q. Mr. Alo, because six of the seven lines of direct evidence support the conclusion that there is no significant difference from reference, wouldn't you agree that there is not a significant aquatic life impairment at NA09?

MR. CARRIGAN: Vague. Incomplete hypothetical.

THE WITNESS: Not aquatic life impairment, but significant difference from reference.

BY MR. RICHARDSON:

Q. For the one test?

A. For the one test.

Q. Okay. I'm asking you overall, Mr. Alo, with seven lines of evidence, my understanding -- I guess we should back up.

My understanding is the purpose of multiple lines of evidence is to look for congruency. Right? So where you have six direct lines of evidence indicating that there's no difference than reference conditions and only one line of evidence to suggest there may be impact, would you agree that there's not a significant impact to aquatic life impairment at Station NA09? 10:31

MR. CARRIGAN: Vague.

THE WITNESS: No. I'm going to always turn back to the -- our triad approach that we use to determine aquatic life impairment. I simply can't just 10:31 go by, you know, toxicity and benthic community. I need to consider the third leg in making a decision on aquatic life impairment.

BY MR. RICHARDSON:

Q. And we'll definitely talk about the third leg. 10:31 I'm not asking you to provide an opinion now on your methodology using the chemistry line of evidence also. I'm asking solely based on this data where six lines of direct evidence show that there's not a significant difference in the reference, wouldn't you agree that 10:31 there's not a significant difference from reference?

A. Yes.

Q. The next one, NA15, which should be labeled "C" on your page. Correct?

A. Correct. 10:32

Q. This is Station NA15, and for all seven lines of direct evidence of toxicity and benthic community would you agree that there is no difference than background reference conditions?

A. Yes. 10:32

Q. Similar to NA06, based on these seven lines of evidence, would you agree that there is no impairment to aquatic life at NA15? 10:32
A. Significant difference.
Q. Is there any difference compared to reference for these seven lines of evidence? 10:32
A. No, there isn't.
Q. Okay. The next page is NA17. It should be labeled now as "D." Is that correct?
A. "D." 10:32
Q. Okay. For NA17 would you agree that all seven direct lines of evidence demonstrate there's no differences between NA17 and reference conditions with respect to toxicity and benthic community?
A. Correct. 10:33
Q. Would you also agree that, based on these seven lines of evidence, there's is no impairment to aquatic life at NA17?
A. Significant difference.
Q. Is there any, based on these seven lines of evidence, is there any at all difference? 10:33
A. No, there isn't.
Q. Next slide is NA19, should be labeled as "E." Correct?
A. Yes. 10:33

Q. Would you agree that six of the seven direct lines of evidence of toxicity and benthic community analysis for NA19 are the same as background conditions? 10:33
A. Correct.
Q. Would you agree that there's one test that was significantly different than reference conditions? 10:33
A. Yes.
Q. And that was the bivalve test?
A. Correct.
Q. So, based on these seven lines of evidence, six of which show no difference compared to reference conditions, would you agree that there is not a significant aquatic life impairment at NA19? 10:34
A. Significant difference to reference.
Q. There is no significant difference? 10:34
A. No significant difference.
Q. Okay. Thank you.
So, Mr. Alo, the significant differences that were observed for these tests -- I'm sorry -- the significant differences that were observed for two of the stations that we reviewed, the only significant differences that we saw in all five of these stations related to the bivalve development tests. Correct? 10:34
A. Correct.
MR. RICHARDSON: Mr. Alo, I've tried to 10:35

MR. CARRIGAN: Overbroad. Lacks foundation. Calls for speculation. 11:31

You can answer if you have an opinion.

THE WITNESS: I wouldn't know. I would have to go collect the samples. 11:31

BY MR. RICHARDSON:

Q. Other than the consensus of the group that you identified previously that did not involve industry, what is the basic rationale for using a minimum of a low impairment for the different lines of evidence? 11:31

A. The low impairment you said? Is -- I don't recall what the underlying rationale was. It was just the three categories that we all decided upon as a group.

Q. And you recognize that the State Water Board promulgated sediment quality objectives that do include a nontoxic category. Correct? 11:32

A. Correct.

Q. And that the State did adopt a no-effect level for the benthos. Correct? 11:32

A. Correct.

Q. But, in the methodology that's presented in the DTR, the lowest category is low?

A. That's correct.

Q. And the basis for that is solely the 11:32

development by the group that you mentioned previously? 11:32
A. That's correct.
Q. Mr. Alo, doesn't that minimum level of low impairment introduce an inherent bias into the analysis?
MR. CARRIGAN: Calls for a legal conclusion. 11:32
THE WITNESS: It could.
BY MR. RICHARDSON:
Q. It could?
A. Yeah.
Q. I want to talk about the bivalve test and, specifically, the bivalve test that was conducted in connection with the study that was reported by Exponent in 2003. Okay? 11:32
A. Okay.
Q. Are you aware of any standard protocol, an ASTM method or any other published scientific article, that describes the bivalve test that was used in that study? 11:33
A. I'm not aware of any.
Q. Are you aware of any criticisms of using this type of bivalve test for this study? 11:33
A. No, I'm not aware of any.
Q. At the time that this study plan was being developed, do you recall any criticisms of the test?
A. No, I don't recall other than, you know, the confounding factors issue. 11:33

Correct? 11:50

A. Correct.

Q. So for many of the stations that we looked at there, indeed for all of the benthic community stations, the categorization is no significant differences 11:50 compared to reference. Correct?

A. Correct.

Q. So, Mr. Alo, can you explain how we can have a possible likelihood of benthic community impairment when both the toxicity and benthic community variables under 11:51 seven different tests are not in any way different than the background reference conditions?

MR. CARRIGAN: Vague.

You can answer.

THE WITNESS: Mainly due to the sediment 11:51 chemistry leg that we see it triggered a high category, but yet I do understand the low low. And so, therefore, because of that high is that further evaluation is required.

BY MR. RICHARDSON: 11:51

Q. Okay. And would that further evaluation include looking at the toxicity and benthic community results?

A. Yeah, among other things.

Q. Okay. Are you aware of any other interpretive 11:51

framework published anywhere or any other agency documents where there is possible impairment in a circumstance where there's high chemistry but no toxicity and no benthic community impairment? 11:51

A. It's been a while, but not that I'm aware of. 11:52

Q. How would the weight-of-evidence framework change if you created a "no" category for both toxicity and benthic community assessment?

MR. CARRIGAN: Incomplete hypothetical. Vague.

THE WITNESS: Difficult to answer that question. Would change probably a lot of these results that we see here by adding a fourth category. 11:52

BY MR. RICHARDSON:

Q. I'm sorry. Could you repeat that?

A. It would be difficult to answer that question only because, if we added that fourth category, a lot of this would kind of change. 11:52

Q. Okay.

A. And, myself, I wouldn't be able to provide that opinion. I would need a group of others to help out. 11:53

Q. Okay. And those others that would help out, would it include someone from the State Board that's an expert on sediment quality?

A. Yes.

MR. CARRIGAN: Calls for speculation. 11:53

Amphipod Survival Results for All NASSCO Stations

Reference/Background
73%
(95% LPL)

Not As Protective As Reference/Background

NA11: 70%

As Protective As Reference/Background

NA07: 74%
NA06: 78%
NA01: 80%
NA04: 80%
NA12: 82%
NA03: 84%
NA09: 88%
NA19: 89%
NA05: 89%
NA16: 90%
NA20: 90%
NA17: 95%
NA15: 97%

Urchin Fertilization Results for All NASSCO Stations

Reference/Background
42%
(95% LPL)

Not As Protective As Reference/Background

As Protective As Reference/Background

NA19: 72%
NA20: 78%

NA03: 84%
NA16: 84%
NA01: 86%
NA04: 88%
NA15: 88%
NA17: 88%
NA12: 89%

NA05: 95%
NA09: 99%
NA11: 101%
NA07: 102%
NA06: 103%

Bivalve Development Results for All NASSCO Stations

Reference/Background
37%
(95% LPL)

Not As Protective As Reference/Background

- NA09: 1%
- NA19: 2%
- NA16: 3%
- NA12: 15%

As Protective As Reference/Background

- NA01: 49%
- NA06: 74%
- NA11: 80%
- NA17: 80%
- NA20: 80%
- NA04: 84%
- NA07: 88%
- NA15: 93%
- NA03: 94%
- NA05: 94%

BRI Results for All NASSCO Stations

Reference/Background
57.7
(95% UPL)

Not As Protective As Reference/Background

As Protective As Reference/Background

NA01: 42.2
NA12: 42.6
NA05: 44.4
NA07: 44.6
NA03: 45.5
NA11: 46.0
NA19: 46.7
NA16: 48.0
NA04: 49.6
NA09: 51.1
NA15: 51.0
NA20: 54.0
NA06: 54.4
NA17: 55.3

EXHIBIT
1125
PENGAD 800-631-6989
AR-135

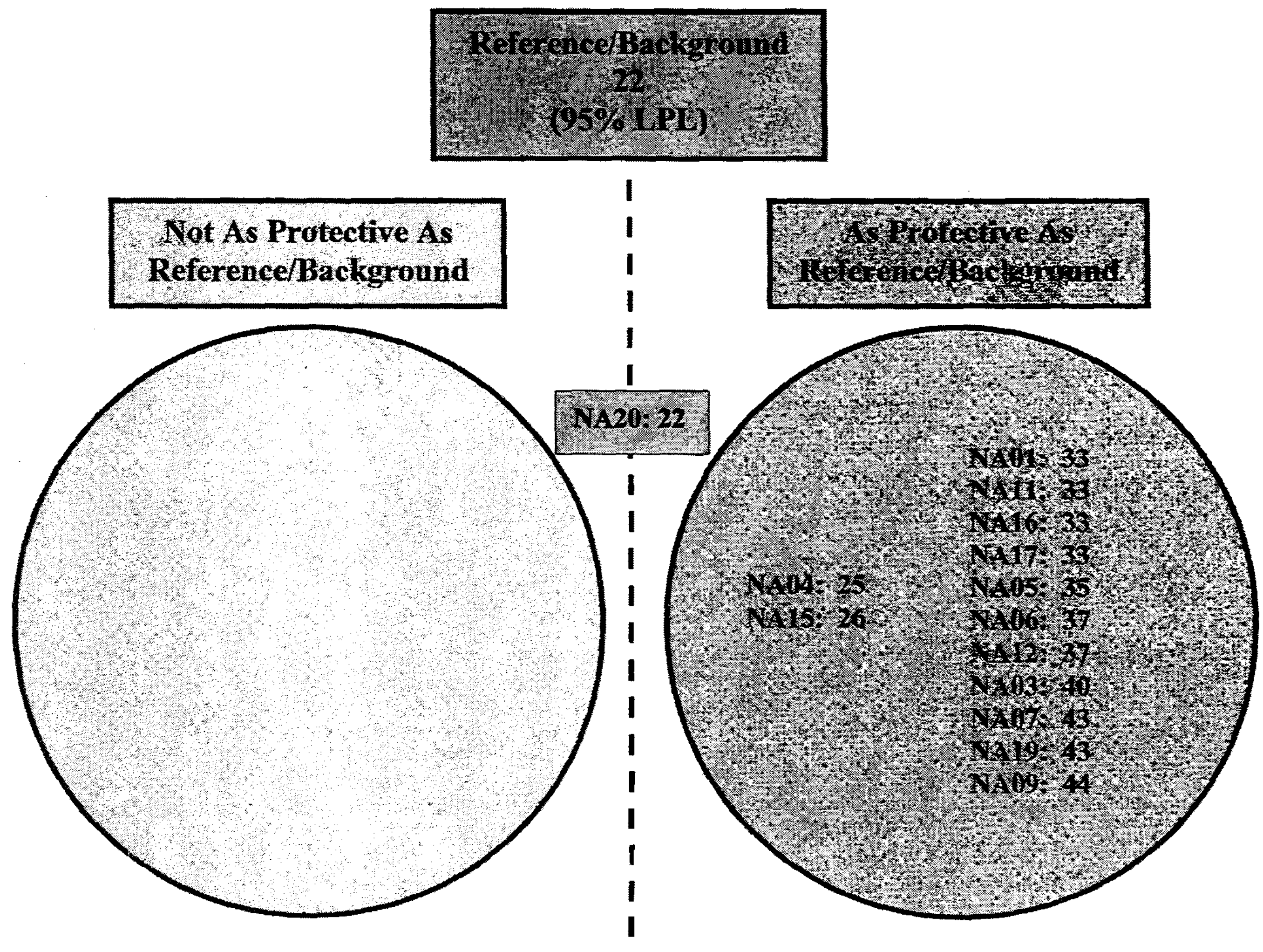
Abundance Results for All NASSCO Stations

Reference/Background
239
(95% LPL)

Not As Protective As Reference/Background	As Protective As Reference/Background	
	NA04: 285	NA16: 522
	NA15: 306	NA12: 538
	NA20: 412	NA05: 569
	NA17: 418	NA11: 604
	NA01: 447	NA06: 611
	NA07: 475	NA19: 828
	NA03: 492	NA09: 862

4

Number Taxa Results for All NASSCO Stations



B

S-W Diversity Results for All NASSCO Stations

Reference/Background
1.8
(95% LPL)

Not As Protective As Reference/Background	As Protective As Reference/Background
	NA15: 2.3 NA20: 2.3 NA05: 2.4 NA11: 2.4 NA04: 2.5 NA09: 2.6 NA16: 2.6 NA16: 2.6 NA06: 2.7 NA12: 2.7 NA17: 2.7 NA19: 2.7 NA01: 2.8 NA03: 3.0 NA07: 3.0

Exponent®

Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site

Expert Report of
Thomas C. Ginn, Ph.D.

Exponent

Evaluation of Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the NASSCO Shipyard Sediment Site

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March 11, 2011

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Before I discuss my specific criticisms of the Staff's approach and present my interpretation of the available data, it must be emphasized that a WOE approach in general represents an appropriate assessment strategy and is consistent with standards of practice and EPA policy for sediment assessments. WOE assessments have been conducted at sediment sites throughout the U.S. since the early 1980s. Although WOE approaches are common, they vary widely based on the overall decision framework, how the lines of evidence are integrated, and how the final decisions are made. As will be demonstrated in subsequent sections of this report, the WOE approach described in the DTR appears to be an unconventional assessment method developed specifically for this case, which bears little resemblance to the standards of practice for sediment quality assessments. Little or no scientific basis is provided by the Staff to justify their deviation from standard data interpretation methods, resulting ultimately in arbitrary cleanup levels with no risk basis.

A fundamental problem with the Staff's WOE approach is the framework that concludes that adverse effects on benthic macroinvertebrates are "possible" when there is no significant sediment toxicity and no adverse effects on benthic macroinvertebrates (see Table 18-14 of DTR). In these cases, the conclusion of "possible" effects is driven by the characterization of "high" for sediment chemistry. In such cases where chemical and biological indicators disagree, rather than prematurely concluding that effects on benthic macroinvertebrates are "possible," the investigator should evaluate the reason for the difference between chemical and biological indicators of effect, especially because this situation may result from low bioavailability of sediment chemicals The Staff even recognizes this situation in Section 15.1 of the DTR: "For example, sediment chemistry provides unambiguous measurements of pollutant levels in marine sediment, but provides inadequate information to predict biological impact." In Section 16 of the DTR, a citation to Long (1989) is provided which states: "Although the sediment chemistry, toxicity, and benthic community data should be complementary, the degree of impairment implied by each line of evidence may not be in complete agreement because they measure different properties of the surficial sediment." Notwithstanding these explicit acknowledgements at a theoretical level, the DTR assessment places an unwarranted emphasis on sediment chemistry data in the WOE approach.

Summary of Triad Assessment

A critical step in Triad assessments is the final integration of the three LOEs into a single assessment of sediment quality at a sampling station. In the relatively rare case where all individual LOEs indicate the same condition, MLOE interpretation is straightforward. The difficulty and primary challenge of MLOE assessments is interpreting differences in individual LOE indicators. The challenge with weight of evidence approaches then becomes how much weight to give which evidence. Longstanding EPA guidance on sediment assessment explicitly recognizes this fact: "The use of complementary assessment methods can provide a kind of independent verification of the degree of sediment contamination if the conclusions of the different approaches agree. If the conclusions differ, that difference indicates a need for caution in interpreting the data since some unusual site-specific circumstances may be at work" (U.S. EPA 1992).

The analyses presented here demonstrate that the Staff has not adequately considered what circumstances may exist at NASSCO that lead to divergent Triad LOEs. Rather, they appear to be operating under the assumption that elevated sediment chemistry is always indicative of risk, regardless of what the site-specific biological indicators show. Elevated chemistry is typically the trigger for a Triad investigation, and is therefore present at virtually all sites where Triad data are collected. Sediment chemistry is the most readily measurable attribute of contamination and possible risk, but it can be used only to infer the potential for risk, not demonstrate it. It is relevant to risk only in that Triad studies are ordinarily performed only where chemical concentrations are believed to be predictive of exposure, and measurement of the chemical concentrations can provide confirmation and explanation of any adverse effects observed in the biological legs of the Triad. Biological indicators, including toxicity tests and community data, directly measure the important attributes that chemical concentrations are assumed to be responsible for. According to regulatory guidance, when biological and chemical indicators diverge, greater weight should be placed on the biological over the chemical LOEs: "some legs of the SQT [sediment quality triad] are given more weight than others. In general, toxicity/benthos are given a higher weight than sediment ...." (U.S. EPA 1992). In this case, the Staff has inappropriately chosen to weight chemistry and some marginal toxicity results over biology.

The need for independent evaluation of Triad LOEs is explicitly recognized in the DTR, even if it is not apparent in their decision framework. "As noted by U.S. EPA (1992a), there is no single method that will measure all contaminated sediment effects at all times and to all biological organisms. For example, sediment chemistry provides unambiguous measurements of pollutant levels in marine sediment, but provides inadequate information to predict biological impact" (RWQCB 2010, section 15.1). The DTR acknowledges that the benthic macroinvertebrate data are important in confirming whether there are adverse effects *in situ*: "This benthic data provides confirmatory evidence concerning the potential impacts that contaminated sediment is having on the resident benthic community" (RWQCB 2010, section 16.1), but does not appear to use benthic macroinvertebrate data as a primary LOE in the assessment. The report goes on to conclude that effects on benthic macroinvertebrates are "likely" or "possible" when the Staff's own analyses of the NASSCO data show no adverse effects on benthic macroinvertebrates beyond the two stations near the mouth of Chollas Creek. Therefore, the benthic macroinvertebrate data were not confirmatory of the sediment chemistry data, but rather showed that benthic macroinvertebrates were not adversely affected by the elevated chemical concentrations for all but one small part of the shipyard near Chollas Creek. The benthic macroinvertebrate data were confirmatory, however, for most of the sediment toxicity data, especially the ecologically-relevant and sensitive amphipod test. Given these results, the Staff should have questioned the interpretation of the sediment chemistry data and looked for causal explanations for the Triad results. Based on the presentations in the DTR, they apparently did not conduct such an evaluation, but continued to apply their biased framework to erroneously conclude that impairment of benthic macroinvertebrate communities was "likely" at stations NA19 and NA22 (see Table 2).

Since development of the Triad approach, many authors have presented logical decision frameworks for the interpretation of Triad results. Recently Bay and Weisberg (2008) presented a framework for using BPJ to assess sediment sites in California (Figure 6). Their framework is much more detailed than the simplified decision framework used in the DTR (Table 18-14) and represents a considerable advancement over the simplified DTR approach. Although I do not agree with all of the decision endpoints specified in Bay and Weisberg (2008), their framework is much more logical for certain MLOE results. For example, the DTR characterizes a station with "high" chemistry and no significant toxicity or benthic effects as Possible, while Bay and Weisberg (2008) show that these results are inconclusive. Similarly, the DTR characterizes a station with "moderate" chemistry, "moderate" toxicity, and no benthic effects as Possibly Impacted, while Bay and Weisberg (2008) would characterize this station as Likely Unimpacted. As discussed previously, the SQOs for enclosed bays and estuaries characterize a station as likely unimpacted with "high" chemistry, "reference" benthic community conditions and "low" sediment toxicity. Therefore, the DTR decision framework consistently biases the interpretive framework in the direction of impacts by overemphasizing elevated chemistry even though toxicity or benthic effects may be minimal or comparable to reference conditions. Moreover, the DTR decision framework is clearly inconsistent with other published frameworks, including the Part 1 SQOs for California enclosed bays and estuaries.

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SAN DIEGO REGION

IN THE MATTER OF:)
)
TENTATIVE CLEANUP AND ABATEMENT)
ORDER NO. R9-2011-0001)
)
)
______________________________)

DEPOSITION OF DAVID GIBSON

San Diego, California

MARCH 11, 2011

REPORTED BY BRIDGET L. MASTROBATTISTA

REGISTERED MERIT REPORTER, CSR NO. 7715

and the amphipod survival test are common in sediment sites, correct?

A They are very commonly used, yes.

Q And those are also included within the State sediment quality objectives, correct?

A I believe that they are, yes.

Q This direct line of evidence of toxicity, should this direct line of evidence of toxicity be given more weight than chemistry?

A As a biologist, I would say yes because the reaction of the organism itself is a better indicator of the true risk than the chemistry alone; but they do have to both be considered together.

Q Okay. So sometimes we have chemistry that's not bioavailable, correct?

A That's correct. Yes.

Q Do you agree that sediment conditions, other than concentrations of pollutants, can result in toxicity responses that are different from reference values?

A Yes, I would expect that.

Q For example, sediment particle size --

A Yes.

Q -- could be a factor?

A (Witness nods head.)

Importance of Bioavailability for Risk Assessment of Sediment Contaminants at the NASSCO Site – San Diego Bay

Expert Report

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March 11, 2011

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Summary and Conclusions

The total concentration of a chemical in sediment is not necessarily predictive of adverse biological effects. High concentrations of a chemical do not always lead to a high biological effect and low concentrations of a chemical do not always lead to a low biological effect. The degree to which the chemical is available to organisms (bioavailable) must be integrated into the assessment to achieve a valid prediction of the potential effect of the chemical. The Tentative Cleanup and Abatement Order (California Regional Water Quality Control Board - San Diego Region, 2010a) is deficient in not considering the bioavailability of chemicals in the sediments.

Consider this simple example. Take two pint containers filled with water and place a fish in each. Add 100 grams of copper wire to one container and 1 gram of copper in the form of copper sulfate to the other. The fish in the container to which copper sulfate was added will quickly die, but the fish in the container with the copper wire will not, despite the much greater amount of copper present. If 6 grams of the chemical EDTA is then added to the container with the copper sulfate and another fish is introduced to the container, the new fish will not die. EDTA is a widely used complexing agent that finds application in foods and personal care products, such as shampoos, as well as in industrial applications. It chemically reacts with metals to form stable compounds that resist precipitation. After the addition of the EDTA to the solution containing the copper sulfate, the copper concentration has not changed; there has simply been a change in the chemical form of the copper. Clearly, the form of the chemical is paramount in controlling the effect.

To evaluate the biological effect it is important to consider bioavailability of both metals and organic compounds in addition to the chemical's total concentration. Bioavailability is the fraction of the total concentration that reaches the biological receptor site and is able to interact and cause beneficial or adverse effects. This report considers a number of chemicals that have been measured in sediment or pore water (the water contained within the settled particles), and their bioaccumulation in organisms exposed to sediments from the NASSCO Shipyard. Based on an analysis of the data, and in using scientific

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VIDEOTAPED DEPOSITION OF DAVID BARKER
Volume I, Pages 1 - 208
San Diego, California
March 1, 2011

Reported By: Anne M. Zarkos, RPR, CRR,
CSR No. 13095

R-149

not effect the biological receptor. Except I guess there is a caveat to that. Some biological receptors eat the sediment. So whether it's -- even though it's bound to the sediment particle. 12:03:01 12:03:10 12:03:14 12:03:17

Q. Okay. So if it's not bioavailable, the organism does not uptake that chemical? 12:03:19 12:03:27

A. Yes. 12:03:30

Q. But if it is bioavailable, then it may cause harm? 12:03:32 12:03:35

A. That's correct. 12:03:35

Q. And isn't it true that even if the -- the organism uptakes the sediment where a pollutant is adhered to it, it still does not mean the pollutant will be bioavailable to that organism; correct? 12:03:37 12:03:39 12:03:44 12:03:47

A. That's true. 12:03:50

Q. A professor once explained this to me as -- as an aquarium. So imagine an aquarium, and you have fish swimming around, and you have copper wire. And you drop the copper wire in the tank, and the fish swim around it and have a great time. 12:03:53 12:03:55 12:04:00 12:04:03 12:04:08

But if you take a different form of copper, such as copper sulfate, in the same amount and put it in a fish tank, it may have a harmful impact -- 12:04:10 12:04:12 12:04:15

A. Right. 12:04:18

Q. -- on the fish, may actually kill the fish even. 12:04:18

A. Right. 12:04:21
Q. And so by looking at bioavailability, we're 12:04:23
trying to find out whether it's the copper wire form or 12:04:25
the copper sulfate form; correct? 12:04:29
A. That's correct, yes. 12:04:31
Q. So the form of a substance is very important in 12:04:32
determining whether that chemical can cause impairment; 12:04:35
correct? 12:04:39
A. Yes. 12:04:39
Q. Can you define for me "bioaccumulation"? 12:04:41
A. It's -- I would have to refer to the definition 12:04:46
in the -- in the DTR. But it refers to the concentration 12:04:50
of a contaminant in a biological organism as a result of 12:04:56
its uptake of the contaminant. 12:05:01
Q. So would you agree it's sort of the degree to 12:05:03
which these chemicals enter the -- the aquatic food web? 12:05:05
A. Yes. 12:05:11
Q. So why do we care if a chemical is 12:05:12
bioaccumulating in an organism? 12:05:15
A. Well, the chemical could bioaccumulate to levels 12:05:19
that would be harmful to the organism or harmful to other 12:05:22
receptors that might consume the organism. 12:05:27
Q. Great. Thank you. 12:05:36
And last definition for you. 12:05:37
A. Okay. 12:05:41

IV. Monitored Natural Attenuation Justified

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 92-49

File Number:

(As Amended on April 21, 1994 and October 2, 1996)

03-0284.051

POLICIES AND PROCEDURES FOR INVESTIGATION AND CLEANUP AND ABATEMENT OF DISCHARGES UNDER WATER CODE SECTION 13304

WHEREAS:

1. California Water Code (WC) Section 13001 provides that it is the intent of the Legislature that the State Water Resources Control Board (State Water Board) and each Regional Water Quality Control Board (Regional Water Board) shall be the principal state agencies with primary responsibility for the coordination and control of water quality. The State and Regional Water Boards shall conform to and implement the policies of the Porter-Cologne Water Quality Control Act (Division 7, commencing with WC Section 13000) and shall coordinate their respective activities so as to achieve a unified and effective water quality control program in the state;

2. WC Section 13140 provides that the State Water Board shall formulate and adopt State Policy for Water Quality Control;

3. WC Section 13240 provides that Water Quality Control Plans shall conform to any State Policy for Water Quality Control;

4. WC Section 13304 requires that any person who has discharged or discharges waste into waters of the state in violation of any waste discharge requirement or other order or prohibition issued by a Regional Water Board or the State Water Board, or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance may be required to clean up the discharge and abate the effects thereof. This section authorizes Regional Water Boards to require complete cleanup of all waste discharged and restoration of affected water to background conditions (i.e., the water quality that existed before the discharge). The term waste discharge requirements includes those which implement the National Pollutant Discharge Elimination System;

5. WC Section 13307 provides that the State Water Board shall establish policies and procedures that its representatives and the representatives of the Regional Water Boards shall follow for the oversight of investigations and cleanup and abatement activities resulting from discharges of hazardous substances, including:

a. The procedures the State Water Board and the Regional Water Boards will follow in making decisions as to when a person may be required to undertake an investigation to determine if an unauthorized hazardous substance discharge has occurred;

short time;

3. Require the discharger to extend the investigation, and cleanup and abatement, to any location affected by the discharge or threatened discharge;

4. Where necessary to protect water quality, name other persons as dischargers, to the extent permitted by law;

5. Require the discharger to submit written workplans for elements and phases of the investigation, and cleanup and abatement, whenever practicable;

6. Review and concur with adequate workplans prior to initiation of investigations, to the extent practicable. The Regional Water Board may give verbal concurrence for investigations to proceed, with written follow-up. An adequate workplan should include or reference, at least, a comprehensive description of proposed investigative, cleanup, and abatement activities, a sampling and analysis plan, a quality assurance project plan, a health and safety plan, and a commitment to implement the workplan;

7. Require the discharger to submit reports on results of all phases of investigations, and cleanup and abatement actions, regardless of degree of oversight by the Regional Water Board;

8. Require the discharger to provide documentation that plans and reports are prepared by professionals qualified to prepare such reports, and that each component of investigative and cleanup and abatement actions is conducted under the direction of appropriately qualified professionals. A statement of qualifications of the responsible lead professionals shall be included in all plans and reports submitted by the discharger;

9. Prescribe cleanup levels which are consistent with appropriate levels set by the Regional Water Board for analogous discharges that involve similar wastes, site characteristics, and water quality considerations;

B. The Regional Water Board may identify investigative and cleanup and abatement activities that the discharger could undertake without Regional Water Board oversight, provided that these investigations and cleanup and abatement activities shall be consistent with the policies and procedures established herein.

III. The Regional Water Board shall implement the following procedures to ensure that dischargers shall have the opportunity to select cost-effective methods for detecting discharges or threatened discharges and methods for cleaning up or abating the effects thereof. The Regional Water Board shall:

A. Concur with any investigative and cleanup and abatement proposal which the discharger demonstrates and the Regional Water Board finds to have a substantial likelihood to achieve compliance, within a reasonable time frame, with cleanup goals and objectives that implement the applicable Water Quality Control Plans and Policies adopted by the State Water Board and Regional Water Boards, and which implement permanent cleanup and abatement solutions which do not require ongoing maintenance, wherever feasible;

B. Consider whether the burden, including costs, of reports required of the discharger during the investigation and cleanup and abatement of a discharge bears a reasonable relationship to the need for the reports and the benefits to be obtained from the reports;

C. Require the discharger to consider the effectiveness, feasibility, and relative costs of applicable alternative methods for investigation, and cleanup and abatement. Such comparison may rely on previous analysis of analogous sites, and shall include supporting rationale for the selected methods;

D. Ensure that the discharger is aware of and considers techniques which provide a cost-effective basis for initial assessment of a discharge.

1. The following techniques may be applicable:

a. Use of available current and historical photographs and site records to focus investigative activities on locations and wastes or materials handled at the site;

b. Soil gas surveys;

c. Shallow geophysical surveys;

d. Remote sensing techniques;

2. The above techniques are in addition to the standard site assessment techniques, which include:

a. Inventory and sampling and analysis of materials or wastes;

b. Sampling and analysis of surface water;

c. Sampling and analysis of sediment and aquatic biota;

d. Sampling and analysis of ground water;

e. Sampling and analysis of soil and soil pore moisture;

f. Hydrogeologic investigation;

E. Ensure that the discharger is aware of and considers the following cleanup and abatement methods or combinations thereof, to the extent that they may be applicable to the discharge or threat thereof:

1. Source removal and/or isolation;

2. In-place treatment of soil or water:

unit is equipped with features that will ensure full and complete containment of the waste for the treatment or storage period); and

c. If cleanup and abatement involves actions other than removal of the waste, such as containment of waste in soil or ground water by physical or hydrological barriers to migration (natural or engineered), or in-situ treatment (e.g., chemical or thermal fixation, or bioremediation), the Regional Water Board shall apply the applicable provisions of Chapter 15, to the extent that it is technologically and economically feasible to do so; and

3. Implement the applicable provisions of Chapter 16 for investigations and cleanup and abatement of discharges of hazardous substances from underground storage tanks;

G. Ensure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable 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; in approving any alternative cleanup levels less stringent than background, apply Section 2550.4 of Chapter 15, or, for cleanup and abatement associated with underground storage tanks, apply Section 2725 of Chapter 16, provided that the Regional Water Board considers the conditions set forth in Section 2550.4 of Chapter 15 in setting alternative cleanup levels pursuant to Section 2725 of Chapter 16; any such alternative cleanup level shall:

1. Be consistent with maximum benefit to the people of the state;

2. Not unreasonably affect present and anticipated beneficial use of such water; and

3. Not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards; and

H. Consider the designation of containment zones notwithstanding any other provision of this or other policies or regulations which require cleanup to water quality objectives. A containment zone is defined as a specific portion of a water bearing unit where the Regional Water Board finds, pursuant to Section III.H. of this policy, it is unreasonable to remediate to the level that achieves water quality objectives. The discharger is required to take all actions necessary to prevent the migration of pollutants beyond the boundaries of the containment zone in concentrations which exceed water quality objectives. The discharger must verify containment with an approved monitoring program and must provide reasonable mitigation measures to compensate for any significant adverse environmental impacts attributable to the discharge. Examples of sites which may qualify for containment zone designation include, but are not limited to, sites where either strong sorption of pollutants on soils, pollutant entrapment (e.g. dense non-aqueous phase liquids [DNAPLS]), or complex geology due to heterogeneity or fractures indicate that cleanup to applicable water quality objectives cannot reasonably be achieved. In establishing a containment zone, the following procedures, conditions, and restrictions must be met:

1. The Regional Water Board shall determine whether water quality objectives can reasonably

be achieved within a reasonable period by considering what is technologically and economically feasible and shall take into account environmental characteristics of the hydrogeologic unit under consideration and the degree of impact of any remaining pollutants pursuant to Section III.H.3. The Regional Water Board shall evaluate information provided by the discharger and any other information available to it:

a. Technological feasibility is determined by assessing available technologies, which have been shown to be effective under similar hydrogeologic conditions in reducing the concentration of the constituents of concern. Bench-scale or pilot-scale studies may be necessary to make this feasibility assessment;

b. Economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions. The evaluation of economic feasibility will include consideration of current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger. Economic feasibility, in this Policy, does not refer to the discharger's ability to finance cleanup. Availability of financial resources should be considered in the establishment of reasonable compliance schedules;

c. The Regional Water Board may make determinations of technological or economic infeasibility after a discharger either implements a cleanup program pursuant to III.G. which cannot reasonably attain cleanup objectives, or demonstrates that it is unreasonable to cleanup to water quality objectives, and may make determinations on the basis of projection, modeling, or other analysis of site-specific data without necessarily requiring that remedial measures be first constructed or installed and operated and their performance reviewed over time unless such projection, modeling, or other analysis is insufficient or inadequate to make such determinations;

2. The following conditions shall be met for all containment zone designations:

a. The discharger or a group of dischargers is responsible for submitting an application for designation of a containment zone. Where the application does not have sufficient information for the Regional Water Board to make the requisite findings, the Regional Water Board shall request the discharger(s) to develop and submit the necessary information. Information requirements are listed in the Appendix to this section;

b. Containment and storage vessels that have caused, are causing, or are likely to cause ground water degradation must be removed or repaired, or closed in accordance with applicable regulations. Floating free product must be removed to the extent practicable. If necessary, as determined by the Regional Water Board, to prevent further water degradation, other sources (e.g., soils, nonfloating free product) must be either removed, isolated, or managed. The significance and approach to be taken regarding these sources must be addressed in the management plan developed under H.2.d.;

c. Where reasonable, removal of pollutant mass from ground water within the containment zone may be required, if it will significantly reduce the concentration of pollutants within the

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

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IN RE THE MATTER OF	)
	)
TENTATIVE CLEANUP AND ABATEMENT	)
ORDER NO. R9-2011-0001	)
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VIDEOTAPED DEPOSITION OF DAVID BARKER

Volume II, Pages 209 - 430

San Diego, California

March 2, 2011

Reported By: Anne M. Zarkos, RPR, CRR,
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proven remediation strategy." 10:34:22

A. Let's see. We're on -- 10:34:26

Q. Page 30-1. 10:34:27

A. Okay. Hold on. 10:34:28

Q. The very last paragraph. 10:34:30

A. All right. 10:34:31

Q. I think I gave you a courtesy copy earlier. 10:34:32

A. Okay. Let me see if I can locate that. Hang on a second. 10:34:35 10:34:39

Q. Whatever is easier. 10:34:40

A. Okay. I'll just find it here. 30-1. And we are in the -- 10:34:41 10:34:45

Q. Very last paragraph, full -- full paragraph. 10:34:53

A. Okay. Let me just check that. 10:34:54

MR. RICHARDSON: Yeah. 10:34:56

MS. TRACY: Kelly, what page are you on? 10:34:57

MR. RICHARDSON: Page 30-1 of the DTR. 10:34:59

MS. TRACY: Thank you. 10:35:00

MR. RICHARDSON: And I'm in the last full paragraph. 10:35:03 10:35:04

THE WITNESS: Okay. I see that. 10:35:16

BY MR. RICHARDSON: 10:35:23

Q. Okay. So it says that the natural recovery among other alternatives are readily employable and proven remediation strategies. Do you agree with that? 10:35:23 10:35:26 10:35:29

A. Yes.
Q. Why does the Cleanup Team believe that natural recovery is a proven technology?
A. It's a strategy -- sometimes at contaminated sediment sites, it's -- a determination is made it's -- that it's better to control the source of the problem and just -- and not disturb the contaminants and let natural processes take care of any environmental effects associated with it. And it's -- not all sediment sites are cleaned up. Some are just documented but just left in place.
Q. So sometimes the remedy itself might cause more environmental problems than simply allowing --
A. Yes.
Q. -- the natural attenuation?
A. Yes. As we've discussed, for example, when sites are dredged, benthic communities are destroyed in the process.
Q. And there's resuspension and air emissions and traffic issues and other things; correct?
A. Yes. Yes, that's correct.
Q. In your position at the Regional Board, have you been involved in any sediment remediation projects in which natural recovery was employed?
A. Yes. Yes, I have.

10:35:33 10:35:34 10:35:36 10:35:39 10:35:44 10:35:51 10:36:02 10:36:08 10:36:13 10:36:20 10:36:26 10:36:28 10:36:30 10:36:33 10:36:33 10:36:35 10:36:38 10:36:43 10:36:43 10:36:46 10:36:48 10:36:50 10:36:51 10:36:55 10:37:04

discussed it in -- in very broad terms. They didn't get into subtle discussions about situations where source control was less than 100 percent obtained. Source control -- I mean, there's different scenarios. Source control efforts can be underway and coordinated with a decision to remediate and -- and have that -- and have that -- the result from that be that the site was not recontaminated. So yeah. 10:57:43 10:57:53 10:58:00 10:58:07 10:58:10 10:58:14 10:58:19 10:58:23

Q. An inability to control the off-site sources, though, shouldn't be a reason to favor one remedy over another, should it? 10:58:32 10:58:36 10:58:39

MR. CARRIGAN: Vague. Incomplete hypothetical. 10:58:41

THE WITNESS: The -- oh. The inability to control off-site sources. In one -- in one way of thinking, it would be the same consideration. Are these off-site sources, whatever remedy is selected, going to re-deposit contaminants at a site where they accumulate to levels that would present the need for another remedial action. So from that perspective, the analysis would be -- would be the same. 10:58:43 10:58:45 10:58:55 10:59:01 10:59:04 10:59:09 10:59:12 10:59:19

I don't know if you would view -- I guess one could view the possibility of disturbances at a site as being a -- kind of an off-site type factor that would say, you know, that would factor into a monitored natural recovery in a way that -- and it might not be as relevant 10:59:26 10:59:30 10:59:35 10:59:43 10:59:46

for another remedial method.
BY MR. RICHARDSON:
Q. Okay. I'm just -- I don't quite understand that. So --
A. Yeah.
Q. If we have off-site sources that are continuing to contaminate a site, it will continue to contaminate the site whether we do natural recovery, dredging, capping, or any other remedy; right?
A. Right. That's correct. Yeah.
Q. I'm having trouble understanding how that could influence a decision on which remedy to select.
A. Oh, you're having trouble where there are off-site sources?
Q. Why that would favor any type of dredging. For example -- I'll give you an example. If you dredge the site and there's recontamination, then you may simply have to dredge it again.
A. Yes.
Q. So that would be an ineffective remedy and you'd have remedy failure.
A. Yeah.
Q. So if you choose capping, as is the case with Convair Lagoon, where sources weren't controlled and there's additional pollution on top of the cap, there's

10:59:55 10:59:59 11:00:00 11:00:02 11:00:04 11:00:04 11:00:06 11:00:09 11:00:12 11:00:14 11:00:15 11:00:18 11:00:22 11:00:25 11:00:32 11:00:34 11:00:36 11:00:40 11:00:41 11:00:41 11:00:45 11:00:46 11:00:47 11:00:50 11:00:53

further remediation necessary.
A. Yes.
Q. In monitored natural attenuation those pollutants would continue to add to the area that we're trying to naturally attenuate; correct?
A. Yes.
Q. So to me that, factor doesn't support any of the remedies that could be implemented at a site; correct?
MR. CARRIGAN: Vague.
THE WITNESS: Other than, say, for example, from just a contaminant level viewpoint, where you dredge and remove contaminants from a site and then that mass of contaminants is out of the system, recontamination might occur at -- at a -- at some rate, where -- but the marine environment might be less stressed in that scenario because a certain mass of pollutants was removed.
And yes, source contaminants are still coming into the site, but there's a lower -- they're accumulating at lower levels, if you're kind of following what I'm trying to describe.
Q. I think so.
A. Okay.
Q. So if there's natural attenuation occurring at a rate that has the capacity to assimilate the additional pollution that comes on site, then it would not disfavor

11:00:56 11:00:58 11:00:59 11:00:59 11:01:02 11:01:05 11:01:05 11:01:07 11:01:11 11:01:14 11:01:19 11:01:25 11:01:30 11:01:39 11:01:48 11:01:54 11:01:58 11:02:01 11:02:05 11:02:09 11:02:11 11:02:12 11:02:13 11:02:15 11:02:19

natural attenuation; correct? 11:02:23

A. Yes, that's -- yes. 11:02:25

Q. Okay. DTR page 30-3 again, in that same paragraph at the -- near the end states that, "Natural recovery processes are active at the site, but the natural recovery may not be fully effective in all areas of the Shipyard Sediment Site." 11:02:28 11:02:34 11:02:37 11:02:41 11:02:44

A. Yeah. 11:02:46

Q. Do you see that? 11:02:46

A. Let's see. Hang on. 11:02:47

Q. It's in the same paragraph we've been discussing. 11:02:51 11:02:53

A. Okay. Yeah. There, I guess that's referring to site characteristics. There could be parts of the site that are in quiet areas of the site, not as subject to physical disturbances, and other areas where there's a lot of physical disturbance. 11:02:53 11:03:05 11:03:08 11:03:14 11:03:18

Q. Okay. So natural recovery would be more likely to occur in areas where there's less of the physical disturbances? 11:03:23 11:03:26 11:03:28

A. Right. 11:03:29

Q. I'll hand you a courtesy copy of the portion of the Tentative Cleanup & Abatement Order. 11:03:36 11:03:39

A. Okay. 11:03:44

Q. We're looking at Attachment 2 to the order. 11:03:44

A. Okay. 11:03:46
Q. The polygons targeted for remediation. 11:03:48
A. Yes. 11:03:51
Q. The statement that -- in the DTR that some areas 11:03:53
of the site may not have -- strike that. 11:03:58
The natural recovery may not be occurring in 11:04:07
certain areas of the site. 11:04:10
A. Yeah. 11:04:12
Q. Could you mark on the diagram where you believe 11:04:16
natural recovery is not occurring? 11:04:19
A. I don't know that I could. I could -- I would 11:04:22
be -- I could point to areas where there's a potential 11:04:31
for it to not be occurring. The area over in 11:04:33
Chollas Creek where, I think, there's testing of vessel 11:04:41
engines in that area -- 11:04:51
Q. If I can pause, Mr. Barker, are there any areas 11:04:54
where you know natural attenuation is not occurring? 11:04:58
A. No, no. I don't think we've -- we've not 11:05:01
studied it in that level of detail. So no. 11:05:05
Q. Very fair. So if I could ask you, then, the 11:05:08
areas that you believe may not be having natural 11:05:11
attenuation occur. 11:05:14
A. Okay. 11:05:16
Q. Could you mark -- as you describe them, could 11:05:16
you mark them on the diagram so I can follow along with 11:05:19

correct? 02:03:24

A. Yes, that's correct. 02:03:25

Q. And this data that we're seeing on Exhibit 1228, page E, is consistent with that finding, isn't it, where we see a 72 percent reduction in TBT over the course of seven years? 02:03:26 02:03:29 02:03:35 02:03:39

A. Yeah. Yes. It -- it indicates that trend is -- that that might be the reason for that trend there, yes. Could be other reasons, but maybe that's a primary reason. 02:03:40 02:03:46 02:03:50 02:03:53

Q. Okay. Looking at this data collectively, we sample the total of five stations in the 2009 testing; correct? 02:03:54 02:03:58 02:04:02

A. Yes. 02:04:02

Q. The post remedial SWAC numbers for at least these five areas have been met for three of the CoCs; correct? 02:04:08 02:04:12 02:04:16

MR. CARRIGAN: At the five stations? 02:04:23

MR. RICHARDSON: At the five stations, right. 02:04:25

THE WITNESS: Let's see. So -- so far we examined tributyltin and copper, mercury, PCBs. And one of those was not below the level, I think. And the other three were, yeah. 02:04:27 02:04:28 02:04:39 02:04:44

BY MR. RICHARDSON: 02:04:46

Q. Okay. So of the two that were not, copper, the 02:04:47

goal is 159. And we are at 167. 02:04:49
A. Yeah. 02:04:53
Q. Which seems marginally above the goal? 02:04:54
A. Right. 02:04:56
Q. And then the second one is mercury at .8, when the cleanup level is .7 or .68, which again seems marginally above the goal; correct? 02:04:57 02:04:59 02:05:03
A. Uh-huh. 02:05:06
Q. Was that yes? 02:05:06
A. Yes. 02:05:07
Q. And then the remaining three are all below the alternative cleanup levels; correct? 02:05:07 02:05:10
A. Yes. 02:05:13
Q. Yesterday we discussed Exhibit 1206, which was the directive of the Regional Board to conduct the assessment at the shipyard site that ultimately resulted in the 2001/2002 test data; correct? 02:05:22 02:05:31 02:05:36 02:05:39
A. Correct. 02:05:42
Q. And in that study, if you recall from our discussion yesterday, it required an evaluation of the potential natural processes that could support a no action alternative, including dispersal of contaminants by natural processes and natural detoxification of contaminated sediments, restricting access to the site, monitoring of water sediments and organisms. 02:05:43 02:05:46 02:05:50 02:05:57 02:06:02 02:06:04 02:06:08

A. 2A -- okay. 02:16:46

Q. I'll give you a minute to read it and refresh your recollection. 02:16:51 02:16:53

A. Okay. 02:16:58

Q. Okay. So this states that, "The Regional Water Board shall prescribe cleanup levels which are consistent with appropriate levels set by the Regional Water Board for analogous discharges that involve similar waste, site characteristics, and water quality considerations." Do you see that? 02:16:59 02:17:01 02:17:06 02:17:09 02:17:12 02:17:16

A. Yes. 02:17:17

Q. So in essence, would you agree that Resolution 92-49 requires the Regional Boards to treat similar sites similarly? 02:17:18 02:17:20 02:17:24

MR. CARRIGAN: Calls for a legal conclusion. 02:17:28

THE WITNESS: It suggests that that -- it should be a goal, yes. 02:17:33 02:17:35

BY MR. RICHARDSON: 02:17:37

Q. This is back to the consistency purpose of 92-49; right? 02:17:37 02:17:39

A. Right. 02:17:42

Q. Did the Cleanup Team follow Resolution 92-49 when it evaluated what cleanup levels to set for the site? 02:17:43 02:17:46 02:17:50

A. Yes, pretty much yes. The -- in evaluating 02:17:57

Q. -- for NASSCO and Southwest Marine, dated 03:00:01
February 17, 1999. Do you see that? 03:00:04
A. Yes. 03:00:07
Q. Do you recall this document? 03:00:07
A. Yes, I do. 03:00:08
Q. Did you work on the preparation of this 03:00:09
document? 03:00:10
A. Let's see. I -- I had staff under my 03:00:11
supervision that was working on it, yes. 03:00:21
Q. Would you look at page -- Bates page last three 03:00:30
numbers 257. 03:00:34
A. 257. Okay. 03:00:35
Q. The very last full paragraph. 03:00:37
A. Yes. I see that. 03:00:40
Q. The staff report notes that it was appropriate 03:00:43
to apply cleanup levels developed for Campbell site to 03:00:45
the NASSCO and Southwest Marine sites. 03:00:48
A. Yes. 03:00:50
Q. And that it's based on similarities between 03:00:51
physical, biological, and chemical conditions. 03:00:53
A. Yes. 03:00:56
Q. At Campbell and NASSCO. 03:00:56
A. Yes. 03:00:58
Q. And the fact that Campbell Shipyard is 03:01:00
physically located in San Diego Bay just north of NASSCO? 03:01:02

A. Yes. 03:01:08
Q. Do you see the bullets under that paragraph? 03:01:09
A. Yep. 03:01:14
Q. Where it notes, "Campbell and NASSCO are comparable in terms of site activities, waste materials, and matrices"? 03:01:15 03:01:17 03:01:20
A. Yes. 03:01:22
Q. That Campbell and NASSCO are similar -- sorry -- the same hydrodynamic and biogeographic zones. 03:01:23 03:01:24
A. Yes. 03:01:29
Q. And that Campbell and NASSCO are influenced by a similar suite of pollutants from off site? 03:01:29 03:01:31
A. Yes. 03:01:34
Q. On page 658. 03:01:36
MR. CARRIGAN: 258? 03:01:45
MR. RICHARDSON: Sorry. Two -- 258. Page 258. 03:01:46
MR. CARRIGAN: The very next page. 03:01:49
MR. RICHARDSON: The very next page. 03:01:50
BY MR. RICHARDSON: 03:01:53
Q. The very last sentence of the first paragraph, do you see that? It begins "it is appropriate." 03:01:54 03:02:00
A. The very last sentence of the first. 03:02:09
Q. Yeah, the first paragraph discusses Shelter Island Boatyard. 03:02:09 03:02:10
A. Yeah. I got it. 03:02:14

Q. The very last paragraph says it's appropriate to apply the Shelter Island Boatyard mercury cleanup levels, 4.2 milligrams per kilogram, to the NASSCO site. 03:02:14 03:02:14 03:02:18
A. Yes. 03:02:22
Q. And then it lists the explanations for that. 03:02:22
A. Yes. Okay. 03:02:24
Q. Do you see that? 03:02:25
A. Yes, I do. 03:02:26
Q. And the boatyards are similar to the shipyards in terms of site activities, waste materials, and matrices? 03:02:26 03:02:30 03:02:30
A. Yes. 03:02:31
Q. The boatyards and shipyards are both in San Diego Bay? 03:02:32 03:02:34
A. Uh-huh. 03:02:35
Q. And that the data from the 11 stations used to derive Shelter Island Boatyard mercury level is comparable to the 15 stations used to derive the Campbell cleanup levels? 03:02:35 03:02:39 03:02:39 03:02:44
A. Yes. 03:02:45
Q. Do you agree that the analysis in these last two pages we've been discussing was the -- your staff's attempt to comply with the provisions of 92-49 that similar sites be treated similarly? 03:02:48 03:02:51 03:02:55 03:03:00
A. Yes. And it was kind of an attempt to also 03:03:03

expedite cleanup of the site by taking advantages of a biological study, effect study done at one site and weighing the benefits of just applying those results at another site and obtaining a -- a quicker cleanup in the process.

Q. Okay. We'll come back to that.

A. Okay.

Q. Would you agree that the cleanup levels for the shipyard site are significantly lower than the levels established for Campbell and Shelter Island?

MR. CARRIGAN: Vague.

THE WITNESS: If I could just examine that --

MR. RICHARDSON: It will be Exhibit 8 to Exhibit 1210.

THE WITNESS: That big spreadsheet.

MR. RICHARDSON: Yeah.

MR. CARRIGAN: I keep thinking I have that out.

THE WITNESS: Okay.

MR. CARRIGAN: Oh, there it is.

THE WITNESS: Okay. Got it. All right. Cleanup levels at Campbell, yes, they are -- they are -- the proposed levels at the shipyard site are more stringent than the Campbell levels, yes.

BY MR. RICHARDSON:

Q. Okay. I'll introduce this as 1231.

between Campbell and the NASSCO site as to the appropriate application of the AETs revisited in the 2005 tentative CAO? 03:16:16 03:16:20 03:16:25

A. I don't recall that it was. I think it was back in 2001 when we issued the investigative order, we basically let go of that concept as a viable option. 03:16:26 03:16:32 03:16:38

Q. And that was let go also in the first release of the Cleanup Team's Draft Technical Report in 2008; correct? 03:16:42 03:16:45 03:16:49

A. Yes. 03:16:50

Q. However, in the current CAO and DTR, there is a discussion of AETs; correct? 03:16:53 03:16:56

A. Yes, there is. 03:16:59

Q. So the DTR has used the apparent effects threshold approach developed for the Campbell Shipyard Site but with site-specific NASSCO data; correct? 03:17:00 03:17:04 03:17:07

A. Yes. I just caveat my answer. Along with another sediment chemistry threshold methodology referred to as SSMEQ and along with employment of a conservative, I guess, safety factor for the advance -- or excuse me -- adverse effects threshold, yeah. Yeah. 03:17:12 03:17:17 03:17:26 03:17:32 03:17:38

Q. So the LAET you're referring to, the lowest apparent effects threshold, you mentioned conservative factors. So the DTR used the LAET model but put some level of additional conservatism in it? 03:17:42 03:17:46 03:17:49 03:17:54

A. Absolutely, yes. 03:17:58
Q. And what was that conservatism? 03:18:00
A. It applied a 60 percent of -- of the -- whatever the calculated LAET value was for a chemical that was 60 percent of that was -- it had a safety factor of 60 percent multiplied, times to further reduce it. 03:18:03 03:18:07 03:18:14 03:18:18
Q. Okay. So if my understanding is correct, at the Campbell shipyard they used an apparent effects threshold. 03:18:25 03:18:27 03:18:30
A. Yes. 03:18:30
Q. We used the lowest apparent effects threshold, which is the lowest number that -- 03:18:31 03:18:33
A. Yes. 03:18:35
Q. -- there is an apparent effect. 03:18:35
A. Yes. 03:18:36
Q. And then we took a 40 percent safety buffer below that and used that as our measure of protectiveness? 03:18:36 03:18:41 03:18:43
A. A 60 percent. 03:18:44
Q. So it's 60 percent of that number. It's 40 percent below the lowest number; correct? 03:18:45 03:18:47
A. Okay. Yes. 03:18:50
Q. And that -- both the SSMEQ and that LAET approach are reliable predictors of likely benthic impairment; correct? And I'd refer you to page 32-34 of 03:18:51 03:18:57 03:19:03

Item No. 6 - Supporting Document 10a
Volume 7

Certified Copy

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN RE THE MATTER OF	)
	)
TENTATIVE CLEANUP AND ABATEMENT	)
ORDER NO. R9-2011-0001	)
	)
	)
	)

DEPOSITION OF DAVID BARKER

Volume IV, Pages 680 - 953

San Diego, California

March 10, 2011

Reported By: Anne M. Zarkos, RPR, CRR,

CSR No. 13095

Q. Besides the Hunter's Point site, there were no other sites outside of San Diego Bay that you looked at as potentially similar sites? 04:58:01 04:58:03 04:58:07

A. We took an interest in the Hudson River PCB cleanup that's underway. But not with an angle towards adopting findings from that and incorporating them into this analysis. 04:58:09 04:58:12 04:58:23 04:58:27

Q. Mr. Barker, I'm going to hand you a excerpt from Master Exhibit 1. It's page 15 of -- of Master Exhibit 1. And it just has the tentative cleanup levels chart that shows the surface weighted average concentrations for the contaminants of concern that have been set in the tentative cleanup & abatement order for the shipyard site. 04:58:32 04:58:35 04:58:39 04:58:45 04:58:50 04:58:53 04:58:56

A. Yes. 04:58:57

Q. Do you see that? 04:58:57

A. Yes. 04:58:58

Q. And I'm just going to briefly run through a couple other EPA records of decision that address similar contaminants and ask you to compare them to that table. 04:59:01 04:59:03 04:59:07

A. Okay. 04:59:11

Q. I'd like to mark as Barker Exhibit 1284 a EPA Superfund record of decision for Commencement Bay in Pierce County, Washington dated September 30th, 1989. 04:59:15 04:59:27 04:59:34

(Exhibit 1284 was marked.) 04:59:38

MR. CARRIGAN: This is a Superfund site, 04:59:46
Counsel? 04:59:48
MR. WATERMAN: Yeah. 04:59:49
MR. CARRIGAN: Okay. Let the record reflect. 04:59:49
BY MR. WATERMAN:
Q. Mr. Barker, is that what you've got in front of 04:59:55
you? 04:59:57
A. Yes, it is. 04:59:58
Q. Can you turn to the very last page where it says 04:59:59
"Table 5." 05:00:01
A. Yes. 05:00:08
Q. And in Table 5, there are three types of 05:00:11
contaminants that are similar to those that are listed in 05:00:13
Table 2 of Master Exhibit 1. In the very first set of 05:00:18
contaminants which was metals, do you see that on the top 05:00:25
of Barker Exhibit 1284? 05:00:30
A. Yes. 05:00:36
Q. Do you see the "Copper" line item? 05:00:38
A. Yes, I do. Yes, I do. 05:00:41
Q. Says 390 PPM, or 390 milligrams per kilogram dry 05:00:43
weight? 05:00:52
A. Mine says 390L. 05:00:53
Q. Right. Do you see that there? 05:00:55
A. Yes. 05:00:57
Q. Comparing that to Table 2, what is the copper 05:00:58

concentration for -- or the copper SWAC for the shipyard site? 05:01:01 05:01:08
A. One -- 159 milligrams per kilogram. 05:01:12
Q. So roughly half that of what's in Commencement Bay? 05:01:16 05:01:19
A. Yes. 05:01:23
Q. Looking down Table 5, do you see the "High Molecular Weight PAH" line item? 05:01:24 05:01:27
A. Yes. 05:01:32
Q. And what does that read? 05:01:33
A. 17,000 milligrams per kilogram. 05:01:36
Q. And looking at Table 2 of Master Exhibit 1, what is the HPAHs' -- or SWAC there? 05:01:40 05:01:42
A. It is 2,451 micrograms per kilogram. 05:01:49
Q. Roughly seven times lower; is that right? 05:01:54
A. I think even -- I mean, the units are -- are different. If I'm reading this right, the high molecular weight in Table 5 is 17,000 milligrams per kilogram. And the HPAH level in the tentative cleanup order is 2,451 micrograms per kilogram. So it's -- which would be, I guess, 2.4 milligrams per kilogram. So the 17,000 would be many times higher. 05:02:10 05:02:13 05:02:21 05:02:26 05:02:33 05:02:39 05:02:46
Q. Mm-hmm. Looking at the "PCB" line item for total PCBs. 05:02:47 05:02:57
A. Yes. Okay. 05:03:00

Q. Can you do that comparison?
A. Yes. It looks like it's 1,000 milligrams per kilogram. I'm a little troubled by this letter "B" by it. I don't know what those letters --
Q. The footnotes are on the very back page.
A. Okay. I see.
Q. "B" stands for benthic.
A. Okay. So yeah. The total PCBs in Table 5 is 1,000 milligrams per kilogram. And in the cleanup order there are 194 micrograms per kilograms of PCBs, many times more stringent.
Q. And I'd like to introduce as Barker Exhibit 1285.
(Exhibit 1285 was marked.)
BY MR. WATERMAN:
Q. This is the EPA Superfund record of decision for the Puget Sound Naval Shipyard complex?
A. Yes.
Q. Dated June 13th, 2000?
A. Yes.
Q. We're just going to do the same type of comparison we just did. I'd like you to look at --
MR. CARRIGAN: This is another Superfund site?
MR. WATERMAN: Another Superfund site.
MR. CARRIGAN: NASSCO is not a Superfund site,

05:03:03 05:03:08 05:03:13 05:03:19 05:03:23 05:03:26 05:03:27 05:03:29 05:03:33 05:03:39 05:03:45 05:03:49 05:03:51 05:03:52 05:03:52 05:04:03 05:04:08 05:04:14 05:04:19 05:04:21 05:04:26 05:04:27 05:04:31 05:04:33 05:04:35

is it, not yet? 05:04:37

MR. WATERMAN: No. 05:04:38

MR. HANDMACHER: Might be easier for once. 05:04:41

BY MR. WATERMAN:

Q. I'd like you to look at Table 9.1 and Table 9.2, which are on the second to last and the last page of this exhibit. 05:04:48 05:04:52 05:04:56

A. Okay. 05:04:57

Q. And do you see the line item for PCBs in Table 9.1 of Barker Exhibit 1285? 05:05:02 05:05:05

A. Yes. 05:05:11

Q. Where it says the action level is 12 milligrams per kilogram of PCBs. 05:05:12 05:05:17

A. Yes. 05:05:20

Q. And would you -- if we were to do the conversion to micrograms per kilogram, would that be 1200 micrograms per kilogram? 05:05:22 05:05:24 05:05:30

A. Let's see. 12,000 micrograms per kilogram would be -- excuse me. Hang on. It's late in the day. Am I doing that right? Yes. It would be 12 times ten to the third micrograms per kilogram, or 12,000 micrograms per kilogram equals 12 milligrams per kilogram. 05:05:38 05:05:43 05:05:47 05:05:59 05:06:05

Q. Okay. I'd like you to turn to page -- Table 9-2, next page. 05:06:10 05:06:13

A. Okay. 05:06:16

Q. Do you see where it says "Total PCBs" there?
A. Yes.
Q. And one of the columns says "Cleanup Goal, 1.2 milligrams per kilogram"?
A. Yes.
Q. So if we were going to do that conversion, micrograms per kilogram, would that be 1200 micrograms per kilogram?
A. Yes.
Q. Just comparing that to the shipyard site, once again, the shipyard site, much lower concentrations for SWAC?
A. Yes, it is.
Q. Looking back to the previous page for mercury, on the very last line item, it says, "Three milligrams per kilogram for mercury."
A. Yes.
Q. In comparing that to the shipyard site?
A. Yes. The shipyard SWAC value is .68 milligrams per kilogram, which is less than that value, more stringent.
MR. WATERMAN: Thank you. That was my very last question.
THE WITNESS: Thank you very much.
MR. WATERMAN: Thank you very much.

05:06:17 05:06:19 05:06:20 05:06:24 05:06:27 05:06:27 05:06:30 05:06:34 05:06:38 05:06:42 05:06:46 05:06:50 05:06:50 05:06:51 05:06:59 05:07:02 05:07:06 05:07:07 05:07:17 05:07:22 05:07:27 05:07:27 05:07:30 05:07:31 05:07:32

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

CLEANUP AND ABATEMENT ORDER NO. 95-21

CAMPBELL INDUSTRIES
MARINE CONSTRUCTION AND DESIGN COMPANY

CAMPBELL SHIPYARDS
501 EAST HARBOR DRIVE
SAN DIEGO, CALIFORNIA

SAN DIEGO COUNTY

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

NPDES PERMIT STATUS

1. On April 22, 1985, the Regional Board adopted Order No. 85-01, NPDES Permit No. CA0107646, Waste Discharge Requirements for Campbell Industries, San Diego County. Order No. 85-01 established waste discharge requirements for a the threatened discharge of pollutants from a ship construction and repair facility to San Diego Bay, a water of the United States.

2. On October 23, 1989 the Regional Board adopted Addendum No. 1 to Order No. 85-01. The addendum modifies Monitoring and Reporting Program No. 85-01 to include sediment monitoring requirements and adds the San Diego Unified Port District as a secondary liable responsible party for purposes of compliance with Order No. 85-01, if Campbell Industries fails to comply with the Order and Addenda thereto.

3. Order No. 85-01 contains an expiration date of April 22, 1990. The Regional Board can enforce the terms and conditions of an expired permit under the authority of California Code of Regulations, Title 23, Section 2235.4. Section 2235.4 provides that the terms and conditions of expired NPDES permits are automatically continued if the discharger submits a complete application for permit renewal, prior to permit expiration. On October 19, 1989 Campbell Industries submitted a timely application for renewal of Order No. 85-01. Order No. 85-01 is enforceable pursuant to the provisions of Section 2235.4.

SITE LOCATION AND HISTORY

4. Campbell Shipyards (hereinafter Campbell) is located on the northeastern shore of San Diego Bay at 501 East Harbor Drive in the City of San Diego. The site is leased by Campbell Industries from the San Diego Unified Port District.

5. Campbell Industries, operator of Campbell Shipyards, was started by the Campbell Brothers in 1906. Campbell Industries began operation of Campbell Shipyards at its current location adjacent to San Diego Bay in 1926. Campbell Industries primary business has historically been the construction of commercial fishing vessels. Campbell Industries entered the Naval ship repair business in the early 1980's due to a decline in commercial fishing vessel orders.

6. A diesel and gasoline tank farm facility, owned and operated by General Petroleum Company, occupied the south parking lot of the Campbell site from at least 1939 to 1956. There is an abandoned diesel pipeline that runs along the southern portion of the Campbell site that may have been connected to the tank farm.

7. A San Diego Gas & Electric (SDG&E) facility is located approximately two blocks northeast of the Campbell Shipyards site. Campbell reports that this facility is a likely offsite source of petroleum-contaminated ground water. Petroleum production activities occurred at this site from 1888 through 1984, beginning with the production of oil gas from crude petroleum (in 1888), and followed by the generation of coal gas and oil gas. SDG&E switched from oil gas to natural gas in 1932.

8. Campbell Industries' predecessor, Campbell Machine Company, had facility structures that occupied the east parking lot area from the early 1900s to the 1930s. A number of other facilities owned by other entities have occupied all or parts of the east parking lot area, including an ice skating rink, a City of San Diego garbage disposal plant, other machining companies, and truck repair facilities. San Diego Unified Port District (SDUPD) owns and operates a maintenance facility adjacent to the east parking lot.

9. Campbell Industries is currently a California Corporation that is a wholly owned subsidiary of Marine Construction and Design Company Holding, Inc. of Seattle (MARCO), located at 2300 West Commodore Way, Seattle, Washington, 98199.

10. Campbell Industries proposes to redevelop the current leasehold. Under the proposed redevelopment plan, the shipyard activities at the site will cease entirely and the site will be converted to a public and commercial

recreational area. Campbell Industries has conducted a site investigation to identify polluted soils, ground water and bay sediment and determine appropriate remedial actions in order to expedite and facilitate the closure of the shipyard site.

DISCHARGERS NAMED IN THIS ORDER

11. The following parties are named as "dischargers" in this cleanup and abatement order pursuant to Water Code Section 13304:

    a) Campbell Industries in their capacity as the operators of Campbell Shipyards at the time when the unauthorized discharges occurred.

    b) MARCO Seattle in their capacity as the parent company to the operators of Campbell Shipyards.

SHIPBUILDING AND REPAIR SITE OPERATIONS

12. Shipbuilding and repair operations at Campbell Shipyards historically encompassed a large number and variety of activities and industrial processes including, but not limited to, formation and assembly of steel hulls; application of paint systems; installation and repair of a large variety of mechanical, electrical, and hydraulic systems and equipment; repair of damaged vessels; removal and replacement of expended/failed paint systems; and provision of entire utility/support systems to ships (and crew) during repair.

13. There were three major types of building/repair facilities at Campbell Shipyards, which, together with cranes, enabled ships to be assembled, launched, or repaired. These facilities were floating drydocks, marine railways, and berths/piers. With the exception of berths and piers, the basic purpose of each facility was to separate the vessel from the bay and provide access to parts of the ship normally underwater. Campbell Shipyards had three floating drydocks and three sets of marine railways of varying lengths and capacities. Campbell Shipyards also had five (5) berths. The berths and piers were overwater structures to which vessels were tied during repair or construction activities. Because drydock space was limited and expensive, many operations were conducted pierside. For example, after painting the parts of a ship normally

underwater, the ship was moved from the drydock to a berth where the remainder of the painting would be completed.

14. The primary activities at Campbell Shipyards involved a multitude of industrial processes, many of which were conducted over San Diego Bay waters or very close to the waterfront. As a result of these processes, an assortment of wastes were generated. The industrial processes at Campbell Shipyards included the following:

a) SURFACE PREPARATION AND PAINT REMOVAL Methods of surface preparation and paint removal included dry abrasive blasting, wet abrasive or slurry blasting, hydroblasting, and chemical paint stripping.

b) PAINT APPLICATION After preparation, surfaces were painted. Most painting occurred in a drydock and involved the ship hull and internal tanks. Painting was also conducted in other locations throughout the shipyard including piers and berths. Paint application was accomplished by way of air or airless spraying equipment and was a major activity at Campbell Shipyards.

c) TANK CLEANING Tank cleaning operations used steam to remove dirt and sludges from internal tanks, particularly fuel tanks and bilges. Detergents, cleaners, and hot water may be injected into the steam supply hoses. Campbell reports that wastewater generated has typically been removed and disposed of by outside subcontractors.

d) MECHANICAL REPAIR/MAINTENANCE/INSTALLATION A variety of mechanical systems and machinery required repair, maintenance, and installation.

e) STRUCTURAL REPAIR/ALTERATION/ASSEMBLY Structural repair, alteration, and assembly generally involved welding, cutting, and fastening of steel plates or assembly blocks and other industrial processes.

f) INTEGRITY/HYDROSTATIC TESTING Hydrostatic or strength testing (flushing) was conducted on hull, tanks, or pipe repairs. Integrity testing was also conducted on new systems during ship construction phases.

q) REFURBISHING/MODERNIZATION/CLEANING Refurbishing, modernization, and cleaning of ships processes were conducted at Campbell Shipyards.

r) AIR CONDITIONING/REFRIGERATION REPAIR Campbell reports that refrigeration repair was done almost exclusively on tuna vessels utilizing ammonia as a refrigerant.

MATERIALS USED

15. Materials commonly used at Campbell Shipyards are summarized below beginning with those utilized during floating drydock operations. Although a few specific materials are included, the list consists primarily of major categories.

a) ABRASIVE GRIT Typically slag was collected from coalfired boilers and consisting principally of iron, aluminum, silicon, and calcium oxides. Trace elements such as copper, zinc and titanium were also present. Sand, cast iron, or steel shot were also used as abrasives. Enormous amounts of abrasive were needed to remove paint to bare metal; removing paint from a 15,000 square foot hull can take up to 6 days and consume 87 tons of grit. Grit was needed in all dry and wet (slurry) abrasive blasting.

b) PAINT Paints contained copper, zinc, chromium, and lead as well as hydrocarbons. Two major types of paints were used on ship hulls:

(1) Anticorrosive Paints (primers)Vinyl, vinyl-lead, or epoxy based coatings were used. Others contain zinc chromate and lead oxide.

(2) Antifouling Paints were used to prevent growth and attachment of marine organisms by continuously releasing toxic substances into the water. Cuprous oxide and tributyltin fluoride or tributyltin oxide were the principal toxicants in copper-based and organotin-based paints, respectively.

c) Miscellaneous materials included the following: Oils (engine, cutting, and hydraulic); Lubricants, Grease; Fuels; Weld; Detergents, Cleaners; Rust Inhibitors; Paint Thinners; Hydrocarbon and Chlorinated

g) PAINT EQUIPMENT CLEANING All air and airless paint spraying equipment was generally cleaned following use. Paint equipment cleaning was a major producer of waste, including solvents, thinners, and paint wastes, and sludges.

h) ENGINE REPAIR/MAINTENANCE/INSTALLATION Automotive repair, ship engine repair, maintenance, and installation generated waste oils, solvents, fuels, batteries, and filters.

i) STEEL FABRICATION AND MACHINING Fabrication of engine and ship parts occurred at Campbell Shipyards. Cutting oils, fluids, and solvents were used extensively including acetone, methyl ethyl ketone (MEK) and chlorinated solvents.

j) ELECTRICAL REPAIR/MAINTENANCE/INSTALLATION The repair, maintenance, and installation of electrical systems involved the use of numerous hazardous materials including trichlorethylene, trichloroethane, methylene chloride, and acetone.

k) HYDRAULIC REPAIR/MAINTENANCE/INSTALLATION The repair, maintenance, and installation of hydraulic systems involved the replacement of spent hydraulic oils.

l) TANK EMPTYING Bilge, fuel, and ballast tanks were typically emptied prior to ship repair activities.

m) FUELING Fueling operations occurred at Campbell Shipyards.

n) SHIPFITTING Shipfitting was conducted at Campbell Shipyards, and is defined as the forming of ship plates and shapes, etc. according to plans, patterns, or molds.

o) BOILER CLEANING Campbell reports that the vessels built and repaired, were primarily diesel vessels. Campbell reports that a few cases involving small auxiliary boiler cleaning on vessels were accomplished by sub-contractors who were required to carry away any spoils.

p) CARPENTRY Woodworking was conducted at Campbell Shipyards.

Solvents; Degreasers; Acids; Caustics; Resins; Adhesives/Cement/Sealants; and Chlorine.

WASTE GENERATED

16. Categories of wastes commonly generated by Campbell Shipyards industrial processes included but were not limited to those listed below.

    a) ABRASIVE BLAST WASTE: SPENT GRIT, SPENT PAINT, MARINE ORGANISMS, RUST Abrasive blast waste, consisting of spent grit, spent paint, marine organisms, and rust was generated in significant quantities during all dry or wet abrasive blasting procedures. The constituent of greatest concern with regard to toxicity was the spent paint, particularly the copper and tributyltin antifouling components, which were designed to be toxic and designed to continuously leach into the water column. Other pollutants in paint included zinc, chromium, and lead. Abrasive blast waste can be conveyed by water flows, become airborne (especially during dry blasting), or fall directly into receiving waters.

    b) FRESH PAINT Losses occurred when paint ended up somewhere other than its intended location (e.g., drydock floor, bay, worker's clothing). These losses were results from spills, drips, and overspray. Typical overspray losses were estimated at approximately 5% for air spraying; and 1-2% for airless spraying.

    c) BILGE WASTE/OTHER OILY WASTEWATER This waste was generated during tank emptying, leakages, and cleaning operations (bilge, ballast, fuel tanks). In addition to petroleum products (fuel, oil), tank washwater also contained detergents or cleaners (nitrogen and phosphorus compounds) and was generated in large quantities. Campbell reports that for many years these wastes were disposed of off-site by sub-contractors.

    d) BLAST WASTEWATER Hydroblasting generated large quantities of wastewater. In addition to suspended and settleable solids (spent abrasive, paint, rust, marine organisms) and water, blast wastewater also contained rust inhibitors such as diammonium phosphate and sodium nitrite.

e) OILS (engine, cutting, and hydraulic) In addition to spent products, fresh oils, lubricants, and fuels were released as a result of spills and leaks from ship or drydock equipment, machinery, and tanks (especially during cleaning and refueling).

f) WASTE PAINTS/SLUDGES/SOLVENTS/THINNERS These wastes were generated from cleaning paint equipment.

g) CONSTRUCTION/REPAIR WASTES AND TRASH These wastes included scrap metal, welding rods, slag (from arc welding), wood, rags, plastics, cans, paper, bottles, packaging materials, etc.

h) MISCELLANEOUS WASTES These wastes included lubricants, Grease; Fuels; Sewage (black and grey water from vessels or docks); Boiler Blowdown, Condensate, Discard; Acid Wastes; Caustic Wastes; Aqueous Wastes (with and without metals).

WASTE AND WATER DISCHARGES TO SAN DIEGO BAY

17. Actual and potential waste discharges to San Diego Bay from Campbell are described below. The discharges listed below were either the direct result of an industrial process (drydock, marine railway, or berth operations) or, more commonly, the result of water coming into contact with wastes, typically spent abrasive blast waste. There were numerous sources of waste discharge at Campbell Shipyards including industrial processes; building or repair facilities (e.g., floating drydock); vessels under repair (e.g., cooling water); bay water (e.g., due to tidal influence or wave action); storm water; or other sources.

a) FLOATING DRYDOCK DEBALLASTING (tanks) This discharge occurred when the ballast tanks were flooded with San Diego Bay water to lower the drydock and then emptied to raise the drydock. A floating drydock was typically submerged and raised twice for each ship docked.

b) FLOATING DRYDOCK SUBMERGENCE/EMERGENCE (platform) This discharge occurred when bay water flowed over the drydock platform each time the dock was sunk. Water was discharged over the ends of the platform and through sally ports and other openings each time the dock was raised. Sinking and raising typically

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

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

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

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

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

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

In the matter of Tentative Cleanup and Abatement Order No. R9-2011-0001 (Formerly R9-2010-0002) Shipyard Sediment Cleanup	Regional Board Cleanup Team's Responses & Objections to Designated Party NASSCO's Second Set of Special Interrogatories

Propounding Party: National Steel and Shipbuilding Company ("NASSCO")

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

Set Number: Two (2)

Pursuant to the Presiding Officer's February 18, 2010 Order Issuing Final Discovery Plan for Tentative Cleanup and Abatement Order No. R9-2010-0002 and Associated Draft Technical Report, the Parties' August 9, 2010 Stipulation Regarding Discovery Extension and all applicable law, Designated Party the San Diego Water Board Cleanup Team ("Cleanup Team"), hereby responds and objects to NASSCO's Second Set of Special Interrogatories (the "Interrogatories") as follows:

GENERAL STATEMENT OF OBJECTIONS

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

1. Privilege Objection. The Cleanup Team objects to each Interrogatory to the extent it requests information protected by the attorney-client privilege, joint prosecution privilege, common interest privilege, settlement communication privilege, mediation privilege or deliberative process privilege, and to the extent it requests information subject to the work-product exemption, collectively referred to herein as the "privilege" or "privileged." The Cleanup Team contends that all information exchanged between it and its counsel is privileged. The Cleanup Team objects to identifying or producing any and all products of investigations or inquiry conducted by, or pursuant to the direction of counsel, including, but not limited to, all products of investigation or inquiry prepared by the Cleanup Team in anticipation of this proceeding, based on the attorney-client privilege and/or the work-product doctrine. The Cleanup Team further objects to identifying information subject to or protected by any other privilege, including, but not limited to, settlement communications, the joint prosecution privilege, the common interest privilege, the mediation privilege and/or the deliberative process privilege. Inadvertent production of privileged documents shall not constitute a waiver of said privileges.
2. Scope of Discovery Objection. The Cleanup Team objects to each Interrogatory to the extent it purports to impose any requirement or discovery obligation other than as set forth in Title 23 of the California Code of Regulations, sections 648 et seq., the California Government Code, sections 11400 et seq. and/or applicable stipulations, agreements and/or orders governing this proceeding.

3. Irrelevant Information Objection. The Cleanup Team objects to the Interrogatories to the extent they are overbroad and/or seek information that is not relevant to the claims or defenses asserted in this proceeding and are not reasonably calculated to lead to the discovery of admissible evidence.
4. Burdensome and Oppressive Objection. The Cleanup Team objects to each Interrogatory to the extent that it seeks the identification of documents that have already been produced, or that otherwise are equally available to NASSCO, or are already in NASSCO's possession, custody or control, which renders the Interrogatory unduly burdensome and oppressive. The Cleanup Team has already provided NASSCO with a copy of the electronic, text searchable administrative record for this matter. Therefore, the burden of identifying documents that are equally accessible to NASSCO is no greater on NASSCO than it would be on the Cleanup Team, and the Cleanup Team will not create a compilation or index of documents that NASSCO could create itself with equal or less burden.
5. Overbroad Objection. The Cleanup Team objects that certain Interrogatories are overbroad, and are framed in a manner that prevents any reasonable ability to search for and locate all responsive information. Such Interrogatories create an unreasonable risk of inadvertent noncompliance as framed.
6. Cleanup and Abatement Order Proceeding is Ongoing. The instant Cleanup and Abatement Order proceeding is ongoing, and the Cleanup Team expects that additional evidence will be provided by the Designated Parties hereto in accordance with governing statutes, regulation and applicable hearing procedures. While the Cleanup

Team's response to each of these Interrogatories is based on a reasonable investigation and search for the information requested as of this date, additional information may be made available to the Cleanup Team subsequent to the date of this response. These responses are provided without prejudice to the Cleanup Team's right to supplement these Responses, or to use in this proceeding any testimonial, documentary, or other form of evidence or facts yet to be discovered, unintentionally omitted, or within the scope of the objections set forth herein.

<u>OBJECTIONS TO DEFINITIONS</u>

1. The Cleanup Team objects to the defined term "DOCUMENTS" on the ground and to the extent that it seeks information protected by settlement confidentiality rules, the attorney-client privilege, the joint prosecution privilege, the work product doctrine, the mediation privilege, the common interest privilege, the deliberative process privilege, and/or any other privilege or confidentiality protection.
2. The Cleanup Team objects to the defined terms "YOU" and "YOUR" on the grounds that they are overbroad, and that they are vague, ambiguous and unintelligible. For purposes of this Response, the Cleanup Team shall use the term REGIONAL BOARD as if it means all persons employed by the California Regional Water Quality Control Board, San Diego Region, other than the ADVISORY TEAM.
3. The Cleanup Team objects to the defined term "COMMUNICATIONS" on the ground and to the extent that it seeks information protected by the attorney-client privilege, the joint prosecution privilege, the work product doctrine, the common interest

privilege, the mediation privilege, the deliberative process privilege, and/or any other privilege or confidentiality protection.

RESPONSES TO SPECIAL INTERROGATORIES

INTERROGATORY NO. 1:

For each response to a Request in NASSCO's Second Set of Requests for Admission:

a. State the number of the Request;

b. State all facts supporting your response;

c. IDENTIFY each PERSON who has knowledge RELATING TO the facts; and

d. IDENTIFY all DOCUMENTS that RELATE TO YOUR response.

RESPONSE TO INTERROGATORY NO. 1.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as overbroad, and unduly burdensome and harassing. The Interrogatory is improperly disguised as a single interrogatory, when, in fact, it constitutes 84 distinct interrogatories (4 x 21 Requests for Admissions). All facts supporting and Response by the Cleanup Team to NASSCO's Second Set of Requests for Admission that are denials are set forth specifically in the individual Request and these facts are equally available to NASSCO in the electronic, text searchable administrative record and/or the CAO, the Draft Technical Report and/or the appendices. The persons with knowledge relating to the facts set forth in the electronic, text searchable administrative record include the persons identified therein, David Barker, Julie Chan, David Gibson, Tom Alo, Craig Carlisle, and unknown members of the named Dischargers and their agents, consultants and employees. All documents that relate to the Cleanup Team's responses have already been provided to and are equally available to NASSCO in either the Draft Technical Report or electronic, text searchable administrative record, and the Cleanup Team will not prepare a compilation or abstract of those documents since the burden of doing so is equal or less for NASSCO than it is for the Cleanup Team.

INTERROGATORY NO. 2:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of the human health risk assessment utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 2.

Tom Alo

David Barker

Craig Carlisle

Julie Chan

INTERROGATORY NO. 3:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of the ecological risk assessment utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 3.

Tom Alo

David Barker

Craig Carlisle

Julie Chan

David Gibson

INTERROGATORY NO. 4:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of the economic feasibility analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 4.

David Barker

Julie Chan

Craig Carlisle

INTERROGATORY NO. 5:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of the technological feasibility analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 5.

David Barker

Julie Chan

Craig Carlisle

INTERROGATORY NO. 6:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any cost analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 6.

David Barker

Julie Chan

Craig Carlisle

INTERROGATORY NO. 7:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any remedy selection alternatives analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 7.

David Barker

Julie Chan

David Gibson

Craig Carlisle

INTERROGATORY NO. 8:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any aquatic life impairment analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 9.

Tom Alo

David Barker

Julie Chan

Craig Carlisle

David Gibson

INTERROGATORY NO. 9:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any aquatic-dependent wildlife impairment analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 9.

Tom Alo

David Barker

Julie Chan

Craig Carlisle

David Gibson

INTERROGATORY NO. 10:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any bioavailability analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 10.

Tom Alo

David Barker

David Gibson

Julie Chan

Craig Carlisle

INTERROGATORY NO. 11:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any alternative sediment cleanup levels analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 11.

David Barker

Julie Chan

David Gibson

Craig Carlisle

Tom Alo

INTERROGATORY NO. 12:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of any remedial monitoring analysis utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 12.

David Gibson

David Barker

Julie Chan

Tom Alo

Craig Carlisle

INTERROGATORY NO. 13:

IDENTIFY the CLEANUP TEAM staff primarily responsible for preparation of the analysis regarding the contribution of stormwater to sediment contamination in the San Diego Bay, utilized in connection with proposed cleanup levels and remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 13.

Tom Alo

David Barker

Julie Chan

Craig Carlisle

David Gibson

INTERROGATORY NO. 14:

IDENTIFY all site(s) in San Diego Bay where contaminated sediment has been remediated, the remedy selected, and the starting and ending dates of such remediation, including but not limited to the Campbell Shipyard Site, Paco Terminals, Commercial Basin and Convair Lagoon.

RESPONSE TO INTERROGATORY NO. 14.

1. Paco Terminals Inc
2. Teledyne Ryan (Convair Lagoon)
3. Bay City Marine (Americas Cup Harbor)
4. Driscoll Boatyard (Americas Cup Harbor)
5. Kettenburg Marine (Americas Cup Harbor)
6. Koehler Kraft (Americas Cup Harbor)
7. Mauricio and Sons (Americas Cup Harbor)
8. Campbell Industries Shipyard
9. BF Goodrich (Upland Tidal Marsh)

(See Exhibit A attached hereto for additional responsive information.)

INTERROGATORY NO. 15:

For any sites identified in response to the preceding Special Interrogatory, IDENTIFY the constituents of concern that were remediated and the cleanup levels that were set for those constituents.

RESPONSE TO INTERROGATORY NO. 15.

Responsive information is attached on Exhibit A.

INTERROGATORY NO. 16:

IDENTIFY all site(s) within the REGIONAL BOARD'S jurisdiction, other than San Diego Bay, where sediment contamination has been remediated in rivers, bays, estuaries, ocean, wetlands, or any other surface water body, and the starting and ending dates of such remediation.

RESPONSE TO INTERROGATORY NO. 16.

There are no sites within the Regional Board's jurisdiction, other than those identified in Response to Interrogatory No. 15, where sediment contamination has been remediated in rivers, bays, estuaries, ocean, wetlands, or any other surface water body.

INTERROGATORY NO. 17:

For any sites identified in response to the preceding Special Interrogatory, IDENTIFY the constituents of concern that were remediated and the cleanup levels that were imposed for those constituents.

RESPONSE TO INTERROGATORY NO. 17.

There are no sites within the Regional Board's jurisdiction, other than those identified in Response to Interrogatory No. 15, where sediment contamination has been remediated in rivers, bays, estuaries, ocean, wetlands, or any other surface water body.

INTERROGATORY NO. 18:

IDENTIFY all site(s) within the State of California where sediment contamination in rivers, bays, estuaries, ocean, wetlands, or any other surface water body has been remediated, and the starting and ending dates of such remediation.

RESPONSE TO INTERROGATORY NO. 18.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as burdensome and harassing to the extent it seeks information about sites outside the jurisdiction of the San Diego Water Board on the ground and to the extent that the information sought is not known by the Cleanup Team and is equally available to NASSCO. The Cleanup Team further objects to this Interrogatory on the ground that it is not reasonably calculated to lead to the discovery of admissible evidence because, on its face, it seeks information about cleanups over which the San Diego Water Board has no jurisdiction.

INTERROGATORY NO. 19:

For any sites identified in response to the preceding Special Interrogatory, IDENTIFY the constituents of concern that were remediated and the cleanup levels that were imposed for those constituents.

RESPONSE TO INTERROGATORY NO. 19.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as burdensome and harassing to the extent it seeks information about sites outside the jurisdiction of the San Diego Water Board on the ground and to the extent that the information sought is not known by the Cleanup Team and is equally available to NASSCO. The Cleanup Team further objects to this Interrogatory on the ground that it is not reasonably calculated to lead to the discovery of admissible evidence because, on its face, it seeks information about cleanups over which the San Diego Water Board has no jurisdiction

INTERROGATORY NO. 20:

IDENTIFY any alternative cleanup methodologies YOU considered in connection with the remediation of the SITE.

RESPONSE TO INTERROGATORY NO. 20.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to the Interrogatory as vague and ambiguous with respect to "alternative cleanup methodologies." Subject to and without waiving the foregoing objections, the Cleanup Team considered natural attenuation, monitored attenuation, cleanup to background, and cleanup to various multiples of background all as set forth in detail in the CAO, the supporting DTR and/or the appendices.

INTERROGATORY NO. 21:

IDENTIFY all COMMUNICATIONS between YOU and ENVIRONMENTAL GROUPS RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

RESPONSE TO INTERROGATORY NO. 21.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. Subject to and without waiving these objections, the Cleanup Team responds as follows: After reasonable investigation, the Cleanup Team was unable to identify any non-privileged communications between the Cleanup Team or San Diego Water Board staff and environmental groups relating to the tentative order that were not already produced or otherwise provided to NASSCO. Because of the ambiguous definition of "YOU," the Cleanup Team clarifies that it does not have access to ADVISORY TEAM COMMUNICATIONS that were not otherwise made to all parties.

INTERROGATORY NO. 22:

IDENTIFY all COMMUNICATIONS between YOU and any PERSON RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

RESPONSE TO INTERROGATORY NO. 22.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as overbroad, and unduly burdensome and harassing. Subject to and without waiving these objections, the Cleanup Team responds as follows: After reasonable investigation, the Cleanup Team was unable to identify any non-privileged communications between the Cleanup Team or San Diego Water Board staff and any other person relating to the tentative order that were not already produced or otherwise provided to NASSCO. Because of the ambiguous definition of "YOU," the Cleanup Team clarifies that it does not have access to ADVISORY TEAM COMMUNICATIONS that were not otherwise made to all parties.

INTERROGATORY NO. 23:

IDENTIFY all COMMUNICATIONS between YOU and any local, state or federal agency RELATING TO the TENTATIVE ORDER or TECHNICAL REPORT.

RESPONSE TO INTERROGATORY NO. 23.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as overbroad, and unduly burdensome and harassing. Subject to and without waiving these objections, the Cleanup Team responds as follows: After reasonable investigation, the Cleanup Team was unable to identify any communications between the Cleanup Team or San Diego Water Board staff and any local, state or federal agency relating to the tentative order that were not already produced or otherwise provided to NASSCO. Because of the ambiguous definition of "YOU," the Cleanup Team clarifies that it does not have access to ADVISORY TEAM COMMUNICATIONS that were not otherwise made to all parties.

INTERROGATORY NO. 24:

IDENTIFY all COMMUNICATIONS between YOU and any PERSON RELATING TO YOUR dismissal of natural attenuation as a preferred remedy for the SITE.

RESPONSE TO INTERROGATORY NO. 24.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as overbroad, and unduly burdensome and harassing. Subject to and without waiving these objections, the Cleanup Team responds as follows: After reasonable investigation, the Cleanup Team was unable to identify any non-privileged communications between the Cleanup Team or San Diego Water Board staff and any other person relating to its rejection of natural attenuation as a preferred remedy for the site. Because of the ambiguous definition of "YOU," the Cleanup Team clarifies that it does not have access to ADVISORY TEAM COMMUNICATIONS that were not otherwise made to all parties.

INTERROGATORY NO. 25:

IDENTIFY all COMMUNICATIONS between YOU and any PERSON RELATING TO the results and findings of the June 2009 sediment quality testing performed by Exponent at the SITE.

RESPONSE TO INTERROGATORY NO. 26.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. Subject to and without waiving these objections, the Cleanup Team responds as follows: After reasonable investigation, the Cleanup Team was unable to identify any non-privileged communications between the Cleanup Team or San Diego Water Board staff and any other person relating to the results and finding of the June 2009 sediment quality testing performed by Exponent at the site. Because of the ambiguous definition of "YOU," the Cleanup Team clarifies that it does not have access to ADVISORY TEAM COMMUNICATIONS that were not otherwise made to all parties.

INTERROGATORY NO. 26:

IDENTIFY all COMMUNICATIONS between YOU and any PERSON RELATING TO any alternative cleanup methodologies YOU considered for the remediation of the SITE, including but not limited to Lowest Apparent Effects Thresholds ("LAETs").

RESPONSE TO INTERROGATORY NO. 26.

The Cleanup Team incorporates each of the General Objections set forth above as if set forth in full herein. The Cleanup Team further objects to this Interrogatory as overbroad, and unduly burdensome and harassing. Subject to and without waiving these objections, the Cleanup Team responds as follows: After reasonable investigation, the Cleanup Team was unable to identify any non-privileged communications between the Cleanup Team or San Diego Water Board staff and any other person relating to the alternative cleanup methodologies the Cleanup Team considered for remediation of the site, including LAETs, that were not already produced or otherwise provided to NASSCO. Because of the ambiguous definition of "YOU," the Cleanup Team clarifies that it does not have access to ADVISORY TEAM COMMUNICATIONS that were not otherwise made to all parties.

Dated: October 4, 2010

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

By: [signature]

Christian Carrigan

NASSCO WRITTEN DISCOVERY VERIFICATION

I, David Barker, declare:

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

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

Dated: October 7, 2010

David Barker

Exhibit A to Cleanup Team's Responses to NASSCO's Special Interrogatory and BAE Systems' Special Interrogatory

Cleanup Site	Paco Terminals, Inc.	Teledyne Ryan (Convair Lagoon)	Eichenlaub Marine	Shelter Island Boatyard	Bay City Marine	Driscoll Boatyard	Kettenburg Marine	Koehler Kraft	Mauricio and Sons	Campbell Industries Shipyard		BF Goodrich (Upland Tidal Marsh)	Shipyard Sediment Site	
										Campbell Industries CAO	Campbell Industries (CAP As Constructed Design)			
Order No.	CAO No.85-91	CAO No. 86-92	CAO	CAO	CAO No.88-79	CAO No. 89-31	CAO No. 88-78	CAO No. 89-32	CAO No. 88-86	CAO No. 95-21	WDR R9-2004-0295	CAO No. 98-08	Tentative CAO No. R9-2011-0001	
Year Order Issued	1985	1986	1988	1988	1988	1989	1988	1988	1988	1995	2004	1998	2010 (Latest Draft)	
No. of Responsible Parties	2	1	1	1	2	1	2	1	1	1		1	8	
Year Cleanup Level Set by San Diego Water Board	1991	1991	12/9/1991	10/28/1991	10/28/1991	10/28/1991	10/28/1991	10/28/1991	10/28/1991	1995	2004	2004		
Cleanup Remedial Action Completion	12/16/1994	5/15/1998	12/9/1991	10/28/1991	7/30/1998	8/15/2001	8/15/2001	1/27/1995	8/15/2001	6/30/2008		10/15/2004		
Cleanup Level Threshold	Copper Ocean Plan Water Quality Objective (water column)	USFDA Shellfish Standard	No Cleanup Required	No Cleanup Required	Apparent Effects Threshold (AET)	Apparent Effects Threshold (AET)	Apparent Effects Threshold (AET)	Apparent Effects Threshold (AET)	Apparent Effects Threshold (AET)	Apparent Effects Threshold (AET)		NOAA Effects Range Low (ERLs)	Multiple lines of evidence for benthic community protection. Human health and aquatic dependent wildlife risk assessment.	
Cleanup Level Metric	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration			Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Site-wide Maximum not to be Exceeded Concentration	Post Remedial Surface-Area Weighted Average Concentrations	Post-Remedial Dredge Area Concentrations (Background Levels)
Pollutants of Concern	Copper Ore	PCBs	Copper, Mercury, TBT	Copper, Mercury, TBT	Copper, Mercury, TBT	Copper, Mercury, TBT	Copper, Mercury, TBT	Copper, Mercury, TBT	Copper, Mercury, TBT	Copper, Lead, Zinc, Mercury, TBT, TPH, HPAH and PCBs	Copper, Lead, Zinc, Mercury, TBT, TPH, HPAH and PCBs	Antimony, Arsenic, Cadmium, Copper, Mercury, Lead, Nickel, Silver, Zinc, PAHs, and PCBs	Primary CoC - Copper, Mercury, HPAH, PCBs and TBT. Secondary CoC - Arsenic, Cadmium, Lead and Zinc.	
Arsenic												8.2 mg/kg		
Cadmium												1.2 mg/kg		
Chromium														
Copper	1000 mg/kg				530 mg/kg	530 mg/kg	530 mg/kg	530 mg/kg	530 mg/kg	810 mg/kg	264 mg/kg	34 mg/kg	159 mg/kg	121 mg/kg
Lead										231 mg/kg	88 mg/kg	46.7 mg/kg		
Mercury					4.8 mg/kg	4.8 mg/kg	4.8 mg/kg	4.8 mg/kg	4.8 mg/kg			0.15 mg/kg	0.68 mg/kg	0.57 mg/kg
Nickel												20.9 mg/kg		
Silver												1 mg/kg		
Zinc										820 mg/kg	410 mg/kg	150 mg/kg		
TBT					Natural Degradation	Natural Degradation	Natural Degradation	Natural Degradation	Natural Degradation	5.75 mg/kg	0.121 mg/kg		110 ug/kg	22 ug/kg
TPH										4300 mg/kg	<14 mg/kg			
LPAH												552 ug/kg		
HPAH										44 mg/kg	3.47 mg/kg	1700 ug/kg	2451 ug/kg	663 ug/kg
Benzo[a]pyrene												430 ug/kg		
PCBs		4.6 mg/kg								0.95 mg/kg	0.11 mg/kg	22.7 ug/kg	194 ug/kg	84 ug/kg
Cleanup to Background Evaluated	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Alternative Cleanup levels greater than background approved by San Diego Water Board	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes		Yes	San Diego Water Board Approval Pending	
Benthic Community Effects Evaluated	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Aquatic Dependent Wildlife Risk Evaluated										Yes		Yes	Yes	
Human Health Risk Evaluated		Yes								Yes			Yes	
Cleanup Method	Dredging	Capping			Dredging	Dredging	Dredging	Dredging	Dredging	Capping/ Dredging		Dredging	Dredging/Sand Covering	
Sediment Dredge Disposal	Bay- side landfill, Part of dredged material recycled to copper mine in Arizona for copper ore recovery. Copper ore recovered was exported to Japan.	-			Landfill	Landfill	Landfill	Landfill	Landfill	Landfill		Landfill	To be determined.	
Dredge Volume (Cubic Yards)	20,926		0	0	17,250	700	8,799	300	1,845	41,000		795	143,400	
Capped Volume (Cubic Yards)		112,933								135,000				
Remediation Monitoring	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Post Remediation Monitoring		Yes								Yes			Yes	

Linda S. Adams
Secretary for Environmental Protection

State Water Resources Control Board

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Arnold Schwarzenegger
Governor

REVISED

DRAFT

UST Case Closure Summary
Former Rocco's Freestone Corners (Jed Wallach Trust)
12750 Bodega Highway, Sebastopol

Summary
The release from the subject site was discovered during underground storage tank (UST) removals in 1989. The residual contaminants impact only shallow soil and groundwater in the immediate vicinity of the site. The Sonoma County Local Oversight Program (County) recommended case closure and requested concurrence from North Coast Regional Water Quality Control (Regional Board) staff. Regional Board staff did not concur with the County and recommended that additional groundwater monitoring be conducted, especially during the dry season when groundwater is at its lowest elevation. Regional Board staff indicated that additional data is needed to determine trends that show that water quality objectives (WQOs) will be reached within a reasonable period for the constituents of concern and that impacts to current and future beneficial uses of water will be prevented.

Groundwater fluctuates seasonally between 2 to 10 feet below ground surface (bgs) and residual petroleum hydrocarbons appear limited to between 6 and 10 feet bgs. The mass of remaining residual petroleum hydrocarbons is adsorbed to shallow fine grain soil and dissolved petroleum constituents are degrading. There is a septic tank leach field down gradient of the former UST but it is unclear if the associated leach field dissolved contaminant plume in groundwater is commingling with and contributing to biodegradation of the dissolved petroleum hydrocarbon plume. Although monitoring wells screened in the source area have consistently had elevated concentrations of residual petroleum hydrocarbons in groundwater, after over 20 years the groundwater plume does not extend more than approximately 120 feet from the UST excavation. Analytical data from the two monitoring wells located farther than approximately 120 feet down gradient from the former USTs have had non-detect results for all sampling events conducted over the past 12 years. Trend lines for down gradient monitoring well MW-8 located approximately 90 feet from the source area show that WQOs will be reached in several decades:

The site is located in an unincorporated area of Sonoma County that is served by a public water supply although many properties have individual drinking water wells. An onsite irrigation water supply well is located down gradient approximately 230 feet from the UST excavation, an offsite water supply well is located down gradient approximately

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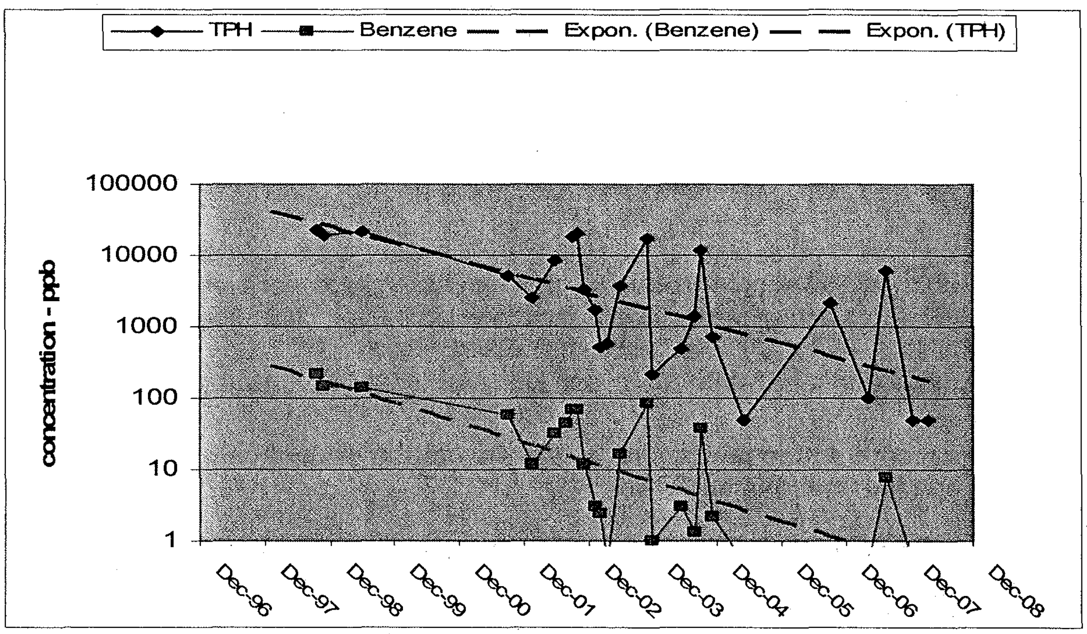
Because source area contamination impacts shallow soil and groundwater in the immediate vicinity of the site, the mass of remaining residual petroleum hydrocarbons is limited and dissolved petroleum constituents are degrading. The rate of biodegradation of the remaining mass is dissolution limited and the natural biodegradation in groundwater is effectively limiting the length of the dissolved plume to less than approximately 120 feet from the source area for the past 20 years.

Groundwater Concentrations and Trends
MW-8



WQOs	TPHg – 5 ppb	benzene – 0.15 ppb

Objections to closure and response:
The Regional Board staff did not concur with the County's recommendation for case closure because of the following concerns;

- Additional dry season groundwater monitoring data is needed to determine trends that show that WQOs will be met within a reasonable period..

Survey Station	Area (m^2)	Copper (mg/kg dry)					Mercury (mg/kg dry)					Tributyltin (µg/kg dry)					Total PCB Congeners (ng/g dry)					Total HPAH (µg/kg dry)				
		2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)	2001/2002 Data		2009 Data		RPD (%)
		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area		Conc.	Conc. X Area	Conc.	Conc. X Area	
NA23	6,269.43	350	2,194,301	258	1,617,513	-26.3%	1.10	6,896	1.13	7,084	2.7%	120	752,332	7.4	46,394	-93.8%	510	3,197,409	840	5,266,321	64.7%	3,400	21,316,062	4,800	30,093,264	41.2%
NA24	5,933.83	200	1,186,766	250	1,483,458	25.0%	0.88	5,222	1.18	7,002	34.1%	59	350,096	31.0	183,949	-47.5%	290	1,720,811	110	652,721	-62.1%	2,100	12,461,043	3,600	21,361,788	71.4%
SW06	2,392.36	170	406,701	229	547,850	34.7%	0.75	1,794	0.86	2,057	14.7%	100	239,236	120.0	287,083	20.0%	380	909,097	210	502,396	-44.7%	12,000	28,708,320	7,300	17,464,228	-39.2%
SW19	20,190.77	110	2,220,985	100	2,019,077	-9.1%	2.10	42,401	0.50	10,095	-76.2%	37	747,058	5.6	113,068	-84.9%	94	1,897,932	26	524,960	-72.3%	1,100	22,209,847	600	12,114,462	-45.5%
SW30	6,511.23	240	1,562,695	194	1,263,179	-19.2%	1.10	7,162	0.94	6,121	-14.5%	200	1,302,246	51.0	332,073	-74.5%	380	2,474,267	130	846,460	-65.8%	4,900	31,905,027	2,100	13,673,583	-57.1%
Totals	41,297.6		7,571,447.6		6,931,076.5			63,475.4		32,359.7			3,390,968.1		962,566.8			10,199,516.6		7,792,858.0			116,600,299.0		94,707,325.0	
	SWAC	183.3		167.8		-8.5%	1.5		0.8		-49.0%	82.1		23.3		-71.6%	247.0		188.7		-23.6%	2823.4		2293.3		-18.8%

Polygon	Copper (mg/kg dry)		
	2001/2002	2009	
NA23	350	258	
NA24	200	250	
SW06	170	229	
SW19	110	100	
SW30	240	194	
			% Change
SWAC	**183.3**	**167.8**	**-8.5%**

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A

Polygon	Mercury (mg/kg dry)		
	2001/2002	2009	
NA23	1.10	1.13	
NA24	0.88	1.18	
SW06	0.75	0.86	
SW19	2.10	0.50	
SW30	1.10	0.94	
			% Change
SWAC	**1.5**	**0.8**	**-49.0%**

B

Polygon	Total HPAH (µg/kg dry)		
	2001/2002	2009	
NA23	3,400	4,800	
NA24	2,100	3,600	
SW06	12,000	7,300	
SW19	1,100	600	
SW30	4,900	2,100	
			% Change
SWAC	**2,823.4**	**2,293.3**	**-18.8%**

C

Polygon	Total PCBs (ng/g dry)		
	2001/2002	2009	
NA23	510	840	
NA24	290	110	
SW06	380	210	
SW19	94	26	
SW30	380	130	
			% Change
SWAC	**247.0**	**188.7**	**-23.6%**

D

Polygon	Tributyltin (µg/kg dry)		
	2001/2002	2009	
NA23	120	7.4	
NA24	59	31.0	
SW06	100	120.0	
SW19	37	5.6	
SW30	200	51.0	
			% Change
SWAC	**82.1**	**23.3**	**-71.6%**

E

TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

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

NATIONAL STEEL AND SHIPBUILDING COMPANY

BAE SYSTEMS SAN DIEGO SHIP REPAIR, INC.

CITY OF SAN DIEGO

STAR & CRESCENT BOAT COMPANY

CAMPBELL INDUSTRIES

SAN DIEGO GAS AND ELECTRIC

UNITED STATES NAVY

SAN DIEGO UNIFIED PORT DISTRICT

SHIPYARD SEDIMENT SITE
SAN DIEGO BAY
SAN DIEGO, CALIFORNIA

forth in detail herein, this comparison revealed that the incremental benefit of cleanup diminishes significantly with additional cost beyond a certain cleanup level, and asymptotically approaches zero as remediation approaches background. Based on these considerations, cleaning up to background sediment chemistry levels is not economically feasible.

ALTERNATIVE SEDIMENT CLEANUP LEVELS

32. **ALTERNATIVE CLEANUP LEVELS**. Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*, the San Diego Water Board may prescribe alternative cleanup levels less stringent than background sediment chemistry concentrations if attainment of background concentrations is technologically or economically infeasible. Resolution No. 92-49 requires that alternative levels must be set at the lowest levels the discharger demonstrates and the San Diego Water Board finds is technologically and economically achievable. Resolution No. 92-49 further requires that any alternative cleanup level shall: (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial uses of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

The San Diego Water Board is prescribing the alternative cleanup levels for sediment summarized in the table below to protect aquatic life, aquatic-dependent wildlife, and human health based beneficial uses consistent with the requirements of Resolution No. 92-49. Compliance with alternative cleanup levels will be determined using the monitoring protocols summarized in Finding 34 and described in detail of Section 34 of the Technical Report.

Table 2. Alternative Cleanup Levels: Shipyard Sediment Site

Aquatic Life	Aquatic Dependent Wildlife and Human Health	
Remediate all areas determined to have sediment pollutant levels likely to adversely affect the health of the benthic community.	Surface Weighted Average Concentrations (site-wide)	
	Copper	159 mg/kg
	Mercury	0.68 mg/kg
	HPAHs[1]	2,451 μg/kg
	PCBs[2]	194 μg/kg
	Tributyltin	110 μg/kg

1. HPAHs = sum of 10 PAHs: Fluoranthene, Pyrene, Benz[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-c,d]pyrene, Dibenz[a,h]anthracene, and Benzo[g,h,i]perylene.

2. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

In approving alternative cleanup levels less stringent than background the San Diego Water Board has considered the factors contained in Resolution No. 92-49 and the California Code of Regulations, Title 23, section 2550.4, subdivision (d):

Alternative Cleanup Levels are Appropriate. Cleaning up to background sediment quality levels at the Shipyard Sediment Site is economically infeasible. The alternative cleanup levels established for the Shipyard Sediment Site are the lowest levels that are technologically and economically achievable, as required under the California Code of Regulations Title 23 section 2550.4(e).

Alternative Cleanup Levels are Consistent with Water Quality Control Plans and Policies. The alternative cleanup levels provide for the reasonable protection of San Diego Bay beneficial uses and will not result in water quality less than prescribed in water quality control plans and policies adopted by the State Water Board and the San Diego Water Board. While it is impossible to determine the precise level of water quality that will be attained given the residual sediment pollutant constituents that will remain at the Site, compliance with the alternative cleanup levels will markedly improve water quality conditions at the Shipyard Sediment Site and result in attainment of water quality standards at the site.

Alternative Cleanup Levels Will Not Unreasonably Affect Present and Anticipated Beneficial Uses of the Site. The level of water quality that will be attained upon remediation of the required cleanup at the Shipyard Sediment Site will not unreasonably affect San Diego Bay beneficial uses assigned to the Shipyard Sediment Site represented by aquatic life, aquatic-dependent wildlife, and human health. Cleanup of the remedial footprint will restore any injury, destruction, or loss of natural resources.

Alternative Cleanup Levels are Consistent with the Maximum Benefit to the People of the State. The proposed alternative cleanup levels are consistent with maximum benefit to the people of the State based on the San Diego Bay resource protection, mass removal and source control, and economic considerations. The Shipyard Sediment Site pollution is located in San Diego Bay, one of the finest natural harbors in the world. San Diego Bay is an important and valuable resource to San Diego and the Southern California Region. The alternative cleanup levels will result in significant contaminant mass removal and therefore risk reduction from San Diego Bay. Remediated areas will approach reference area sediment concentrations for most contaminants. Compared to cleaning up to background cleanup levels, cleaning up to the alternative cleanup levels will cause less diesel emission, less greenhouse gas emission, less noise, less truck traffic, have a lower potential for accidents, and less disruption to the local community. Achieving the alternative cleanup levels also requires less barge and crane movement on San Diego Bay, has a lower risk of re-suspension of contaminated sediments, and reduces the amount of landfill capacity required to dispose of the sediment wastes. The alternative cleanup levels properly balance reasonable protection of San Diego Bay beneficial uses with the significant economic and service activities provided by the City of San Diego, the NASSCO and BAE Systems Shipyards and the U.S. Navy.

33. **PROPOSED REMEDIAL FOOTPRINT AND PRELIMINARY REMEDIAL DESIGN**. Polygonal areas were developed around the sampling stations at the Shipyard Sediment Site using the Thiessen Polygon method to facilitate the development of the remedial footprint. The polygons targeted for remediation are shown in red and green in Attachment 2. The red areas are where the proposed remedial action is dredging. The areas shown in green represent inaccessible or under-pier areas that will be remediated by one or more methods other than dredging. Portions of polygons NA20, NA21, and NA22 as shown in Attachment 2 were omitted from this analysis because it falls within an area that is being evaluated as part of the TMDLs for Toxic Pollutants in Sediment at the Mouth of Chollas Creek TMDL and is not considered part of the Shipyard Sediment Site for purposes of the CAO.

The polygons were ranked based on a number of factors including likely impaired stations, composite surface-area weighted average concentration for the five primary COCs, Site-Specific Median Effects Quotient (SS-MEQ)[3] for non-Triad stations, and highest concentration of individual primary COCs. Based on these rankings, polygons were selected for remediation on a "worst first" basis.

In recognition of the methodologies and limitations of traditional mechanical dredging, the irregular polygons were converted into uniform dredge units. Each dredge unit (sediment management unit or "SMU") was then used to develop the dredge footprint. The conversion from irregular polygons to SMUs is shown in Attachments 3 and 4. These attachments show the remedial footprint, inclusive of areas to be dredged ("dredge remedial area," in red) and under-pier areas ("under-pier remedial area," in green) to be remediated by other means, most likely by sand cover. Together, the dredge remedial area and the under-pier remedial area constitute the remedial footprint.

Upland source control measures in the watershed of municipal separate storm sewer system outfall SW-4 are also needed to eliminate ongoing contamination from this source, if any, and ensure that recontamination of cleaned up areas of the Shipyard Sediment Site from this source does not occur.

34. **REMEDIAL MONITORING PROGRAM**. Monitoring during remediation activities is needed to document that remedial actions have not caused water quality standards to be violated outside of the remedial footprint, that the target cleanup levels have been reached within the remedial footprint, and to assess sediment for appropriate disposal. This monitoring should include water quality monitoring, sediment monitoring, and disposal monitoring.

[3] The SS-MEQ is a threshold developed to predict likely benthic community impairments based on sediment chemistry at the Shipyard Sediment Site. The development, validation, and application of the SS-MEQ are described in Section 32.5.2 of the Technical Report.

VOLUME II






DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA
Water Boards

STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

30. Finding 30: Technological Feasibility Considerations

Finding 30 of CAO No. R9-2011-0001 states:

Although there are complexities and difficulties that would need to be addressed and overcome (e.g. removal and handling of large volume of sediment; obstructions such as piers and ongoing shipyard operations; transportation and disposal of waste), it is technologically feasible to cleanup to the background sediment quality levels utilizing one or more remedial and disposal techniques. Mechanical dredging, subaqueous capping, and natural recovery have been successfully performed at numerous sites, including several in San Diego Bay, and many of these projects have successfully overcome the same types of operational limitations present at the Shipyard Sediment Site, such as piers and other obstructions, ship movements, and limited staging areas. Confined aquatic disposal or near-shore confined disposal facilities have also been employed in San Diego Bay and elsewhere, and may be evaluated as project alternatives for the management of sediment removed from the Shipyard Sediment Site.

30.1. Technological Feasibility to Cleanup to Background Conditions

Technological feasibility is determined by assessing available technologies which have been shown to be implementable and effective in either reducing pollutant levels in contaminated marine sediments or isolating contaminated marine sediment from the marine environment.

The feasibility study in the Shipyard Report (Exponent, 2003) identifies and evaluates natural recovery, subaqueous capping, dredging, and treatment as candidate remedial options. Exponent's screening of these candidate remedial options retains natural recovery and dredging for further evaluation, and does not retain subaqueous capping and in situ treatment. However, the parties subject to the cleanup and abatement order have evaluated other remedial options and determined that those remedial alternatives screened out in the Shipyard Report (Exponent, 2003) may be appropriate for certain areas within the site, especially those areas where piers or other over-water structures prevent or make it difficult to implement traditional remedial measures such as dredging. Note that remedial measures may be used in combination since a given remedial measure may be enhanced by other measures to achieve the desired cleanup goal.

The evaluation of remedial measures must also consider the short and long term impacts associated with its implementation. In this regard, a remedial strategy should include an evaluation of impacts to the local community and beyond. The San Diego Water Board evaluated whether or not it is technologically feasible to cleanup to background using the three readily employable and proven remediation strategies: natural recovery, subaqueous capping, and dredging. Other alternatives that may be available, in whole or in part, for management of the dredge material include confined aquatic disposal (CAD) or near-shore confined disposal facility (CDF). And, while these alternatives may be less desirable than removal of the contaminated sediment from San Diego Bay, these alternatives may mitigate impacts resulting from off-site transportation and disposal.

Natural recovery, subaqueous capping, and dredging alternatives are discussed below.

30.1.1. Monitored Natural Recovery

The National Research Council defines Monitored Natural Recovery (MNR) as a contaminated sediment remedy that depends on un-enhanced natural processes to reduce risk to human and environmental receptors to acceptable levels (NRC 2000). Natural recovery involves leaving the contaminated sediment in place and allowing the ongoing aquatic processes to contain, destroy, or otherwise reduce the bioavailability of the sediment pollutants in order to achieve site specific remedial action objectives (U.S. EPA, 2005a; NRC, 1997; Magar et al., 2009). Underlying MNR processes may include biodegradation, biotransformation, bioturbation, diffusion, dilution, adsorption, volatilization, chemical reaction or destruction, resuspension, and burial by clean sediment. Monitoring is fundamental to the remedy in order to assess whether risk reduction and ecological recovery by natural processes are occurring as expected. Successful implementation of MNR requires that (1) natural recovery processes are actively transforming, immobilizing, isolating, or removing chemical contaminants in sediments to levels that achieve acceptable risk reduction within an acceptable time period, and (2) source control has been achieved or sources are sufficiently minimized such that these natural recovery processes can be effective. Source control is common to all sediment remedies but particularly to MNR because slow rates of recovery could be outpaced by ongoing releases (Magar et al., 2009).

Monitored natural recovery is not a passive, no-action, or no-cost remedy. While it does not require active construction, effective remediation via MNR relies on a fundamental understanding of the underlying natural processes that are occurring at the site. MNR remedies require extensive risk assessment, site characterization, predictive modeling, and monitoring to verify source control, identify natural processes, set expectations for recovery, and confirm that natural processes continue to reduce risk over time as predicted (Magar et al., 2009). The remedial investigation and feasibility study are used to establish lines of evidence to verify acceptable rates and relative permanence of risk reduction measured and/or predicted for MNR.

Natural recovery processes occur at all contaminated sediment sites, and the extent to which these processes can be relied upon to achieve acceptable risk reduction must be determined by the results of the remedial investigation and feasibility study (Magar and Wenning, 2006; U.S. EPA, 2005a; NRC, 2001). The following conditions that are particularly conducive to MNR include (U.S. EPA, 2005a):

- Assessment indicates that natural recovery processes will continue at rates that contain, destroy, or reduce the bioavailability or toxicity of contaminants within an acceptable time frame.
- Short-term exposure can be reasonably limited by institutional controls during the recovery period.
- Contaminant exposures in biota and the biologically active zone of sediment are moving toward risk-based goals.
- For sites relying on natural isolation, the sediment bed is reasonably stable.

Because they are always present to varying degrees, natural recovery processes should be considered in every remedial action, even in cases when MNR is not expected to be the sole or primary remedy for a contaminated site (Magar and Wenning, 2006; U.S. EPA, 2005a; NRC, 2001). Natural recovery processes are often combined with other engineering approaches to increase the overall success of the remedial action (Magar et al., 2009). Many sites utilize hybrid remedies that combine dredging, capping, and MNR. For example, MNR may be used to control risk from areas of widespread, low-level sediment contamination following dredging or capping of more highly contaminated areas where analysis reveals that MNR cannot achieve acceptable risk reduction within targeted time frames, or MNR may be combined with thin-layer placement of clean sediment at sites where the natural rate of sedimentation is insufficient to bury contaminants in a reasonable time frame (U.S. EPA, 2005a).

Based on the available lines of evidence from the assessment (Exponent, 2003) a range of natural recovery processes are active at the Shipyard Sediment Site. Sedimentation rates in the range of 1-2 cm/year suggest that the surface sediment layer will be actively improved by natural deposition (see Section 5.8). Active efforts are underway to control sources. Elevated chemical concentrations are generally restricted to a limited spatial area within the pier areas. Bioavailability of site chemicals to benthic organisms appears to be limited based on lack of observed toxicity or benthic community degradation relative to reference conditions in most areas. Current site use for shipbuilding and repair activities may lead to sediment disturbances due to ship launching and other ship movements. Complete control of site sources has not been fully demonstrated to a level that would assure adequate rates of recovery. Therefore, based on current site use and site characteristics, while natural recovery processes are active at the site the remedy may not be fully effective in all areas of the Shipyard Sediment Site. For this reason, monitored natural recovery is not recommended as the primary remedy for the Shipyard Sediment Site, but is likely to provide an additional level of effectiveness and margin of safety in combination with more active remedial measures.

30.1.2. Subaqueous Capping

Subaqueous capping (i.e., in-place capping) is the placement of clean material on top of the contaminated sediment. Capping effectiveness can be achieved through three primary mechanisms including (1) physical isolation of the contaminated sediment from the benthic environment, (2) stabilization of contaminated sediments, preventing resuspension and transport to other sites, and (3) reduction of the flux of dissolved contaminants into the water column (U.S. EPA, 2005a; U.S. EPA, 1998c). The capping material is typically clean sand, silty to gravelly sand, and/or armoring material, or may involve a more complex design with geotextiles, liners and multiple layers. To achieve these results, an in-situ capping project must be treated as an engineered project with carefully considered design, construction, and monitoring (Palermo et al., 1998). Effective capping requires sufficient cap thickness, careful cap placement to avoid disturbance, and cap integrity maintenance from disturbances. Capping also requires monitoring to ensure integrity and effectiveness. Capping is a procedure that can be used at appropriate sites, and its success depends on careful design and implementation.

31. Finding 31: Economic Feasibility Considerations

Finding 31 of CAO No. R9-2011-0001 states:

Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, determining "economic feasibility" requires an objective balancing of the incremental benefit of attaining further reduction in the concentrations of primary COCs as compared with the incremental cost of achieving those reductions. Resolution No. 92-49 provides that "[e]conomic feasibility does not refer to the dischargers' ability to finance cleanup." When considering appropriate cleanup levels under Resolution No. 92-49, the San Diego Water Board is charged with evaluating "economic feasibility" by estimating the costs to remediate constituents of concern at a site to background and the costs of implementing other alternative remedial levels. An economically feasible alternative cleanup level is one where the incremental cost of further reductions in primary COCs outweighs the incremental benefits.

The San Diego Water Board evaluated a number of criteria to determine risks, costs, and benefits associated with no action, cleanups to background sediment chemistry levels, and alternative cleanup levels greater than background concentrations. The criteria included factors such as total cost, volume of sediment dredged, exposure pathways of receptors to contaminants, short- and long-term effects on beneficial uses (as they fall into the broader categories of aquatic life, aquatic-dependent wildlife, and human health), effects on shipyards and associated economic activities, effects on local businesses and neighborhood quality of life, and effects on recreational, commercial, or industrial uses of aquatic resources. The San Diego Water Board then compared these cost criteria against the benefits gained by diminishing exposure to the primary COCs to estimate the incremental benefit gained from reducing exposure based on the incremental costs of doing so. As set forth in detail herein, this comparison revealed that the incremental benefit of cleanup diminishes significantly with additional cost beyond a certain cleanup level, and asymptotically approaches zero as remediation approaches background. Based on these considerations, cleaning up to background sediment chemistry levels is not economically feasible.

31.1. Evaluation of Economic Feasibility of Cleaning Up to Background

Economic feasibility is a term of art under Resolution No. 92-49, and refers to the objective balancing of the incremental benefit of attaining more stringent cleanup levels compared with the incremental cost of achieving those levels. Economic feasibility does not refer to the subjective measurement of the discharger's ability to pay the costs of a cleanup. The benefits of remediation are best expressed as the reduction in exposure of human, aquatic wildlife, and benthic receptors to site-related COCs.

Economic feasibility was assessed by ranking the 65 shipyard sediment stations based on ~~according to~~ the contaminant levels for the five primary COCs found in surficial sediment samples. ~~This process used Triad data and site-specific median effects quotient (SS-MEQ).~~[25] A series of cumulative cost scenarios was then evaluated by starting with the six most contaminated stations, then adding the six next most contaminated stations, progressing sequentially down the list until the entire Shipyard Sediment Site was included in the scenario (see Appendix for Section 31). For each scenario, the required dredging volume and associated cost of remediation for the set of Thiessen polygons[26] included in the step was estimated. The estimated post-remedial surface-area weighted average concentrations (SWAC) and exposure reduction for the primary COCs was also estimated for each cost scenario. Exposure reduction was defined for this purpose as the reduction in sediment SWAC for the shipyard site, relative to background, where the pre-remedial SWAC is considered zero reduction and background is considered 100 percent reduction. As chemical concentrations are reduced and mass removed, the SWAC for each COC decreases, which is equivalent to an expected exposure reduction for the target receptors. The following equation represents the relationship of exposure reduction to post-remedy SWAC.

$$\textbf{Exposure Reduction} = \textbf{SWAC}_{\textbf{current}} - \textbf{SWAC}_{\textbf{post-remedy}}$$

To estimate the relative exposure reduction of a cost scenario, it is appropriate to normalize the exposure reduction to background. For example, current conditions represent 0 percent exposure reduction, whereas as post-remedial SWAC equal to background represents 100 percent exposure reduction. This equation is the calculation of the percent of exposure reduction relative to background.

$$\%\ \text{Exposure Reduction} = \frac{\text{SWAC}_{\text{current}} - \text{SWAC}_{\text{post-remedy}}}{\text{SWAC}_{\text{current}} - \text{Background}} \times 100$$

Subscript “final” changed to “post-remedy”

The following equation is an example of quantifying exposure reduction. This example assumes a current SWAC of 10 ppm for COC1 and a final SWAC of 2 ppm. The background concentration used in this example is 1 ppm for COC1.

$$\frac{10\,\textbf{ppm} - 2\,\textbf{ppm}}{10\,\textbf{ppm} - 1\,\textbf{ppm}} \times 100 = 89\%$$

In this example, the exposure reduction relative to background when cleaning up a current SWAC of 10 ppm to a post-remedial SWAC of 2 ppm is 89 percent. An average exposure reduction for each cost scenario was calculated by averaging the percent exposure reduction for each primary COC (copper, mercury, HPAHs, PCBs, and TBT; see Appendix for Section 31).

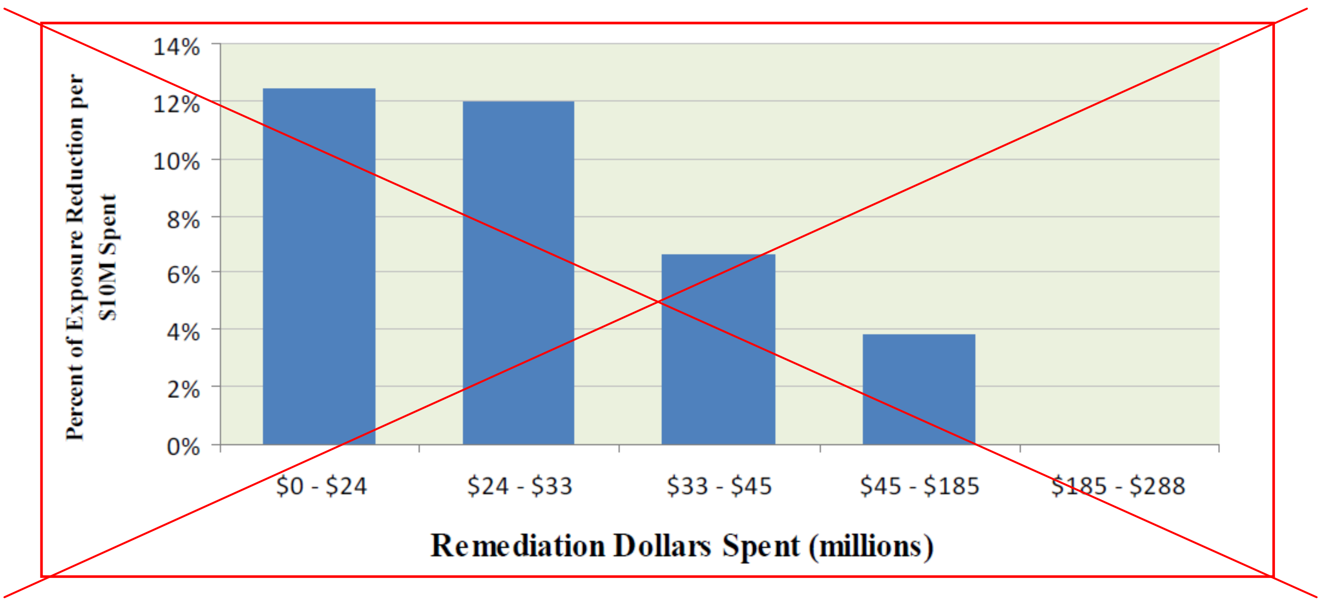
25 The ranking methodology is discussed in Section 32.2.3. ~~The development and application of the SS-MEQ values is discussed in Section 32.5.2.~~

26 To calculate surface-area weighted average concentrations for COCs at the Shipyard Sediment Site, a geospatial technique (Thiessen polygons) was used to represent the area represented by each sediment sample. This methodology is discussed in Section 32.2.

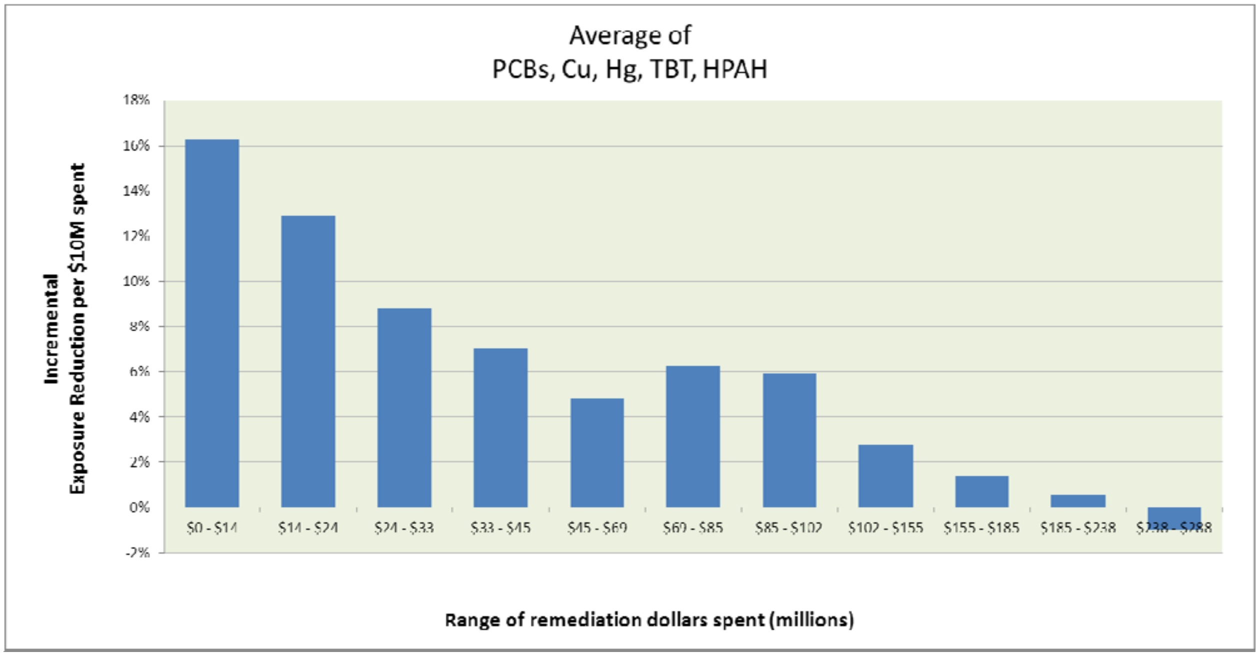
31.2. Comparison of Incremental Cost versus Incremental Benefit

A cost-benefit relationship became readily apparent in the San Diego Water Board's analysis. Initial expenditures return a relatively high exposure reduction benefit, but additional expenditures yield progressively lower returns per dollar spent on remediation. Further expenditures eventually reach a point where exposure reduction benefits become negligible. For additional significant sums of money spent, the environmental condition is not substantially improved. Figure 31-1 illustrates this relationship.

Figure 31-1 Percent Exposure Reduction versus Remediation Dollars Spent



DELETE FIGURE 31-1 AND REPLACE WITH NEW FIGURE 31-1



Note: See Appendix for Section 31 for supporting calculations

The highest net benefit per remedial dollar spent occurs for the first $2433 million (128 polygons), based on the fact that initial exposure reduction is above 1216 to 13 percent per $10 million spent. Beyond $2433 million, however, exposure reduction drops consistently as the cost of remediation increases. Exposure reduction drops belowto 7 percent or below per $10 million spent after $33 million, and below 4 percent3 percent after $102245 million. Based on these incremental costs versus incremental benefit comparisons, cleanup to background sediment quality levels is not economically feasible.

VOLUME III






DRAFT TECHNICAL REPORT FOR TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2011-0001

FOR THE SHIPYARD SEDIMENT SITE • SAN DIEGO BAY, SAN DIEGO, CA

SEPTEMBER 15, 2010

CALIFORNIA Water Boards

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARDS

32. Finding 32: Alternative Cleanup Levels

Finding 32 of CAO No. R9-2011-0001 states:

Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*, the San Diego Water Board may prescribe alternative cleanup levels less stringent than background sediment chemistry concentrations if attainment of background concentrations is technologically or economically infeasible. Resolution No. 92-49 requires that alternative levels must be set at the lowest levels the discharger demonstrates and the San Diego Water Board finds is technologically and economically achievable. Resolution No. 92-49 further requires that any alternative cleanup level shall: (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial uses of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

The San Diego Water Board is prescribing the alternative cleanup levels for sediment summarized in the table below to protect aquatic life, aquatic-dependent wildlife, and human health based beneficial uses consistent with the requirements of Resolution No. 92-49. Compliance with alternative cleanup levels will be determined using the monitoring protocols summarized in Finding 34 and described in detail of Section 34 of the Technical Report.

Alternative Cleanup Levels: Shipyard Sediment Site

<table>
<tr><th>Aquatic Life</th><th colspan="2">Aquatic Dependent Wildlife and Human Health</th></tr>
<tr><td rowspan="6">Remediate all areas determined to have sediment pollutant levels likely to adversely affect the health of the benthic community.</td><td colspan="2">Surface Weighted Average Concentrations (site-wide)</td></tr>
<tr><td>Copper</td><td>159 mg/kg</td></tr>
<tr><td>Mercury</td><td>0.68 mg/kg</td></tr>
<tr><td>HPAHs[1]</td><td>2,451 µg/kg</td></tr>
<tr><td>PCBs[2]</td><td>194 µg/kg</td></tr>
<tr><td>Tributyltin</td><td>110 µg/kg</td></tr>
</table>

1. HPAHs = sum of 10 PAHs: Fluoranthene, Pyrene, Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo(a)pyrene, indeno[1,2,3-c,d]pyrene, Dibenz[a,h]anthracene, and Benzo[g,h,i]perylene.
2. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

In approving alternative cleanup levels less stringent than background the San Diego Water Board has considered the factors contained in Resolution No. 92-49 and the California Code of Regulations, Title 23, section 2550.4, subdivision (d):

Draft Technical Report
for
Tentative Cleanup and Abatement
Order No. R9-2011-0001

APPENDIX FOR SECTION 31

ECONOMIC FEASIBILITY CONSIDERATIONS

September 15, 2010

List of Tables

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Area (ft2)	PCBs (µg/kg)	Mercury (mg/kg)	Copper (mg/kg)	TBT (µg/kg)
				Station Concentrations			
Pre-Remedy							
	1	SW04	22,682	4000	1.75	1500	3250
	2	SW08	16,829	2100	2.25	920	1850
	3	SW02	39,162	5450	4.45	580	167
	4	SW24	21,179	950	1.90	300	165
	5	SW09	24,479	710	0.96	660	910
1	6	SW13	38,257	490	0.86	800	790
	7	NA17	36,471	550	0.85	510	1350
	8	SW01	33,394	1600	1.45	560	450
	9	SW16	17,835	430	0.95	430	1100
	10	SW21	11,896	2400	1.40	260	170
	11	SW28	51,554	2100	0.88	265	150
2	12	NA06	61,035	640	2.35	395	225
	13	SW20	28,175	1600	0.99	290	130
	14	SW05	24,163	1200	0.96	230	170
	15	SW23	30,077	1000	1.00	280	210
	16	SW22	3,762	900	1.10	260	190
	17	SW17	55,898	540	0.98	270	440
3	18	NA19	32,043	990	0.78	270	570

California Regional Water Quality Control Board
San Diego Region

Response to Comments Report

Tentative Cleanup and Abatement Order No. R9-2011-0001 and Draft Technical Report for the Shipyard Sediment Site San Diego Bay

August 23, 2011

Under Water Code section 13360, the San Diego Water Board may not specify the particular manner by which dischargers must cleanup or abate the effects of their wastes, and a person subject to an order under Water Code section 13304 may comply with it in any lawful manner. Accordingly, the consistent and longstanding practice of the San Diego Water Board, and indeed of all the Water Boards, has been to require dischargers to propose the method for complying with a CAO and for the Water Boards to review, analyze and concur with the method proposed. This longstanding practice was codified by the State Water Board in 1992, when it adopted its Resolution No. 92-49. *See* Resolution No. 92-49, ¶ 18. Despite the somewhat tortured process in which the Cleanup Team engaged to develop and present TCAO No. R9-2011-0001 to the San Diego Water Board for its consideration and adoption, its development in the form presented to the San Diego Water Board at this time did not substantially vary from the Water Boards' normal process. The TCAO represents an amalgam of concepts and ideas for cleanup and abatement presented by the named dischargers, as a group in mediation, then reviewed, analyzed and recommended by the Cleanup Team for approval by the San Diego Water Board. As a practical matter, given the named dischargers' inability for nearly ten years to agree on an acceptable and sufficiently protective method of cleanup or abatement and propose it for review and approval, the Cleanup Team had no other realistic choice.

To ensure that dischargers have the opportunity to select cost-effective methods for cleaning up and abating their discharges, the San Diego Water Board must concur with any cleanup and abatement proposal which the dischargers have demonstrated has a substantial likelihood of achieving compliance with cleanup goals and objectives *within a reasonable time frame*. Resolution No. 92-49, § III (A). Those cleanup goals and objectives must, in turn, implement applicable Water Quality Control Plans and Policies and implement permanent cleanup and abatement solutions which do not require ongoing maintenance. *Ibid*. The TCAO and supporting DTR contain data and analyses gathered and submitted by the dischargers, and reviewed, analyzed and recommended by the Cleanup Team. There is a considerable body of evidence in the administrative record and DTR to support findings that the alternative cleanup levels proposed in the TCAO have a substantial likelihood of achieving compliance with cleanup goals and objectives within a reasonable time frame.

Substantial Evidence Supports The TCAO's Findings That The Shipyard Sediment Site Is Impaired And That MNA Cannot Achieve Beneficial Use Protection With A Reasonable Time.

Relying wholly on the Shipyard Report (Exponent 2003), NASSCO and BAE Systems contend that no substantial evidence in the record supports the finding that the Shipyard Sediment Site is impaired. Specifically, NASSCO and BAE Systems contend that the Cleanup Team's analyses, assumptions and interpretation of the same data Exponent used in its analyses are too conservative and that MNA is a sufficient "abatement" action for the Site. NASSCO's and BAE Systems's criticisms are inapt. First, Exponent's MNA proposal implicitly acknowledges there is at least some beneficial use impairment. Otherwise there would be no need to monitor the site

---

number in the TCAO, this responds to claims by various Designated Parties that the TCAO does not legally comply with Resolution No. 92-49.

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

IN THE MATTER OF:)
)
TENTATIVE CLEANUP AND ABATEMENT)
ORDER NO. R9-2011-0001)
)
)
_______________________________________)

DEPOSITION OF DAVID GIBSON

San Diego, California

MARCH 11, 2011

REPORTED BY BRIDGET L. MASTROBATTISTA

REGISTERED MERIT REPORTER, CSR NO. 7715

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Q Okay. Looking at Page 30-1 of the DTR and via courtesy copy of it here to make it easy.

The very last paragraph, if you have a moment to review that, I will have a few questions for you.

A Thank you. I read it.

Q The question that I have is: The DTR states that natural recovery is a readily employable and proven remediation strategy.

Do you know why the Cleanup Team believes that natural recovery is a proven remediation strategy?

A Natural recovery has been shown and has been preferred in some other cases. I can't name specific ones in our region. But, generally speaking, if the pollutants of concern are not readily biologically available, they're likely to be buried.

If the site is not a very active site, it might be better simply to leave them in place rather than dig them up and other pollutants associated with them and distribute them in the process of dredging. So, in some cases, natural recovery is, in fact, a preferred choice.

Q In your position at the Regional Board, have you been involved in any sediment remediation project that involved natural recovery?

A I have not personally, no.

Q Are you aware of any California State guidance

San Diego News

Decades Of Contaminants In SD Bay Hurting Wildlife, People

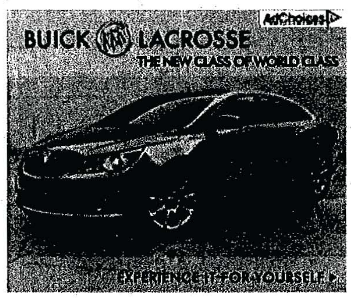
POSTED: 9:18 pm PST December 21, 2009
UPDATED: 1:11 pm PST December 22, 2009

SAN DIEGO -- Heads turn on Pepper Park Fishing Pier as one of the men gives a shout, and a flash of silver breaks through the water, wriggling on the end of his line. Yet this meal, caught fresh from San Diego Bay, comes with a risk to one's health.

"We have a lot of contaminants that are out there that are very persistent," said Katie Zeeman, a toxicologist with the U.S. Fish and Wildlife Service.

"This one's small kind of, but it's still good," said Israel Juarez as he held up his catch.

A large yellow sign warns of the dangers in four languages: "Fish from the bay may contain chemicals believed to cause cancer and birth defects." The warnings are posted all around the bay. But many still fish despite the warnings. For some fishing is a necessity, while others shrug off health concerns.



"Sometimes I make them into tacos," said Juarez.

"The one you hear about a lot in San Diego Bay is PCBs," said Zeeman.

Polychlorinated biphenyls, or PCBs, are man-made chemicals that were once widely used in items such as plastics and electrical equipment. Cancer, behavioral and immune system problems have all been linked to PCBs. They were banned in 1976 because of their toxicity and persistence; they remain in the environment for an extremely long time, growing in concentration as they move up the food chain.

"Even if you use them for a short time, they're there for so long," said Zeeman.

Zeeman has been studying contaminants for 25 years, including a recent study on seabirds in South San Diego Bay whose eggs failed to hatch.

"That's a crushed egg -- indicates that they've got thin eggshells," said Zeeman.

She said she suspects they're thin because the fish the birds eat are contaminated from the toxic sediments on the bottom of the bay. She found PCBs, along with DDT and other toxins in the fish and in the thin eggshells.

"The contaminant levels are high enough that we would like to figure out if they're causing this crushing," said Zeeman.

If that proves to be true, it would be more evidence that PCBs are still a serious threat 30 years after they were banned.

"It's a classic lesson that it's easier to prevent the problem than it is to fix it once it's been introduced into the environment," said David Gibson, executive officer of the San Diego Regional Water Quality Control Board. It's the agency responsible for monitoring local water bodies, including the bay, and ordering cleanups.

Past studies have shown San Diego Bay as one of the country's most toxic.

"Some sediments that are contaminated, the best thing to do is actually to leave them there. They're deep enough that they won't become disturbed and release their toxins again. In some cases, what you have to do is go in and dredge," Gibson explained.

The water board is expected to make a landmark recommendation on Dec. 22 to dredge one toxic hot spot along the shipyards south of Coronado Bridge, on the eastern shore of the bay: 60 acres of

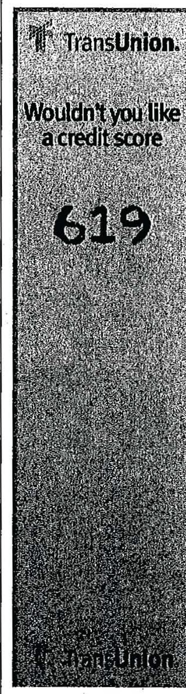


EXHIBIT 1304
Gibson
PENGAD 800-631-6989

sediment. It was first proposed four years ago, but got stalled while documents were produced and mediation begun. Now the board hopes to bring the cleanup order back on track.

Tuesday's recommendation will revise the four-year-old cleanup. After a public comment period, a hearing will be held to determine the final cleanup order. The board hopes the final order will come in mid to late 2010.

In past reports, the water board determined these groups as the responsible polluters of the shipyard sediment site: National Steel and Shipbuilding Company, BAE Systems, Marine Construction and Design Company and Campbell Industries, Inc., the city of San Diego, San Diego Gas and Electric, and the U.S. Navy.

"The overall goal is to take these pieces of the bay one at a time as best as we can do and as best as we can afford it as a society and clean them up," said Gibson.

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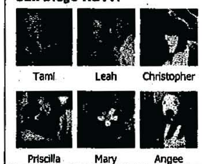

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NASSCO and Southwest Marine Detailed Sediment Investigation

Volume I

Prepared for

NASSCO and Southwest Marine
San Diego, California

SAR105417
R-236

- The feasibility and costs of remediation
- Site hydrodynamics, including sediment transport
- The time required for natural recovery.

Natural recovery processes include:

- Deposition of new sediment resulting in dilution and burial of existing surface sediment
- Degradation of organic compounds through both chemical and biological processes
- Recolonization of sediment by benthic macroinvertebrates.

If offsite sources were to be controlled, natural recovery of benthic macroinvertebrate communities would be expected to occur within a 3–5 year period. Sediment deposition rates in San Diego Bay have been estimated to be 1 cm per year (Peng et al. 2003). This rate of sediment accumulation will lead to substantial changes in surface sediment conditions in just a few years. Although this sediment accumulation rate will nominally result in complete replacement of the most biologically active surface sediment layer (0–2 cm) in 2 years, physical and biological processes may mix the sediment to a greater depth. The apparent RPD depth at the shipyards generally ranged from 1 to 2.5 cm (Section 8.1.1.1), indicating the depth range over which bioturbation is likely to mix newly deposited sediment. Newly deposited sediment will therefore have a substantial impact on existing surface sediment in a period of 2 to 4 years.

Petroleum hydrocarbons are the chemicals that most commonly exceed LAET values at the shipyards, but petroleum hydrocarbons weather relatively quickly. The most toxic components of petroleum hydrocarbons are broken down in weeks to months in the marine environment (Lee and Page 1997; NOAA 2001; Page et al. 2001). As a result, remediation of subtidal sediments is ordinarily not required even after a major oil spill. A relatively short period of natural recovery is therefore expected to address any effects of petroleum hydrocarbons.

Destruction of the existing biotic community is an immediate impact of dredging. The severity, or importance, of this impact depends upon the value of that community and the time that may be required for it to be replaced. As discussed below, dredging may also alter the habitat in such a way that the original community cannot be restored. Removal of a healthy benthic community can also have harmful impacts on higher trophic level organisms (e.g., fish and birds) that feed on that community.

Soft-bottom benthic communities generally show substantial recovery in 3–5 years. However, if eelgrass, kelp, or other rooted plants are present, more time may be required for them to become reestablished and to mature to a point that they can sustain the original community.

Dredging ordinarily alters habitat suitability in a number of ways that can affect the health or type of biotic community that can become established after dredging:

- Increased water depth, with concomitant changes in pressure, temperature, and light penetration
- An exposed surface that has substantially different physical characteristics than the original surface (e.g., grain size, organic chemical content)
- An increased sediment deposition rate, as a consequence of the stilling effect of deeper water
- Removal of physical structures, such as boulders, logs, and pilings, resulting in an absence of anchoring points or shelter for some fauna.

Thus, the short-term effect of destruction of the biotic community may be accompanied by long-term alterations in habitat suitability. The post-dredging benthic community may therefore differ from the communities found in appropriate site-specific reference locations.

economically feasible. Overall, aquatic life, aquatic-dependent wildlife, and human health beneficial uses are at approximately 95 percent of ideal conditions, and active remedial alternatives will result in improvements that are minimal—on the order of only a percent or so. Thus, Alternatives B1 (offsite disposal) and B2 (onsite CDF disposal), which involve removal of sediments to the site-specific LAET criteria, provide little or no incremental benefit over baseline conditions but impose significant impacts on shipyard operations and on the local community, and do so at a high cost. Alternative C, remediation to final reference pool chemical conditions, similarly provides little long-term benefit and imposes even more severe impacts on shipyard operations and on the local community; this alternative is consequently technically and economically infeasible to implement. Because there are uncontrolled contaminant sources nearby (Chollas Creek and municipal storm drains), and because physical sediment disturbance associated with shipyard operations will continue indefinitely, sediment conditions are likely to return to current conditions even if extensive dredging were to be conducted. Monitored natural recovery is therefore the most technically and economically feasible approach to addressing current sediment conditions at the shipyards.