Exponent®

EXTERNAL MEMORANDUM

TO: T. Michael Chee

FROM: Rick Bodishbaugh, Gary Bigham

DATE: June 23, 2011

PROJECT: PH10719.001

SUBJECT: Critique of Comments and Untimely Expert Evidence Offered by the Environmental Health Coalition and Coastkeeper, City of San Diego, San Diego Unified Port District, San Diego Gas & Electric, and the U.S. Navy

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At your request, Exponent has provided technical comments in response to the comments submitted by the Environmental Health Coalition and Coastkeeper (EHC/Coastkeeper), and the City of San Diego, on May 26, 2011, on the Tentative Cleanup and Abatement Order, No. R9-2011-0001, and accompanying Draft Technical Report (September 15, 2010).

In addition, Exponent has also reviewed and provided technical comments on the untimely expert evidence submitted by the U.S. Navy, San Diego Gas & Electric, and San Diego Unified Port District, also on May 26, 2011.

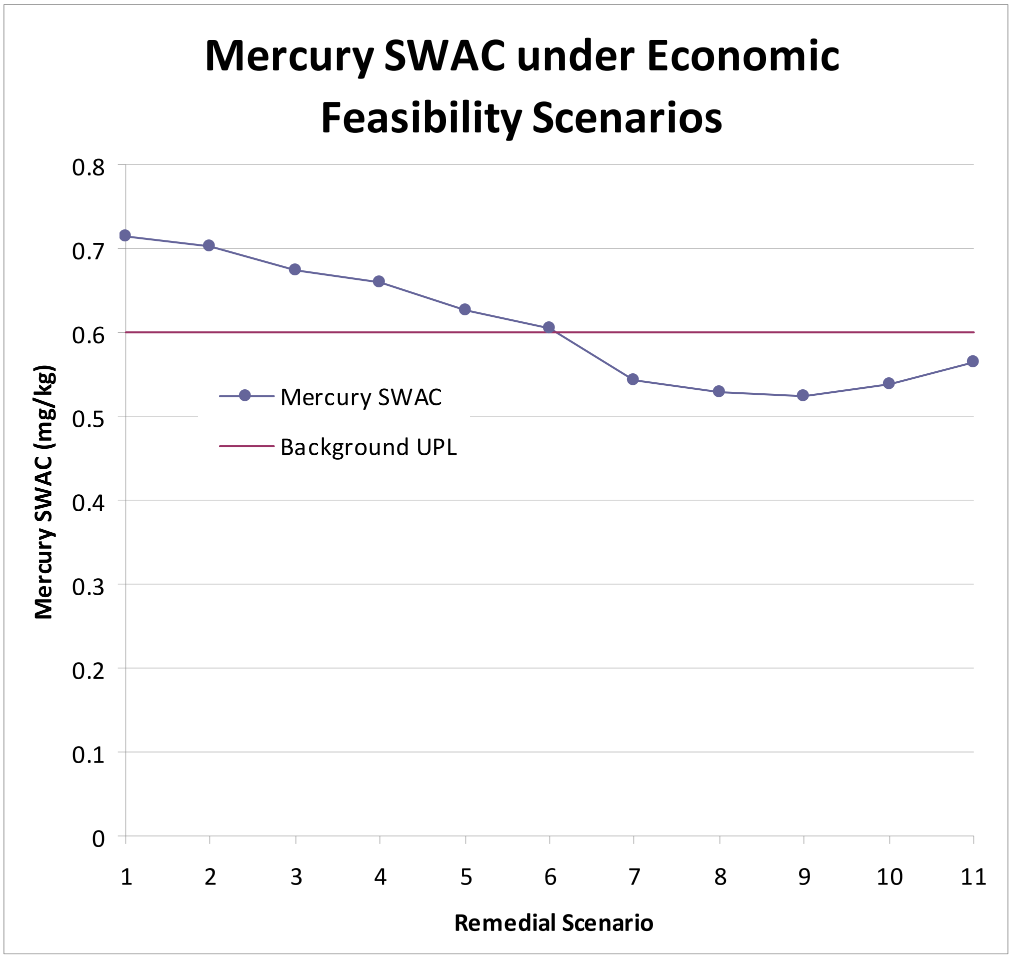
I. EHC/COASTKEEPER

EHC/Coastkeeper Comment No. 14: The economic feasibility was not determined on a constituent-by-constituent basis.

EHC/Coastkeeper asserts that averaging the pollutant reduction concentration for the five primary COCs, as was done in the DTR, masks variability in pollutant exposure reduction for individual pollutants, and suggests that, when pollutants are analyzed individually, progression from cost scenario 6 ($69.5 million-$85.3 million) to cost scenario 7 ($85-$101.6 million) results in “more than 20% exposure reduction in mercury.” However, EHC/Coastkeeper’s proposed constituent-by-constituent reanalysis of the economic feasibility data merely illustrates that the five COCs are not identically distributed across the site, without addressing the issue of net remedial cost-benefit. It also confirms that incremental benefits generally decrease with increasing cost.

Of particular concern, EHC/Coastkeeper’s proposed reanalysis also obfuscates the net benefits, leading to absurd results and illustrating why this analysis is a poor standalone basis for selecting a remedy (something it was never intended to do). Specifically, EHC/Coastkeeper’s proposed analysis fails to recognize that the mercury SWAC achieved in scenario 7 is actually below the site-specific reference concentration (i.e., background UPL) for mercury. Under current conditions, the mercury SWAC at the shipyard is not highly elevated relative to background (only 1.2x background UPL prior to any remediation), and very quickly approaches background as the highest composite SWAC polygons are remediated. Accordingly, at scenario 6, mercury is essentially at background. Under scenarios 7 to 11, the mercury SWAC is predicted to be below background, because the remaining unremediated stations all have mercury concentrations below the background UPL (see Figure 1). Scenarios 9 and 10 actually predict a rise in mercury SWAC with continued remediation, because areas with mercury levels below background are being dredged and the dredged area is assumed to equilibrate to the higher background level after remediation. As a result, the apparent “reduction” in mercury exposure from scenario 6 to scenario 7 actually produces no benefit to the public relative to the reference condition (defined as 100% exposure reduction), at a cost of more than $16 million.

Figure 1. Mercury SWAC Under Economic Feasibility Scenarios.



EHC/Coastkeeper Comment No. 20: The site-wide alternative cleanup levels were calculated based on remediating to background pollutant levels.

It is correct that post-remedial SWAC calculations were completed with the assumption that the SWAC inside the footprint would be remediated to the background UPL concentrations derived in Section 29 of the DTR. DTR, at 32-12. However, it should be noted that in reality, the SWAC within the footprint following remediation may well be less than the background UPL, or result in chemical concentrations below background in certain areas.

In order to calculate a Sitewide post-remedial SWAC for any scenario or reason, it is necessary to assume an average COC concentration for the remediated area. Background was selected as a conservative (i.e., more protective) alternative to lower values, even though the site data clearly show that areas with individual COC concentrations below the background UPL currently exist at the Site, which suggests that concentrations are likely to be even lower following remediation. Thus, EHC/Coastkeeper's concern that the post-remedial SWAC is not protective is invalid.

EHC/Coastkeeper Comment No. 27: The Order sets the "Remedial Goals" as compliance with "Trigger Concentrations" above the Alternative Cleanup Levels - and in some cases ABOVE existing pollutant levels.

As described in the DTR, post-remedial trigger concentrations seek to account for random variation that is inherent in any sampling data. DTR, at 34-7. It has been determined that a post-remedial SWAC concentration equivalent to the trigger concentration is statistically indistinguishable from the target post-remedial SWAC, given the number of samples that make up the SWAC.

EHC/Coastkeeper's assertion that the cleanup can be completed without removing any mercury from the Site is misleading, and takes the post-remedial trigger out of the context in which it is to be used. While the trigger concentration for mercury (0.78 mg/kg) is higher than the pre-remedial Sitewide SWAC (0.72 mg/kg), it is much lower than the concentration in the remedial footprint. As noted above (see response to Comment No. 14), the mercury SWAC at the Site is not highly elevated (1.2x background), and average mercury levels do not presently pose a significant risk to any receptor. The primary cleanup goal with respect to mercury is to remove isolated areas of elevated mercury, not to lower the Sitewide SWAC. Elevated mercury is limited to a few areas, and these areas have been targeted by the DTR recommended cleanup. Eight of the 10 polygons with the highest surface concentrations of mercury are included in the proposed footprint (see DTR Table 33-4), with concentrations ranging from 4.5 to 1.2 mg/kg. The post-remedial monitoring program will ensure that these target areas are remediated, and verify that the target Sitewide mercury SWAC (which is only slightly lower than the pre-remedial SWAC) is achieved within reasonable statistical precision.

EHC/Coastkeeper Comment No. 28: The Post Remedial Monitoring program will mask ongoing pollutant problems.

Exponent has reviewed and analyzed BAE's comments on this topic, and agrees with the conclusions reached therein. Accordingly, Exponent incorporates those comments herein. <u>See</u> BAE Initial Comments, at 64-65, 68.

Compositing samples over the entire site is a meaningful way to analyze and assess average concentrations across the site. Sitewide average concentration (in the form of SWAC) is the basis for specifying the alternative cleanup levels, and is the appropriate basis on which to assess cleanup success.

The stratification scheme described in the DTR is intended to provide interpretive information concerning the spatial distribution of COC concentrations throughout the Site, and will document, not mask, the true spatial extent of COC concentrations throughout the Site.

Similarly, the subsampling and replication framework described in Section D of the TCAO is an appropriate method to assess whether the alternative cleanup levels were achieved and the remediation was successful. Collecting replicates is useful to provide an estimate of variances in the compositing process, and will improve the estimates of the COC concentrations in each of the polygon groups and facilitate evaluation of remedy effectiveness.

EHC/Coastkeeper Comment No. 31: The "success" of the clean-up will rely heavily on data from polygons that were not dredged.

Sitewide SWAC values are being used to assess the cleanup success. It is necessary to determine SWAC values in order to evaluate whether the remedial goals expressed in the alternative cleanup levels have been met, and SWAC measurements necessarily include data from areas outside the remedial footprint.

EHC/Coastkeeper Comment No. 32: The Post Remedial Monitoring program's six sampling areas are arbitrary.

The six sampling areas were defined in a systematic and rational manner. Site stations were pooled into zones of each shipyard with similar size, bathymetry, distance from shore, and COC concentration. All polygons within a group are either contiguous or in close proximity.

EHC/Coastkeeper Comment No. 33: The Post Remedial Monitoring plan's requirement to test replicate sub-samples of composited sediment samples tests how good the lab is, not the variability of pollutants remaining at the Site.

The described replication is not intended to assess variability in the site chemistry or conditions. As described in the DTR, "The three replicate sub-samples of composite samples provide an estimate of variances in the compositing process" (DTR, page 34-5). This is an important quality control check on the post-remedial monitoring procedure.

EHC/Coastkeeper Comment No. 36: Failure to assure that the Alternative Cleanup Levels are met through the remediation process renders the cleanup illegal.

The TCAO does not fail to assure that the alternative cleanup levels are met through the remediation process. First, it is necessary to assume an average COC concentration for the remediated area in order to calculate a sitewide post-remedial SWAC. The fact that the post-remedial SWAC calculations were completed with the assumption that the SWAC inside the footprint will be remediated to the background concentrations derived in Section 29 of the DTR is a conservative (i.e., protective) assumption, since it is likely that the SWAC within the remedial footprint following the remediation will be less than the background UPL.

Second, the 120% background trigger for a second dredging pass is not a "failure to assure the alternative cleanup levels are met." Rather, this is a means of accounting for the natural variability in sediment conditions in determining whether the alternative cleanup levels have been met. Deposition of David Gibson, at 133:17 – 135:7 (confirming that there is natural variability in the data collected, and that the purpose of post-remedial monitoring is to ensure the cleanup standard has been met). If such variability is not accounted for, additional dredging could be triggered even though the post-remedial SWAC has been met. Accordingly, "it is critical to account for the variability of the predicted post-remedial SWAC" and trigger concentrations must be set to "represent the surface-area weighted average concentration expected after cleanup, accounting for the variability in measured concentrations throughout the area" in recognition that "it is critical to account for the variability of the predicted post-remedial SWAC." DTR, at 34-7. The trigger concentrations were thus developed appropriately, recognizing the reality that measurements of sediment chemical concentrations always are associated with some degree of error.

EHC/Coastkeeper Comment No. 38: The Alternative Clean-up Levels cannot ensure that fish and benthic invertebrate beneficial uses will not be unreasonably affected at the Shipyard Sediment Site.

Benthic invertebrate communities are protected by inclusion of "likely impacted" Triad stations in the proposed remedial footprint, and application of protective site-specific chemistry benchmarks (SS-MEQ and LAET), as well as additional safety buffers, to assess non-Triad stations. Moreover, a detailed statistical comparison of histopathology (i.e., incidence of lesions) in fish captured at the Site with reference area fish has already indicated that there are no significant adverse effects in Site fish as a result of observed chemistry concentrations. Exponent Report, at §§ 8.2, 9.3.4.

EHC/Coastkeeper Comment No. 39: The Order and DTR fail to include numeric clean-up levels for benthic invertebrates and fish.

EHC/Coastkeeper suggests that the alternative cleanup levels will not be protective of benthic invertebrates and fish, when in fact, the TCAO and DTR are highly protective of both benthic invertebrates and fish.

EHC/Coastkeeper relies primarily on the conclusions in Mr. MacDonald's 2011 report. Mr. MacDonald's report acknowledges that "reliance on multiple lines of evidence is generally recommended for assessing contaminated sediments," but claims that the cleanup levels are not protective of aquatic life based on several invalid criticisms, including: (1) SS-MEQ, which is the metric Mr. MacDonald refers to as being used to evaluate sediment chemistry data in the non-triad samples, is not effects-based; (2) the reference pool used to evaluate the results of the amphipod test is invalid because it included several survival values below 80%; and (3) reference pools for the bivalve and echinoderm toxicity tests were invalid because the bivalve reference pool included only four stations and the echinoderm reference pool included two samples with fertilization rates below 70%.

All three of these critiques are invalid. First, Mr. MacDonald's assertion that SS-MEQ does not provide an effects-based tool for predicting adverse effects on benthic communities is incorrect, as the SS-MEQ was specifically developed to be a site-specific, effects-based assessment tool. DTR, at § 32.5.2. It was developed using all six of the "likely" impaired stations that were found at the Site under the DTR's effects-based Triad analysis, and is therefore directly analogous to the manner in which Long, et al. (1995) developed ER-M values. Further, the predictive reliability of SS-MEQ was evaluated, and a threshold of 0.9 selected, using the site-specific effects determinations for the 30 triad stations, as well as the five supplemental triad stations sampled at the Site. Accordingly, there is no scientific basis for asserting that SS-MEQ is not effects-based. Additionally, using SS-MEQ rather than SQGQ1 to assess impacts on benthic communities is justifiable because the SQGQ1 is based on generic sediment quality values that do not explicitly consider site-specific conditions, whereas SS-MEQ is based on chemical and biological data collected at the Site.

Second, Mr. MacDonald's criticisms of the reference pool as it relates to the amphipod toxicity test are unfounded. The reference pool for the Site was selected by the Regional Board to comply with EPA guidance, as well as methods commonly used by environmental practitioners in assessing sediment. DTR, at § 17.2 (summarizing EPA guidance documents for reference pool selection). Applicable guidance states that reference areas should reflect the habitat conditions and background levels of chemical contamination that would exist at a study site in the absence of site-related sediment contamination. Id. Reference conditions should incorporate levels of chemical contamination or biological responses that are considered representative of the general conditions of a water body removed. Thus, the DTR appropriately sought to select reference areas "consistent with the San Diego Water Board's goal of establishing a reference condition that represents contemporary bay-wide ambient background contaminant levels that could be expected to exist in the absence of the Shipyard Sediment Site discharges and some level of natural variability in toxicity and benthic communities that could exist due to factors other than sediment contamination." Id. If, as Mr. MacDonald suggests, reference stations with amphipod survival of less than 80% were excluded, the analysis would ignore the full range of responses that occur in valid reference areas in San Diego Bay, and bias the analysis to in favor of a pre-conceived notion concerning what the minimum level of survival in reference areas should be. Notably, sediment management standards from other jurisdictions recognize that amphipod survival in reference areas may be as low as 75%. See BAE Initial Comments (citing Washington State Sediment Management Standards (Ecology 1995); Phillips et al. (2001).

Third, Mr. MacDonald's criticisms of the reference pools for the remaining toxicity tests are also unjustified. In addition to the above discussion concerning the selection of reference pools, the results of the DTR bivalve and echinoderm tests were the same as those found by Exponent, using a different reference pool and different statistical procedures (analysis of variance vs. reference envelope). Accordingly, these results demonstrate that the statistical results for both tests are robust, since they were the same under two different methods of analysis.

Lastly, Mr. MacDonald's criticisms focus on the toxicity results for reference stations to the exclusion of other factors involved in selection of the reference pool; however, additional information, such as chemistry and benthic community information, was also used to select the reference pool.

EHC/Coastkeeper Comment No. 40: Failure to include numeric cleanup levels to protect fish is particularly egregious, as no information was presented in the Order or the DTR on how the potential for adverse effects on fish were explicitly considered.

Exponent has reviewed and analyzed BAE's comments on this topic, and agrees with the conclusions reached therein. Accordingly, Exponent incorporates those comments herein. See BAE Initial Comments, at 60.

EHC/Coastkeeper erroneously states that the TCAO and DTR provide no information concerning the potential for adverse effects on fish at the Site. However, the DTR contains detailed analyses assessing impacts to spotted sand bass, including histopathology analysis and PAH metabolite analysis in bile, as well as evaluations of chemistry data and indirect impacts to fish via the benthic community. Exponent Report, at §§ 8.2, 8.3, 9.3.4, 9.3.5. As discussed in NASSCO's initial comments, empirical data were collected at the Site and evaluated for effects on spotted sand bass, and unacceptable risks were not found. Exponent Report, at §§ 8.2, 8.3, 9.3.4, 9.3.5. The Regional Board also conducted an independent analysis, based on the data collected by Exponent, extensively evaluating the potential effects of sediment contamination on fish at the Site, and concluded that no effects could be conclusively attributed to contaminant exposure at the Site. DTR, at A15.1, A15.2. Because no adverse effects on fish were detected, numeric cleanup levels for fish are not necessary. Moreover, even though there are no demonstrated adverse effects on fish, the TCAO conservatively requires remediation of "all areas determined to have sediment pollutant levels likely to adversely affect the health of the benthic community," which would also protect benthic fish. TCAO, at Table 2.

EHC/Coastkeeper Comment No. 41: The lines of evidence developed to assess benthic invertebrate communities are likely to be minimally protective as they rely on comparisons to a reference pool that included samples that would not meet criteria for negative control samples.

Exponent has reviewed and analyzed BAE's comments on this topic, and agrees with the conclusions reached therein. Accordingly, Exponent incorporates those comments herein. See BAE Initial Comments, at 59-60.

Consistent with California Water Code Section 13304 and State Water Board Resolution, a reference pool should represent San Diego Bay conditions absent Shipyard Sediment Site discharges. That is, an appropriate reference pool for benthic community assessment should include all stressors and conditions that could affect the benthic community, with the exception of site-related chemical contamination. The DTR correctly states that the reference pool is intended to distinguish between pollution effects at the Site, and those found generally in the surrounding water body. DTR, at 17-2. Meeting criteria for negative laboratory controls is not a criterion for reference selection. The presence of all non-Site related stressors, including background chemical contamination, are part of the reference condition.

EHC/Coastkeeper Comment No. 42: The Proposed Remedial Footprint is too small to ensure that the remaining pollutant levels will not unreasonably affect present and anticipated beneficial uses of San Diego Bay.

Size of the remedial footprint is irrelevant to the assessment of beneficial uses or remediation to mitigate beneficial use impairment. The only relevant consideration is whether residual sediment chemicals are protective of beneficial uses, as determined by exposure assessment on an appropriate spatial scale. At many sites, remedial goals can be achieved through the selective removal of hot spot contamination.

Further, there is ample evidence set forth in NASSCO's initial comments demonstrating that the cleanup is excessively conservative, and that site conditions do not warrant any remediation beyond monitored natural attenuation, which is already occurring.

EHC/Coastkeeper Comment No. 70: Requiring sediment samples to be collected at only five sampling stations to evaluate benthic community conditions is inadequate because it will provide data on only about eight percent of the polygons at the Sediment Shipyard Site.

As stated in the DTR, "The purpose of assessing benthic community conditions as part of post-remedy monitoring is to demonstrate the remediation will successfully create conditions that would be expected to promote re-colonization of a healthy benthic community" DTR, at 34-8. There is no intention nor need to re-evaluate the benthic community at the entire Site. The DTR further states "The intent of these benthic community measurements is to track the degree to which the benthic community re-colonizes the area and will not be used to evaluate the success of the remedy" DTR, at 34-11.

II. UNITED STATES NAVY

Please see Exponent's technical report critiquing the Navy Apportionment Report, prepared by Gary Bigham (June 22, 2011).

III. CITY OF SAN DIEGO

City Comment No. 1.4: Measured Chollas Creek discharge data as referenced in Katz (2003) are insufficient for drawing conclusions that Chollas discharges have significantly impacted shipyard sediments.

The City states that measured Chollas Creek discharge data as referenced in Katz (2003) are insufficient for drawing conclusions that Chollas Creek discharges have significantly impacted shipyard sediment.[1] To support its comment, the City points out that COC loadings were measured at two points on Chollas Creek on a flow-weighted basis, while COC loadings from the three stormwater outfalls on the Navy's property adjacent to Chollas Creek were collected on a time-proportional basis. The City concludes that because of this difference, comparisons of concentrations or mass loading should not be made.

It is important to note that the City's criticism does not affect one's ability to draw conclusions regarding the impact of Chollas Creek discharges on shipyard sediments. The poster prepared by Katz et al. (2004) also presents data in Figure 5 that characterize the plume emanating from Chollas Creek toward the Shipyard Site. It is this plume that potentially affects shipyard sediments. The City does not comment on this aspect of the Katz et al. (2004) poster. Accordingly, the City's comment has no merit with respect to conclusions of impact of Chollas Creek on the Shipyard Site.

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[1] The resource the City is commenting on was actually generated in 2004. See Katz, C.N., Carlson-Blake, A. and Chadwick, D.B. 2004. Poster: Spatial and Temporal Evolution of Stormwater Plumes Impacting San Diego Bay. U.S. Navy, Marine Environmental Quality Branch, SPAWAR, San Diego, CA.

IV. SAN DIEGO GAS & ELECTRIC

SDG&E Comment No. 1.1: DTR's Benthic beneficial use impairment is critically flawed and should be replaced with a causal approach to adequately identify risk.

SDG&E advocates replacing the triad study with a putative "causal" and self-serving approach to benthic risk evaluation proposed by SDG&E's expert witness, Jason Conder. While it is true that a Triad study cannot, by itself, establish specific chemical causality of observed adverse effects on benthic organisms, a Triad study that demonstrates the absence of adverse effects as a function of exposure to sediment chemicals is clear indication that there is no causal linkage between any measured chemical contamination and benthic impacts, at the exposure levels observed.

The alternative aquatic life BUI analysis put forward by Dr. Conder in the subject memorandum is based on a novel method of analysis proposed in his expert report critiquing the DTR aquatic life beneficial use impairment (BUI) assessment, submitted earlier this year (Conder 2011). However, the proposal currently being reviewed goes well beyond the original application and conclusions reached by Conder (2011). Conder (2011) re-evaluated the DTR findings of impaired benthic community at the Shipyard Site, and concluded that a much smaller remedial footprint was justified than that proposed in the DTR (Conder 2011, Figure 3). In contrast, the present analysis by Conder is a de novo re-assessment of benthic BUI for the entire Shipyard Site, and concludes that a remedial footprint much larger than the one proposed in the DTR is warranted based solely on benthic BUI (see subject memorandum, Figure 3). While the scope of the current analysis is clearly different from the one contained in Conder (2011), the discrepancy between the two sets of recommendations with regard to remediation is not explained or justified in any way.

Furthermore, the theoretical approach advocated in the comment does not establish the site-specific causality that is suggested to be necessary, because it does not evaluate the presence of a site-specific exposure-response relationship or of co-occurrence of exposure with adverse effects. Rather, the toxic unit approach infers causality at the Site from a theoretical equilibrium model of exposure, combined with an assumed causal relationship developed from laboratory exposure data collected to assess water column toxicity rather than sediment toxicity. As a result, the proposed alternative approach would ignore available site-specific information about the presence or absence of an exposure-response relationship at the Site, and would rely instead on a theoretical causal relationship that may not be relevant under conditions or to receptors found at the Site. Proper interpretation of synoptic chemistry data, sediment toxicity testing (using three different organisms), and benthic community analysis are a far better basis from which to infer causality than a simple comparison of Site chemistry data to literature benchmarks for aqueous toxicity. Furthermore, the comment ignores the fact that a site-specific causal assessment metric, the apparent effects threshold (AET), was developed from the Triad study data and incorporated into the DTR approach for non-Triad stations (see response to comment no. 3 below).

In summary, the proposed alternative approach would do nothing to improve understanding of causality in the assessment of benthic impacts at the Shipyard Site, and would in fact be misleading and inferior to the DTR approach in this regard. The alternative approach advocated would, at most, be appropriate only as a screening tool for potential BUI if Site-specific biological information was unavailable. Any characterization of aquatic life BUI based on the proposed alternative approach would be seriously flawed, and unnecessary, since extensive site-specific biological information exists for the Site.

SDG&E Comment No. 1.2: Triad approach flawed as it lacks scientifically valid consideration of COCs.

This comment is erroneous and invalid. SDG&E claims that the toxic unit approach is scientifically superior to the SQGQ1 chemistry evaluation solely because it includes TBT. However, SDG&E blatantly ignores existing site specific information and previous analyses showing that there is no exposure-response relationship between TBT in sediments or pore water and adverse effects. The comment mischaracterizes the significance of TBT as a risk driver at the Shipyard Site, and fails to mention the extensive consideration and evaluation of TBT that has taken place during the last decade of assessment of sediment chemicals at the Shipyard Site. In fact, the possibility of an exposure-response relationship for TBT in both sediment and pore water was specifically investigated and addressed during the Detailed Sediment Investigation, and the lack of such a relationship for TBT is well-documented in the public record. Across the range of TBT concentrations measured in sediments at the 30 Sitewide Triad stations (38 - 3,250 µg/kg), there are no significant correlations between sediment concentration and toxicity from any of the three tests performed, or total abundance or species richness. Exponent Report, at Table 9-1. Furthermore, the relationship between sediment TBT levels and pore water TBT levels, while significant, is non-linear, a finding that contradicts the fundamental assumptions of the equilibrium partitioning model upon which the proposed toxic unit assessment approach for pore water is based. Exponent 2003, at 5-4. In addition, the regressions of pore water and sediment concentrations for most other primary COCs (copper, mercury, and PCBs) were found to have positive y-intercepts, indicating that those substances would be expected to be found in pore water, even if absent in sediment. This finding also contradicts the assumption of thermodynamic equilibrium, indicating that an equilibrium partitioning approach to estimate concentrations of these substances in pore water is inappropriate at the Shipyard Site, and will yield incorrect results.

Other fundamental assumptions of SDG&E's toxic units approach are contradicted and revealed to be false by Site-specific empirical data. This is readily apparent in the poor predictive performance of the toxic unit calculations themselves. The SDG&E alternative chemistry analysis, as summarized in Table 19, predicts toxicity to benthic organisms at nine Triad stations (of 30 total) where sediments were tested and found to be non-toxic in all three of the standard bioassays performed: NA04, NA05, NA06, NA15, NA17, SW08, SW09, SW18, SW21. Furthermore, no evidence of benthic community disturbance was found at any of these nine stations. With a false positive rate of 30 percent, it is difficult to defend the relevance of the toxicity unit thresholds to the Site, let alone justify claims that the method is a rigorously causal approach.

An examination of the toxicological basis of the putative risk-driving benchmarks in the alternative assessment further reveals the lack of relevance and poor scientific justification for selection of these thresholds as sediment toxicity benchmarks. The threshold values for copper and TBT, the two substances that drive the toxic unit method's erroneous predictions of widespread toxicity in Shipyard sediments, are both ambient water quality final chronic values (FCV), developed by U.S. EPA for assessment of toxicity to aquatic organisms living in the water column. Ambient water quality values in general have no direct relevance to pore water concentrations, only surface water concentrations. Even most burrowing benthic infauna actively irrigate their burrows with overlying surface water, and are not continually immersed in pore water. The very reliance on toxicity data from aquatic immersion exposures presumes that exposure is primarily driven by passive diffusion from sediment to pore water to organisms, a poor assumption for sediment exposure. Given that the sediments and pore water at the Shipyard Site are generally not in equilibrium (see discussion above), active pathways such as dietary exposure and direct contact are likely to be more important than passive diffusion, and these pathways are heavily dependent on bioavailability of sediment constituents (a consideration the toxic units approach completely ignores).

Finally, the data upon which saltwater FCV criteria are based are primarily from acute toxicity tests of water column species (adjusted downward to estimate chronic values), and may not have high relevance to benthic invertebrate species. For example, the three most sensitive species driving the TBT FCV calculation are mysid shrimp, copepods, and Chinook salmon, all water column species that poorly represent the benthic community at the Shipyards (see USEPA 2003, Table 3). For all of these reasons, the use of a generic water column exposure benchmark is inferior to the use of thresholds derived from Site-specific sediment exposure bioassays that more accurately reflect Site exposure conditions and pathways (i.e., AETs).

In summary, SDG&E's proposed alternative assessment method is scientifically flawed and clearly inferior to the DTR approach, notwithstanding the repeated claims to the contrary made in SDG&E's comments. Under SDG&E's proposal, tenuous, theoretical relationships are misrepresented as factual, even though readily available Site-specific data prove that key basic assumptions upon which they are based are scientifically invalid. These erroneous assumptions include:

- Exposure-response relationships exist for primary COCs in sediments and sediment toxicity at the Shipyard Site
- Sediments are at equilibrium with pore water at the Shipyard Site
- Equilibrium partitioning accurately predicts pore water concentrations at the Shipyard Site
- Exposure to pore water is continuous and is the most important pathway of exposure for benthic organisms
- Selected literature benchmarks of aquatic toxicity accurately predict benthic toxicity of Shipyard sediments when compared to estimated or measured pore water concentrations

SDG&E Comment No. 1.3: Non-triad approach fails to address causal connection between COCs and Benthic risk and 60% is arbitrary and without scientific support.

This comment is erroneous and invalid. The metrics comprising the non-triad approach provide valuable causal information, and are scientifically supported.

The AET is a direct causal metric that relates individual sediment contaminant exposure to statistically meaningful adverse effects. Under the DTR approach, causal relationships were developed between COC exposure and seven separate empirical measures of adverse effects on benthic macroinvertebrates: amphipod survival, echinoderm fertilization, bivalve larval development, total abundance, number of taxa present, benthic response index (BRI), and Shannon-Weiner diversity index. As a highly protective, site-specific benchmark of exposure, the lowest adverse effect threshold (LAET) was selected from this suite of seven effects, and a 40 percent safety factor was added to result in the 60% LAET value. Although the AET does not, by itself, prove causality, it provides valuable site-specific causal information on individual substances. The AET is both chemical-specific, and entirely reliant on site-specific empirical data. Accordingly, use of the AET provides unequivocal evidence that exposure for that specific substance at that sediment concentration does not cause adverse effects.

Furthermore, the SS-MEQ is an integrated index of multiple chemical exposure that quantitatively relates exposure at any non-Triad station to the exposure level at which evidence of impairment was observed in the Triad stations. While chemical causality can only be inferred from the SS-MEQ analysis rather than measured directly, the same is true of the toxic unit method's reliance on literature effect thresholds, and the SS-MEQ has the advantage of being based on Site-specific data, for multiple lines of evidence. The proposed alternative approach would substitute a generic, theoretical causal assessment approach for an empirical, site-specific causal assessment approach, resulting in an inferior aquatic life BUI assessment.

With regard to the proposed toxic unit assessment approach, SDG&E claims to incorporate a causal analysis, and concludes erroneously that there is a causal relationship of theoretical benthic effects with TBT. However, SDG&E's analysis does not follow any identifiable causal analysis framework, and instead relies on a purely theoretical analysis of causal relationships based on water quality criteria and theoretical sediment pore water concentrations. SDG&E's analysis therefore erroneously prioritizes tenuous theoretical relationships over both site-specific empirical data on measured concentrations of substances, and multiple lines of evidence of effects that use actual biological data for the site.

Given the above, SDG&E appears to be unaware of criteria for determining causation, and the use of these criteria in causal analysis frameworks that are available in the scientific literature. Authors from EPA have recently summarized available information on causal analyses and recommended a framework to ensure that the Agency's approach is appropriate and defensible (Suter et al., 2010). Key steps in the process include a clear identification of alternative causes, and an identification of the strength of evidence for each of the alternative causes. Important causal evidence for a site study includes:

- Spatial/temporal co-occurrence of measured biological effects with candidate stressors

- Stressor response relationships that document an increasing level of effect with increasing exposure to the candidate substance

- Field and Laboratory experiments that increase or decrease exposure and measure biological response

The authors stress the importance of including all potential applicable methods for causal analysis into a consistent framework.

All of the aforementioned evidence for causality was available as part of the shipyard sediment studies using a Triad approach. Notwithstanding this evidence, SDG&E embarked on an independent assessment of causation using a novel theoretical approach that ignores all of the other available data. This represents a scientifically flawed assessment that is inconsistent with the current standards of practice in environmental investigations and frameworks established by the U.S. EPA and published in the available scientific literature.

SDG&E Comment No. 1.4: The Toxic Unit approach used to derive the proposed footprint shown in Figure 1 is superior to the SQG-based evaluation used in part to identify polygons for remediation by MacDonald (2009, 2011) because the latter approach relies on empirical SQGs that suffer from the same weaknesses as the SQGQ1, SS-MEQ, and 60% LAET approaches (lack of chemical causality between concentrations and effects). The Toxic Unit approach is also a more scientifically-rigorous chemical line of evidence than the approach Spadaro et al. (2011) used to derive an alternate footprint to address Aquatic Life BUI in the BAE portion of the Site.

This comment is invalid, as described in NASSCO's Response to SDG&E Comment No. 1.3. A standard tenet of environmental Site assessment is that Site-specific empirical data are more reliable and preferred for remedial decision-making purposes than use of generic benchmarks, and should be preferentially used for site characterization. The toxic unit approach is not Site-specific, and is therefore far less scientifically valid than the DTR approach, which relies on both direct causal analysis and inferences drawn from empirical Site-specific observation to establish the presence or absence of biological impacts and causality with regard to aquatic life BUI. The toxic units approach relies completely on theoretical exposure estimates and generic benchmarks, and is little more than a screening approach.

SDG&E Comment No. 1.5: [T]he Toxic Unit approach detailed in Conder (2011a) is considered to be a more scientifically defensible sediment chemistry-only approach compared to the SS-MEQ and 60% LAET evaluation. It also includes all five relevant primary Site COCs, in contrast to the Triad sediment chemistry line of evidence, which omits TBT. The Toxic Unit approach should be adopted for use in sediment chemistry line of evidence approaches for the CRWQCB (2010) Triad and Non-Triad Data approaches, and thus should be used for deriving a remedial footprint in conjunction with other considerations regarding technical and economic feasibility in a manner consistent with the approaches discussed in CRWQCB (2010).

Whereas the toxic unit approach is, in fact, a chemistry-only assessment approach, the same is not true of the DTR non-Triad station assessment. The LAET is a direct function of the empirical exposure-response relationship for individual COCs, and the SS-MEQ is correlated with a state of apparent impairment determined by a multiple line of evidence assessment of aquatic life BUI. Unlike the toxic unit approach, both DTR metrics incorporate site-specific measurements of sediment toxicity and benthic community disturbance, and therefore incorporate critical Site-specific elements of exposure, such as bioavailability of COCs in sediments.

Furthermore, the toxic unit approach relies on an implicit assumption that SDG&E does not acknowledge or test, even though it is readily testable. The approach presumes that there is a measureable exposure-response relationship between sediment or pore water contaminant levels and adverse effects on benthic organisms under Site conditions. Such a presumption may be reasonable for screening chemistry data in the absence of Site-specific biological data, but not at a Site where a Triad study has been performed. At this Site, whether or not an exposure-response relationship exists for any sediment chemical can actually be determined. As Table 9-1 from the Detailed Sediment Investigation report (Exponent 2003) shows, none of the primary COC concentrations in sediments, are significantly correlated with any adverse effect. Note that this kind of analysis is one of the key criteria used in the EPA analysis of causation (Suter et al., 2010), which was ignored by SDG&E.

While the alternative remedial proposal put forward by SDG&E includes elimination of some polygons from the remedial footprint on the basis of a lack of BUI for humans and aquatic dependent wildlife receptors, seven additional polygons are added to the DTR footprint, due to alleged benthic BUI. A station-by-station review of the Site-specific data available for these polygons illustrates the lack of scientific validity in the SDG&E aquatic life BUI assessment.

<u>Station NA10</u>
Primary COCs are relatively low:
Composite SWAC ranking = 54 of 66 polygons
Copper (160 mg/kg) ranking = 48 of 66 polygons
Mercury (0.58 mg/kg) ranking = 51 of 66 polygons
HPAH (1,800 µg/kg) ranking = 54 of 66 polygons
PCB (160 µg/kg) ranking = 54 of 66 polygons
TBT (91 µg/kg) ranking = 44 of 66 polygons

Chemistry is below conservative biological benchmarks:
No exceedances of 60% LAETs
SS-MEQ = 0.35

No direct evidence of impacts to benthic community:
Non-Triad Station
SPI data indicate Stage III successional stage present.

Based on relatively low chemistry, and a lack of evidence for benthic impacts, NA10 was properly excluded from the proposed remedial footprint in the DTR.

<u>Station NA11</u>
Primary COCs are relatively low:
Composite SWAC ranking = 49 of 66 polygons
Copper (180 mg/kg) ranking = 43 of 66 polygons
Mercury (0.85 mg/kg) ranking = 34 of 66 polygons
HPAH (2,800 µg/kg) ranking = 44 of 66 polygons

PCB (190 µg/kg) ranking = 45 of 66 polygons
TBT (38 µg/kg) ranking = 56 of 66 polygons

Chemistry is below conservative biological benchmarks:
No exceedances of 60% LAETs
SS-MEQ = 0.42

No clear indication of impacts to benthic community:
Triad Station: "Possible" benthic impacts

DTR chemistry score = moderate
SQGQ1 is less than 1.0. Only 1 chemical exceeds both DTR SQG and UPL.

DTR toxicity score = moderate
Amphipod test scored slightly below reference LPL. Bivalve and urchin tests scored above reference LPLs.

DTR benthic disturbance score = low
No evidence of disturbance. BRI is below reference UPL. Abundance, # taxa, and diversity index are all above reference LPL.

SPI data indicate Stage I and III successional stages present.

There are no highly elevated COPC levels at this station. There are no clear impacts to the benthic community. None of the four benthic community indicators evaluated is significantly different from reference conditions. Only one of the three toxicity tests (amphipod survival) was slightly lower than reference. Due to a lack of high chemistry and no clear indication of benthic impacts, NA11 was properly excluded from the proposed remedial footprint in the DTR.

<u>Station NA18</u>
Primary COCs are relatively low:
Composite SWAC ranking = 39 of 66 polygons
Copper (230 mg/kg) ranking = 31 of 66 polygons
Mercury (0.79 mg/kg) ranking = 37 of 66 polygons
HPAH (2,400 µg/kg) ranking = 49 of 66 polygons
PCB (350 µg/kg) ranking = 32 of 66 polygons
TBT (210 µg/kg) ranking = 19 of 66 polygons

Chemistry is below conservative biological benchmarks:
No exceedances of 60% LAETs
SS-MEQ = 0.56

No direct evidence of impacts to benthic community:
Non-Triad station
No SPI data

Based on relatively low chemistry, and the lack of evidence of benthic impacts, NA18 was properly excluded from the proposed remedial footprint in the DTR.

Station NA21

Only TBT is relatively high:

Composite SWAC ranking = 41 of 66 polygons
Copper (150 mg/kg) ranking = 50 of 66 polygons
Mercury (0.51 mg/kg) ranking = 58 of 66 polygons
HPAH (2,100 µg/kg) ranking = 50 of 66 polygons
PCB (177 µg/kg) ranking = 51 of 66 polygons
TBT (410 µg/kg) ranking = 12 of 66 polygons

Chemistry is below conservative biological benchmarks:

No exceedances of 60% LAETs (including TBT)
SS-MEQ = 0.50

No direct evidence of impacts to benthic community:

Non-Triad Station
No SPI data

Based on relatively low chemistry, and the lack of evidence of benthic impacts, NA21 was properly excluded from the proposed remedial footprint in the DTR.

Station NA27

Primary COCs are relatively low:

Composite SWAC ranking = 36 of 66 polygons
Copper (390 mg/kg) ranking = 10 of 66 polygons
Mercury (1.20 mg/kg) ranking = 10 of 66 polygons
HPAH (2,800 µg/kg) ranking = 44of 66 polygons
PCB (210 µg/kg) ranking = 40 of 66 polygons
TBT (100 µg/kg) ranking = 42 of 66 polygons

Chemistry is below conservative biological benchmarks:

No exceedances of 60% LAETs
SS-MEQ = 0.69

No direct evidence of impacts to benthic community:

Non-Triad Station
No SPI data

Based on relatively low chemistry, and the lack of evidence of benthic impacts, NA27 was properly excluded from the proposed remedial footprint in the DTR.

Station NA28

Primary COCs are relatively low:

Composite SWAC ranking = 42 of 66 polygons
Copper (290 mg/kg) ranking = 14 of 66 polygons
Mercury (0.89 mg/kg) ranking = 31 of 66 polygons
HPAH (3,400 µg/kg) ranking = 36 of 66 polygons
PCB (180 µg/kg) ranking = 47 of 66 polygons
TBT (90 µg/kg) ranking = 45 of 66 polygons

Chemistry is below conservative biological benchmarks:

No exceedances of 60% LAETs
SS-MEQ = 0.55

No direct evidence of impacts to benthic community:

Non-Triad Station
No SPI data

Based on relatively low chemistry, and the lack of evidence of benthic impacts, NA28 was properly excluded from the proposed remedial footprint in the DTR.

Station SW34

Only copper is relatively high:

Composite SWAC ranking = 48 of 66 polygons
Copper (320 mg/kg) ranking = 12 of 66 polygons
Mercury (0.75 mg/kg) ranking = 40 of 66 polygons
HPAH (1,400 µg/kg) ranking = 57 of 66 polygons
PCB (130 µg/kg) ranking = 58 of 66 polygons
TBT (38 µg/kg) ranking = 56 of 66 polygons

Chemistry is below conservative biological benchmarks:

No exceedances of 60% LAETs (including copper)
SS-MEQ = 0.55

No direct evidence of impacts to benthic community:

Non-Triad Station
No SPI data

Based on relatively low chemistry, and the lack of evidence of benthic impacts, NA28 was properly excluded from the proposed remedial footprint in the DTR.

In summary, the Site-specific data do not support the allegation that any of the seven additional polygons proposed for remediation by SDG&E exhibit aquatic life BUI or should be remediated.

SDG&E Comment No. 2.0: DTR's Section 31 economic feasibility analysis fails to consider costs to reduction in Benthic risk exposure and should be revised.

The comment correctly notes that the DTR economic feasibility analysis measured benefit based on exposure reduction for receptors that average exposure over the entire site. However, it must be noted that benefits to the benthic community must be assessed on a point by point basis, and cannot be represented by an area weighted average concentration metric. The remedy proposed in the DTR directly addressed all areas identified as likely to impact aquatic life due to sediment contamination. No areas of likely benthic impacts were omitted from the DTR remediation footprint due to economic feasibility concerns.

SDG&E Comment No. 2.2, 2.3 : A revised economic feasibility analysis is shown in Figure 2, based on calculations shown in Tables 20 and 21. In this revised economic feasibility analysis, the percent exposure reduction for all three BUIs is considered via calculation of a composite percent exposure reduction based on SWACs for aquatic-dependent wildlife and human health (as in CRWQCB (2011)) and the area exhibiting aquatic life BUI, as based on a Toxic Unit approach for the sediment chemistry line of evidence (Figure 3; Conder, 2011a). The Toxic Unit approach is a causal chemical exposure modeling to account for bioavailability of chemicals to benthic invertebrates and predict potential chemical risk. It was used as a replacement approach for the flawed SQGQ1 approach used in the CRWQCB (2010) Triad sediment chemistry line of evidence in order to re-classify Triad stations. It was also used as a replacement approach for the flawed SS-MEQ and 60% of the LAET calculations used in the Non-Triad Data Approach. Both the revised Triad and Non-Triad Data approaches were used to identify polygons for Aquatic Life BUI (Figure 3). Economic feasibility was also calculated using a footprint designated to address Aquatic Life BUI only (Figure 4). The approach ranked polygons exhibiting Aquatic Life BUI by the highest Toxic Unit result multiplied by the area of the polygon (Table 22). Remedial cost was estimated for five increments according to approximate cost rates suggested by Table A31-1 (Table 23). This approach is more technically-defensible because Aquatic Life BUI is the most likely BUI exhibited at the Site and modeling of human health and ecological risk to aquatic-dependent wildlife is flawed. A revised economic feasibility approach should be adopted by CRWQCB to enable a complete and accurate evaluation of economic feasibility for any propose remedial footprint for the protection of BUIs at the Site.

As noted in Exponent's reply to the preceding comment, the toxic unit approach does not represent an improvement over the DTR approach to assessment of aquatic life BUI. It is flawed and inappropriate for use in characterizing BUI at the Site. In fact, the SDG&E approach represents a large step backward in that it reverts to a preliminary screening analysis based on an unsubstantiated theoretical relationship in lieu of using the rich, site-specific, empirical database for the shipyard site. Any economic feasibility analysis based on this assessment approach will be similarly flawed. Furthermore, the use of reduction in Sitewide SWAC as the metric of benefit for benthic invertebrate species is inappropriate. Unlike mobile human and wildlife receptors, which spatially average exposure over relatively large areas, benthic invertebrate communities are largely sessile, and must be assessed on a station-by-station basis. Sitewide average sediment conditions are not meaningful in measuring aquatic life BUI or BUI mitigation, and the alternative economic feasibility analysis presented is therefore invalid.

V. SAN DIEGO UNIFIED PORT DISTRICT

Port Comment No. 17 (Exhibit No. 3, Declaration of Expert Michael Johns, ¶ 5): It is my opinion that there is sufficient evidence that the Shipyard Site sediment contamination has contributed to the impairment of beneficial uses in San Diego Bay and likely continues to harm human health and environmental resources for the following reasons:

a. **Sediment contaminants in Site sediments are present, bioavailable, and, for a number of the contaminants, bioaccumulative.**

b. **Fish and shellfish collected at the Site have accumulated contaminants at concentrations predicted to harm seafood consumers (i.e., recreational and subsistence fishers).**

c. **Although fishing and shellfish harvesting do not occur on the Site because of security restrictions, there are nearby public access points and the fish and shellfish that have accumulated contaminants are mobile.**

d. **Shipyard activities at the Site periodically disturb contaminated sediments, creating an ongoing source of legacy contaminants and impacting beneficial uses in the Bay.**

None of Dr. Johns' four assertions regarding human wildlife exposure and risk constitute scientifically valid evidence of existing or likely future beneficial use impairment from Site sediment contamination for the following reasons:

¶ 5.a. "Sediment contaminants are present, bioavailable, and bioaccumulative." Although this statement is supported by available data in the DTR in a qualitative sense, the presence, bioavailability, and bioaccumulative potential of chemicals do not, in and of themselves, constitute a human health risk or beneficial use impairment. Impairment cannot be assessed without a quantitative assessment of exposure and toxicity, which Dr. Johns does not provide.

¶ 5.b. "Fish and shellfish at the site contain harmful levels of contaminants to human anglers." This conclusion requires an exposure and toxicity assessment. Because Dr. Johns does not provide any such assessment, it appears he is relying solely on the Tier II human health risk assessment contained in the DTR, which is critically flawed. See 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. (March 11, 2011) ("Ginn 2011"); Chemrisk, Brent Finley, Ph.D., Expert Opinion Letter Regarding the Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 (March 11, 2011) ("Finley 2011"). The DTR Tier II human health risk assessment for both recreational and subsistence anglers assumes a highly unrealistic fractional intake from the Site of 100 percent. A quantitative assessment with more realistic assumptions concerning fractional intake, conducted in a manner consistent with regulatory guidance and precedents, would conclude that no unacceptable risk for human anglers exists. Ginn 2011 at 92-98; Finley 2011 at 23-28; 36-51.

¶ 5.c. "The mobility of fish and lobsters indicates a risk to anglers who fish outside the Site boundaries." No quantitative exposure analysis is presented to substantiate this claim, and no analysis of off-site angler exposure is contained in the DTR. Site-related contaminants carried by motile fish and lobsters to areas frequented by anglers can only pose a risk to human consumers if they are caught and consumed in sufficient quantity and frequency to exceed chemical-specific toxicity thresholds. Without data to support this claim, it is purely speculative, and without scientific basis. Furthermore, the Ginn and Finley expert reports document that there is no risk to recreational or subsistence anglers. Ginn 2011 at 76-100, 109; Finley 2011 at 7-51.

¶ 5.d. "Shipyard activities disturb sediments, creating beneficial use impairment throughout the Bay." While it is likely, and Site-specific data support the notion that a certain degree of vertical mixing and resuspension of buried sediments takes place within the Shipyard leasehold, in areas where vessel movements and engine testing take place, there is no analysis of any kind presented to support Dr. Johns' assertion of Bay-wide impacts. The DTR does not contain any quantitative analysis of sediment transport beyond the site boundaries, and Dr. Johns does not claim to have performed any such analysis or present any evidence that would support his allegation of beneficial use impairment beyond the Shipyard Site boundaries.

Port Comment No. 18 (Exhibit No. 3, Declaration of Expert Michael Johns, ¶ 6): It is my opinion that COCs are bioaccumulating in biota for the following reasons:

a. **Laboratory exposures to site-collected sediments established that statistically significant accumulations of selected contaminants (arsenic, copper, lead, mercury, zinc, TBT, total PCBs, and high molecular weight PAHs) occur in clams that are in direct contact with and ingest contaminated sediments, providing evidence that Site sediments contribute to the contaminant residues in the tissues of benthic organisms.**

b. **Benthic organisms are an important component of marine food webs and are a major component of the diet for both the sand bass and spiny lobster as well as many other fish, invertebrate and bird species.**

c. **Many of the fish and shellfish that prey upon contaminated benthic organisms within the Site can be consumed by people, are highly mobile and can migrate off the Site throughout large portions of San Diego Bay. These mechanisms contribute to the transfer of contaminants from the sediment to higher order receptors (including those relevant to human exposure) outside of the Site. The life histories of sand bass and spiny lobster, the two species targeted for human health evaluation at the Site, involve migration over large portions of San Diego Bay?**

d. **PCBs are bioaccumulative, and cleanup is necessary for incremental improvement in the beneficial use of San Diego Bay by recreational and subsistence fishers.**

Dr. Johns enumerates four reasons to believe that Shipyard Site sediment contaminants are accumulating in biota. While the Site-specific data and the analyses contained in the DTR do support the generic conclusion that some bioaccumulation of COCs occurs, nothing put forward in this comment supports his assertion that bioaccumulation results directly in beneficial use impairment. Such a conclusion could only be supported by a quantitative exposure and toxicity assessment for higher trophic order consumer species, and Dr. Johns apparently relies solely on the food web associated risk assessments presented in the DTR. The flaws inherent in the DTR Tier II human health assessment are described in Ginn 2011. See Ginn 2011 at 79-94. The DTR Tier II aquatic dependent wildlife risk assessment is similarly flawed. This is so because all wildlife exposure calculations in the DTR were based on a highly unrealistic assumption of 100 percent area use for all receptors and exposure scenarios, and included inappropriate toxicity reference values for lead. See Ginn 2011 at 59-64, 71-73.

A quantitative risk assessment using realistic exposure and toxicity assumptions, performed and interpreted in accordance with regulatory guidance and precedent would conclude that no unacceptable risk for wildlife exists. See Ginn 2011 at 59-78. Accordingly, there is no justification for remediation to protect human or wildlife receptors on the basis of food web mediated exposure.

Port Comment No. 19 (Exhibit No. 3, Declaration of Expert Michael Johns, ¶ 7): It is my opinion that Site activities likely expose and/or redistribute legacy contaminants and create an ongoing source to San Diego Bay based on the following:

a. **Site activities contribute to the release and potential transport of sediment-bound and dissolved contaminants in San Diego Harbor.**

b. **While legacy contaminants can be buried over time by natural sedimentation, subsurface contaminants can be exposed through vessel maneuvering, engine testing, and other Site activities.**

c. **Resuspension of bottom sediments can increase the bioavailability of contaminants (e.g., contaminants can temporarily partition to the water prior to settling back to the bottom) and serve to locally redistribute contaminants.**

d. **This physical reworking of the sediments in areas impacted by Site contaminants creates an ongoing source to San Diego Bay and continues to impact beneficial uses through the mechanisms discussed above.**

Dr. Johns cites four reasons to believe that physical disturbance and resuspension of Site sediments is taking place. As noted above, a certain degree of vertical mixing and resuspension of buried sediments is possible in certain areas of the Shipyard Sediment Site where vessel movements and engine testing take place. This factor has been acknowledged since the early stages of the Sitewide Sediment Investigation. See Exponent 2003, Table 4-2. However, the shipyard activities and Site conditions described by Dr. Johns have been ongoing for several decades, and any effects on exposure due to them are already factored into current contaminant distributions, and the existing exposure and risk assessments. As noted above, the DTR Tier II risk assessments, when adjusted for more realistic and scientifically defensible exposure assumptions, indicate no unacceptable risk for human anglers or aquatic dependent wildlife. See Ginn 2011 at 59-78. Therefore, nothing in Dr. Johns description of physical conditions at the Site substantiates or supports his assertion of impaired beneficial use at the Shipyard or in San Diego Bay.

Port Comment No. 20 (Exhibit No. 3, Declaration of Expert Michael Johns, ¶ 8): In my opinion, the process used by the Water Board to identify areas requiring remedial actions (e.g., use of polygons to define the remedial footprint) was appropriate. In using the polygons, the Water Board recognized that species such as fish and spiny lobster are mobile and that exposure to Site contaminants can occur site-wide rather than only at a single location. In developing the proposed remedial footprint, the Water Board correctly addressed impairment to more sedentary species, such as the organisms that form the benthic community. The factors used by the Water Board to select "worst first" polygons are consistent with my findings.

No response necessary. Dr. Johns' views on the appropriateness of the Regional Board's methodology has no bearing on whether the proper outcome was reached.

Port Comment No. 21 (Exhibit No. 3, Declaration of Expert Michael Johns, ¶ 9): It is my opinion that the remedial footprint contemplated by the DTR will adequately address risks posed by contaminated sediments within the Site in accordance with the Water Board's responsibility to protect the beneficial uses of waters of the state pursuant to California Water Code section 13304, with the following caveats:

a. Polygon SW29 - Only a portion of this polygon was included in the proposed remedial action footprint; the remaining area will be the subject subsequent action by the Water Board. Having reviewed additional data collected from within the boundaries of the SW29 polygon (i.e., split sample data from the samples collected by SDG&E under Order No. R9-2004-0026), I found that total PCB concentrations measured in samples represent some of the highest found within the Site. In addition polygon SW29 is at the edge of the study area and represents an unbounded area of higher concentrations of total PCBs. Because ofthese factors (i.e., high PCB concentrations not bounded by sediment data showing lower concentrations), the portion of polygon SW29 not currently included in the remedial footprint warrants subsequent action.

b. **Polygon NA23 -The DTR acknowledges the high ranking of this polygon using the "worst first" analysis but concludes that it is technically infeasible to dredge because doing so would adversely affect Pier 12, the tug boat pier, and the riprap shoreline, as well as undermine the sediment slope for the floating dry dock sump. However, other areas in which dredging is not feasible are currently included in the remedial action footprint. Alternative remedial technologies proposed in these latter areas include capping and backfill. The constraints that precluded dredging in polygon NA23 (e.g., inaccessibility of sediment under piers) appear to have been overcome for**

these other areas. Therefore, the decision not to include polygon NA23 in the remedial action footprint on the basis of technical feasibility should be re-evaluated.

Dr. Johns' comment with respect to polygon SW29 suggests that remedial action should occur at all areas of polygon SW29 not included in the DTR remedial footprint due to PCB concentrations that are "…some of the highest found within the Site" and because the polygon is near the edge of the study area. However, he presents no analysis that suggests the proposed remedial footprint is insufficient to protect beneficial uses, nor does he explicitly assert that PCBs (or any other COC) concentrations at polygon SW29 pose an unacceptable risk or beneficial use impairment that requires remediation to mitigate. He apparently is suggesting that the remedial footprint be expanded solely on the basis of relative chemistry – only one leg of the Triad analysis – and not on the basis of biological effects or receptor exposure. The spatially-weighted average exposure approach for assessing food web risks, and the weight of evidence approach for assessing risk to aquatic life, both of which Dr. Johns apparently agrees with, support the protectiveness of the DTR proposed remedial footprint, even given the extreme assumptions of the DTR exposure analyses for humans and wildlife.

Furthermore, Dr. Johns' comment with respect to polygon NA23 appears to be premised on the notion that "inaccessibility of sediment under piers" is the primary reason why dredging is infeasible at polygon NA23.

In fact, remediation of polygon NA23 is significantly more problematic than the remediation of other polygons, including those where sediment is inaccessible due to the presence of an overwater pier, due to the unique combination of conditions at NA23.

Specifically, NA23 is comprised largely of steep and lengthy slopes, which are located immediately adjacent to the pile-supported structure of Pier 12 and the armored shoreline, and which leave little to no room in which to establish a stabilizing offset distance. NASSCO Comments, Attachment D, Anchor QEA Technical Memorandum at 2 (May 26, 2011). These sloping areas are inclined at up to approximately 3H:1V (close to the sediment's natural angle of repose) and encompass 30 to 40 feet of vertical relief, making them among the steepest and highest in relief of any slopes at the shipyard site. Id. In such situations, dredging on any part of the slope must be accompanied by dredging to a similar extent all the way up the slope in order to maintain overall slope stability; otherwise, undredged areas higher up would quickly collapse into dredged areas below. Id. at 2-3.

However, since the upper portions of the slopes at NA23 are adjacent to Pier 12 and the armored shoreline slope, removal of material would lessen the stability of these features, and necessitate significant structural improvements to prevent catastrophic collapse of these features. Id. at 2-3. Elsewhere on the project site, such a scenario can be mitigated by installing a rock buttress alongside the structure of slope, so that it will be less likely to be undermined or weakened. Id. at 3. At polygon NA23, however, there is limited to no room in which to add such a feature, and in any event, situating one at the top of a dredged slope would be inherently unstable due to the fact that there is insufficient room to maintain a stabilizing offset distance. Id.

Thus, the unique set of conditions found at NA23, including the (1) steep slopes, (2) presence of adjoining features, and (3) limited ability to counteract the destabilizing influence of dredging along those features, renders remediation of NA23 technically infeasible.

Finally, Dr. Johns provides no biological or risk basis for concluding that NA23 should be added to the remediation footprint. The available data for Station NA23 suggest the opposite in fact (see summary below). Based on relatively low chemistry, and the lack of toxicity, benthic impacts from sediment contamination at NA23 are not considered likely. This area is known to be periodically disturbed by raising and lowering of the large floating dry dock, and it is likely that the single benthic community indicator that was outside reference conditions (total abundance) is due to physical disturbance. Accordingly, NA23 was properly excluded from the proposed remedial footprint in the DTR.

<u>Station NA23</u>
Primary COCs are relatively low:

- Composite SWAC ranking = 31 of 66 polygons
- Copper ranking = 11 of 66 polygons
- Mercury ranking = 13 of 66 polygons
- HPAH ranking = 36 of 66 polygons
- PCB ranking = 20 of 66 polygons
- TBT ranking = 36 of 66 polygons

Chemistry is below conservative biological benchmarks:

- No exceedances of 60% LAETs
- SS-MEQ = 0.72 (less than 0.90 benchmark)

No direct evidence of impacts to benthic community:

- Non-Triad Station in Phase 2
- Triad Station in 2009: "Possible" benthic impacts
- DTR chemistry score = moderate
  SQGQ1 is less than 1.0. Only one chemical exceeds both DTR SQG and UPL.
- DTR toxicity score = low
  Amphipod, and urchin tests both scored above reference LPL.
- DTR benthic disturbance score = moderate
  The total abundance is below that found in the reference condition. However, the other three indicators show no sign of disturbance. BRI is below the reference UPL. Number of taxa and diversity index are above reference LPL. The relatively low abundance is likely the result of physical disturbance in this area, due to dry dock operations.
- No SPI data

Port Comment No. 22 (Exhibit No. 4, Declaration of Expert Ying Poon, ¶ 12): The Bay Model shows that, during a 1-year flood event and a 100-year flood, the clay and silt deposition patterns differ from the transport patterns of salinity and suspended sediment. The fresh water plume extends throughout the Site, showing a northward transport. The suspended sediment plume is visible in the Site, but the clay deposition pattern shows that most of the clays will settle elsewhere in the bay. The silt mainly deposited near the creek mouth, with some deposited in the shipyard areas and further north. The clay and silt deposition patterns determined from the Bay Model were consistent with the other sediment transport studies conducted by the U.S. Navy for Chollas Creek.

The Port has not yet provided the Regional Board or the Designated Parties with Dr. Poon's hydrodynamic and water quality numerical model (the Bay Model), summarized in his declaration. While he has applied a well known hydrodynamic and water quality model, he provides no description of the model grid and the limited description of the data used to set up the model and the data used to calibrate and verify the model is well below standard modeling practice. Accordingly, it is impossible to verify his conclusions. A model cannot be properly evaluated unless there is a demonstration that the model input data were representative and that the model calibration and validation results were a reasonable representation of actual field data.

It is notable, however, that Dr. Poon concludes that sediment is transported by Chollas Creek storm water flows to the Site.

Port Comment No. 23 (Exhibit No. 4, Declaration of Expert Ying Poon, ¶ 12): The Bay Model shows that, during a 1-year flood event and a 100-year flood, the clay and silt deposition patterns differ from the transport patterns of salinity and suspended sediment. The fresh water plume extends throughout the Site, showing a northward transport. The suspended sediment plume is visible in the Site, but the clay deposition pattern shows that most of the clays will settle elsewhere in the bay. The silt mainly deposited near the creek mouth, with some deposited in the shipyard areas and further north. The clay and silt deposition patterns determined from the Bay Model were consistent with the other sediment transport studies conducted by the U.S. Navy for Chollas Creek.

Dr. Poon's conclusions are not credible. While he has applied a well known hydrodynamic and water quality model, he provides no description of the model grid and the limited description of the data used to set up the model and the data used to calibrate and verify the model is well below standard modeling practice.

Furthermore, the critical problem with Dr. Poon's declaration is that he relies on the model's portrayal of the deposition of clay and silt size particles based on his characterization of inflow from Chollas Creek and ignores sediment data which indicates where clay and silt size particles derived from Chollas Creek actually do settle out. For example, Figures A-3 through A-5 of SCWRP, 2005, Sediment Assessment Study for the Mouths of Chollas and Paleta Creek, San Diego Phase I Report: Appendix A – F**,** clearly shows deposition of not only silt, but also clay even within the mouth of Chollas Creek. For this reason, Dr. Poon's statement that fine-grained particles settle out in the mouth of Chollas Creek and that clay-size particle are dispersed throughout the Bay with very minimal deposition in the SY should not be considered.

Port Comment No. 1 (Exhibit No. 4, Declaration of Expert Ying Poon, ¶ 13): Based on the Bay Model simulation results, the Exponent Report overestimates Chollas Creek as a source of toxics to the Site based on the results shown in the Schiff Report. This is because:

a. **Transport of the fresh water flows from Chollas Creek moves northward during ebb tides and southward during flood tides;**

b. **A snapshot of the fresh water plume does not necessarily reflect the corresponding sediment deposition patterns;**

c. **Clay-sized particles from Chollas Creek are predominantly transported throughout the entire San Diego Bay; and**

d. **Silt-sized particles from Chollas Creek tend to deposit shortly after entering the bay near the creek mouth.**

Dr. Poon's conclusions are not credible. As stated above, while he has applied a well known hydrodynamic and water quality model, he provides no description of important data used to set up the model and the data used to calibrate and verify the model. For example, there is no mention in Dr. Poon affidavit of the distribution of particle sizes that he assumed for Chollas Creek runoff. This is a critical issue, because if the distribution is too coarse, the particles settle out too soon and if too fine, the particles settle out too slowly or not at all.

Another critical problem with Dr. Poon's declaration is that he relies on the model's portrayal of the deposition of clay and silt size particles based on his characterization of inflow from Chollas Creek and ignores sediment data which indicates where clay and silt size particles derived from Chollas Creek actually do settle out. For example, Figures A-3 through A-5 of, Sediment Assessment Study for the Mouths of Chollas and Paleta Creek, San Diego Phase I Report (SCWRP and U.S. Navy, 2005): Appendix A – F**,** clearly shows deposition of not only silt, but also clay even within the mouth of Chollas Creek, as shown in Figure 2 below. For this reason, Dr. Poon's statement that fine-grained particles settle out in the mouth of Chollas Creek and that clay-size particle are dispersed throughout the Bay with very minimal deposition in the SY should not be considered.

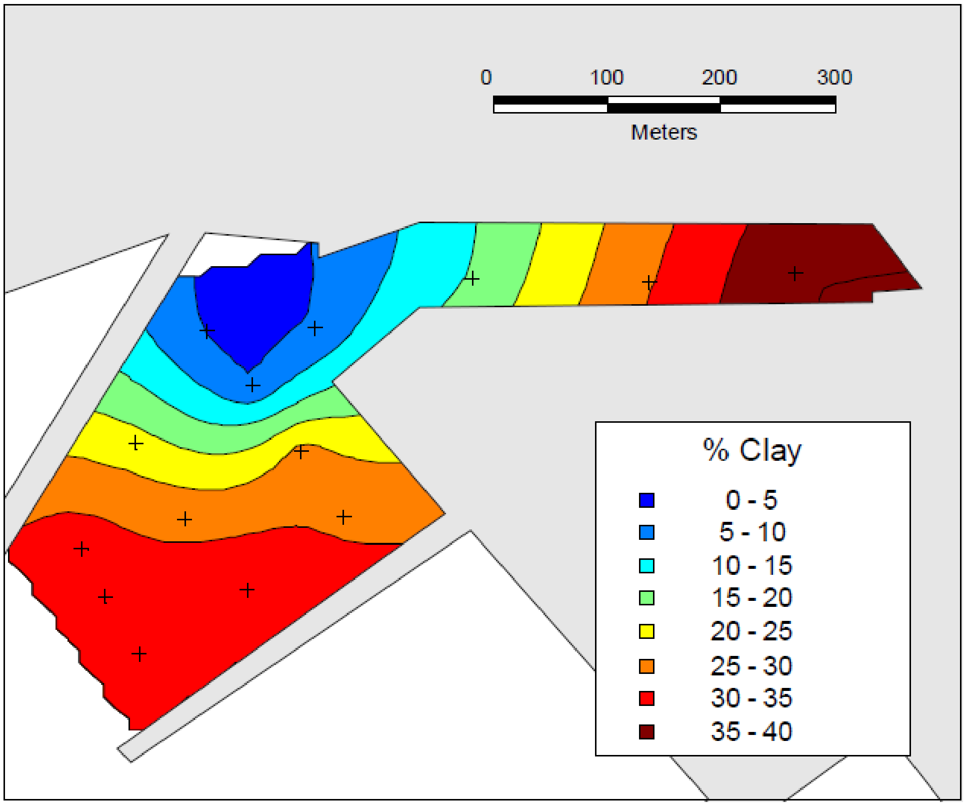

Figure 2. Shown is Figure A-4 from SCCWRP and U.S. Navy (2005) depicting the distribution of clay a Chollas Creek.

Port Comment No. 25 (Exhibit No. 4, Declaration of Expert Ying Poon, ¶ 14): Consequently, for a 100-year rain event, the predicted clay deposition thicknesses at the Site are less than .04 mm and the predicted silt deposition thickness is less than 1 mm. For the more typical 1-year rain event, the predicted clay deposition thickness at the Site is .002 mm and the predicted silt deposition thicknesses are less than .05 mm.

Dr. Poon's conclusions are not credible for the reasons set forth in Exponent's response to Port Comment No. 24.

Port Comment No. 26 (Exhibit No. 4, Declaration of Expert Ying Poon, ¶ 15): Given these results, it is unlikely that Chollas Creek would be a major source of contaminants that bind with fine sediments to the NASSCO and BAE shipyards. Even under are 100-year event, sediment deposition at the Site was predicted to be insignificant compared to the proposed remedial dredge depths. Based on the remedial footprints and dredged volumes specified in Tentative Cleanup and Abatement Order No. R9-2011-0001, the remedial dredge depths for BAE and NASSCO were estimated to be approximately 1.4 m and 1.9 m, respectively. The Bay Model results show that it would take thousands of 100-year rain events for sediment discharging from Chollas Creek to have accumulated to similar thicknesses at the remedial dredge depths.

Dr. Poon's conclusions are not credible for the reasons set forth in Exponent's response to Port Comment No. 24.

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Exponent

EXTERNAL MEMORANDUM

TO: T. Michael Chee, NASSCO

FROM: Gary N. Bigham

DATE: June 23, 2011

PROJECT: PH10719.001 1003

SUBJECT: Critique of the Navy's Apportionment Report

Introduction

The U.S. Navy (Navy) has submitted Comments and Evidentiary Submission dated May 26, 2011 in response to the San Diego Regional Water Quality Control Board's (RWQCB's) Tentative Shipyard Cleanup and Abatement Order (TCAO), No. R9-2011-0001. I have been retained by Latham & Watkins, on behalf of National Steel and Shipbuilding Company (NASSCO) to comment on the Navy's Apportionment Report, which is Appendix B of the May 26, 2011 submittal (U.S. Navy 2011). I have specifically been asked to comment on the Navy's assertions that their contribution of contaminants of concern (COCs) related to storm water loading in Chollas Creek (Pathways 1 and 2) is "negligible."

I was asked to perform this evaluation based on my education and experience related to the transport and fate of contaminants in the environment. I am a principal scientist employed by Exponent, Inc., in Bellevue, Washington. My educational background is in the earth sciences. I have a B.S. degree in geology from Oregon State University and an M.S. degree in geophysical sciences from the Georgia Institute of Technology. My M.S. thesis was an investigation of the movement of water masses from rivers on the Georgia coast across the continental shelf using clay minerals as a natural tracer. I have also completed post graduate course work in Environmental Engineering at the University of Southern California. I am a licensed geologist in the state of Washington (#1303). I have more than 30 years of experience in evaluating the transport and fate of contaminants in the environment.

My current resume is included as Appendix A. Information regarding Exponent is available at www.exponent.com.

The Navy's Apportionment Report

The Navy, in the Appendix B Apportionment Report, presents its evaluation of the RWQCB's contribution evaluation presented in the TCAO. This evaluation, developed in the Board's technical support document (RWQCB 2010), evaluated all specific sources of contaminants to the Shipyard Sediment Site (SY) and provided estimates of the contribution of contaminants from each source. The Board's report identified the following three pathways by which COCs were transported from Navy property to the SY:

- Releases to the Bay from the former Navy 28th Street Landing Station (28th Street) that was operated by the Navy from 1938 to 1956
- Storm water discharges from Naval Base San Diego (NBSD) into Chollas Creek with subsequent transport and accumulation of contaminants in bottom sediment with the SY footprint
- Discharges/releases from NBSD directly into the Bay with subsequent transport and accumulation of contaminants in bottom sediment within the site footprint.

The contribution of each of these pathways is evaluated by the Navy in their Apportionment Report. This critique is focused on the first two pathways, which are related to transport of COCs from Chollas Creek to the SY. In both cases, the Navy acknowledges a contribution, but uses technically faulty arguments to conclude that those contributions are "minimal."

Pathway 1 – Releases from the Former Navy 28th Street Landing Station

The TCAO establishes a contribution from 28th Street to the SY, according to the Navy, based on the presence of COCs observed in two nearby cores at depths that could have been deposited at the time 28th Street was operational. There are no monitoring data from the period of operation to corroborate the sediment data. The Navy presents historical evidence to clarify the extent of Navy facilities at that time. However, faced with a general lack of data, the Navy falls back to estimating its contribution from 28th Street based on the surface areas and periods of operation of the BAE Systems San Diego Ship Repair, Inc. (BAE), NASSCO, and 28th Street. The surface areas and periods of operation were multiplied by the Navy to obtain acre-years for each facility and then calculate the percentage of the total acre-years for each facility, which becomes the allocation for each facility.

This approach is completely irrelevant to contaminants in sediments near 28th Street because it presumes that all storm water-related COCs, derived from surface runoff, from the entire surfaces of the BAE and NASSCO facilities, contributed to the small area near 28th Street (near the two sediment core locations), which they did not. Even if this were appropriate, the Navy biases the result further by limiting its area of contribution to just 28th Street (one acre) and disregarding the area of the rest of the NBSD. Finally, consideration of storm water runoff only from surfaces ignores inputs from historical point sources that were likely much more significant before implementation of the Clean Water Act, California Porter-Cologne Act, and point source permitting programs. The Navy's conclusion regarding its historical contribution from 28th Street is not credible and should not be considered.

Pathway 2 – Storm Water Discharges from NBSD to Chollas Creek

The RWQCB's (2010) Draft Technical Report (DTR) developed estimates of the contribution of storm water runoff from NBSD to the annual loading of copper, lead, and zinc from Chollas Creek to San Diego Bay (the Bay). The Navy presents arguments related to the transport of sediment from Chollas Creek to the SY and spatial gradients in the deposition of sediment derived from Chollas Creek, including the Navy's contribution, to conclude that the Navy's contribution to the SY is even smaller than that determined by the Board and is "negligible."

Transport

Studies of the mass loading of contaminants from Chollas Creek and their transport to the Bay and the SY show a consistent pattern of transport of sediments into the Bay. The Navy argues that their contribution to Chollas Creek loading developed by the Board should be reduced because much of the suspended sediment settles out in Chollas Creek before it can be transported and deposited at the SY. In support, the Navy presents information on the trapping efficiency of sediment in Chollas Creek.

Trapping efficiency is the amount of sediment and particulate-bound COCs that settle and are retained in the mouth of the creek and at the shoreward end of Chollas Channel compared to particles that are exported to the Bay. Based on numerical modeling results, the average trapping efficiencies at the Chollas Creek mouth are reported to be about 46 percent, which means that approximately 54 percent of the solids are exported to the Bay, and potentially, toward the SY. According to the Navy, most of the trapped solids (99 percent) are the largest, fastest settling particles and most of the exported solids are silt (25–57 percent) and clay (99.8 percent). The Navy correctly points out that this is significant for the transport of contaminants because smaller particles carry a higher percentage of the total Chollas Creek storm water COC loading. This is true because the smaller particles have more surface area per unit weight for COCs to adsorb to.

The Navy concludes that their contribution to the Chollas Creek storm water loading should be reduced to reflect the trapping that occurs at the creek mouth. The critical problem with this argument is that the solids in the Navy's storm water runoff are exactly the finer-grained (silt and clay – less than 62.5 μm) solids that are largely not retained in the mouth of Chollas Creek. Roger et al. (1998) as cited in Pitt et al. (2004) showed that the majority of sediment transported by stormwater runoff from a roadway was less than 50 μm in diameter. Li et al. (2005) also report that particle sizes from paved roadways were generally in the 10-50 μm diameter range. Although these studies are for roadways, they provide some indication as to expected particle sizes of stormwater-transported sediment that might be expected from paved or impervious surfaces and that these sediments are usually fine grained.

Additionally, because the Navy's property is relatively flat lying, the relatively low-energy runoff would be expected to suspend and transport predominantly fine particles.[1] Alternatively, the steeper slopes (see Weston 2006; p. 47) in the upland portions of the Chollas Creek Watershed would tend to supply a larger and more significant proportion of any coarse grained sediments to Chollas Creek. It is also important to note that of the three Navy storm water outfalls in Chollas Creek, two are near the mouth of the creek, but one is located in the outer portion of Chollas Channel, well beyond (Bayward of) the area of Chollas Creek where sediment trapping occurs. Because little trapping of the smaller particles that carry the adsorbed contaminants in storm water actually takes place in Chollas Creek, a reduction of the Navy's allocation is not appropriate.

Spatial Gradients (Figure 11)

The Navy argues that modeled patterns of contaminant transport show that concentration gradients decrease with distance away from the mouth of Chollas Creek and thus, do not support the assertion that contamination from Chollas Creek is impacting sediment at the SY. This may be true for the sand-sized sediments that are deposited near the mouth and in the channel. However, Figure 11 of the Navy's report clearly shows transport and deposition of silt and clay, the most important size fractions with respect to COC transport, in the SY. For the same reasons noted above, a reduction of the Navy's allocation is not appropriate.

Spatial Gradients (Figure 12)

The Navy presents Figure 12 showing cadmium concentrations plotted against zinc concentrations (in other words, the concentration ratios) for sediments from the Chollas Creek area and the SY. It argues that the ratios should be similar if the Chollas Creek sediments are a significant source of contaminants to the SY. The Navy's Figure 12 indeed shows that the plotted points for the Chollas Creek sediment and the SY sediment fall on different trend lines.

[1] Land in the Navy's property slopes between 0-1 degree based on information in Weston Solutions (2006; p. 47).

The Navy does not report exactly which data points were used in its analysis, or if it analyzed surface or subsurface samples, except to say that the data are from SCCWRP 2005 and Exponent 2001.[2] Similar plots are presented below from contemporaneous surface sediment samples.

Chollas Creek sediment samples[3] are from the top 2 cm, taken in July/Aug 2001 (SCCWRP and SPAWAR 2005). SY stations[4] data are from Exponent collected in 2001 and 2002. Figure 1 is a plot of cadmium and zinc concentrations similar to the Navy's Figure 12. However, these samples of surface sediment collected within a year of each other do not show a clear difference. The data points for Chollas and SY (NASSCO) samples show significant overlap in cadmium – zinc ratios, which indicates that Chollas Creek is indeed a source of COCs to the SY.

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[2] The source of the Navy's data from "Exponent (2001)" is not clear. We do not have a record of this document as it is cited in the Navy's references. Additionally, this document (as cited by the Navy) is not found as a reference in the DTR. The closest document we have is "Exponent. 2001. Technical Memorandum 1 Phase 1 sediment chemistry data for the NASSCO and Southwest Marine detailed sediment investigation. Prepared for NASSCO and Southwest Marine, October 2001."

[3] Stations C01–C14

[4] Stations NA13, NA14, NA22, NA25, NA30, and NA31

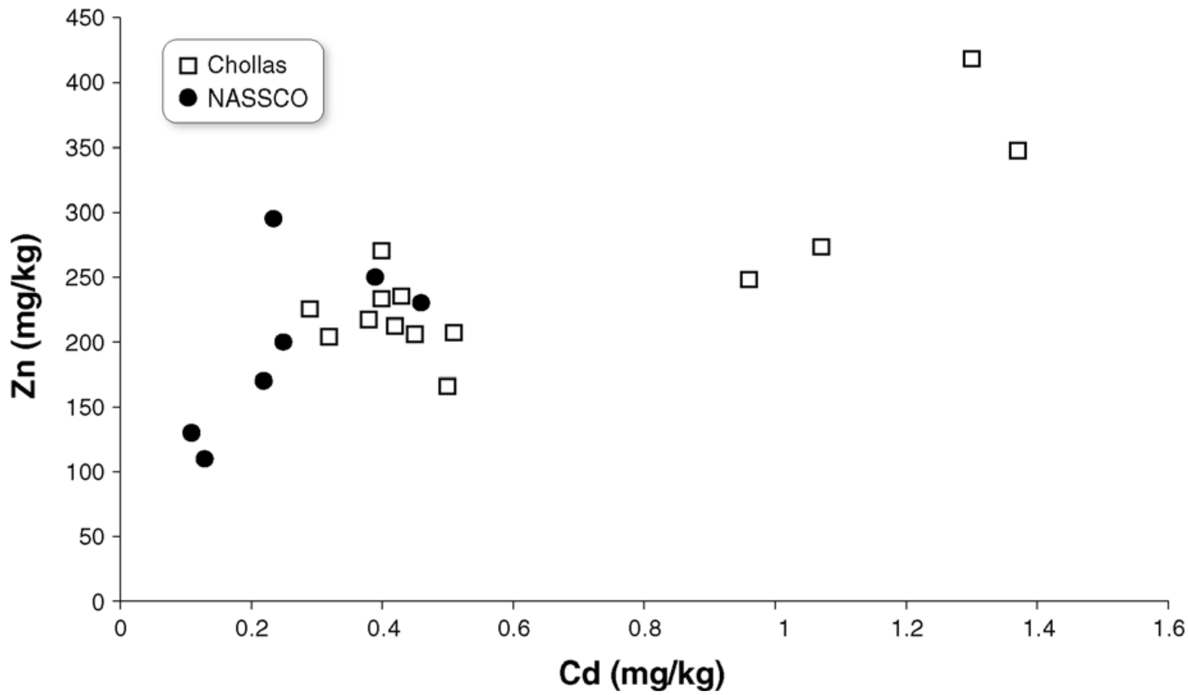

Figure 1. Metals ratios (cadmium and zinc) for sediments from Chollas Creek and SY

A more relevant comparison is a comparison of copper and zinc ratios because they are both significant COCs in the Chollas Creek and the SY area. The ratios of copper and zinc are shown in Figure 2. In this case, copper – zinc ratios for Chollas Creek show a wide spread distribution. There is also significant overlap with the copper – zinc ratios for SY sediments which again indicates, contrary to the Navy's argument, that Chollas Creek sediments are a source of copper and zinc to the SY.

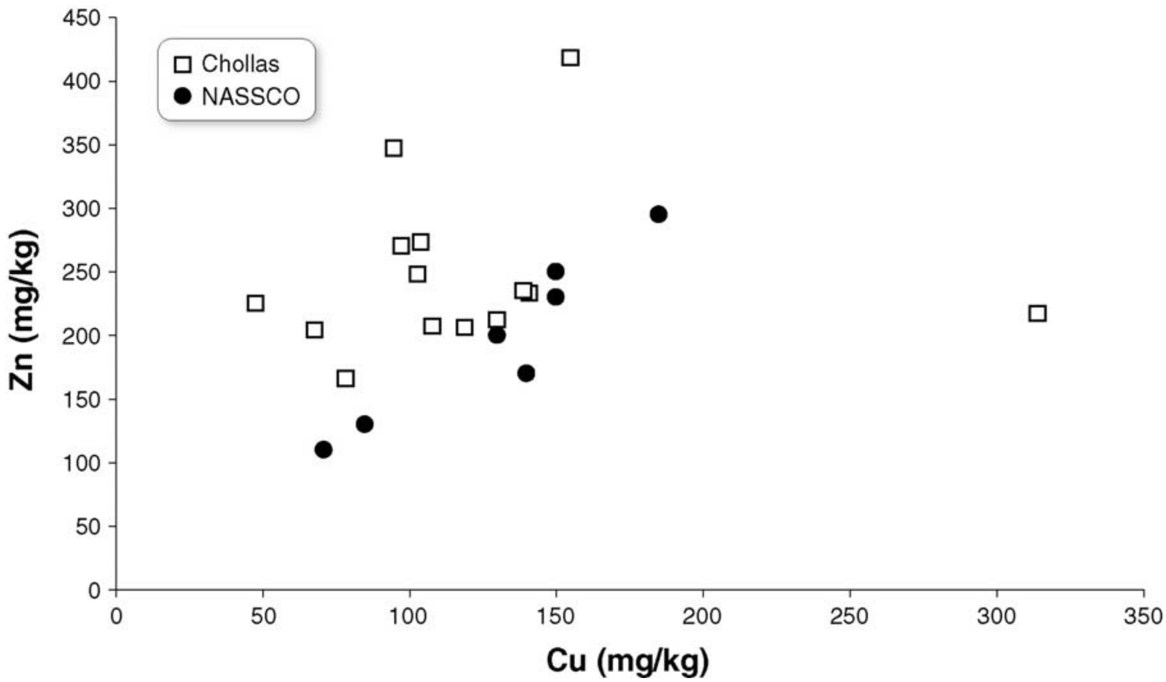

Figure 2. Metals ratios (copper and zinc) for sediments from Chollas Creek and SY

The Navy also notes that concentrations of copper and zinc are higher in SY sediments than in the Chollas Creek sediments. It alleges that this suggests that leachate from Navy vessels in the Chollas Creek region is not a significant source of copper and zinc in the SY sediments. This conclusion is misleading because even though the concentrations are higher in SY sediments this should not detract from the fact that there is a gradient of copper and zinc from the Chollas Creek sediments in the direction of the SY. Sources in the Chollas Creek area may not be the largest sources of copper and zinc to the SY sediment, but they are still a significant source.

Conclusions

The contribution of COCs in storm water runoff from the Navy's facilities near Chollas Creek is not "negligible." In addressing Pathway 1, the Navy attempts to reduce its contribution from 28th Street established in the TCAO. It claims that the contribution from 28th Street can be estimated by comparing the surface areas and periods of operations of the BAE, NASSCO, and 28th Street properties. This approach is not useful because it ignores historical point source contributions that were likely more significant prior to implementation of federal and state point source permitting programs. Because the TCAO apportionment is based on contaminants near 28th Street, the surface areas of the BAE and NASSCO properties are irrelevant.

In addressing Pathway 2, the Navy attempts to reduce its contribution to the COC loading of Chollas Creek established in the TCAO. The Navy first argues that its contribution via three storm water outfalls to Chollas Creek should be discounted because most of the solids-associated COCs settle out in the mouth of Chollas Creek and are not transported further to the Bay and SY. While most sand-sized particles and some silt does settle out before reaching the Bay and SY, the finer-grained particles, which carry most of the adsorbed COC load, do not. It is important to consider that most of the particles in the runoff from the Navy property are likely finer-grained than the storm water arriving from the Chollas Creek watershed. Furthermore, one of the three Navy storm water outfalls is located closer to the Bay and SY in the outer portion of the Chollas Channel.

Using another line of evidence, the Navy, in their Figure 12, presents a plot of cadmium and zinc concentrations, taken from SCRWP 2005 and Exponent 2001, in sediment from the mouth of Chollas Creek and from the SY. The stations and sample depths are not identified. The Navy's Figure 12 shows plotted cadmium and zinc values for Chollas Creek and the SY following distinctly different trend lines, from which the Navy concludes that the cadmium and zinc in SY sediments did not come from the Chollas Creek area. However, plots of cadmium and zinc concentrations in surface sediment samples from nearly contemporaneous data sets collected in 2001 and 2002 do not show distinctly different trends. There is significant overlap in the data, which indicates that sediments in the Chollas Creek area are a source to the SY.

Given the above, the Navy's contributions from 28th Street and storm water discharges to Chollas Creek are not "negligible," as the Navy argues. The Navy's apportionment determined in the TCAO should not be reduced.

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Appendix A

Resume of Gary N. Bigham

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Gary N. Bigham, L.G.
Principal

Professional Profile

Mr. Gary Bigham is a Principal in Exponent's Environmental Sciences practice who specializes in the evaluation of transport, fate, and effects of contaminants in aquatic habitats, soil, sediment, and groundwater. He has managed and been the principal investigator of field, laboratory, and theoretical assessments of a wide variety of contaminants in lakes, rivers, estuarine waters, ocean waters, and groundwater. Mr. Bigham has also directed RI/FSs, human health and ecological risk assessments, cost allocation studies, and NRDAs for sites involving soils, sediments, and waters contaminated with arsenic, chlorinated benzenes, dioxin, mercury, metals, PAHs, PCBs, petroleum hydrocarbons, and solvents. He has also completed several evaluations of mercury in indoor air. Recent examples of contaminant transport and fate analyses include the development of a numerical model of mercury cycling and bioaccumulation for Onondaga Lake; a detailed evaluation and modification of sediment transport and PCB bioaccumulation models for the Fox River and Green Bay, Wisconsin; and an evaluation of the effects of eutrophication on mercury bioaccumulation in the Florida Everglades. Mr. Bigham is the author of numerous publications on the behavior of mercury in the environment.

Mr. Bigham has been designated an expert witness in class action and individual tort claims on the issue of PCB and PAH transport in streams and rivers, and dioxins/furans in a lake; in litigation involving mercury bioaccumulation in the Florida Everglades; and assessments of exposure to mercury vapor, crude oil, and produced water. Mr. Bigham has also completed environmental forensic investigations of mercury-contaminated sediments and soil, groundwater contaminated with chlorinated solvents and petroleum hydrocarbons, and for allocation of remediation costs of a PAH-contaminated sediment site in Boston Harbor. He has also had a lead role in NRDAs related to mercury contamination in surface waters and involving solvents in groundwater. He has also served as a consulting expert on a major NRD claim involving confined animal feeding operations (CAFOs) in Oklahoma and Arkansas.

Mr. Bigham's international experience includes serving as resident manager for a multi-year air quality and marine environmental monitoring program in Saudi Arabia. He led the technical development of a natural resource damage claim for the Kingdom of Jordan to the United Nations Compensation Commission for damages arising from the first Gulf War. He recently completed an environmental assessment for a major oil export facility in Abu Dhabi and evaluated potential human exposure to spilled oil and produced-water discharges in the Amazon basin of Ecuador. He applied a water quality model to predict conditions in and downstream of a proposed reservoir in Bolivia and assessed water quality and greenhouse gas emissions for a proposed reservoir in Guyana. He has also completed an assessment of potential human exposure to mercury vapor from a spill in the Peruvian highlands.

Academic Credentials and Professional Honors

Post-graduate course work in Environmental Engineering, University of Southern California, 1975–1976
M.S., Geophysical Sciences, Georgia Institute of Technology, 1972
B.S., Geology, Oregon State University, 1968

Licenses and Certifications

Licensed Geologist, Washington, #1303
Hazardous Waste Operations Management and Supervisor 8-hour training program

Publications

Bigham G, Law S. Agriculture meets Natural Resource Damage claims. Agricultural Management Committee Newsletter, American Bar Association, August 2009.

Bigham G, Chan W, Dekermenjian M, Reza A. Indoor concentrations of mercury vapor following various spill scenarios. Environmental Forensics 2008; 9(2):187–196.

Chan W, Bigham G, Dekermenjian M. Exposure to elemental mercury from a spill. In: Abstracts—11th International Conference on Indoor Air Quality and Climate, Copenhagen, Denmark, August 17–22, 2008.

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Bigham GN. Zone of influence, inner continental shelf of Georgia. Journal of Sediment Petrol 1973; 31(1):207–21.

Prior Experience

Vice President, PTI Environmental Services, 1987–1997
Senior Scientist, Tetra Tech, Inc., 1974–1987
Environmental Scientist, U.S. Army Corps of Engineers, 1972–1974

Project Experience

Contaminant Transport and Fate

Evaluated the transport and fate of spilled oil and produced water alleged in a toxic tort claim related to oil exploration and production from the Sacha field in the Amazon basin region of Ecuador and provided an expert report for ChevronTexaco.

Evaluated the transport and deposition of PCB-contaminated sediment in a Kentucky river system and provided expert jury-trial testimony for Rockwell International.

Prepared an expert report in a property damage case in Brunswick, Georgia, regarding deposition of mercury and PCBs on intertidal and riparian properties.

Prepared an expert report and provided expert hearing testimony in a class-action property damage case regarding the transport of PCB-contaminated sediment in a stream system at Rome, Georgia, for General Electric.

Prepared an expert report in a property damage case regarding transport of PCB-contaminated stormwater runoff onto a property in Rome, Georgia, for General Electric.

Selected by SERDP (U.S. Department of Defense's Strategic Environmental Research and Development Program) in 2005 to review research grant proposals on "Assessment and Measurement of Processes Impacting the Fate and Transport of Contaminants in Sediments," and in 2006, to review proposals on "Ecosystem Risk and Recovery Assessment for Contaminated Sediments."

Managed an ecological risk assessment and potential natural resource assessment for Honeywell at a tidal marsh in Georgia contaminated by mercury, PCBs, and other substances. The project included a detailed evaluation of mercury species and PCB congeners in sediment, water, and biota, as well as food-web modeling of ecological effects.

Assisted in the design and implementation of field data collection and field experimentation to predict water quality for an open-pit mine in Indonesia.

Provided an analysis of the long-term effects of drilling-mud deposits from offshore oil exploration and production platforms in southern California.

Conducted a program for measuring sediment oxygen demand in Great South Bay, New York, and developed input for a numerical water quality model.

Developed a simple leach-test procedure to evaluate the water quality effects of dredged material disposal. Procedure was adopted as a standard test by the U.S. Army Corps of Engineers and EPA.

Assisted in developing a laboratory selective leaching procedure for the U.S. Army Corps of Engineers to determine how metals are bound to contaminated sediments.

Served as project manager to provide technical support regarding transport, fate, and effects of PCBs for a contractor at a dredging site on the St. Lawrence River at Massena, New York.

Served as project manager to develop a method to predict concentrations of bacteria and suspended sediments at a site within Grays Harbor, Washington, resulting from dredged material disposal at the Point Chehalis disposal site for the U.S. Army Corps of Engineers.

Served as project manager for a critical review of projected risks of spilled oil to the southern sea otter population in California for an oil and gas company.

Managed an analysis of the wave propagation and flushing characteristics of a marina in Puget Sound, Washington. Project included physical modeling and field verification.

Performed stream gauging, determined river-aquifer exchange, and collected historical surface and groundwater data along the Rockaway River, New Jersey.

Environmental Assessment

Performed an evaluation of potential impacts of dredging and related modifications to a container port facility in Buenos Aires, Argentina.

Project manager for an environmental impact assessment for modifications of oil storage facilities at the major oil export terminal at Abu Dhabi, UAE.

Project manager for the investigation of potential dredged material disposal sites within San Francisco Bay, California.

Developed approach and managed the preparation of a draft and final EIS for the National Science Foundation–funded Deep Ocean Drilling Program.

Served as project manager to provide shipboard and technical support to EPA's ocean dumping program. Prepared ocean dumping site designation reports, and developed a QA/QC program for marine sample collection and shipboard and shore-based analyses.

Served as project manager for planning, design, and construction supervision of a marina and related facilities in Tulalip Bay, Washington. Prepared an environmental assessment, and provided permitting support.

Served as project manager for a precision bathymetric survey and the production of bathymetric maps of Boca de Quadra Fjord near Ketchikan, Alaska.

Served as resident manager in Jubail, Saudi Arabia, for an extensive environmental baseline survey. Program included air quality monitoring, marine biological and physical oceanographic surveys, and sediment transport studies.

Performed a preliminary siting survey for a single-point mooring oil terminal on the southern coast of Oman.

Evaluated effluent characteristics and water quality effects of a major oil and gas gathering project in the Arabian Gulf.

Served as assistant project manager of an EIS for a major beach restoration project along the south shore of Long Island, New York. Project involved placing sand dredged from offshore onto the beach.

Performed an analysis of the potential impacts of a proposed single-point mooring oil terminal facility off Morro Bay, California.

Served as contract manager for a marine environmental investigation of the effects of major improvements to the Los Angeles/Long Beach Harbor, California.

Environmental Forensics

Prepared an expert report and provided deposition testimony regarding the extent of contamination and need for remediation at a former chemical manufacturing site near Tacoma, Washington. The project involved review of past manufacturing and waste disposal practices and evaluation of chemical analyses of soil and groundwater data. Degradation of chlorinated and petroleum hydrocarbons in groundwater and groundwater velocities were also evaluated.

Prepared a report on behalf of BP/ARCO and provided deposition testimony in support of a motion to dismiss in a toxic tort claim. The claim involved alleged damages related to vapor intrusion from comingled PCE, TCE, and petroleum hydrocarbon groundwater plumes. The objective of the report was to determine the timing of a release of petroleum hydrocarbons from a wholesale distribution site and whether the plume had reached the plaintiffs' property.

Prepared an expert report and provided deposition testimony in opposition to class certification regarding the sources, transport, and deposition of sediment and associated dioxins and furans in Lake Sam Rayburn, Texas, on behalf of defendants International Paper and Abitibi.

Prepared an expert report regarding the sources, transport, and deposition of contaminated sediments and the chemical fate of associated PCB, PAH, and metals in a small stream in Brockport, New York, for General Electric.

Prepared an expert report on behalf of BP/ARCO regarding the nature of contamination at a former bulk fuel distribution site in Pomona, California. Weathered gasoline and diesel fuel were present on the site along with PCE. One source of PCE to the vadose zone was determined to be a nearby solvent wholesaler site.

Prepared an expert report on behalf of BP/ARCO evaluating the potential contamination of a municipal supply well in Norwalk, California, with 1,1-DCA by near-surface releases from a service station.

Performed field research of circulation patterns on the inner continental shelf of Georgia by using suspended and deposited clay minerals as tracers.

Prepared a historical sedimentation and fate analysis in allocation mediation among three companies for remediation costs of PAH-contaminated sediments at a site in Boston Harbor. Conducted an environmental forensics investigation of the timing and nature of transport and deposition of wastes from coke, coal tar, and manufactured gas plants.

Managed the development of a risk-based cost allocation method to allocate remediation costs at a commercial landfill site in the New Jersey Pine Barrens. Also conducted an environmental forensics investigation to determine the sources of onsite contaminants.

Mercury

Developed estimates of mercury vapor emission rate associated with the ordered removal of brine mud landfills at a former mercury-cell chlor-alkali plant on the Penobscot River in Maine. The emission rates were back-calculated, using AERMOD, from measured vapor emissions from similar material during remediation at another chlor-alkali plant.

Performed a survey of mercury concentrations in indoor air and soil vapor at a chemical facility in Canton, Ohio.

Evaluated potential exposure to mercury vapor related to a spill of elemental mercury over 40 km of highway in the Peruvian highlands. Exposure occurred when residents took the mercury home. The project included construction of a room similar to a rural Peruvian home and measuring mercury vapor concentrations in the room following a controlled mercury release. The results were used to verify a mathematical mercury evaporation and exposure model. Also evaluated mercury in urine data to corroborate model results.

Performed a reconnaissance of the Almaden Quicksilver County Park on behalf of the Santa Clara County Parks and Recreation Department to identify sites of soil erosion. The areas were prioritized according to their potential contribution of sediment and mercury to the Guadalupe River system.

Prepared comments on behalf of the Santa Clara Parks and Recreation Department on the Guadalupe River Mercury TMDL report.

Prepared an expert report in defense of a class action claim against a natural gas utility for mercury exposure related to removal of gas pressure regulators. The work included evaluation of regulator removal procedures and estimation of the potential short- and long-term mercury exposure in indoor air.

Prepared and submitted comments on the TMDL report for mercury in San Francisco Bay on behalf of the Santa Clara Valley Water District.

Provided review and comment of a TMDL for mercury in the Guadalupe River prepared by a contractor for the Santa Clara Valley Water District.

Project manager for a cooperative Natural Resource Damage Assessment for the Guadalupe River Basin that drains the former Almaden Mercury Mining District near San Jose, California. Work also included additional sampling, analyses, and interpretation of mercury data for various media.

Project manager for evaluation of factors that influence bioaccumulation of mercury and other contaminants in fishes for the Michigan DEQ. Also recommended parameters to include in fish monitoring programs. The objective was to ensure that all appropriate parameters needed to identify the cause of long-term trends are measured.

Provided comments for Westinghouse Savannah River Laboratory on the draft TMDL for mercury in the Savannah River developed by U.S. EPA Region 4.

Designated as an expert witness in standard-of-care litigation involving a consulting engineering firm's clean up of a mercury-contaminated building.

Member of a panel of mercury experts to evaluate mercury behavior, bioaccumulation, and remedies at South River, a tributary of the Shenandoah River, Virginia, for DuPont and the VADEQ.

Project manager for evaluation of the behavior, effects, and remediation of elemental mercury spilled in homes from gas pressure regulators in Detroit, Michigan.

Project manager for evaluation of mercury toxicity and treatability in petroleum industry effluents for the American Petroleum Institute. Project also included a separate evaluation of reported mercury concentration data in crude oil.

Managed a project designed to evaluate mercury cycling and bioaccumulation in fresh and estuarine waters to help guide future investigations for the Aluminum Company of America.

Expert witness on the issue of the relationship between mercury bioaccumulation in aquatic food webs and the degree of eutrophication in the south Florida Water Conservation Areas and the Everglades.

Natural Resource Damage Assessment

Served as a consulting expert for a first-of-its-kind NRD claim involving confined animal feeding operations (CAFOs) in Oklahoma and Arkansas. Evaluated animal waste and soil chemical data along with information in nutrient management plans. Evaluated transport of contaminants by stormwater runoff and potential water quality effects on downstream surface waters and a reservoir. Developed a comprehensive web-based compilation of reports and data linked to a GIS map of relevant locations.

Prepared a preliminary estimate of potential natural resources damage liability for a chemical facility in Delaware. Potential damages were related to solvents in groundwater, surface water, and tidal wetlands.

Prepared an expert report and provided deposition testimony regarding delineation of a PCE groundwater plume and associated natural resource damages at a former manufacturing facility in North Brunswick, New Jersey.

Project manager for a cooperative Natural Resource Damage Assessment for the Guadalupe River Basin that drains the former Almaden Mercury Mining District near San Jose, California. Project included development of a Habitat Equivalency Analysis and negotiation of restoration with resource trustees.

Performed a preliminary Habitat Equivalency Analysis of natural resource damages related to mercury contamination of Onondaga Lake, New York.

Project manager to provide an evaluation of a Natural Resource Damage Assessment prepared by the State of New Jersey for a landfill site. Evaluated injuries to fisheries, groundwater, and wetlands and prepared alternative assessment. Project also included development of restoration alternatives.

Developed the technical claim to the United Nations Compensation Commission on behalf of the Kingdom of Jordan for environmental damages to water resources incurred during the Gulf War. Also developed a claim and work plan for monitoring and assessment to further quantify damages.

Directed a preliminary natural resource damage evaluation for a complex aquatic system in Montana affected by mining wastes.

NPDES Permitting

Prepared an expert report regarding compliance of the City and County of Honolulu's Sand Island and Honouliuli municipal sewage treatment plants with terms of their NPDES discharge permits and Section 301(h) waivers from the requirements of secondary treatment. Also addressed the appropriateness of the City and County's applications for NPDES permit and Section 301(h) waiver renewals.

Served as resident manager for a numerical water quality modeling study of the effects of municipal wastewater discharges to all the bays around Long Island, New York.

Served as project manager and technical director to evaluate the fate and effects of submarine tailings disposal to a fjord in southeastern Alaska, for EPA's evaluation of an NPDES discharge permit.

Managed and performed an EPA field evaluation of the effects of fish processing waste disposal on marine waters and sediment at a site in the Aleutian Islands, Alaska.

Managed an investigation for two fish processing companies to support a request to EPA and the State of Alaska for continued discharge of fish processing waste at a site in the Aleutian Islands, Alaska.

Remedial Investigations/Feasibility Studies

Performed an evaluation of potential liability for a multinational manufacturing company related to past offsite disposal of hazardous wastes at facilities worldwide.

Managed a major RI/FS and natural resource damage investigation at Onondaga Lake, New York, for AlliedSignal Inc., to evaluate impacts of historical discharges from soda ash and mercury cell chlor-alkali plants. Project includes modeling mercury cycling and bioaccumulation in the lake and assessing the toxicity of a variety of contaminants in sediments. Results of the modeling and human health and ecological risk assessments will be used to select effective remedies.

Directed an evaluation of human health and ecological risks at the Butte and Anaconda, Montana, mining and smelting sites. Project included preparing risk assessment scoping documents for several operable units where arsenic, cadmium, and lead were the primary contaminants of concern. Also conducted in-depth research on the bioavailability of soil contaminants to demonstrate the reduced risk posed by mining-waste-related soils.

Provided deposition testimony for Shell Oil Company regarding the identification of wastes disposed of at Lowry Landfill (Colorado) as hazardous.

Project director of an RI/FS for the Smelter Hill operable unit of the Anaconda Smelter site in Anaconda, Montana. Investigations involved collecting more than 10,000 soil samples and evaluating soil phytotoxicity, human health risks, and contaminant transport in air and groundwater.

Project manager for technical litigation support related to a Superfund site near Kent, Washington. Project included evaluating organic and inorganic contaminant migration from the site to adjacent property via groundwater and air for a law firm representing two PRPs.

Managed an investigation of the extent of contamination at an industrial site near Grays Harbor, Washington, for a party interested in acquiring the site. Investigation included assessing soil, surface water, and groundwater contamination related to an abandoned municipal landfill, a truck maintenance shop, a wood waste landfill, and a log sort yard. Estimated cleanup costs and initiated soil removal.

Managed development of the work plan of a major historical mining district for the Butte, Montana, Superfund site RI/FS.

Project director to develop a work plan for the Bunker Hill, Idaho, Superfund site RI/FS. The 21-mi^2 site contains mill tailings and lead and zinc processing wastes.

Managed a Phase I RI/FS at a Superfund site in Anaconda, Montana. This complex site contains a wide variety of copper smelting and sulfide ore processing wastes, including approximately 7 mi^2 of impounded mill tailings.

Managed a remedial investigation examining the human health effects of arsenic-contaminated soils and potential remedial actions for Mill Creek, Montana, a small community adjacent to a Montana Superfund site.

Water Quality Modeling

Prepared a water quality evaluation of the proposed Amaila Falls Reservoir in Guyana on behalf of the project developer. Applied the water quality model CE Qual W2 to simulate water quality in the reservoir and downstream. A particular focus of the study was evaluation of greenhouse gases emitted by the pre-reservoir tropical river compared to emission from the reservoir.

Performed a modeling study to evaluate the behavior of discharge plumes from methane extraction facility on the stability of Lake Kivu, Rwanda. Utilized the Computational Fluid Dynamics code to determine the depth of plume stratification. Also evaluated water quality impacts of the wash water discharge on near surface waters.

Prepared a water quality evaluation for the proposed Misicuni Reservoir in Bolivia on behalf of the Inter-American Development Bank. Applied the coupled DYRESM-CAEDYM hydrodynamic and water quality models to predict water quality in the reservoir. Also applied the biogeochemical model PHREEQC to evaluate the release of contaminants from sediments under anaerobic conditions.

Prepared a risk evaluation of mineral oil spilled from a transformer at a hydroelectric dam in western Montana for submittal to EPA Region 8. The evaluation included estimation of the spill rate and transport and dilution, which were compared to anecdotal observations of oil sheen. Special attention was given to the fate of the PCBs contained in the mineral oil.

Managed an evaluation for NCR of sediment transport, water quality, and food-web models applied to PCB-contaminated sediments in the Fox River and Green Bay, Wisconsin, for a potential natural resource damage claim. Also participated on a state-industry work group to evaluate and modify applicable models.

Developed a method to allocate costs to remediate PCB-contaminated sediments in the Fox River, Wisconsin. The method was based on results of a sediment transport model.

Managed and directed technical analysis of legal, technological, and environmental factors related to future ocean disposal of manganese nodule processing wastes for NOAA. Project included development of a simplified waste dispersion model for screening of potential ocean dump sites.

Performed an analysis of oil spill trajectories in the Santa Barbara Channel, California, for an oil company.

Served as project manager and technical director for portions of EPA's evaluation of the fate and effects of drilling muds and cuttings in Alaska's marine waters. Applied the Offshore Operators Committee model to simulate dispersion of the plume.

Served as project manager for an analysis of the fate of drilling mud and cuttings discharges to the Beaufort Sea for two oil companies. Applied the Offshore Operators Committee model to simulate dispersion of the plume.

Served as project manager and technical director for portions of EPA's evaluation of the fate and effects of drilling muds and cuttings in Alaska's marine waters.

Served as project manager for an analysis of the fate of drilling mud and cuttings discharges to the Beaufort Sea for two oil companies.

Performed analyses of the fate and effects on water quality of municipal sewage discharge plumes to marine waters of the U.S. West Coast and Puerto Rico and evaluated compliance with water quality criteria as part of EPA's evaluation of applications, nationwide, for Section 30l(h) waivers from the requirement of secondary treatment.

Managed a numerical water quality evaluation and field verification study for a harbor development project in Saudi Arabia. Performed bathymetric surveys and dye dispersion tests. Measured tides, currents, and alongshore sediment transport.

Served a resident manager of water quality modeling studies of all of the bays around Long Island, New York. The purpose of the studies was to determine the optimum location for municipal sewage outfalls as part of a long-term regional (Section 208) planning program.

Professional Affiliations

- American Chemical Society
- Geological Society of America
- International Society of Environmental Forensics
- Society of Environmental Toxicology and Chemistry
- Associate Member, American Bar Association

Deposition/Trial Testimony

Maine Department of Environmental Protection v Mallinckrodt, Maine Board of Environmental Protection, Penobscot County, Maine, January 25–February 4, 2010. Hearing testimony.

Middlesex Corporation v Phelps, Superior Court of Washington, Pierce County, Case No. 08-2-05524-3, September 9, 2009. Deposition testimony.

Huddleston et al., v. Union Pacific Railroad et al., Superior Court of the State of California, Contra Costa County, Case NO. C 05 – 02394, March 19, 2009. Deposition testimony.

New Jersey Department of Environmental Protection (NJDEP) and the Administrator of the New Jersey spill compensation Fund v Parker-Hannifin Corporation, State Court of New Jersey Docket No.: MID-L-286-06, March 13, 2008. Deposition testimony.

City of Pomona v ARCO et al., U.S. District Court Central District of California, Case No. CV 05 2353 RGK (JTLx), March 27, 2006. Deposition testimony.

Donald Brophy v Philadelphia Gas Works, Court of Common Pleas of Philadelphia County, First Judicial District of Pennsylvania, Civil Trial Division, Case No. 07MR05J1, March 7, 2005. Class certification hearing testimony.

Anderson v. Donahue Industries, Inc., et al., 1st Judicial District Court, Jasper County, Texas, Case No. 24516, April 13, 2004, Deposition testimony.

Richard L. Muller Jr. v. General Electric Company, U.S. District Court Northern District of Georgia, Rome Division, Case No. No. 4:99-CV-294-HLM, May 2002 and March 2004.

Edwin Watters et al. v. General Electric Company, U.S. District Court Northern District of Georgia, Rome Division, Case No. 4:98-CV-0195-HLM, July 8, 1999. Class certification hearing testimony.

Mercer et al. v. Rockwell International, U.S. District Court, Western District of Kentucky at Bowling Green, Case No. 1:87CV-106-H, September 1997. Jury trial testimony.

Sugar Cane Growers v. South Florida Water Management District, U.S. District Court, Southern District of Florida, Case No. 88-1886-CIV-Hoeveler, November 1995.