Appendix D

Responses to Comments

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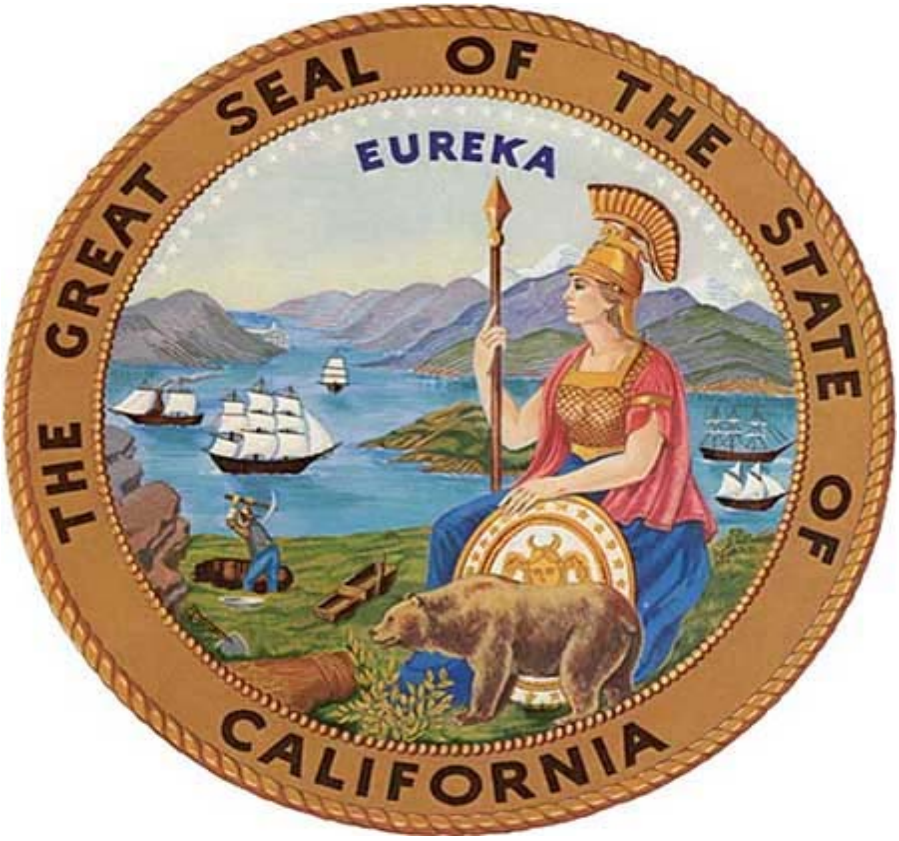
SITE-SPECIFIC WATER QUALITY OBJECTIVES FOR COPPER in SAN FRANCISCO BAY

Responses to Comments



California Regional Water Quality Control Board
San Francisco Bay Region

June 6, 2007

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I. RESPONSES TO WRITTEN COMMENTS ON MARCH 2, 2007, STAFF REPORT AND DRAFT BASIN PLAN AMENDMENT

On March 2, 2007, the San Francisco Bay Water Board released, for public review and comment, the Staff Report on proposed site-specific objectives for copper for San Francisco Bay. We received four comment letters during the public review period that closed on April 16, 2007.

Comment Letters Received:

1. US Environmental Protection Agency, Region IX
2. Bay Area Clean Water Agencies (BACWA)
3. Copper Development Association(CDA)
4. City of San Jose Environmental Services Department

1. Comment Letter No. 1 received from US Environmental Protection Agency, Region IX, Douglas E. Eberhardt, April 16, 2007

Comment No. 1.1: "We encourage Water Board staff to continue to work closely with the NMFS, as the agency has expressed significant concerns regarding sublethal effects on salmonids."

We intend to work with NMFS to resolve the uncertainty associated with possible sublethal effects on salmonids. See also the response to the comments made by Joe Dillon at the May 9, 2007, testimony hearing.

Comment No. 1.2: "The proposed Basin Plan language states that the implementation plan calls for requirements in NPDES permits to support investigations regarding possible effects on the olfactory system of salmonids. EPA encourages Water Board staff to start developing the specifics of these NPDES requirements."

Staff agrees that the details of these permit requirements need to be ironed out. Staff is working internally to develop the details of the NPDES permit requirements for inclusion into NPDES permits. See also the response to the comments made by Joe Dillon at the May 9, 2007, testimony hearing.

Comment No. 1.3: "As we reviewed the staff report, it was unclear how the WER analysis takes into account seasonal effects. Please include a more detailed discussion of seasonal variability in the staff report."

Consistent with the 1994 USEPA WER guidance document, the toxicity study was designed to investigate the possibility of seasonal differences in WERs. This was accomplished by computing WERs for four sampling events – two in the dry season (September 2000 and June 2001) and two in the wet season (January and March 2001). The WERs for three of these events were very similar, but the WERs for one of the wet season events (January 2001) were markedly higher. Because of the consistency between the two dry season events and the March 2001 wet season event, we did

not find clear evidence of a seasonal pattern to the toxicity data so the entire data set was used to compute the geometric means used derive SSOs as recommended by USEPA guidance. To make this point clear in the Staff Report, the following passage was added to the end of the second paragraph on pg. 4-9.

> Although the measured WERs were noticeably higher during the January 2001 wet season sampling event, the WERs were consistent for the three other sampling events. Therefore, there was no clear evidence of a seasonal pattern in the WERs.

Comment Letter No. 2, Bay Area Clean Water Agencies (BACWA), Michele M. Pla, Executive Director, April 16, 2007

Comment 2.1: "Despite a nationally recognized pollution prevention and pretreatment program, BACWA members cannot comply with current CTR limit for copper."

Comment noted.

Comment 2.2: "Sublethal effects of copper in freshwater laboratory studies cannot be directly applied to San Francisco Bay."

Comment noted. In fact, the Staff Report contains language that makes this very point. This lack of applicability motivates the need to investigate this possible effect in marine/estuarine waters.

Comment 2.3: "BACWA requests that the Implementation Plan language be changed to state that support for additional studies to reduce uncertainties will be implemented through participation in the CEP and not via requirements in individual NPDES permits."

The Basin Plan states that the "requirement to conduct or cause to be conducted technical studies to investigate possible copper sediment toxicity and sublethal effects on salmonids" should be placed in NPDES wastewater permits. This language does not call out specifically the Clean Estuary Partnership or any other group to support these studies, but the language does provide the flexibility to do so. Thus, no change to the amendment language is needed to accommodate the commenter's request. See also the response to the comments made by Joe Dillon at the May 9, 2007, testimony hearing.

Comment 2.4: "Requiring a water quality based effluent limit in the face of no reasonable potential is overly protective and violates state and federal law. Both federal regulations at 40 C.F.R. §122.44(d) and state law at Water Code section 13263.6 only require the imposition of effluent limitations where the discharge will cause, or has the reasonable potential to cause or contribute to an excursion of an applicable water quality objective or standard. "

Section 2 of the Staff Report explains that mandatory copper effluent limits are proposed for all Bay wastewater dischargers. The SIP specifies a methodology for determining which priority pollutants require effluent limits. Step 7 of Section 1.3 of the SIP provides that Water Boards may

find that numeric effluent limits are required for pollutants even if Steps 1 through 6 do not trigger the requirement for the water-quality based limits. We are employing Step 7 to assert that mandatory numeric effluent limits for wastewater sources are needed, given the need to comply with antidegradation policies and to ensure full commitment of resources from dischargers to maintain current performance and pollution prevention efforts. Thus, the effluent limitations are consistent with state law.

Comment 2.5: "BACWA requests that the Regional Water Board remove the automatic effluent limitations or, at least, include a program evaluation component into the proposed Basin Plan language that will require an adaptive management review and evaluation of this standard and the implementation after 5 or 10 years. The purpose of this review would be to evaluate the effectiveness of these requirements and to determine if there is new scientific or water quality information that could support revisions to this site specific objective or its implementation measures. "

We acknowledge the clean water agencies' continued efforts toward providing effective treatment of wastewater, pollution prevention and restoration of water quality in San Francisco Bay. However, permit effluent limits are an effective tool for maintaining the water quality of San Francisco Bay. Therefore, staff does not support the inclusion in the proposed Basin Plan amendment of a provision to review and evaluate effluent management requirements after 10 years. The triennial review regularly conducted by the Water Board provides an opportunity to identify and address any issues related to the implementation programs in the Basin Plan.

Comment 2.6: "BACWA encourages the Water Board to adopt a nickel chronic SSO of 11.9 μg/L throughout the Bay."

Based on our review of available information, we found that it is not necessary to adopt SSOs for nickel in the Bay. There are other regulatory means such as metal translators to resolve any potential permit compliance challenges for wastewater dischargers. If future information suggests that it is necessary to adopt nickel SSOs, we will consider doing so.

Comment 2.7: "BACWA encourages the Water Board to remove nickel from the 303(d) list as BACWA had requested of the State Water Board in our October 20, 2006 comment letter."

Comment noted. The Water Board will consider this request in the context of preparing the 2008 303(d) list of impaired waterbodies.

Comment Letter No. 3, Copper Development Association, Inc. (CDA), Ray Arnold, April 16, 2007

Comment 3.1: "Could you please add language to state specifically what the Board Staff is referring to when using the term "wash water" in Table 5-1 on page 5-2 of the proposed basin plan amendment. As stated, there may be confusion as to what needs to be prohibited from discharge to the storm drains. Does it mean the water solution resulting from the intentional act

of rinsing any cleaning and treating chemicals used on copper architectural features (particularly patina treatments) involving corrosive solutions that may contain relatively high concentrations of copper?"

The control measure is intended to target cleaning and treating copper architectural features (particularly patina treatments) using corrosive solutions that may result in wash waters with high copper concentrations. The discharge of such wash waters should be prevented.

To make it clear how the architectural copper control measure should be implemented, we made the following change to Table 5-1 on page 5-2 of the Staff Report.

> ~~1)~~ Prevent storm drain discharges of waste solutions generated from cleaning and treating copper architectural features (e.g., patina treatments, or other corrosive cleaning solutions) both during installation and throughout the life of the feature.
>
> ~~2) Prohibit discharge of copper roof wash waters to storm drains during life of the feature.~~

Comment Letter No. 4, City of San Jose Environmental Services Department (The City), John Stufflebean, Director, April 16, 2007

Comment 4.1: "The City is concerned that the Water Board's permitting section may interpret the language in the staff report as requiring NPDES permittees to "conduct or cause to be conducted" specific Uncertainty Reduction studies (sediment toxicity and sublethal effects on salmonids). The City recommends that the staff report explicitly state that active participation in the Clean Estuary Partnership (CEP) shall fulfill the requirements of this provision."

The Basin Plan states that the "requirement to conduct or cause to be conducted technical studies to investigate possible copper sediment toxicity and sublethal effects on salmonids" should be placed in NPDES wastewater and urban runoff management agency permits. This language does not call out specifically the Clean Estuary Partnership or any other group to support these studies, but the language does provide the flexibility to do so. Thus, no change to the amendment language is needed to accommodate the commenter's request.

Comment 4.2: "The staff report (Section 3.3) discusses the importance of particulate copper from resuspended sediments as a significant source of copper in the Bay. It also discusses the effect of organic complexation on dissolved copper levels (p. 3-7) and the toxicity of copper when it is in the unbound, free ionic state. However, the staff report does not synthesize the discussion of these three issues clearly. For example, the report discusses the high suspended sediments loads and associated high contaminant levels, including copper, at station BD15 at the mouth of the Petaluma River. This can be seen in Figure 3-3, which indicates that dissolved copper levels are much greater than at other stations. What is not discussed in the report, however, is that these high particulate and dissolved copper concentrations may not be bioavailable. The purpose of the Water-Effect Ratio (WER) study from which the SSOs were derived, was to determine the bioavailability of copper spiked into various Bay site waters.

What was missing from the report was discussion that EC50 and WER values for station BD15 for each study event were equal to or higher (i.e. less toxicity exhibited) than the other 12 North Bay stations sampled. "

We agree with the commenter that the WER studies, in effect, address the bioavailability of copper at the mouth of the Petaluma River despite the higher suspended sediment loads and associated contaminant loads observed at this location. Chapter 3 of the staff report includes an adequate discussion of the chemical, physical, and biological features of the Bay relevant to copper necessary to constitute a sound scientific basis for the site-specific objectives, and any further discussion of the bioavailability of copper at that location is not central to the task of establishing SSOs. Therefore, no changes to the staff report were made.

Comment 4.3: "When sediments are resuspended, natural or synthetic organic ligands, which bind to copper, may also be resuspended. Evaluation of particulate copper and its potential to "desorb from the suspended sediment and contribute substantially to dissolved concentrations," as noted on p. 3-13 of the report, does not explain why dissolved copper concentrations have changed little in the Bay for the past 10 years. The equilibrium between organically-complexed dissolved copper and copper bound to particulates must be examined. For station BD15, it is likely that natural humic and fulvic acids coming from the Petaluma River or the wetlands surrounding the river mouth contribute greatly to both high dissolved copper levels and high amelioration of copper toxicity observed at that station. High suspended solids account for the very high total copper levels at that location. However, the WER results demonstrate that much less of this total copper is bioavailable compared to other parts of the Bay. Therefore, the importance of particulate copper in resuspended sediments appears to be overstated in the report, since this copper is largely not bioavailable."

We disagree that the importance of particulate copper in resuspended sediments is overstated. We have cited credible information regarding the role of sediment-bound copper in contributing to dissolved copper concentrations. The statement in the Staff Report cited by the commenter is in the section of the Staff Report that discusses technical uncertainties associated with tributary loading. Chapter 3 of the Staff Report contains a clear presentation of the various forms of copper (page 3-8) and explains the importance of the free ionic form in determining copper toxicity and bioavailability.

Comment 4.4: "The City is also concerned about the staff report reference to the Phillips et al. 2003 study results. City staff has previously reviewed this paper and found that the results of the study do not support the study conclusions concerning copper. There was more toxicity in the three samples that was not explained versus what was understood; therefore, it was misleading to conclude that copper was the most probable cause of toxicity. Using this quotation in the staff report is a misrepresentation of the results of the study. "

The Staff Report directly quotes a Phillips, et al. (2003) paper from a respected, peer-reviewed scientific journal. This paper identified copper as the probable cause of toxicity in the samples, and the authors appear to present sufficient evidence to support this conclusion; the peer reviewers for

that article did not dispute this finding. In any case, further work is on-going on the issue of sediment toxicity and staff clearly identified this as an uncertainty in the basin plan amendment.

Comment 4.5: "These types of studies should not be mandated in NPDES permits without first being discussed and evaluated through a wider stakeholder group such as the CEP or RMP. "

The public forum for discussing inclusion of these types of studies in the implementation plan is the public process associated with adoption of these SSOs. The studies in question (sediment toxicity) have been discussed through various RMP meetings with stakeholders and are currently included in work being conducted by the RMP. Inclusion of these requirements in NPDES permits helps insure that the sediment toxicity uncertainty may be addressed in a timely fashion.

Comment 4.6: "The staff report's environmental checklist (Appendix C) states that "... "Surface sediment samples have exhibited toxicity to test organisms at a number of sites throughout the Bay with copper as the most probable cause of toxicity." This is an incorrect and incomplete characterization of sediment toxicity in the Bay. The City recommends that Water Board staff utilize Regional Monitoring Program (RMP) sediment chemistry results to make the case for uncertainty with respect to copper toxicity in sediments. The RMP data show that Bay area sediments have copper concentrations generally above the ERL (Effects Range-Low) where no toxic effects would be expected but well below the copper ERM (Effects Range-Medium) of 270 mg/kg, above which toxic effects would be likely. In other words, most Bay locations have sediment copper concentrations in the "possible" effects range. "

We agree that sediment toxicity is an uncertainty and that sediment copper concentrations in most Bay locations are in the "possible" effects range. The statement in Appendix C refers only to those stations where toxicity was observed and not all bay sediments. Further work is needed in this area to resolve these questions.

Comment 4.7: "There may be "uncertainty" about extrapolation of the NOAA results to fresh surface waters but there is no evidence that copper impairs olfaction in marine environments such as the San Francisco Bay. Until studies examine the role of organic carbon in ameliorating the effects of copper on olfaction, incorporate natural surface water into their experimental design, and conduct olfactory studies in marine and estuarine waters, the City believes this is an unresolved technical issue more appropriate for academic research. The City is reluctant to dedicate its limited resources to such studies that do not apply to the Bay. The City strongly recommends a "watch" approach to this issue while NOAA Fisheries re-examines their salmonid olfactory work on copper and addresses a critique prepared by the City on their sublethal effects investigations.

We agree that there currently is no evidence that copper impairs olfaction of organisms living in marine environments. Because this issue affects San Francisco Bay copper objectives, the Water Board and local dischargers have a role to address this uncertainty. In view of this, we have crafted a flexible approach for local dischargers to support these studies. See also the response to Joe Dillon's comment from the May 9, 2007, testimony hearing.

II. RESPONSES TO ISSUES RAISED AT THE MAY 9, 2007, PUBLIC HEARING

Board Member Ms. Bruce asked, "How frequently would you re-evaluate the SSO water quality measurements? There is already a difference in SSOs due to differences in dissolved organic carbon. When the South Bay Salt Pond restoration happens, chances are that will have some effect on water quality either seasonally or over a long period of time. Is there a plan for updating the SSOs resulting from changes in water quality due to restoration efforts or the effects of other work like TMDLs that may change sediment delivery or work from the Central Valley that changes runoff patterns? Can we periodically recalibrate the WER perhaps by season and look at the trend in the toxicity? The restoration work may change the calculation of the WER over time."

We agree that conditions may change in the Bay over time and that it is important to track and evaluate the appropriateness of the SSOs on an ongoing basis. A cost-effective way to accomplish this ongoing evaluation is to monitor dissolved organic carbon (DOC). The RMP has been monitoring DOC at more than 20 locations throughout the Bay every year since 1993 and will continue to do so. There are some differences in DOC concentration at different RMP stations; however, despite some variability, there is no clear long-term trend in the DOC data at any station during this time interval. Conducting a new copper toxicity study is complex and costly. The study on which the current SSOs are based cost more than $500,000 and included two wet season events and two dry season events at 13 monitoring locations. It would be necessary to have a monitoring effort of similar scope in order to meaningfully reevaluate the WERs using toxicity data. Because DOC correlates well with toxicity to mussel larvae, it is a relevant surrogate for the protective effect of Bay water against aquatic toxicity that is the basis of the SSOs. As part of a periodic review process, we will look at these DOC trends for all parts of the Bay as a leading indicator of possible changes in copper binding capacity and aquatic toxicity. The decision to conduct a new toxicity study would be based on an evaluation of changes in conditions in the Bay as evidenced by a downward trend in the DOC data.

DOC concentrations may change in the future as a result of changes in freshwater inflows from the Central Valley Rivers, in response to phytoplankton growth, or perhaps as a result of DOC export from restored wetlands. The large scale wetland restoration planned for the Bay may have the effect, if any, of increasing Bay DOC concentrations. Unless freshwater inflows are drastically altered, the natural seasonal variability will probably mask small changes in freshwater inflows resulting from active management. Consideration of the DOC data as well as appropriate follow-up studies can be accommodated as part of the triennial review of our Basin Plan objectives.

In order to address this issue we made the following edits to page 5-8 of the Staff Report:

> The implementation plan establishes baseline copper control measures as well as additional measures that would be implemented if ambient dissolved concentrations increase. <u>The implementation plan also includes periodic assessment of the</u>

appropriateness of copper SSOs for San Francisco Bay given ongoing changes in water and sediment management, as well as restoration activities around the Bay. Dissolved organic carbon (DOC) is a cost-effective surrogate to assess the degree to which Bay water prevents toxicity to mussel larvae because such toxicity correlates very well with DOC. Therefore, analysis of trends in DOC data collected through the RMP will determine whether or not additional toxicity tests are needed to confirm the values of the SSOs. The DOC analysis and consideration of an appropriate response will be accomplished through the triennial review of the Basin Plan.

In order to determine systematically if ambient dissolved concentrations…

We revised the Basin Plan Amendment to include the following language:

The Water Board will assess the continued appropriateness of the SSOs for San Francisco Bay should conditions change in Bay water quality. Dissolved organic carbon (DOC) will be used as a surrogate measure of the protective effect of Bay water against copper water column toxicity. An analysis and evaluation of trends in DOC data collected through the RMP will determine whether or not additional water column toxicity tests are needed to confirm that the SSOs are protective. The need for a reevaluation of the SSOs or other regulatory actions will be established through the triennial review of the Basin Plan.

Board Member Dr. Terry Young asked, "Along a similar line….the water quality objectives relate to the dissolved concentration. Some of the discharge and some of the copper in the Bay exists in particulate form, in forms that we would not be measuring either in the SSO or the trigger levels we are using. The non-dissolved forms are invisible to the regulatory system that we are putting together but not invisible to nature. It goes somewhere and builds up in some compartments in the Bay and then can become dissolved through various physical, biological, or chemical mechanisms, so we do have to worry about where the copper, not picked up in our dissolved forms, builds up…..consider whether we want to put something akin to a trigger level for the compartments where we expect the particulate forms of copper to show up. My preference is to do something that makes use of available monitoring……It might be a good idea to have a trigger or reevaluation system for this purpose so that we know that if we see some warning signs, that would start a process that would allow us to determine if there should be some additional board action……put some kind of a blueprint into the Basin Plan Implementation Plan so that we would know that we would have a process that would happen in a routine and timely manner. What is building up in the sediments and then becomes bioavailable to particulate feeders….and biota?"

The Regional Monitoring Program (RMP) already substantially provides the type of monitoring called for by Board Member Young. That program provides on-going surveillance of water, sediments, and biota for copper and many other constituents as well. These monitoring data are routinely analyzed and interpreted through the various RMP workgroups, which Water Board staff participate in. These data are reviewed as part of an annual analysis of status and trends in water quality indicators and every two years as part of preparing the 303(d) list of impaired waters. Chapter 1 of the Basin Plan does contain a general blueprint for the basin planning process, and how we would respond to information about trends in copper or any other pollutant. We review the Basin Plan every three years, and the broad scope of this review allows us to respond to

the varied information coming from the RMP as well as other monitoring programs. As a matter of routine, we would evaluate pollutant concentration trends in water, sediment, and biota and determine the responsible course of action given the particulars and nature of the possible threat.

Copper and other trace metals were much bigger concerns when the RMP was started in the early 1990s and were among the primary motivations for the creation of the RMP. Because of the RMP, we have learned a lot since the early 1990s. For example, there was a thorough process in the late 1990s to identify appropriate indicators of copper impairment of the Bay as part of the copper SSO project in South San Francisco Bay. This consideration was not limited to dissolved copper in the water column. In fact, the South Bay project considered seven indicators of impairment ranging from individual species toxicity tests, phytoplankton, benthic macroinvertebrates, and even charismatic macrofauna (harbor seals and birds) (TetraTech 2000)[1]. After a thorough review of these potential indicators, water column toxicity was identified as the most appropriate indicator of impairment.

We also know that copper does not accumulate up the aquatic food chain like PCBs or mercury (ATSDR 2004)[2]. The RMP has been monitoring sediment and bivalve copper concentrations since 1993. Despite year to year variability, there is no discernible temporal trend in these concentration data at any RMP station in the Bay. In other words, copper does not appear to be accumulating in the sediments or bivalves at any of these stations. The RMP has also conducted sediment toxicity work and plans to conduct additional sediment toxicity studies very soon.

The year-to-year variability in the sediment and bivalve copper data makes it difficult to establish meaningful trigger concentrations in the same way that we did for dissolved concentrations. Moreover, the sediment copper concentration variability is likely due in large part to variability in the particle size distribution of the sediment sample rather than variability in the degree of copper contamination at the sampling location. In other words, if the sediment sample contained a greater proportion of fine sediment, the concentration of all sediment-associated constituents (like copper) would increase. However, this increase would not necessarily reflect accumulation of contaminants in sediment but rather variability in the sediment size distribution.

Through the RMP we will continue to track the future trends of sediment, bivalve, and fish copper concentrations and evaluate the need for additional monitoring or control measures if we see clear evidence of increased copper accumulation in sediments at locations around the Bay. In order to address this issue, we made changes to the Staff Report and Basin Plan amendment.

We added the following paragraph to page 3-14 of the Staff Report just before the section on Sublethal Effects of Copper on Salmonids:

> As presented in Section 1.4 above, the RMP has been monitoring sediment copper concentrations since 1993. These data show that, despite year to year variability, there is no discernible temporal trend in copper sediment concentration at any RMP station (SFEI

[1] TetraTech 2000. ***Impairment Assessment Report for Copper and Nickel in Lower South San Francisco Bay***.
[2] Agency for Toxic Substances and Disease Registry (ATSDR) 2004. ***Toxicological Profile for Copper.***

2007). Continued collection and analysis of these data along with the results of sediment toxicity studies will allow the Water Board to regularly evaluate copper accumulation in sediments.

We made the following edits to page 5-8 of the Staff Report:

The implementation plan establishes baseline copper control measures as well as additional measures that would be implemented if ambient dissolved concentrations increase. The implementation plan also includes an evaluation of sediment copper concentration and sediment toxicity data collected through the RMP to assess possible copper accumulation in Bay sediments and toxicity to biota.

We added a citation to the reference section:

San Francisco Estuary Institute (SFEI) 2007. ***1993-2004 RMP Sediment Copper Data*** SFEI.ORG website. (website: http://sfei.org/rmp/data.htm). San Francisco Estuary Institute.

We revised the Basin Plan amendment to include the following language:

In addition, the Water Board will evaluate sediment copper concentration and sediment toxicity data collected through the RMP to assess possible effects related to copper accumulation in Bay sediments. The need for a reevaluation of the SSOs or other regulatory actions will be established through the triennial review of the Basin Plan.

Joe Dillon of the National Marine Fisheries Service said, "Bottom line, there is a data gap in the SSO process related to olfaction impacts on salmonids and possibly green sturgeon. Toxicity testing targets impacts for toxicity caused by uptake across biotic ligands. This does not cover the olfactory impacts. The BPA appropriately calls for studies…..the only thing that we ask is a more concrete timeline for conducting or starting those studies."

We also want the necessary studies to be conducted in a timely manner. However, it is important to point out that local dischargers are not exclusively responsible for addressing this uncertainty and do not have complete control over the pace at which the studies are completed. Instead, the Water Board, local dischargers, U.S. EPA, and National Marine Fisheries Service (NMFS) have a shared responsibility to make sure that the necessary studies are supported and completed.

It is likely that the NPDES permit requirements will require a workplan with a time schedule for accomplishing the dischargers' role in these studies. However, as evidenced by the comments from BACWA and the City of San Jose, it is likely that the local dischargers will prefer to support the studies through the Clean Estuary Partnership, the Regional Monitoring Program, or another regional effort, and this may allow the work to be initiated more quickly.

We recognize that the salmonid olfaction issue is also of national importance because it will potentially apply to copper objectives everywhere in the United States, not just San Francisco Bay. Consequently, federal agencies like U.S. EPA and NMFS should play a leadership role in supporting and conducting the studies. Because the accomplishment of the olfactory studies is a

shared responsibility between the State, local dischargers, and federal agencies, it is problematic to require that the dischargers alone ensure that the studies are completed in a specific timeframe. Local dischargers will not be exclusively responsible for completing the studies and may not be able to control the pace at which they are completed because of the need for cooperation with other parties. We expect that the studies can be initiated within two years and accomplished within five years, but the fulfillment of these time frames will depend on cooperation between the entities having shared responsibility.

Michele Pla of BACWA said, "BACWA strongly supports the BPA and urges the Board to adopt it next month".

Comment Noted.

Michele Pla of BACWA said, "The WER is important part of this study and hope that upcoming permits adopted over the next year or year and a half can make use of this for computing effluent limits because about 37 of 44 facilities cannot meet the existing CTR copper number."

Comment Noted. This Basin Plan amendment does not speak to the use of WERs in permits prior to final approval of the amendment. That is an issue to be addressed as the individual permits come up for adoption before the Board.

Michele Pla of BACWA stated, "BACWA supports doing sublethal effects studies and request that it can be done through the CEP so they can be done quicker."

Comment Noted.

Board Member Dr. Terry Young asked Richard Looker, "You mentioned that you were working with DPR on anti-fouling paints…..the write-up in staff report makes it sound collegial and informal, and I was wondering if you would like to take this or a future opportunity to let us know if there is some additional oomph that you would like to see in the Basin Plan to move the process along in a timely manner.

At this time, staff does not feel that any additional language in the Basin Plan is needed.

III. RESPONSES TO PEER REVIEW COMMENTS ON FEBRUARY 16, 2007, STAFF REPORT AND BASIN PLAN AMENDMENT

On February 16, 2007, we completed a draft Basin Plan Amendment and supporting staff report for copper site-specific objectives in San Francisco Bay, and provided copies to two scientific peer reviewers: Professor Emeritus Alex Horne, and Professor Emeritus David Jenkins. Both these reviewers reviewed the scientific basis of a similar project for South San Francisco Bay in 2002.

The reviewer comments focus mainly on the scientific portions of the Basin Plan Amendment and staff report. The intent of the review was to ensure that the proposed amendment is based on sound scientific knowledge, methods, and practices. The full comments from each reviewer are contained in separate documents. The specific comments we received from the reviewers are shown below followed by the staff response.

1. Scientific Peer Review Comment No. 1 Professor Alex Horne, dated March 26, 2007

Dr. Horne made the following recommendations in his comment letter, but overall he concurred that the proposed Basin Plan amendment should be promulgated into law. We respond to his recommendations in the following.

Peer Review Recommendation 1.1: The SSO should use a scientific and transparent calculation of copper toxicity with the non-scientific safety factor added as the very last step and not hidden in the calculations.

Staff presented the calculation based on the procedures established by U.S. EPA for the development of numeric water quality criteria. In the case of copper, this safety factor of '2' is applied to the Final Acute Value to arrive at the acute criterion. The factor is not hidden as it is mentioned explicitly on page 4-10 of the draft Staff Report. We cannot change this procedure for this project. The addition of the safety factor provides for an additional level of protectiveness. No change is required in the Staff Report for this issue.

Peer Review Recommendation 1.2: The rationale for not using the direct free copper as a standard needs to be added (or the future measure of toxic copper changed).

Although research indicates that free ionic copper is the toxic form of copper to aquatic life, it is only possible to measure indirectly the free ion copper concentrations. Water quality criteria for metals like copper are currently expressed as dissolved concentrations. Thus, copper dosing in toxicity tests is measured in dissolved concentrations, and interpretation of the toxicity tests results is made with reference to the dissolved concentration present during the test. It is through the WER that we account for chelation and infer something about what the binding capacity must have been in the test water to provide the protective effect observed in the test organism.

The correspondence between the 6.9 μg/L dissolved copper criterion and the 10^{-11} mol/L free ion copper concentration is based on the work of Buck and Bruland (2003). These researchers estimated, based on their measurements of dissolved copper and binding capacity in San Francisco Bay samples, that more than 99.9% of the copper in a dissolved copper concentration of 6.9 μg/L would be bound by a variety of ligands such that only 10^{-11} mol/L would remain in free ionic form.

While there is a method to compute free ionic copper, it is not a standard laboratory method but a research method that uses a series of ligand titrations to infer what the free ionic concentration would be. So, a standard method would have to be developed. Finally, U.S. EPA would need to establish procedures for translating free ionic ambient copper concentrations to the concentrations that would be measured in the effluent of point sources (metal translators).

In order to clarify the passage in the Staff Report concerning speciation and the relevant test species for computing water quality criteria, on page 3-9 of the Staff Report, we will make the following changes.

> The free ionic form of copper can be toxic to certain species of phytoplankton. However, water quality criteria for copper are not based on phytoplankton toxicity. Rather, the marine criteria are based on toxicity to mussel larvae. Further, although free ion copper concentrations can be measured indirectly and research indicates that free ionic copper is the toxic form of copper to aquatic life, water quality criteria for metals like copper are expressed as dissolved concentrations. Accordingly, copper dosing in toxicity tests is measured as dissolved concentrations, and interpretation of these toxicity tests results is made with reference to the dissolved concentration present during the test. It is through the WER that we account for chelation and infer what the binding capacity must have been in the test water to provide the protective effect observed in the test organism.
>
> During the study, no ambient free ionic copper concentration exceeded 10^{-13} mol/L, a concentration …..

Peer Review Recommendation 1.3: We should be careful about applying results of sub-lethal toxicity tests in this instance. The Board should work with various agencies to sort out the ecological significance of the newer more sensitive tests on the effects of chemicals on wildlife.

We agree with Prof. Horne that we must be careful about how we apply sub-lethal toxicity results to the process of setting water quality objectives. Because of the uncertainty in applying the sub-lethal toxicity information, we did not rely on these data in calculating the proposed site-specific objectives. Instead, we present the available evidence about this sub-lethal effect from freshwater investigations, and we suggest that sub-lethal effects should be investigated for estuarine and marine conditions like those in the Bay. Professor Horne rightly points out many of the difficulties in applying the results of sub-lethal tests to setting numeric criteria (ecological relevance, and effects on populations). The Board intends to work with other agencies on these issues.

2. Scientific Peer Review Comment No. 2 Professor David Jenkins, dated March 11, 2007

Peer Review Comment 2.1: "I have made minor comments on the paper copy of the report that you sent me. This memo contains the more substantive comments."

We reviewed these comments and made several non-substantive text edits in response. These comments are not included in the Board package as they are not related to the scientific basis of the Basin Plan amendment or Staff Report.

Peer Review Comment 2.2: "p 2-2, lines 3-7 and Figure 2-1. It is not a fair statement to say that Figure 2-1 shows that the dissolved Cu concn has decreased slightly or stayed about the same over the period 2001-2003. Please reword. The way I read Figure 2-1 is that the dissolved Cu concn has stayed about the same or increased over the period 2001-2003. "

The text in the Staff Report will be edited as follows:

> During the ~~last decade~~period of 1993 to 2004, there is no readily apparent trend in ambient concentrations of dissolved copper ~~have either stayed the same or decreased slightly~~ in most parts of the Bay….

Peer Review Comment 2.3: "pp 3-1 and 3-2. Table 3-1 and Figure 3-1 are not consistent. Table 3-1 lists 6 segments for the Bay system while the title of Figure 3-2 indicates seven segments. You need to decide whether you are going to include the Delta in the definition of the Bay system."

The reference from which the bathymetric information was taken did not have information for the Delta so it was not included in this table. The bathymetric data are included to provide some physical description of the Bay system, and the omission of the bathymetry for the very small portion (as represented accurately in Figure 3-1) of the Delta included in the definition of San Francisco Bay is a minor omission. The definition of the Bay for the purpose of this project is that portion represented in Figure 3-1.

Peer Review Comment 2.4: "p 3-3, lines 1-4 and Table 3-2. The text seems to discuss different data from that listed in Table 3-2. Also in the following paragraph Davis et al 2001 is given as a source of data in Table 3-2 but not listed in the references cited in the Table title."

The correct citation is Davis (2000), and this citation has been added to the caption of Table 3-2.

Peer Review Comment 2.5: "pp 3-3 to 3-7 including all Tables on these pages. You have just about got every unit possible for expressing Cu loads/source contributions. Please make the text and Tables have the same units. I suggest using metric units with kg/d as the basic load unit."

The units of all copper loads in this section were changed to kg/d as suggested. Further, the order of listed sources in the summary table (Table 3-2) now matches their discussion in the text. A

number of typos were corrected, and we corrected the numeric values shown in Table 3-2 to match what was discussed in the text.

Peer Review Comment 2.6: "pp 3-3 to 3-8, Section 3.2. This section is a jumbled write up that leaves one with an unclear picture of Cu sources. Apart from the unit problem the individual source estimates in Table 3-2 are not dealt with in the order presented in the Table and they are not all dealt with (what about the Sac River etc?). Also the numbers in the table 3-2 and those in the text do not jibe…or totals are not even added up. This section needs a rewrite and a re-review."

We revised this section, and Dr. Jenkins reviewed the edited version of this section of the Staff Report and suggested in his comments (received May 11, 2007) only a few non-substantive, editorial changes. These editorial changes are not included in the Board package.

Peer Review Comment 2.7: "p 3-8 para 4 line 1. Does this concn refer to total u, dissolved Cu or ionic Cu, or what?"

See changes made in response to Professor Horne's comment 1.2 above.

Peer Review Comment 2.8: "p 3-12 para 4 line 7. Do you mean the dry, windy season?"

We fixed a typo to make this sentence clear.

Peer Review Comment 2.9: "p3-14 para 5 lines 1-3 and 10-12. These two sections, in the same para are repetitions (almost to the word). Remove one of them!!...and if you look at p 3-13 para 4 lines 2-3 it is repeated again!"

We eliminated this duplication.

Peer Review Comment 2.10: "p 4-3 Figure 4-1 does not have a label on the vertical axis…total Cu?"

The caption was edited to make it clear that the plot represents total copper concentrations in wastewater effluent.

Peer Review Comment 2.11: "p 4-5 para 3. This is a load of nonsense. If the water supply was dosed with sufficient chemicals it could be made non-corrosive to copper piping. Sure it would cost money but it could be done. So I do not buy this argument about the agencies being unable to meet the Cu standards. I think you need to make an argument that it would be economically unjustifiable to do so…but it is technically feasible."

We have edited the Staff Report language regarding corrosion control (on pg. 4-4) to reflect your comment.

The majority of influent copper in these and most systems is believed to be a function of the relative corrosivity of the potable water supply and corrosion of copper piping and plumbing fixtures. The water purveyors in each of the three dischargers' service areas have had corrosion control programs in place for years, as mandated to comply with the Safe Drinking Water Act Lead and Copper Rule. Some of this corrosion could be controlled through additional corrosion control efforts by water purveyors may result in reduced copper influent concentrations to municipal wastewater facilities. While technically feasible, the additional expense for these efforts may not be warranted because the reduced influent concentrations may not allow wastewater facilities to meet current effluent limits.

Peer Review Comment 2.12: "p 4-11 para 4, line 2. It is not clear who lowered the FAV for M. edulis…you or the EPA?"

This lowering was done by U.S. EPA, and we will make that clear in the Staff Report.

Peer Review Comment 2.13: "p 4-14 para 1 lines 1-2. Better to say" Table 4-4 shows that the WER values for regions 1,2 and 3 are similar, that the WERs for regions 4 and 5 are similar and that the WERs for regions 1,2 and 3 are lower than those for regions 4 and 5. It is not appropriate to identify the differences as "a natural demarcation". That is all in your head!"

We agree and will edit the text accordingly.

Peer Review Comment 2.14: "p 4-18 I do not understand why Figure 4-1 is in here again. Get rid of it and if you need to refer to it, reference it in the text. The people who read this should know how to turn pages!"

We agree and Figure 4-1 was deleted.

Peer Review Comment 2.15: "p 5-1 para 2. You have omitted the Water Treatment Agencies as organizations that need to participate in activities to reduce Cu input to wastewater treatment plant discharges."

There are no explicit control measures for water treatment agencies identified in the implementation plan so they are not included in the list of participating entities or organizations. According to available information, the majority of copper in wastewater originates from corrosion of copper water pipes.

Peer Review Comment 2.16: "p 5-1 para 4 line 7. "Domestic sources" is not a component of urban runoff."

Domestic water supply can contribute to urban runoff when it is discharged into storm drains. Examples of activities that lead to domestic water being discharged to storm drains include landscape irrigation and residential car washing.

Peer Review Comment 2.17: "p 5-4 Table 5-2. This table does not really address the general corrosion of Cu pipes in water distribution piping (indoor plumbing) and you have shown that this is a major part of the Cu loads as well as being the major portion of the residential load. "

The information available to us suggests that corrosion of copper pipes is a major source of copper to wastewater facilities. Corrosion is the likely cause of the domestic water supply contribution to urban runoff. However, since domestic supply is a small contribution to urban runoff, we did not identify corrosion control as a meaningful control measure for controlling copper in urban runoff.

Peer Review Comment 2.18: "p 5-6 para 1 lines 3-4. Does not make sense."

We have edited this passage to improve clarity.

Peer Review Comment 2.19: "p 5-7 para 1 lines 3-6. This sentence is difficult to understand. Please reword it."

This sentence was edited to improve clarity.

Peer Review Comment 2.20: "p 5-6 para 6 lines 7-8. You cannot say this if you are talking about uncertainties. This is prejudging the outcome."

Professor Jenkins is referring to a statement in the last sentence of the first paragraph of page 5-8 regarding the Water Board's expectation that concentrations of copper in the Bay will not increase based on over a decade of consistent ambient data. We are not prejudging an outcome. Rather, we are merely stating our expectation that concentrations will not increase, but we have a monitoring program in place to see if this expectation is met. We made the following change to the Staff Report to make this clearer.

> We do not expect concentrations to increase based on the ~~multi-year~~decade-long pattern of consistent Bay concentrations illustrated in Figure 5-1 and Figure 2-1~~Figure 5-2~~. However, the monitoring program will be able to detect increases if they occur.

Peer Review Comment 2.21: p 5-9 "Do you need to show all three of these figures to make you point. I suggest that the lower figure is all you need."

We edited this figure in the manner suggested.

Peer Review Comment 2.22: p 5-10 "I do not think Figure 5-2 is needed either…in any case it is a repeat of Figure 2-1 and you could just refer to that if you needed to."

We will delete Figure 5-2 and refer to Figure 2-1 as suggested.

Peer Review Comment 2.23: "pp 6-1 to 6-9 not reviewed"

Comment noted.

Peer Review Comment 2.24: "Chapter 8 not reviewed"

Comment noted.

Peer Review Comment 2.25: "Some one needs to check the staff report thoroughly for typos and other syntax errors. I found many without really looking for them. I suggest that, in future, such things be dealt with before staff reports are sent out for review."

We apologize for those errors and typos. We checked the Staff Report more carefully before making it available for public comment.

Peer Review Comment 2.26: "In general the staff report is well done. It is another example of how the SF Water Board, with its own staff, produces technical reports that are well reasoned and well documented, defensible, sound and of the highest quality. Congratulations again!"

The Water Board staff appreciates the reviewer's comment.

IV. STAFF-INITIATED CHANGES

Changes to the proposed Basin Plan Amendment

In the final paragraph at the bottom of page A-10 of the Basin Plan amendment, we fixed a typo.

> ….the Water Board will investigate causes of the exceedances and potential control options and require wastewater and urban runoff dischargers to that segment…

On page 5-8 of the Staff Report, we made the following edit to the third paragraph and to the caption of Table 5-3.

> The 'n' in Table 5-3 is the number of samples that would need to be collected annually in each Bay segment to detect a change in dissolved concentration equivalent to the stated trigger ~~increment~~ level.
>
> Table 5-3 Dissolved Copper (µg/L) Trigger ~~Increments~~ Levels at 99% Statistical Power…..

We made the corresponding to the caption of Table 7.3 of the Basin Plan amendment.

> Table 7.3 Dissolved Copper (µg/L) Trigger ~~Increments~~ Levels at 99% Statistical Power…..