# Appendix E

# Public Comment Letters and Peer Review Comments

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# Appendix E

## Comment Letters Received on the Basin Plan Amendment and Staff Report

| Organization | Commenter |
|---|---|
| U.S. Environmental Protection Agency | Douglas Eberhardt |
| Bay Area Clean Water Agencies | Michele Pla |
| Copper Development Association | Ray Arnold |
| City of San Jose | John Stufflebean |

## Peer Review Comments Received on the Basin Plan Amendment and Staff Report

| | |
|---|---|
| Professor Alex Horne | University of California, Berkeley |
| Professor David Jenkins | University of California, Berkeley |

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901



Richard Looker
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

April 16, 2007

Dear Mr. Looker:

Thank you for the opportunity to comment on the proposed site specific objectives for copper for the San Francisco Bay north of the Dumbarton Bridge. We appreciate the hard work of the Water Board staff in developing this proposed Basin Plan amendment.

As you are aware, prior to EPA approval of this site specific objective for copper, EPA must complete a consultation with the United States Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) pursuant to the Endangered Species Act Section 7. 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. The proposed Basin Plan language states that the implementation plan calls for requirements in NPDES permits to support investigations regarding possible effects on the olifactory system of salmonids. EPA encourages Water Board staff to start developing the specifics of these NPDES requirements.

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.

Thank you for your consideration of these comments. If you have any questions, please contact me at (415) 972-3420, Susan Hatfield at (415) 972-3520 or Nancy Yoshikawa at (415) 972-3535.

Sincerely,

Douglas E. Eberhardt, Chief
CWA Standards and Permits Office

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# Bay Area Clean Water Agencies

*Leading the Way to Protect Our Bay*

*A Joint Powers Public Agency*

*P.O. Box 24055, MS 702*

*Oakland, California 94623*


April 16, 2007

*Via E-Mail and First Class Post*

Mr. Bruce Wolfe, Executive Officer
San Francisco Bay Regional Water
Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

**RE: Proposed Amendment to the Water Quality Control Plan for the San Francisco Bay Basin, Site Specific Water Quality Objectives and Implementation Plan for Copper in San Francisco Bay, North of the Dumbarton Bridge**

Dear Mr. Wolfe:

The Bay Area Clean Water Agencies (BACWA) supports the proposed site specific water quality objectives and the proposed Basin Plan Amendment, which incorporates the Implementation Plan for Copper in San Francisco Bay, North of the Dumbarton Bridge. BACWA also concurs with the Basin Plan Implementation Plan approach to pollution prevention and pretreatment control measures for clean water agencies.

BACWA commends all those who have been working since 2000 on the North of Dumbarton Bridge (NDB) Copper and Nickel Site Specific Objectives project that has resulted in these proposed copper site specific water quality objectives (SSOs). This BACWA and CEP sponsored effort was modeled closely after the work conducted by the City of San Jose that provided the Water Effects Ratio (WER) aquatic toxicity results and associated water chemistry work that led to the 2002 Basin Plan amendment that adopted SSOs for copper and nickel for the Bay South of Dumbarton Bridge.

The WERs developed for the NDB project showed that the bay water quality renders ambient copper concentrations less toxic than in the laboratory water used to develop the 3.1 µg/L California Toxics Rule (CTR) WQO. The four expert members of the Technical Review Committee (TRC) for the NDB project found that the WER and associated data were of high quality and suitable to be used for calculating SSOs. While the recommended SSOs are higher

than the CTR marine copper WQOs that currently apply, they better reflect existing scientific knowledge of copper toxicity and its effects on aquatic organisms specific to the Bay.

**Despite Nationally Recognized Pollution Prevention and Pretreatment Program, BACWA Members Cannot Comply with Current CTR Limit for Copper.**

BACWA members are committed professionally as public agencies to protect the San Francisco Bay and its beneficial uses. Over the last 10 to 15 years, the clean water member agencies of BACWA have implemented extensive pretreatment and pollution prevention programs addressing industrial, commercial, and residential sources of copper, including special focus on copper piping corrosion, vehicle maintenance and service shops, and product bans or substitutions (e.g., root control substances and pesticides).

Many BACWA members, including San Francisco, Fairfield-Suisun, and EBMUD have been recognized by the U.S. EPA, the California Water Environment Association, and the national Water Environment Federation as national leaders in pretreatment and pollution prevention. Our members have well-developed, mature source control programs for addressing copper that have produced excellent results. Nevertheless, many BACWA member agencies cannot be assured of consistent compliance with effluent limits derived from the overly stringent WQO for copper currently contained in the CTR. Without this Basin Plan amendment (BPA), which incorporates site specific objectives and site specific copper translators that are protective of San Francisco Bay, many BACWA member agencies will be required to install advanced treatment facilities in order to be in compliance. The BPA staff report (p. 6-5 – 6-6) acknowledges that 37 of 44 wastewater facilities surveyed would not be able to comply with effluent limits based on the current WQO without costly upgrades.

**Sublethal Effects of Copper in Freshwater Laboratory Studies Uncertainties Prevent Translation to San Francisco Bay**

In freshwater laboratory studies on salmonids, some sublethal sensitivity to copper has been anecdotally observed. BACWA concurs with the Regional Water Board Staff Report (section 3-5 pages 3-14 and 3-15), which states that there are a number of uncertainties that need to be resolved before the results can be extended to San Francisco Bay, which has a completely different chemistry than that found in freshwater laboratory studies. The Implementation Plan in the Basin Plan Amendment proposes that urban stormwater dischargers and clean water agencies support studies aimed at reducing uncertainties related to such sublethal olfactory effects on salmonids (as well as uncertainties associated with sediment toxicity and urban runoff loading).

The staff report states that it is necessary to investigate these technical issues in order to have a greater degree of confidence that beneficial uses are being protected as the SSOs are implemented. However, as alluded to elsewhere, with most environmental systems as complex as the Bay, there will always be some uncertainties. The vast majority of available evidence shows

that the Bay NDB is not impaired by dissolved copper. 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 not via requirements in individual NPDES permits.

**Requiring a Water Quality Based Effluent Limit in the Face of No Reasonable Potential is Overly Protective and More Stringent than Required by Law.**

The Implementation Plan of the Basin Plan amendment proposes that mandatory water quality based effluent limits for copper be included in all wastewater treatment plant NPDES permits, even if there is no finding of reasonable potential (RP) for the discharge to cause or contribute to an exceedence of applicable water quality standards (per State Implementation Plan (SIP) Section 1.3 procedures). BACWA believes this is overly protective, inconsistent with state and federal law, and appears to reflect an unrealistic fear that clean water agencies will somehow "turn up the copper dial" following adoption of the site specific objective.

This type of unfounded concern is also inconsistent with what BACWA believes to be a more accurate characterization of likely events following SSO adoption in Section 6.4 Antidegradation under "Nature of Wastewater Treatment Plant Performance."

> *"In other words, municipalities and industries have neither an incentive nor capability to "reoperate" their plants to "take advantage" of less stringent effluent limits. They would be unable to accomplish such independent degradation of their copper performance without simultaneously worsening performance for other constituents that would likely result in violation of effluent limitations for these other constituents. For this reason, future changes in existing copper effluent concentrations are not likely for the existing treatment facilities, with or without changes in effluent limits."*

The SFEI report "The Pulse of the Estuary 2006,"[1] presents Lower South Bay (LSB) dissolved copper concentration data from 1993 through 2004, covering the time both before and after the LSB SSO as adopted in 2002. The concentrations have remained remarkably constant with no change in overall average concentrations. Furthermore, concentrations have remained consistently below the 4.0 µg/L Phase 1 trigger level established as part of adoption of the 6.9 µg/L SSO in 2002. BACWA believes that this is direct evidence that, as stated above, clean water agencies can and will maintain current effluent performance levels after an SSO is adopted and effluent limits are correspondingly changed. Sound science, not unsubstantiated fears, should drive public policy.

Mandatory effluent limitations for copper as proposed in this Basin Plan also violate state and federal law. Both Federal regulations at 40 C.F.R. §122.44(d) and State law at Water Code

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[1] San Francisco Estuary Institute Regional Monitoring Program for Water Quality in the San Francisco Bay; "the Pulse of the Estuary" 2006, pages 24, 25

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. The State Water Board's Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California ("SIP") similarly requires a demonstration of "reasonable potential" before effluent limitations are imposed. *See* SIP at Section 1.3. Requiring effluent limitations without this demonstration is contrary to law and to the Clean Water Act requirement that water quality-based effluent limitations be necessary to meet the applicable water quality standards. 33 U.S.C. §1311(b)(1)(C).

The SIP reasonable potential process can be viewed as rewarding well performing facilities that have reduced their effluent concentrations below the applicable WQO by not requiring effluent limits for that constituent in their permit. The proposed requirement for mandatory copper effluent limits for facilities without RP for copper turns the normal process on its head and is effectively a punishment rather than a reward.

The mandatory effluent limits proposed in the Basin Plan may lead to program inefficiencies in the future as the clean water agencies will utilize resources to meet regulatory program requirements **regardless** of their overall impact toward pollution prevention and water quality restoration. 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.

**Nickel Site Specific Water Quality Objective Adopted for the Lower South Bay is Applicable Bay-Wide without Further Technical Analysis**

The nickel SSO developed by San Jose and adopted by the Water Board in 2002 was based on modifications to the national water quality criterion (i.e. not based on WERs). As such, the 11.9 µg/L nickel SSO is applicable to the entire San Francisco Bay, not just the lower south bay (south of Dumbarton Bridge). No additional technical work is required to be able to use this SSO for the rest of the Bay. Ever since the initial workplan for SSOs for NDB was developed in early 2000, the effort has always focused on both copper **and** nickel SSOs. A summary of the work conducted by San Jose and the rationale for applying the 11.9 µg/L SSO throughout the Bay was included in the CEP report "*North of Dumbarton Bridge Copper & Nickel Site-Specific Objective (SSO) Derivation Report*" on pages 4 – 6 and in Appendix D. There are minimal if any uncertainties remaining regarding the potential for impairment by nickel. Ambient concentrations throughout the Bay are typically in the 1 – 2 µg/l range. Much of the Regulatory

Analyses in Section 6 of the BPA Staff Report, including the antidegradation analysis is also applicable to nickel.

BACWA encourages the Water Board to finish what has been a long and successful process and move forward with adoption of a consistent 11.9 µg/l nickel SSO throughout the Bay. BACWA also encourages the Water Board to remove nickel from the 303(d) impaired waterbodies list, as BACWA had requested of the State Water Board in our October 20, 2006 comment letter (copy attached) on the 2006 303(d) list.

In summary, BACWA commends the North of Dumbarton Bridge Copper/Nickel SSO project team members, Regional Water Board staff, and the Clean Estuary Partnership for the years of data collection, analysis, and study that have led to this important site specific objective milestone for San Francisco Bay. BACWA hopes that its comments and suggestions will be incorporated before the final version of the implementation plan is adopted.

Sincerely,

Michele M. Pla
Executive Director

Cc: USEPA Region IX, Doug Eberhardt
SWRCB, Ken Harris
BACWA Board Members

**Bay Area Clean Water Agencies**

*Leading the Way to Protect Our Bay*
*A Joint Powers Public Agency*

*P.O. Box 24055, MS 702*
*Oakland, California 94623*

October 20, 2006

Song Her
Clerk to the Board
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814
commentletters@waterboards.ca.gov

SUBJECT: Proposed 2006 Federal Clean Water Act Section 303(d) List of Water Quality Limited Segments for California for Nickel

Dear Ms. Her:

The Bay Area Clean Water Agencies (BACWA) appreciates the opportunity to comment on the proposed 2006 Federal Clean Water Act Section 303(d) List of Water Quality Limited Segments for California. BACWA is an umbrella organization that represents nearly all Publicly Owned Treatment Works (POTWs) in the San Francisco Bay Area. BACWA's mission emphasizes the protection and enhancement of the natural resources of the San Francisco Bay Estuary. Our POTW community works daily to ensure that sanitary and industrial wastewater flows receive treatment that meet and often exceed water quality standards that protect the Bay's natural resources. The 2006 proposed 303(d) listing of impaired waterbodies lists the following segments of San Francisco Bay as impaired for nickel: Lower San Francisco Bay, San Pablo Bay, Suisun Bay, and the Sacramento San Joaquin Delta. It is BACWA's position that all these segments should be delisted for nickel.

During development of the 2002 303(d) list, both the San Francisco Regional Water Board (Regional Water Board) and the State Water Resources Control Board (State Board) supported delisting the San Francisco Bay north of the Dumbarton Bridge (NDB) based on a comparison of ambient data to the California Toxics Rule (CTR) 8.2 ug/L dissolved nickel water quality objective (WQO). However, USEPA in its July 23, 2003 final 2002 section 303(d) approval letter did not approve delisting nickel for Lower San Francisco Bay, San Pablo Bay, Suisun Bay, and the Sacramento/San Joaquin Delta. USEPA asserted that the applicable standard to assess the ambient data was the 7.1 ug/L nickel objective contained in the Basin Plan at that time. The 7.1 nickel WQO was exceeded in 102 of 467 ambient samples collected between March 1993 and April 2001. The CTR 8.2 ug /L WQO was only exceeded four times during that time frame, hence the reason for the Regional Water Board and State Board delisting recommendations (all four excursions were at

mouth of the Petaluma River). USEPA did establish a low priority TMDL ranking for their nickel listing noting that "the State is in the process of developing site specific water quality standards for nickel that will likely be attained. Therefore it is most reasonable to proceed with water quality standards modifications that will likely obviate the need to complete a nickel TMDL for the Bay."

The Regional Water Board subsequently amended the Basin Plan on January 21, 2004 to update the WQOs (including nickel) from total metal concentrations to be identical to the CTR dissolved WQOs (except for cadmium). The State Board approved the Basin Plan amendment on July 22, 2004, the Office of Administrative Law on October 4, 2004, and USEPA on January 5, 2005. Therefore, the 8.2 ug/L nickel WQO in the Basin Plan has been fully approved. Using the same data and rationale submitted for the 2002 listing, all San Francisco Bay segments north of Dumbarton Bridge should be delisted for nickel.

In addition, nickel impairment in the San Francisco Bay has been extensively studied since it was first identified as a pollutant of concern. An abundance of technical work has been performed in San Francisco Bay in accordance with USEPA site-specific criteria guidance that has been used to justify the adoption of site-specific water quality objectives (SSO) for both copper and nickel in the Lower South Bay segment. In May 2002, the Regional Water Board adopted a Basin Plan amendment to establish site-specific objectives for copper and nickel in Lower South Bay. These objectives were approved by USEPA in January 2003.

Recent technical studies and ambient water column monitoring conducted in San Francisco Bay north of the Dumbarton Bridge have determined that aquatic life impairment due to water column levels of dissolved copper and nickel in San Francisco Bay is unlikely. (See Clean Estuary Partnership, *North of Dumbarton Bridge Copper and Nickel Site-Specific Objectives State Implementation Policy Justification Report* - March 2005, *North of Dumbarton Bridge Copper and Nickel Conceptual Model and Impairment Assessment (CMIA) Report* -- March 2005, and *North of Dumbarton Bridge Copper and Nickel Site Specific Objective (SSO) Derivation* - March 2005.) These technical studies documented that the 11.9 ug/L dissolved nickel SSO approved for the Lower South Bay was applicable to the entire San Francisco Bay. Using the results of these studies, the Regional Water Board is in the process of developing a Basin Plan amendment to adopt copper and nickel SSOs for the bay north of the Dumbarton Bridge.

BACWA submitted the above technical information with a request to delist nickel to the State Water Board in its comment letter dated January 31, 2006 regarding the September 2005 draft 303(d) list. This correspondence was identified as comment number 127 in the September 2006 Draft Final Staff Report Response to Comments Volume IV. BACWA respectfully requests reconsideration of the denial of our request for delisting nickel, as indicated in the response to comment number 127.3 on page 164 of the Response to Comments:

> "Because the actual data was not submitted with the comment communication, the data could not be evaluated; consequently a determination to delist, could not be conducted."

The Regional Water Board submitted their nickel delisting analysis, recommendations, and the supporting Regional Monitoring Program ambient San Francisco Bay nickel data as part of the 2002 303(d) list development (see attached February 26, 2002 memorandum from Loretta Barsamian, Executive Officer San Francisco Bay Regional Water Quality Control Board to Stan Martinson,

Chief Division of Water Quality State Water Resources Control Board, Table 2 page 4). Therefore, BACWA believes that the information and data necessary for a delisting decision is already in the administrative record. However, BACWA has attached the above referenced memorandum to our comments for the administrative record.

Furthermore, the Staff Report under Faulty Listings (page 13) includes as one of the criteria for removal from the list if:

> "The evaluation guideline used originally would lead to improper conclusions regarding the status of the water segment."

As noted above, the 7.1 ug/L total metals nickel WQO in the 1995 Basin Plan cited by USEPA as the basis for their 2002 listing decision was replaced by the 8.2 ug/L dissolved nickel WQO in the 2004 amendments to the Basin Plan. Therefore it would be improper and lead to "improper conclusions" for the State Water Board to use the superseded 7.1 ug/L total metals WQO as the basis for the continued nickel listing of San Francisco Bay water segments.

The State Water Board September 15, 2006 proposed 2006 303(d) list tables currently carry forward the 2002 303(d) nickel listings for applicable Bay segments with the notation "This listing was made by USEPA" and "Source Unknown." Based on the above information and documentation in the existing 2002 303(d) listing administrative record, BACWA respectfully requests that the State Water Board remove nickel from the 2006 CWA Section 303(d) List of Water Quality Limited Segments for the Sacramento San Joaquin Delta, Lower San Francisco Bay, San Pablo Bay, and Suisun Bay.

BACWA appreciates the opportunity to provide these comments and thanks you for your consideration. If you have any questions, please call me at 510-547-1174.

Sincerely,

David R. Williams

David R. Williams, Chair
Bay Area Clean Water Agencies

Attachments - 4

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**From:** "Arnold, Ray" <RArnold@cda.copper.org>
**To:** "Richard Looker" <RLooker@waterboards.ca.gov>
**Date:** 4/16/2007 12:44:15 PM
**Subject:** Comment on Copper Site-specific Staff Report

Dear Mr. Looker,

I want to congratulate you on reaching this point in the process of the copper TMDL for the San Francisco Bay. I know that you have worked extremely hard and deserve recognition for a job well done.

I have reviewed the draft of the proposed basin plan amendment and have only one comment. Thank you for considering my comment.

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?

Thank you,

Ray Arnold
Copper Development Association Inc.
260 Madison Avenue
New York, New York 10016

T (212)-251-7220
F (212) 251-7234
e-mail rarnold@cda.copper.org

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CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

*Environmental Services Department*

DIRECTOR'S OFFICE

April 16, 2006

Richard Looker
California Regional Water Quality Control Board
1515 Clay Street, Suite #1400
Oakland, CA 94612
rlooker@waterboards.ca.gov

SUBJECT: Comments on proposal to establish site-specific water quality objectives (SSOs) for copper North of Dumbarton Bridge and a Bay-wide copper SSO implementation plan for San Francisco Bay

Dear Mr. Looker:

The City of San Jose (City) would like to thank you for the opportunity to submit comments on the proposed Basin Plan Amendment for Copper on behalf of the San José/Santa Clara Water Pollution Control Plant (Plant).

The Plant provides wastewater treatment services to the cities of San José and Santa Clara, and other cities and agencies within our tributary area. These include the City of Milpitas, West Valley Sanitary District (Cities of Campbell, Los Gatos, Monte Sereno and Saratoga), Burbank Sanitary District, Cupertino Sanitary District (City of Cupertino), Sunol Sanitary District, and County Sanitation Districts #2 and #3. The Plant service area includes approximately 1.4 million residents and over 16,000 businesses in Silicon Valley.

The City supports the efforts by the San Francisco Bay Water Board (Water Board), Bay Area Clean Water Agencies (BACWA), and Clean Estuary Project (CEP) to develop copper SSOs for the four Bay regions north of the Dumbarton Bridge (NDB) and a Bay-wide Implementation Plan, which includes Bay Region 5, located below Dumbarton Bridge. The City actively participated in the NDB copper SSO development effort and supports the SSOs, ambient monitoring triggers, proposed monitoring schedule, and dissolved-to-total translators recommended in the staff report. The proposed revisions to the Basin Plan streamline and improve the implementation process for existing and proposed copper SSOs. The revised copper management strategy is a reasonable and equitable approach that shares responsibility among all Bay-area dischargers.

However, San Jose staff wish to highlight three issues of concern to the City:

- NPDES Permit requirements for studying uncertainties
- Discussion of copper in Bay sediments
- Characterization of studies conducted by NOAA Fisheries and the need to address the uncertainty of the effect of copper on salmonid olfaction

**NPDES Permit Requirements to Conduct Studies to Reduce Uncertainties**

The City routinely conducts technical activities to help understand the impact of the Plant's discharge and runoff from its urban landscape on San Francisco Bay receiving waters. These investigations currently include an in-Plant mercury Fate and Transport Study and copper/nickel SSO trigger monitoring in Lower South San Francisco Bay (LSB, below Dumbarton Bridge). The City also supports broader Bay-area efforts through the BACWA (e.g. Cyanide), CEP (e.g. cyanide, copper, pesticides, stormwater contaminant loadings), and SCVURPPP (characterization of urban runoff). The language in the current staff report deviates from that used in the past concerning NPDES permittee support for specific studies. For example, Section 2.1, Part 3.d. states that there will be "permit requirements to conduct or cause to be conducted technical studies to investigate urban runoff loads, possible copper sediment toxicity and sublethal effects on salmonids." There is no specific mention that any of these requirements may be fulfilled through active participation in the CEP, RMP, or other collective, stakeholder efforts.

The City believes that the best use of limited Bay-area resources (NPDES permitees, Regional Monitoring Program (RMP), CEP) is accomplished by cooperation, consensus, and prioritization by a Bay-wide stakeholder group rather than by individual NPDES permittees. For example, the amount of resources proposed for sediment toxicity characterization studies in the Bay should be evaluated against other potential or known Bay contaminant issues that need to be addressed or resolved. 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. The City recommends that the staff report explicitly state, similar to what is enforceable in the City's current NPDES Permit, that... "active participation by the Discharger in the Clean Estuary Partnership (CEP) shall fulfill the requirements of this provision."

**Description and Discussion of Sediment Copper Issues in the Staff Report**

The Copper Impairment Assessment Reports for the Bay, for both NDB and LSB Bay Regions, indicate that there continues to be uncertainty over the effect of copper concentrations in Bay sediments on biota. The City agrees with these assessments. However, the statement of the problem presented in the staff report is misleading and the importance of this issue with respect to other monitoring needs in the Bay is not addressed. The City is concerned that this will potentially lead to inefficient utilization of available, but limited Bay-area resources, including those of the City.

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. No station studied had greater potential to ameliorate the effects of added copper than BD15, regardless of its source of copper.

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.

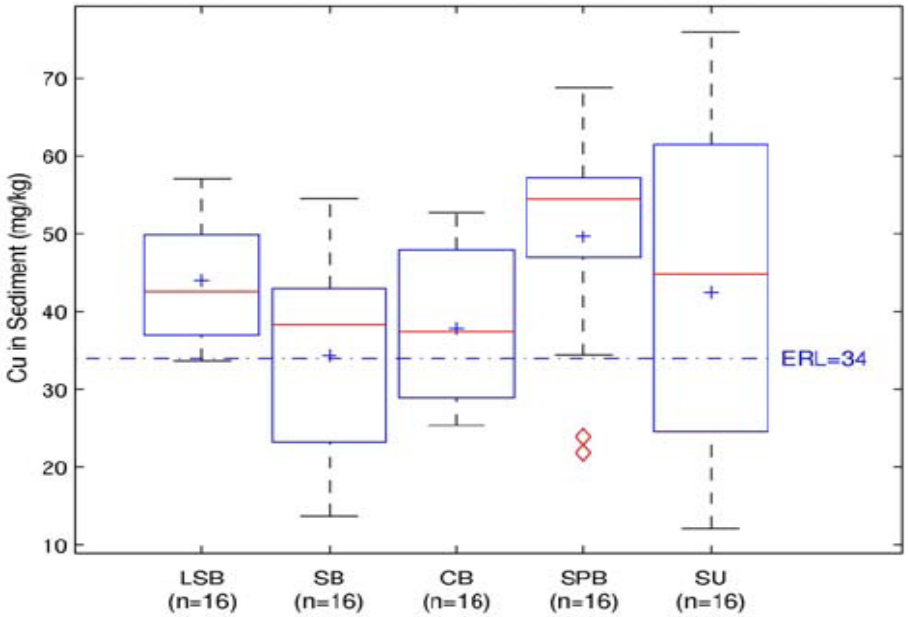
The City is also concerned about the staff report reference to the Phillips *et al*. 2003 study results. City staff has previously reviewed this paper and found that the results of the study do not support the study conclusions concerning copper (see attached comments). There was more toxicity in the 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." The conclusion in Phillips *et al*. 2003 refers only to toxicity removed by divalent cation toxicity amelioration techniques and not to the total toxicity exhibited in the samples. Using this quotation in the staff report is a misrepresentation of the results of the study.

In Phillips *et al*. 2003, none of the observed toxicity in the 100% elutriate samples was removed by any of the treatments. Results were enigmatic. No clear cause of the majority of toxicity in the samples was found. The City would have serious reservations about funding such studies in the future because it is not clear that, as designed, they would yield helpful results. 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 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 (see http://www.sfei.org/rmp/2004to05/AMR_2004-2005_Ch3_Sediment.pdf). Figure 3.6b from this RMP document clearly and concisely shows 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. These results are a much better explanation of the potential role of copper toxicity in Bay sediments than the discussion in the staff report.

## Figure 3.6b (from RMP Ambient Monitoring Results 2004-2005)




Region Code: LSB=Lower South Bay, SB=South Bay, CB=Central Bay, SPB=San Pablo Bay, SU=Suisun Bay

**b) Schematic Box Plot of sediment copper** concentrations for the random sites in five Estuary regions (2004-2005). See Section 1.3.1 for an explanation of the schematic box plot.

**Effects of Copper on Salmonid Olfaction**

NOAA Fisheries studies concerning the role of copper in salmonid olfaction have not been well designed. These studies used municipal or well water rather than natural surface water(s). This makes extrapolation of study results to in-stream effects difficult or impossible. All the NOAA studies concerning the inhibitory role of copper in olfaction failed to consider the role of organic carbon in ameliorating the effects of copper. The shortcomings of the NOAA studies were detailed in a critical review of the effects of copper on salmonid olfaction reported by the City in April 2005, as part of a CEP effort.

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 the above critique.

In closing, the City supports the recommended copper Site-Specific Objectives and the Bay-wide approach to implementing these objectives. The copper objectives are scientifically sound and environmentally protective. The City appreciates the opportunity to have participated in this effort and commends the Water Board staff for their tireless and dedicated effort to establish appropriate water quality standards for copper in the Bay. If you have any questions or concerns, please contact Pete Schafer of my staff at 408-945-5399 with any questions or comments.

Sincerely,

John Stufflebean
Director, Environmental Services
City of San Jose

Attachment

Comments on SFEI's (Phillips et. al.) Grizzly Bay sediment toxicity investigation

Title: Causes of Sediment Toxicity to *Mytilus galloprovincialis* in San Francisco Bay, California

This paper presents some critical information and results characterizing the persistent toxicity associated with Grizzly Bay sediments. Sediment toxicity at this station and its underlying causes appears to be variable, complex, and enigmatic. The paper helps to clarify the role of copper in the persistent toxicity observed at this station. There is concern, however, that the role of copper in the sediment toxicity at this station may have been overstated in the paper's conclusions. The following remarks describe some of these concerns.

The paper describes results of Toxicity Identification Evaluation (TIE) manipulations done on three Grizzly Bay sediment samples. Three of the paper's conclusions (restated below) are critically reviewed with regard to the TIE results obtained for the three samples.

Conclusion 1, stated in the Abstract: "TIE results and chemical analyses of elutriate samples suggested that divalent metals were responsible for the observed toxicity."

Conclusion 2, stated in the Discussion section: "Chemical analyses of three elutriate samples demonstrated copper concentrations were within the range toxic to bivalves."

Conclusion 3, stated in the Discussion section: "Although metal concentrations in Grizzly Bay samples were measured above *M. galloprovincialis* tolerance limits only in the third TIE, it is possible that low concentrations of metals might be working additively or synergistically to cause toxicity."

Comment 1: Regarding Conclusion 1, divalent metals may have been responsible for **some** of the observed toxicity. It could be argued that the toxicity that was not ameliorated by EDTA or cation column was as (or more) significant than the toxicity actually removed by those treatments. For example, 54%, 67%, and 32% of the toxicity in samples 1-3, respectively, was not removed by EDTA or Cation column. None of the observed toxicity in the 100% elutriate samples was removed by any of the treatments.

Comment 2: Conclusions 2 and 3 are overstated. All three samples showed significant toxicity in an elutriate concentration in which the copper concentration was clearly not "within the range" or "above…tolerance limits…" for *M. galloprovincialis.* Copper was measured at 2.5, 0.23, and 8.7 μg/L, respectively, in the three (100%) elutriate samples. Therefore, copper levels in the 50% elutriate concentrations were 1.25, 0.12, and 4.4 μg/L, respectively. All three concentrations are well below the current EPA Final Acute Value (EC50) of 9.625 μg/L for *M. galloprovincialis*, below the author's EC50 of 7.8 μg/L cited in Table 2, and below the author's (MPSL unpublished data cited in RMP contribution # 43) LOEC of 5.6 μg/L for this species. Notwithstanding the reduction in sample 2 toxicity by EDTA, it would be unreasonable and misleading to describe the effect of 0.12 μg/L copper as potentially "synergistic" since the mean oceanic concentration of copper in the North Pacific Ocean is 150 ng/kg (approx. 0.15 μg/L, Bruland 1980). Further, in sample 3, there appears to be a significant effect in the 6.25%

elutriate sample (the author does not say). The concentration of copper in that sample would have been 0.5 μg/L.

Comment 3: The source of toxicity in Grizzly Bay sediment samples is clearly enigmatic. There are several issues that require more investigation before the role of copper can be clearly understood. The increase in toxicity following an upward pH adjustment to sample 2 is one example. As the author mentions, this anomaly requires additional investigation. The results with C18 column treatment is also quite puzzling since one would expect some organic pollutant contamination at the Grizzly Bay station and since C18 is known to remove some divalent cation toxicity (e.g. zinc). It is helpful to keep in mind that the TIE manipulations may not address all of the potential toxicity sources. In fact, it may not address any of them. For example, the author states in RMP contribution # 43 that "Toxicity was not significantly mitigated in any of the TIE manipulations performed on the San Joaquin River sample." Does this mean that there was no "organic" contaminant and no "divalent cation" toxicity in the sample?

This paper increases our understanding of Grizzly Bay sediment toxicity. However, there is much more that we need to know and characterize before we can adequately assess the role of copper in toxicity of elutriate samples from that station.

# Peer Review Comments

**Memo to:** Richard Looker
CC: Dr. David Jenkins
**From:** Alex Horne
**Re:** Proposed Basin Plan Amendments & Staff Report – Copper Site-specific objectives in San Francisco Bay
**Date:** 26 March 2007

## SUMMARY

This memo is part of the required external peer review (SB 1320) the requires a scientific basis for all Basin Plan amendments. In general this amendment proposed standards that are more scientifically-based than the previous standards and so is scientifically welcome. In particular, it is gratifying to see so much good research and monitoring carried out and used here. I concur that the proposed Basin Plan Amendments should be promulgated into law. However, there are still two major areas where science is not well represented and some "hand waving" is involved in the estimation of the numerical standards. How would the US have got to the moon if the strength (weight) of the spacecraft had been doubled as a safety factor? To some extent these are not fully in the control of state agencies but nonetheless should be incorporated over the next five years since the proposed standards may cause undue stress and expense to the public. The three areas are (i) the calculation of the final acute and chronic criteria (ii) the interpretation of the toxicity tests and (iii) the use of an indirect measure of toxic copper.

## RECOMMENDATIONS

- 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.
- Rationale for not using the direct free copper as a standard needs to be added (or the future measure of toxic copper changed).
- The Board work with various agencies to sort out the ecological significance of the newer more sensitive tests on the effects of chemicals on wildlife.

## DETAILS

**A. The calculation of the criteria**. The users of San Francisco Bay (fish, clams, algae, sewage plants, sailors) are most concerned with the final legal acute and chronic criteria. As is indicated on page 4-11, the FAV is the basis for both the chronic and acute criteria. The FAV is stated in the report as the concentration of pollutant that is protective of 95% of the genera of animals and plants that have been tested for toxicity for this pollutant. However, when used in the criteria the FAV is divided by two (as a safety factor). This has been said many times by many scientists; why 2 and why not 4? Either trust the scientific method or go back to witchcraft. How would we have got to play golf on the moon if we had doubled the weight of the spacecraft as a safety factor? While taking half of the number found by painfully precise scientific testing may be a good political move, it is scientifically inappropriate. It is poor scientific practice to mix real numbers with made up ones. It is far better to arrive at the final numerical value using science and then

clearly state at the last step that a new lower politically-based number is being used for the legal criterion.

**B. The interpretation of copper toxicity tests**

1. The concentration and speciation of copper used. All of the numbers used to come up with the final numerical standards are based on comparing toxicity test data with various kinds of measurements of copper species in the water (and some mathematical models of the data). In order to make a toxicity test copper is added to real bay water or laboratory water and the effects on organisms measured. The best science would have the added elevated copper be exactly the same composition of species as in the control sample. Alternately, the copper speciation in the likely added water (sewage effluent, boat scrapings, brake pad debris) could be used. In this case copper species refers to the usual mixture of particulate, weakly or strongly chelated dissolved copper and free ionic copper. If the less toxic species is added, for example only refractory particulate copper, the true toxicity will certainly be severely under-estimated. On the other hand, if the more toxic species is added, for example only free dissolved copper, the toxicity may be (will be?) severely over-estimated. I do not think that the toxicity tests used in this report fully grasp this difference. Therefore, I am not fully satisfied that the proposed criteria are soundly based. I attach a memo sent earlier that amplifies this concern.
2. The use of advanced (sub-lethal) chronic tests. To calculate the lowest acceptable copper values the report partially depends on the effects of copper on salmonid lateral lines or olfactory sensitivity (eg, chapter 3). I have measured other kinds of sub-lethal effects in both animals and plants for example in my work with the CFG on juvenile Dungeness crabs or bay mussels and TOR (chlorinated and dechlorinated wastes). In my opinion it is of dubious scientific merit to use these kind of numbers in the same way as the earlier chronic or acute data. If done with a sufficiently sensitive instrument or with many replicates these advanced sub-lethal effects can be made statistically significant. However, are they ecologically significant? That is do they affect the abundance and diversity of the bay organism? It should not make any difference whether the species affected is endangered or not, since all that counts for a rare species is more of them. If the effect is ecologically insignificant, that is the same number of individuals survive to breed and breed successfully, that effect is not worth fixing. This leaves out the consideration that the animals or plants may not feel fully comfortable at these very low levels of copper. It is not clear if a decrease in lateral line sensitivity in a salmon (the equivalent might be loss of a bit of dark vision in humans) is an important consideration. It might be worth something if all other factors in a salmon (or human) life were ideal. As it is the cost of say, decreasing free copper copper in SF Bay to < 2 ug/L would be very high compared with other stresses on such fish. However, if used creatively, for example by my scheme of dredging, treating and filling the Delta with these sediments, an lower copper level in the Bay could be reached with a profit. Also the use of more natural or artificial chelators (as in the LA trench) was a good method.

**C. The use of a better test copper species**

It is not the best science to use an indirect indicator when the direct on is available. As the report often states, for copper and some other metals it is the free copper species that is toxic. Since there is an easy test for un-chelated copper why not use it? One objection is that the chelation bond between the metal and the ligand can be weak (easily broken) or strong (not easily broken). This report states that work by Bruland in the bay shows the copper-ligand bond to be strong. Thus I would recommend a gradual transfer to the direct measurement of free copper. It would assist in making a final solution since the errors of toxicity would be less using a direct measure of toxic copper.

**APPENDIX. MEMO RE TOXICITY TESTING**

On page 3-8 (last complete paragraph) there is an assumption that 6.9 ug/L of dissolved copper = $10^{-11}$ moles of free copper ($Cu^{++}$; +/- a few water molecules). Since $10^{-11}$ moles of copper = 0.64 ng of copper I assume that:

1. There is error of $10^{4}$ somewhere or, more probably

2. That it is assumed (from earlier in the report) from Bruland's work that measured chelated copper as 99.9% of the total dissolved copper. Thus only 0.1% (1/1,000) as free copper. This solves the $10^{-4}$ effect but creates an interpretation problem for the toxicity.

The normal way to measure toxicity is to add free copper (often as copper sulfate pentahydrate) to cultures of algae, in natural waters or sometimes in artificial media. Thus, for example, a test using 10 ug/L of copper would be 10 ug/L of free ionic copper, not 10 x $10^{-4}$ ug of free copper. Although there may be some organic ligands present in algae cultures they are often present in low concentrations since artificial media are sometimes used, the equilibrium with copper takes some time (as noted in the early part of the Report).

The uptake of free copper uptake into animals and plants is fast so this level of copper (10 ug/L) in toxicity tests is more likely equivalent to 10,000 ug/L or 10 mg/L - four orders of magnitude higher than the level supposed to affect phytoplankton in SF Bay. This error was present in the initial EPA copper toxicity standards which used my paper on copper toxicity (Horne & Goldman, 1974; Suppression of nitrogen fixation by blue-green algae in an eutrophic lake with trace additions of copper. *Science,* 183: 409-411). At this time the value of 5-10 ug/L Cu was the lowest level ever found that would produce a chronic toxicity effect in algae (on $N_2$-fixation, not growth or photosynthesis) and this seems to be the level the RWQCB is using in SF Bay. However, the copper was added as free copper, not copper equilibrated for a few days with natural waters and their ligands. I talked with the EPA at the time about misinterpreting my toxicity data but to no avail.

It is possible that since my work 30 years ago there have been more sophisticated measures of ligands and free copper in toxicity tests. I do not know the exact uptake rate of free copper in to algae versus the rate of chelation of copper with natural ligands and the concentrations likely to be present in natural waters. However, I have not read such an toxicity analysis where the relationship between added ionic copper and toxicity of phytoplankton was considered. It is no use measuring the copper fractions after a few days when toxicity becomes apparent since the damage may have occurred in the first 30 minutes. If you add copper that has been chelated, as for example with wastewater, as Jack Gregg and I did in the 1980s, the toxicity might be more like that when EDTA is added to the class fish toxicity test we use to do at Cal in the 1980s (+ EDTA no effect; without EDTA, even low copper is toxic when added as copper sulfate).

Thus I find the whole underpinning of the copper standard a little creaky, as I did in the past. It seems likely to me that someone has solved this problem of what exactly the algae see in toxicity tests in terms of free and chelated (and inorganically bound) copper but it needs to be made clear in the report since so much money has been spent on copper control so far. I hope you can help me solve this particular concern. If nothing else an explanation is needed in that paragraph.

**Staff Report on Copper Site Specific Objectives in San Francisco Bay, SF Bay Water Board**
**Review comments of David Jenkins, Professor Emeritus, UC Berkeley**

1. I have made minor comments on the paper copy of the report that you sent me. This memo contains the more substantive comments.
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.
3. pp 3-1and 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.
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.
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.
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.
7. p 3-8 para 4 line 1. Does this concn refer to total u, dissolved Cu or ionic Cu, or what?
8. p 3-12 para 4 line 7. Do you mean the dry, windy season?
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!
10. p 4-3 Figure 4-1 does not have a label on the vertical axis…total Cu?
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.
12. p 4-11 para 4, line 2. It is not clear who lowered the FAV for M. edulis…you or the EPA?
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!

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!
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.
16. p 5-1 para 4 line 7. “Domestic sources” is not a component of urban runoff.
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.
18. p 5-6 para 1 lines 3-4. Does not make sense.
19. p 5-7 para 1 lines 3-6. This sentence is difficult to understand. Please reword it.
20. p 5-6 para 6 lines 7-8. You cannot say this if you are talking about uncertainties. This is prejudging the outcome.
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.
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.
23. pp 6-1 to 6-9 not reviewed
24. Chapter 8 not reviewed
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.
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!

David Jenkins
Kensington CA
March 11 2007