

Subject Matter Code: C-02b Copper Aquatic Life

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Comment: Proposed copper criteria ignore San Francisco Bay data that show damage to sensitive populations at lower dissolved copper concentrations and led the state to reject criteria that deregulate total copper in its water quality criteria. The proposed rule states that: "New data including data collected from studies for the New York/New Jersey Harbor and the San Francisco Bay indicated a need to revise the copper criteria documents to reflect a change in the saltwater" criteria. In contrast to this statement, many scientists involved in review of the San Francisco Bay study reached a very different conclusion.

Many scientists commented during the state's review that the data did not necessarily support a revised copper criterion. EPA scientists raised many questions regarding: inadequate seasonal sampling; departure from standard testing recommendations; interpretation of toxicity test endpoints and precision; interpretation of widely varying responses; failure to measure dissolved copper in key bioassays and sites; overestimation of the amount of copper producing an effect; significant problems with algal test interpretation; confusion of acute versus chronic exposure; unmeasured effects of filtration; joint toxicity of copper with other metals; multiple stresses; bioaccumulation; and, generally, how lab results will "mimic environmental reality."(\*17)

Other scientists stated similar and stronger concerns, Dr. Michael Perrone commented that "there isn't a positive demonstration that dissolved copper is a good predictor" of environmental ion.(\*18) The state's Department of Fish and Game also stated that "[t]otal copper can become protect unbound and available for uptake by organisms" in comments voicing many of the concerns listed above, and recommended: "Retain the existing criteria of 2.9 ug/L as total copper."(\*19)

The weight of scientific opinion raised sufficient questions about how these laboratory studies "mimic environmental reality" to warrant analysis of field data. This showed species had responded to changes in Bay copper, and those bivalve shellfish and phytoplankton which are most vulnerable to copper toxicity were severely reduced in abundance although they once thrived here, and thrive in similar estuaries at dissolved copper levels of about 1 ug/L or less.(\*1) Comparison of high quality data between estuaries further demonstrated S.F. Bay copper pollution similar to other polluted estuaries, and dissolved copper levels below 1 ug/L in unpolluted or less polluted estuaries where these copper-sensitive species thrive.(\*2) There is a "reasonable probability" that copper levels in waters of the southern reach affect the ecosystem, and cutting copper pollution will likely benefit aquatic life.(\*1)

Therefore, the state's review of all of this evidence led to a decision to adopt a criterion for total copper that would require reduced copper concentrations. The fundamental rationale for this was that cutting copper pollution was necessary in order to ensure the protection of aquatic life. In contrast, EPA's

proposed 3.1 ug/L dissolved copper criterion, which would not require less copper in most Bay waters as shown in Table 4, and which allows dissolved copper three times levels at which sensitive estuarine species are known to thrive, cannot ensure the protection of Bay aquatic life based on sound scientific rationale.

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(\*1) U.S. Geological Survey, 1992. Letter from Samuel N. Luoma, Ph.D., to Steven R. Ritchie, Executive Officer, Regional Water Quality Control Board. August 24, 1992.

(\*2) Karras, 1992. Comparison of copper in waters of the southern reach of San Francisco Bay and ten other estuaries. Communities for a Better Environment (CBE). July, 1992.

(\*17) USEPA, 1992. Comments on the data presented in the Hansen Report. Includes cover letter from Maria Rea, Chief, Water Quality Standards Section, to Steven R. Ritchie, Executive Officer, Regional Water Quality Control Board, San Francisco Bay Region. July 15, 1992.

(\*18) California State Water Resources Control Board, 1992. Memorandum from Michael Perrone, Ph. D., to Lynn Suer, Ph.D., Regional Water Quality Control Board, re: Review of draft final report entitled "Development of site specific criteria for copper for San Francisco Bay." June 29, 1992.

(\*19) California Department of Fish and Game, 1992. Comments on the Draft Final Report Entitled "Development of site-specific criteria for copper for San Francisco Bay." Letter from John Turner, DFG, to Steven R. Ritchie, RWQCB. July 14, 1992.

Response to: CTR-002-008

EPA does not agree with the commenter's comment concerning a copper criterion of 1 ug/L. This issue was raised in 1992 when the San Francisco Bay Regional Water Quality Control Board (SF RWQCB) published its site-specific copper value (based on total copper). EPA agrees with the SF RWQCB's position, which it articulated in its October 21, 1992, "Responses to Comments - Site-specific Copper Objective" for the September 25, 1992, report titled "Revised Report on Proposed Amendment to Establish a Site-Specific Objective for Copper in San Francisco Bay". The SF RWQCB noted that the ambient concentrations in South San Francisco Bay were well above the 1 ug/L in Tomales Bay and then stated that, "the observation that some organisms are more abundant in Tomales Bay where concentrations are less than 1 ug/L does not mean that 1 ug/L is needed to insure protection of these organisms in San Francisco Bay." This would be setting a criterion "based on correlation rather than controlled experimentation, and does not account for the many other factors that can affect the distribution and abundance of organisms."

EPA believes that the weight of sound scientific evidence fully supports the protectiveness of its copper criterion. EPA does not consider the commenter's interpretation of reference 17 (1992 EPA comments on the site-specific modifications of the copper criterion for San Francisco Bay) relevant to the CTR copper criterion. The subject of reference 17 was not the CTR criterion, and the information available to EPA when it formulated its 1992 comments (the commenter's reference 17) was less than the information available to EPA in formulating the criterion in this rule. In its 1995 "Ambient Water Quality Criteria - Saltwater Copper Addendum", EPA examined the data available from the San Francisco Bay studies and utilized only the data with suitable quality into its revised national criterion (which was used in the CTR).

Concerning the comment about whether dissolved copper is a good predictor of environmental ion

(reference 18), EPA does not agree that such prediction is cogent. The intent of the copper criterion in the rule is to prevent copper toxicity, not to achieve any fixed concentration of free ionic copper.

Concerning the comment that "total copper can become unbound and available", EPA notes that unbound and available copper is covered by the criterion incorporated in the rule. Thus, EPA does not believe that this a concern. See also the response to CTR-026-004 concerning dissolved v. total recoverable metals criteria.

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Comment: II. Use of New Scientific Information

The City acknowledges and supports EPA's update of several water quality criteria including those for mercury, cadmium and arsenic. While a number of criteria were updated to reflect current scientific information, there are a few notable exceptions.

The following briefly addresses the key updates and omissions that should be addressed in the final publication of this rule.

## B. Outdated Science

### 1. Copper

The proposed copper criteria do not reflect the expected toxicity of this pollutant in the environment and will result in unnecessarily restrictive requirements throughout the state. Although required by the National Guidelines, the copper criteria fail to include an adjustment to account for binding with organic material such as that expected to occur in storm waters and in treatment plant effluents that renders this pollutant non-toxic (see enclosed article, Exhibit 5). Application of the criteria as a dissolved standard will likely result in many facilities being identified as in violation of the criteria. Few storm waters are expected to meet the acute criteria due to low hardness of such waters. The City's storm water monitoring has indicated that such waters exceed the proposed acute criteria. The typical Total Organic Copper ("TOC") level present in storm waters (8-20 mg/l) is well above the 3 mg/l value specified in EPA's Copper Criteria Document as indicative of significant organic complexing and the need to modify the criteria. Consistent with the available technical data and criteria development guidelines, the copper criteria must be modified to address organic binding as part of the criteria to avoid classifying many dischargers as toxic threats when no such threat actually exists. The following identifies the scope of concerns regarding proper application of copper criteria and the technical information that demonstrates EPA's copper criteria routinely overestimate actual aquatic life threats.

(a) Introduction

No single issue in the development and application of water quality criteria for metals is of greater importance to NPDES permittees than the accurate assessment of aquatic toxicity of copper. The infrastructure of the nation's drinking water supply depends on copper and copper alloy pipes. Along with drinking water conveyance, copper chemicals are widely used for algae control in drinking water supplies and reservoirs. Because of the intimate association between copper and the nation's water supply, it is inevitable that some form of copper will be discharged in wastewater and present in storm waters.

EPA's current approach to copper regulation assumes that the toxic form of the metal exists in biologically treated effluents and storm waters even when all scientific information confirms that it does not. This assumption causes permittees to conduct expensive studies to correct the standard to reflect the lack of environmental threat present. This approach (1) is wasteful of local resources, constituting an unauthorized, unfunded mandate; (2) penalizes small communities which have both limited budgets and access to updated scientific approaches; (3) is inconsistent with EPA's statutory mandates and guidance; and (4) violates regulatory principles outlined in the President's "Reinventing Environmental Regulation" initiative. Because EPA's approach does not reflect reality and easily implemented, less costly approaches exist to properly regulate copper discharges, this criteria should be withdrawn or, at a minimum, narrowed in its application. The following summarizes the scientific and regulatory bases for withdrawal and reconsideration of laboratory-derived numerical water quality criteria for copper to biologically treated effluents.

First, existing copper criteria are not appropriate for biologically treated effluents or situations where elevated TOC levels are known to exist (the typical case where the criteria are applied) because the database used to derive this criterion did not consider the dramatic detoxification of copper by constituents commonly present in biological waste treatment systems. Second, laboratory studies, field surveys, and water effects ratios conducted by regulatory authorities and independent researchers all confirm that copper rapidly binds ("complexes") with organic and inorganic matter (e.g., phosphates) during biological waste treatment, thus rendering copper non-bioavailable and hence non-toxic to aquatic life. Third, all field studies conducted by EPA and state agencies confirm that copper in biologically treated effluents is not toxic to sensitive species which were used to establish the federal copper criteria. This demonstrates that biologically treated effluents eliminate copper toxicity and should pose no threat to resident species instream after mixing.

Briefly, the current body of laboratory research on the detoxifying effects of organic and inorganic matter on copper, including total organic carbon, particulate matter, humic and fulvic and amino acids, explains why scientific field studies consistently show that copper in biologically treated effluents, and by extension storm waters, is not expected to be toxic to aquatic life. Current copper criteria application to treated effluents and storm waters is not appropriate or necessary to protect aquatic life. Use of acute daphnid whole effluent toxicity tests would be sufficient to regulate copper at a level of protection equivalent to the national criteria for copper and eliminate the need for expensive WER analyses.

(b) EPA Must Follow Its Guidance

EPA's national guidance for Clean Water Act Section 304(a) criteria development requires all relevant factors regarding toxicity of a pollutant to be considered in establishing water quality criteria for that pollutant.<sup>(\*16)</sup> Because the current copper criteria are based on assessments of dissolved metal salts in laboratory water with little or no ability to complex copper, the commonly encountered dramatic detoxifying effect of treated effluent and other naturally existing substances present in storm waters were

not considered.

EPA guidance on implementing metals criteria expressly states that it is only the biologically available fraction of the metal that is intended to be regulated. (\*17) Although recent guidance from EPA specifying that metals criteria assessed as "dissolved" may be a better approximation of the toxic fraction under some circumstances, measurements of filterable "dissolved" copper in biologically treated effluents or in storm water samples with high (greater than 5 mg/l) TOC levels are, to a certainty, not relevant to assessing the toxic fraction of copper. Such measurements erroneously assesses non-toxic filterable organo-copper complexes as "dissolved" which is the form in which the metal will be discharged from these facilities or will preferentially exist in the environment. Because the vast majority of facilities that discharge copper utilize biological treatment, it is apparent that widespread misapplication of the copper criteria may result from use of a dissolved metals approach. Similarly, storm waters typically contain TOC levels equivalent to well treated municipal effluent (5-20 mg/l TOC).

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(\*16) Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses, USEPA (1985) (emphasis supplied).

(\*17) Interim Guidance on Interpretation and Implementation of Aquatic Life Criteria for Metals, USEPA (May 28,1992) ("Interim Guidance").

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See response to CTR-020-012.

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Comment: II. Use of New Scientific Information

The City acknowledges and supports EPA's update of several water quality criteria including those for mercury, cadmium and arsenic. While a number of criteria were updated to reflect current scientific information, there are a few notable exceptions.

The following briefly addresses the key updates and omissions that should be addressed in the final publication of this rule.

(e) Copper Criteria Development and Application

(1) Criteria Based on the Dissolved Metal Fraction Overestimate Bioavailable Copper

In 1992, the Pellston Conference of the Society for Environmental Toxicology and Chemistry recommended that water quality standards be established on the basis of bio-availability.(\*18) On May 28, 1992, EPA released the Interim Guidance on Interpretation and Implementation of Aquatic Life Criteria for Metals ("Interim Guidance"), a final policy which modified all prior Section 304(a) criteria documents for metals and implemented this recommendation. In issuing its Interim Guidance, EPA acknowledged that only the biologically available fraction of metals is responsible for aquatic toxicity, and therefore is the proper focus of permit limit derivation:

The principal issue is the correlation between metals that are measured and metals that are biologically available.(\*19)

In the Interim Guidance and contemporaneous correspondence, EPA acknowledged that expressing water quality criteria for metals as dissolved measurements is a conservative approach and that a state should consider further reductions in toxicity from complexing:

Alternatively, we are allowing States to apply criteria to dissolved metals only. However, we suspect that this may be a somewhat less accurate method of excluding "nontoxic" metal from regulation, because some dissolved metal exists in forms that have little toxicity (particularly copper, a pollutant of great concern to municipal dischargers)...(\*20)

Following the January 1993 Annapolis Conference on the development and implementation of metals criteria, EPA modified its criteria implementation guidance to use dissolved metal (i.e., filterable through a 0.45 u membrane) concentrations in setting water quality standards "because dissolved metal more closely approximates the bioavailable fraction of metal in the water column than does total recoverable metal.(\*21) Scientists at the Annapolis Conference emphasized that under certain circumstances, dissolved metal standards are conservative and may overstate the toxic fraction: "In some cases, even the dissolved concentration may overestimate the bioavailable fraction for metals that strongly complex to either inorganic or organic ligands (e.g., filterable carbon containing particles).(\*22) Because the dissolved approach erroneously equates all "filterable" dissolved copper to bioavailable copper, dissolved metals measurements overstate the toxic metal fraction in biologically treated effluents.

## (2) All Laboratory Studies Confirm Copper is Detoxified by Organic Substances in Sewage

The detoxifying influence of organic and inorganic complexation on copper was reported in EPA's 1984 Copper Criteria Document.(\*23) Among the heavy metals, copper is particularly amenable to complexation with organic and inorganic matter to render this metal non-bioavailable and hence non-toxic to aquatic life. Aquatic organisms respond to free ionic metal and monohydroxy complexes as bioavailable forms.(\*24) Rapid detoxification of copper in the presence of inorganic and organic substances occurs due to the high reactivity of this metal:

[t]he cupric ion is highly reactive and forms moderate to strong complexes with many inorganic and organic constituents of natural waters (e.g., carbonate, phosphate, amino acids and humates), and is readily sorbed onto surfaces of suspended solids.(\*25)

EPA's 1984 criteria application guidance provided a criteria adjustment for hardness -- one of the many substances present in biologically treated effluents -- but omitted similar consideration of organic ligands, even though EPA recognized their greater importance in detoxifying copper:

Lind, et al., (Manuscript) measured the toxicity of copper to *Daphnia pulex* in a variety of surface

waters and found that total organic carbon (TOC) is a more important variable than hardness, with acute values varying approximately 30-fold over the range of TOC covered. Similar results were obtained with the fathead minnow. This indicates that the criteria should be adjusted upward for surface waters with TOC significantly above the 2 to 3 mg/L usually found in waters used for toxicity tests. (\*26)

The scientific literature is replete with peer reviewed studies confirming that organic ligands similar to those in municipal effluents dramatically mitigate copper toxicity. (\*27) Callahan, et al., concluded that most cupric salts are not readily water soluble and reported that inorganic and organic complexation and adsorption of copper reduce the level of soluble copper to very low values, even in the presence of total copper. (\*28) The linear relationship between reduction in toxicity of total copper to rainbow trout with increasing concentrations of suspended organic solids was reported by Brown. (\*29) This work reported that doubling the concentration of organic ligand from 4 mg/l to 8 mg/l approximately doubled the 96-hour LC50 for copper. Brown concluded:

toxicity to rainbow trout of a given total concentration of copper was quantitatively reduced in the presence of a good quality sewage effluent, of an amino acid, of humic substances, and of suspended organic solids. (\*30)

Similar results were obtained by Sunda and Lewis, who reported complexation of 61 to 99 percent of free copper by river water containing natural organic matter at 22 mg/l. (\*31) Erickson, et al., reported that copper complexed with organic ligands appears to be one-fifth as toxic as free ionic copper, and that addition of organic matter (humic substances) increased the LC50 of copper by 2.7. Morrison and Florence reported that copper toxicity to algae and *Daphnia magna* was decreased by sixty (60) percent in the presence of 5 mg/l fulvic acids and eliminated in the presence of 1.3 to 8 mg/l humic acid colloids. (\*32) As noted previously, storm waters typically contain TOC levels in excess of these values.

The above laboratory studies conducted under conditions with relatively low levels of binding agents confirm that even when relatively high "dissolved" copper concentrations were measured, the toxicity of copper to sensitive species was greatly reduced or eliminated in the presence of organic and inorganic compounds. The amount of copper complexed in the presence of high concentrations of organic ligands in biological waste treatment systems or urban storm waters would, of course, be much greater. As the amount of ligands and other binding agents is, stoichiometrically, greatly in excess of the ionic copper for typical municipal and storm water conditions, no copper will be present in a toxic form. This fact was demonstrated by Allen and Hansen. (\*33)

On the basis of over twenty years of observations and research on metal speciation chemistry and fate of metals in receiving waters and in treatment facilities, Dr. Allen concluded that virtually all copper in biologically treated effluent is non-toxic:

Following biological treatment, virtually all the copper present in a municipal treatment plant effluent would be in the form of soluble copper complexes or it would be sorbed to particulate material not removed from the effluent stream in the final clarifier. Certainly, as in any chemical equilibrium situation, there will be a finite concentration of free, ionic copper present in the effluent. However, this concentration will be very low and will not pose a toxicity risk. This is borne out by a lack of metal toxicity in treatment plant effluents when effluent monitoring studies have been conducted. As far as I know, such studies have not demonstrated that there is toxicity from metals in effluents. (\*34)

Field studies of WERs have repeatedly confirmed laboratory observations and validate the total detoxification of copper by biologically treated effluents. DiToro, et al., performed WERs on the site-specific detoxification of copper in the Naugatuck River. (\*35)

Very little difference in toxicity was observed between laboratory water with minimal complexing ability and river water from pristine segments. However, where river water contained treated municipal effluents, up to a twelve-fold reduction in copper toxicity was recorded, and it was concluded that the copper present in the municipal effluent was non-toxic. A 1992 summary of WERs for heavy metals compiled by Brungs showed that copper is up to 26 times less toxic in water influenced by municipal effluent.(\*36) It should be noted that to have a WER significantly above one (1), the existing metal in the discharge must be complexed. The WER actually represents the excess binding capacity of the effluent.

The dramatic detoxification of copper in the presence of municipal effluent was also reported in a field study on Shayler Run by Geckler, et al.

It was suspected that the Shayler Run sewage treatment plant was discharging materials that were detoxifying copper in Shayler Run water. Bioassays, using diluent water from above and below the entrance of the effluent, indicated that copper was much less toxic in Shayler Run water below the plant. Additional toxicity tests, in which Shayler Run water was diluted with a reconstituted water similar in hardness and alkalinity, indicated that the reduction in toxicity was not due to hardness or alkalinity, but to some other detoxifying agent or agents being diluted.(\*37)

The North Carolina Department of Environment, Health, and Natural Resources documented 78 cases in which total recoverable copper in effluents and in receiving waters was measured in excess of water quality criteria without observed chronic toxicity. Instream total copper ranged up to 378 ug/l. Bioassay testing was conducted using *Daphnia magna*, one of the most sensitive species to copper (see Exhibit 7). The Massachusetts Department of Environmental Protection confirmed the same results in their survey of 35 facilities. These documents have previously been provided to EPA as part of the public comments on the May 1995 National Toxics Rule revision. No public response to those comments was ever published. As a result of the extensive NWR analysis performed by the Connecticut Department of Environmental Protection, it was demonstrated that water upstream from municipal dischargers exhibit a typical WER of three (3) while those downstream of publicly owned treatment works ("POTWs") exhibit WERs ranging from 8 to 25 (Exhibit 8). As expected, the higher WERs are associated with increased levels of municipal effluent and organic material.

The above field studies confirm the observations made by laboratory research and validate the rapid detoxification of copper in the presence of treated effluents and elevated TOC levels. Stockton is not aware of any reported instances that contraindicate copper in biologically treated effluent is non-toxic to sensitive species. Thus, it is apparent that there is no technical or environmental basis for concern regarding copper levels typically discharged by biologically treated facilities (copper ranging from 20 to 200 ppb). Nor is there any rational basis to be concerned with low level dissolved copper measurements in storm waters where TOC levels are capable of fully binding the available copper. The continued application of a dissolved criteria approach which would classify these effluents as problematic when they clearly are not is arbitrary and capricious and wastes local resources on problems that do not exist.

### (3) Water Quality Criteria Must be Based on the Latest Scientific Information and the Proper Application of Science

The fundamental oversight in translating dissolved copper criteria into permit conditions is the failure to regulate only bioavailable metal. The laboratory conditions of the EPA criteria development experiments accurately reflect the maximum toxic impacts to highly sensitive species when exposed to a highly toxic dissolved, ionic form of copper in pure water having little or no complexing ability. Such conditions are

plainly unrelated to copper discharged from biological waste treatment systems. Because of the greater abundance of complexing agents present in biological treatment process, all copper in a discharge will be in a complexed and therefore non-bioavailable form. This is particularly true for effluent dominated, low dilution streams and storm waters where proper criteria application is most critical.

EPA must apply copper water quality criteria in the same manner in which they were developed. The National Guidelines prohibit application of the criteria in a manner not contemplated by that document:

Criteria must be used in a manner that is consistent with the way in which they were derived if the intended level of protection is to be provided in the real world... Concentrations, durations and frequencies specified in criteria are based on biological, ecological and toxicological data, and are designed to protect aquatic organisms and their uses from unacceptable effects.(\*38)

Application of water quality standards for copper must reflect the pollutant form assessed in the criteria. The National Guidelines require revision of criteria whenever it is demonstrated that the national criteria "would probably be substantially over or under protective."(\*39) As the dissolved approach has been demonstrated to be overprotective in all cases involving biologically treated effluents and elevated TOC, this procedure requires revision.

By allowing scientifically defensible biomonitoring/bioassay methods as an alternative method of developing water quality criteria and water quality-based effluent limitations, EPA would assure adequate protection of only the toxic or bioavailable fraction of copper. This approach is outlined in the most recent SETAC Conference report on proper application of metals criteria. Unlike standards expressed in terms of analytical measurements (e.g., "total recoverable" or "dissolved"), use of bioassay tests to directly evaluate the bioavailable fraction of copper is rationally related to the actual potential for aquatic life impacts to the species that drove the national criteria (ie., daphnids).

The language of EPA regulations makes it clear that the Agency's authority to develop criteria rests on the scientific accuracy by which those criteria relate to aquatic impacts:

Section 304(a) criteria are developed by EPA under authority of Section 304(a) of the Act based on the latest scientific information on the relationship that the effect of a constituent concentration has on a particular aquatic species and/or human health. 40 C.F.R. 131.3(c) (emphasis supplied).

Therefore, Agency endorsement of test methods that are known to exhibit little relationship to aquatic life protection needs exceeds the scope of the Agency's authority to develop and implement criteria.

#### (4) EPA Is Bound to Adhere to Published Guidance

Both the Clean Water Act and EPA's National Guidelines establish the underlying mechanism for establishing Section 304(a) criteria for metals. As previously discussed, the National Guidelines describe the various methods of justifying numerical criteria values that are protective of aquatic life uses and specify that all factors that significantly influence the toxicity of a pollutant must be taken into account. EPA's National Metals Policies all state that only the biologically available fraction is intended to be regulated. Unfortunately, a dissolved approach to copper does not meet that objective.

EPA is not free to wander from its published guidance and regulations when the result of such deviation adversely affects the substantive rights of an individual who relied on the Agency's published representations.(\*40) In *Massachusetts Fair Share v. Law Enforcement Assistance*, 758 F.2d 708, 711-712 (D.C. Cir. 1985), the court reinforced the philosophy established in *Morton v. Ruiz*:

It has long been settled that a federal agency must adhere firmly to self-adopted rules by which the interests of others are regulated. This precept is rooted in the concept of fair play and in abhorrence of unjust discrimination, and its ambit is not limited to rules attaining the status of formal regulations. The Supreme Court has declared that "[w]here the rights of individuals are affected, it is incumbent upon agencies to follow their own procedures, even though the procedural requirement there spoken of had not been published in the Federal Register, and other courts have concluded similarly.

Both the CWA and EPA's published regulations require that criteria accurately reflect the latest scientific knowledge on aquatic life protection needs. See, 33 U.S.C. section 304(a). EPA's current criteria do not reflect the latest information on copper detoxification by treated effluents or in the presence of elevated TOC levels, the most common cases for applying the criteria. The continued application of current numerical copper criteria to such situations is inappropriate and unnecessary

#### (5) Conclusion

For all the foregoing reasons, EPA should ensure that the criteria-based water quality standard for copper is applied to the same pollutant form assessed in the Copper Criteria Document "bioavailable" or, in this case, ionic copper). Laboratory and field studies overwhelmingly support the conclusion that copper in storm waters and biologically treated effluents exists in organo-complexes and is not bioavailable. There is no information to the contrary. Current approaches to criteria development erroneously equate filterable copper to dissolved bioavailable metal, and overstate the toxic fraction in treated effluents, wasting local and state resources on time consuming, administratively complex and expensive WER tests. Consistent with the National Guidelines and the "Reinventing Government" initiative, a less costly, more environmentally appropriate approach is required.

It is clear from the preceding discussion that the existing copper criteria requires amendment because the criteria, as implemented, are not limited to the toxic form of the metal. Since there are no approved analytical techniques to allow measurement of the toxic form of copper in state waters, EPA needs to establish a procedure to better define the toxic fraction and defer implementation of copper water quality criteria for any discharge that has demonstrated no acute toxicity to copper sensitive organisms. This approach is used by the State of North Carolina and is conceptually the same as the simplified water effect ratio approach EPA is developing. This methodology will provide significant benefit to EPA and better focus environmental resources. By establishing an objective basis to evaluate actual copper toxicity, EPA and the regulated community will better be able to define where real copper toxicity problems exist.

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(\*18) Benson, W.H., Alberts, J., Allen, H.E., Hunt, C.D., and Newman, M.C. "Bioavailability of Inorganic Elements." In A Mechanistic Understanding of Bioavailability: Physical Chemical Interactions, ed. J.K. Hamelink, W.H. Benson, H.L. Bergman, and P.F. Landnim. Chelsea, MI: Lewis Publishers, 1993.

(\*19) Interim Guidance at 1.

(\*20) Letter from LaJuana S. Wilcher, USEPA, to Congressman Hammerschmidt, dated March 13, 1992 (emphasis supplied).

(\*21) Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria, USEPA (October 1, 1993) at 2.

- (\*22) Implementation of Metals Criteria," USEPA Memorandum (April 1, 1993).
- (\*23) Ambient Water Quality Criteria for Copper - 1984, USEPA/440/5-84-031 (January 1985).
- (\*24) Allen, Herbert E. and Bo Shi. Copper Speciation and Bioavailability: Critical Evaluation for POTW Effluent Discharges. Proceedings of the Water Environment Federation Conference on Toxic Substances in Water Environments (May, 1995) pp. 5-11
- (\*25) Copper Criteria Document at 2.
- (\*26) Copper Criteria Document at 7.
- (\*27) Boggs, S., D.G. Livermore, and M.G. Seitz. "Humic Macromolecules in Natural Waters." Reviews in Macromolecular Chemistry and Physics, C25, 599-657 (1985); Sposito, G. "Sorption of Trace Metals by Humic Materials in Soils and Natural Waters." CRC Critical Reviews in Environmental Control (I 6):193-299 (1986); Buffle, J. Complexation Reactions in Aquatic Systems: An Analytical Approach. Ellis-Horwood, London(1988).
- (\*28) Callahan, M.A., M.W. Slimak, N.W. Gabel, I.P. May, C.F. Fowler, J.R. Freed, P. Jennings, R.L. Durfee, F.C. Whitmore, B. Maestri, W.R. Mabey, B.R. Holt and C. Gould. Water-Related Environmental Fate of 129 Priority Pollutants. USEPA 440/4-79-029a (1979).
- (\*29) Brown, V.M., T.L. Shaw, and D.G. Shurben. "Aspects of Water Quality and the Toxicity of Copper to Rainbow Trout." Water Research 8:797-803 (1974).
- (\*30) Id. at 801.
- (\*31) Sunda, W.G. and J.M. Lewis. "Effect of Complexation by Natural Organic Ligands on the Toxicity of Copper to a Unicellular Algae, *Monochrysis lutheri*." Limnology and Oceanography 23:870-876 (1978).
- (\*32) Morrison, G.M.P. and T.M. Florence. "Comparisons of Physicochemical Speciation Procedures with Metal Toxicity to *Chlorella pyrenoidosa*." Analytica Chimica Acta 209:97-109 (1988).
- (\*33) Allen, H.E., and Hansen, D.J. "Importance of Trace Metal Speciation to Water Quality Criteria." Draft manuscript dated January 7, 1994 (attached hereto as Exhibit 2).
- (\*34) Letter from Dr. Herbert E. Allen to J.C. Hall regarding speciation and bioavailability of metals, dated October 15, 1993 (attached hereto as Exhibit 6).
- (\*35) DiToro, D.M., J.A. Halden, and J.L. Plafkin. "Modeling Ceriodaphnia Toxicity in the Naugatuck River: II. Copper, Hardness and Effluent Interactions." Environmental Toxicology and Chemistry 10:261-174 (1991).
- (\*36) Brungs, W.A. "Synopsis of Water-Effect Ratios for Heavy Metals as Derived for Site Specific Water Quality Criteria." USEPA Contract No. 68-CO-0070 (1992).
- (\*37) Geckler, J.R., W.B. Hoving, T.M. Neiheisel, Q.H. Pickering, E.L. Robinson and C.E. Stephan. "Validity of Laboratory Tests for Predicting Copper Toxicity in Streams." USEPA 600/3-76-116 (1976)

at pp. 168-169.

(\*38) National Guidelines at 14 (emphasis supplied).

(\*39) National Guidelines at 18.

(\*40) See *Morton v. Ruiz*, 415 U.S. 199, 235. In a dispute between an American Indian and the Department of Interior's Bureau of Indian Affairs ("BIA"), the Supreme Court held that where the rights of individuals are affected, it is incumbent upon agencies to follow their own procedures. This is so even where the internal procedures are possibly more rigorous than otherwise would be required.

Response to: CTR-020-012

EPA agrees that the factors discussed in the comment strongly affect the toxicity of copper, but does not agree that the criteria formulas specified in the rule do not account for these factors. The freshwater copper criterion is expressed as formula having two parameters, hardness and the water-effect ratio. The saltwater copper criterion is expressed as a formula having one parameter, the water-effect ratio.

The water-effect ratio (WER) is a generalized parameter that accounts for the difference in biological activity or toxicity of the copper in the site water versus in laboratory water. EPA agrees that the WERs typically observed in waters carrying substantial amounts of municipal effluent are generally large enough that no copper toxicity is manifested in such waters. EPA also agrees that the organic carbon content of such waters plays a key role in rendering copper nontoxic. However, EPA does not believe that the facts set forth in the comment indicate that the WER concept incorporated into the rule is incapable of satisfactorily accounting for the effects that organic carbon and other site water factors have on copper toxicity.

The rule has cited EPA's current guidance on determining water-effect ratios. However, the rule does not require that WER determinations follow only this guidance. Rather, it allows "other scientifically defensible methods adopted by the state...and approved by EPA." EPA understands the concerns raised in the comment about the resources needed to complete a WER determination pursuant to its guidance. EPA is working with states and dischargers in developing more streamlined approaches for determining WERs using fewer toxicity tests. EPA has also been funding development of a biotic ligand modeling approach, which will predict a site WER for copper using chemical measurements of hardness, alkalinity, dissolved organic carbon, and pH, thereby eliminating the need for the side-by-side site water and lab water toxicity testing of the traditional WER determination. EPA also supports conventional regression techniques for developing a relationship between site chemical parameters, such as DOC, and the WER. EPA's approval of such alternative procedures will be based on their scientific merit. With the anticipated improvements in techniques for predicting the WER from chemical measurements, EPA believes that in many cases it may be simpler to implement than the whole effluent toxicity approach advocated in the comment.

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Comment ID: CTR-025-004a

Comment Author: Metro. Water Dist. of So. Cal.

Document Type: Water District

State of Origin: CA

Represented Org:

Document Date: 09/26/97

Subject Matter Code: C-02b Copper Aquatic Life

References:

Attachments? Y

CROSS REFERENCES C-16

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Comment: The proposed CTR freshwater aquatic life criteria for copper are also problematical for many drinking water suppliers. Copper algaecides are a necessary element of algal control strategies for drinking water reservoirs and conveyances. Even with a comprehensive reservoir management program based on limnological principles, copper algaecides need to be part of the algal control arsenal. Algal growth, if uncontrolled, can lead to unacceptable levels of trihalomethanes (THMS) in treated water supplies, among other impacts.

The CTR proposes freshwater aquatic life criteria for copper which could severely hamper the ability of drinking water suppliers to use copper algaecides. The dosage of these algaecides which is effective for controlling algal growth could lead to periodic exceedances of the copper freshwater criteria. Yet, use of copper algaecides is sometimes necessary to protect drinking water beneficial uses, and there is currently no economically feasible alternative available. Drinking water suppliers have the difficult task of meeting conflicting requirements to protect drinking water beneficial uses while ensuring that aquatic life criteria for copper are met.

Response to: CTR-025-004a

EPA acknowledges the comment, but notes that tradeoffs between drinking water benefits and aquatic life benefits were not considered.

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Comment ID: CTR-033-001

Comment Author: San Bernardino Muncpl Wtr Dept

Document Type: Water District

State of Origin: CA

Represented Org:

Document Date: 09/25/97

Subject Matter Code: C-02b Copper Aquatic Life

References: Letter CTR-033 incorporates by reference letter CTR-020

Attachments? Y

CROSS REFERENCES

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Comment: The application of the proposed copper criteria to municipal effluent is overly restrictive. Copper in municipal effluents have been demonstrated not to be toxic at higher levels than proposed due to the nature of the constituents in the effluent. Attached is a recent article that appeared in the Water Environment Federation Journal that highlights the rationale for high copper limits in municipal effluent.

Response to: CTR-033-001

See response to CTR-020-012.

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Comment ID: CTR-053-003b

Comment Author: Heal the Bay  
Document Type: Environmental Group  
State of Origin: CA  
Represented Org:  
Document Date: 09/26/97  
Subject Matter Code: C-02b Copper Aquatic Life  
References: Letter CTR-053 incorporates by reference letter 6 and the comments on Dioxin, copper, and the compliance schedule from letter CTR-002  
Attachments? N  
CROSS REFERENCES C-01b  
C-09a

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Comment: In spite of our lack of detailed comments for specific criteria, we have concerns regarding any weakening of California's previously developed standards, particularly those for mercury and copper. Also, we question the absence of criteria for dioxin and dioxin-like compounds. In order to ensure these issues are considered in future improvements of the Rule, we incorporate by reference the comments of the Natural Resources Defense Council regarding mercury, and the comments of Communities for a Better Environment ("CBE") regarding dioxin compounds and copper.

Response to: CTR-053-003b

See response to CTR-002-004b.

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Comment ID: CTR-054-008a  
Comment Author: Bay Area Dischargers Assoc.  
Document Type: Sewer Authority  
State of Origin: CA  
Represented Org:  
Document Date: 09/25/97  
Subject Matter Code: C-02b Copper Aquatic Life  
References:  
Attachments? Y  
CROSS REFERENCES C-24  
E-01c  
R  
S

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Comment: Separate, scientifically defensible, reasonably achievable aquatic life criteria for copper should be adopted for San Francisco Bay, or alternatively EPA should specify in the Preamble implementation policies for copper that will result in reasonable control measures actions. To comply with the Clean Water Act and EPA regulations, EPA is required to consider specific water bodies. To fulfill the spirit of Presidential Executive Order 12866 and the requirements of the Unfunded Mandates Reform Act, EPA is required to evaluate regulatory alternatives based on an analysis of costs and benefits. Based on BADA's analysis of costs and benefits, EPA should either adopt copper criteria that are reasonably achievable or alternatively specify implementation policies that will avoid costly end-of-pipe controls. Potential implementation measures that could be specified include use of the following in calculating effluent limitations: actual dilution based on modeling studies; copper translators; probability of compliance less than 99.9%; and water-effect ratios determined for different

segments of the Bay. Unless EPA specifies these or similar implementation policies in the rule, it is possible that the CTR could result in significant costs (\$12 million per year to \$78 million per year) while resulting in minor environmental benefit (a 1% reduction in copper loading to the Bay). In that case, the CTR would violate the Clean Water Act, EPA regulations, Presidential Executive Order 12866, the Unfunded Mandates Reform Act and the Regulatory Flexibility Act. (see the discussion under Item 11 below.)

Response to: CTR-054-008a

See response to CTR-092-013a.

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Comment ID: CTR-060-013  
Comment Author: San Diego Gas and Electric  
Document Type: Electric Utility  
State of Origin: CA  
Represented Org:  
Document Date: 09/26/97  
Subject Matter Code: C-02b Copper Aquatic Life  
References:  
Attachments? N  
CROSS REFERENCES

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Comment: PROVISIONS SDG&E DOES NOT SUPPORT

As described in the following comments SDG&E does not support the following provisions:

Copper criteria

The metal criteria, including copper, are based on toxicity tests run in relatively pure water. Naturally occurring elevated ambient concentrations of suspended organic matter in bays and estuaries can significantly reduce the bioavailable portion of the metal. Since the criteria do not account for the presence of organic matter, the proposed criteria for metals, including copper, will be unnecessarily over-protective. As provided, water effects ratios (WERs) can be developed to account for this effect. However, WER studies can be very costly (see comments below regarding the economic analysis).

EPA appears to have deviated from its standard protocol in developing the copper criteria. Normally, a criteria is based upon toxicity tests of multiple species. However, the proposed criteria appear to be based upon the single species (i.e., the blue mussel) with the lowest toxicity concentration. This has resulted in a somewhat lower criteria than would have otherwise been derived. The criteria should be recalculated to be based upon the results of multiple species.

Response to: CTR-060-013

Concerning the comment on water-effect ratios, see response to CTR-020-012. EPA does not agree that it has departed from its standard protocol in deriving the saltwater copper criterion. The criteria Guidelines provide that the criterion derived to protect the fifth percentile genus is to be lowered, if necessary, to protect recreationally or commercially important species. This has been done for the saltwater copper criterion.

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Comment ID: CTR-064-001  
Comment Author: El Dorado Irrigation District  
Document Type: Irrigation District  
State of Origin: CA  
Represented Org:  
Document Date: 09/25/97  
Subject Matter Code: C-02b Copper Aquatic Life  
References:  
Attachments? Y  
CROSS REFERENCES

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Comment: The CTR proposes to establish a dissolved approach for copper with typical limits for a low flow stream ranging from 8 to 15 parts per billion (ppb). The preamble to the CTR recognizes that copper rapidly binds with organic materials and may not be toxic in municipal effluents. In fact, EPA has acknowledged in a number of forums that copper is not expected to be toxic in municipal effluents; nonetheless, the proposed CTR does not reflect this reality.

As explained by EPA criteria derivation guidelines, water quality criteria are required to reflect expected environmental impacts and are to be revised if they are determined to be significantly over or under-protective. EPA has in its possession an extensive amount of research data and field study results which demonstrate that copper is never toxic in municipal effluents. If copper is discharged to low flow streams, there is no influence of upstream water quality -and therefore, the toxicity of the copper will not be altered. The copper level in EID's discharge typically ranges from 20 to 40 ppb and has been found to be non-toxic to copper-sensitive organisms (i.e., daphnids).

The proposed copper criteria do not reflect the expected toxicity of this pollutant in the environment and will result in unnecessarily restrictive requirements throughout the state. Although required by the National Guidelines, the copper criteria fall to include an adjustment to account for binding with organic material such as that expected to occur in treatment plant effluents that renders this pollutant non-toxic (see enclosure).

Application of the criteria as a dissolved standard will likely result in many facilities being identified as in violation of the criteria. This proposed approach wastes scarce local resources, imposes an unauthorized, unfunded mandate on municipalities, penalizes small communities which have both limited budgets and access to updated scientific approaches, and is inconsistent with EPA's statutory mandates and guidance.

EPA should take one of two actions: (1) withdraw application of the copper criteria to municipalities, or (2) establish a screening level procedure which will only apply the criteria where copper-sensitive organisms indicate that copper is toxic.

We thank you for the opportunity to comment on this proposed rulemaking and look forward to EPA's reevaluation of the copper criteria as applied to municipalities.

Response to: CTR-064-001

See response to CTR-020-012.

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Comment ID: CTR-065-007  
Comment Author: Environmental Health Coalition  
Document Type: Environmental Group  
State of Origin: CA  
Represented Org:  
Document Date: 09/26/97  
Subject Matter Code: C-02b Copper Aquatic Life  
References:  
Attachments? N  
CROSS REFERENCES

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Comment: PROPOSED COPPER CRITERION WILL CONTRIBUTE TO DEGRADATION OF SAN DIEGO BAY

EPA's proposed 3.1 ug/L dissolved copper criterion will allow copper three times the levels at which sensitive species are known to be impacted in an areas such as San Francisco Bay. San Diego Bay is already listed as impaired for copper. This criterion is too high and will allow more degradation of our water resources.

Response to: CTR-065-007

See response to CTR-002-008.

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Comment ID: CTR-092-013b  
Comment Author: City of San Jose, California  
Document Type: Local Government  
State of Origin: CA  
Represented Org:  
Document Date: 09/26/97  
Subject Matter Code: C-02b Copper Aquatic Life  
References: Letter CTR-092 incorporates by reference letter CTR-035  
Attachments? Y  
CROSS REFERENCES C-24a

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Comment: Validity Of The Proposed Copper Criteria For South San Francisco Bay

Attachment 3 to this letter is a technical report entitled "Development of a Site-Specific Water-Effect Ratio for Copper in South San Francisco Bay", dated September 1997 and prepared by the City of San Jose Environmental Services Department.

This attachment is also incorporated as part of our comments and is being submitted for inclusion in the record for this rulemaking. Because EPA is proposing to promulgate water quality criteria for all waterbodies in the State of California, we believe that it is required to consider site-specific data to the extent that it is available, especially, where, as in the case of the submitted data, it appears that there is a less costly/appropriately protective alternative to the proposed criteria.

Response to: CTR-092-013b

See response to CTR-092-013a.

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Comment ID: CTRH-001-014

Comment Author: Greg Karras

Document Type: Public Hearing

State of Origin: CA

Represented Org: Comm. for Better Environ.

Document Date: 09/17/97

Subject Matter Code: C-02b Copper Aquatic Life

References:

Attachments? N

CROSS REFERENCES

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Comment: On copper, EPA says it has weakened the copper standards to allow copper levels which, again, now violate the state standard of 4.99 in most of the bay. And EPA says this is too tight because the new data shows the quantity standard for total copper is overprotective.

But the highest dissolved copper level found in the estuaries with less copper pollution, where species that are apparently decimated by copper pollution in parts of San Francisco Bay still thrive, is three times smaller than EPA's proposal.

Our question here is, will EPA prove that its proposal will protect these species in the bay before adopting it?

Response to: CTRH-001-014

See response to CTR-002-008.

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Subject Matter Code: C-03b Nickel Aquatic Life

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Comment ID: CTR-063-001

Comment Author: Wilner, Cutler & Pickering

Document Type: Specific Industry

State of Origin: CA

Represented Org: Ni DI, Ni PERA, Inco U.S.

Document Date: 09/22/97

Subject Matter Code: C-03b Nickel Aquatic Life

References:

Attachments? N

**CROSS REFERENCES**

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Comment: In this rulemaking, EPA proposes to set the freshwater acute aquatic life water quality criterion for nickel (the so-called "Criterion Maximum Concentration" or "CMC") at a level of 470 ug Ni/L, while the freshwater chronic aquatic life water quality criterion (the so-called "Criterion Continuous Concentration" or "CCC") would be set at a level of 52 ug Ni/L -in both cases expressed as the dissolved fraction of nickel in the water column corresponding to a water hardness of 106 mg/L as CaCO<sub>3</sub>- See 62 Fed. Reg. at 42169 (Table), 42194, These values are less than one-third of the CMC and CCC values that EPA has adopted for nickel in its National Toxics Rule, See 62 Fed. Reg. at 42169.

As explained in the rulemaking notice, the reason why the freshwater nickel aquatic life criteria proposed for California are so much lower than the values set forth in the National Toxics Rule is that the California values were "calculated using data published subsequent to the issuance of [the Clean Water Act section] 304(a) criteria document [for nickel]." Id. at 42168/3. In particular, eight sets of acute toxicity (LC50/EC50) data were added to the database for nickel. Seven of these eight LC50/EC50 values (adjusted to a water hardness of 50 mg/L CaCO<sub>3</sub>) ranged from 66,100 ug/L to 160,521 ug/L(\*1). The eighth value, an LC50, for the snail species *Physa gyrina*, was 416 ug/L, more than two orders of magnitude lower than the values in the other seven studies.(\*2) This value also was far below any other acute aquatic toxicity value for nickel that had been reported previously.(\*3)

Since EPA calculates the CMC acute toxicity value by using the lowest four Genus Mean Acute Values for the chemical(\*4), the LC50 of 416 mg/L reported for *Physa gyrina* replaced a Genus Mean Acute Value of 6,707 ug/L for the fathead minnow in the calculation of the CMC for nickel.(\*5) This substitution of LC50 values caused the proposed California CMC for nickel to be 470 ug/L at a water hardness of 100 mg/L CaCO<sub>3</sub>, while the National Toxics Rule CMC for nickel corresponding to that water hardness is 1400 ug/L. See 62 Fed. Reg. at 42169. It also caused the proposed California CCC for nickel to be 52 ug/L at a water hardness of 100 mg/L CaCO<sub>3</sub>, compared to a National Toxics Rule CCC of 160 ug/L at that water hardness. See id. (The chronic toxicity CCC was affected by the change in acute toxicity data because, in the absence of sufficient chronic toxicity data for nickel, the CCC was derived by applying an acute to-chronic ratio to the acute toxicity data. See Nickel Criteria Document at K-1.)

The LC50 of 415 ug/L for *Physa gyrina* that is driving the reduction in the acute and chronic aquatic toxicity values for nickel in the California proposal is derived from a study by A.V. Nebeker, et al., "Effects of Copper, Nickel and Zinc on Three Species of Oregon Freshwater Snails," *Environmental Toxicology and Chemistry* 5:807-811 (1986). For the reasons discussed below, we do not believe that data from this study (which was conducted in part to develop new test methods) should be used to calculate CMC and CCC values for nickel.

Under the methodology used by EPA to derive CMC values, "results of acute tests during which the test organisms were fed shall not be used, unless data indicate that the food did not affect the toxicity of the test material>(\*6). The article by Nebeker, et al. does not mention whether or not the snails were fed during testing. When a NiPERA scientist contacted the study's lead investigator in August 1993, she was informed that the investigator believed the snails had been fed. A subsequent check of the original data book for the 96-hour and 30-day *Physa gyrina* zinc test conducted as part of the same study disclosed that food had indeed been placed in each test container.(\*7) The data book for the *Physa gyrina* nickel test could not be found (apparently some archived material was lost when the EPA laboratory was closed in 1985). In the absence of the data book, the study's author explained that while animals normally are not fed during acute (96-hour) tests, they may have been fed in this instance because the investigators "were developing new test methods, as well as obtaining criteria data.(\*8) The authors of the study simply "have no way to verify" whether or not the snails were fed in the *Physa gyrina* nickel test.(\*9)

In these circumstances, data from the *Physa gyrina* nickel test should not be used to set water quality criteria, particularly since the authors' data book clearly shows that the snails were fed in the 96-hour zinc test performed by the same investigators, in the same series of tests, in the same lab.(\*10) Another reason why data from the *Physa gyrina* nickel study should not be used is that the loss of the primary data notebook makes it impossible to verify the experimental conditions and results of the study.

Apart from the possibility that the snails were fed, data from the test by Nebeker, et al. should be interpreted cautiously because these particular snails are very sensitive to heavy metals, especially copper.(\*11) In one of the snail species tested by Nebeker (*Lithoglyphus virens*), the 30-day LC50 for copper was found to be <0.004 mg/L, while in a second test of the same species, 50% of the snails died at a copper concentration of 0.008 mg/L (the lowest level tested) at 96 hours.(\*12) Overall, Nebeker et al. noted that the effect levels they observed were "in the lower range of those that have been reported," a result they attributed in part to the extreme softness of their test water (approximately 20 mg/L) and the resulting "higher percentage of biologically active metal species (e.g., more Cu++ in solution).(\*13) It may be that exposure to low ambient levels of copper and other metals in this extremely soft test water had compromised the overall health of the snails and made them more sensitive to nickel.(\*14) In the absence of positive control data (which are not reported in the article and which are not otherwise available given the loss of the primary data notebooks), one cannot determine whether the snails' health was compromised.(\*15)

In sum, substantial questions exist as to whether the study by Nebeker et al. -which was conducted in part to develop new test methods -- satisfies EPA's methodological criteria for developing acute aquatic toxicity values. The possibility (indeed, likelihood) that the snails were fed during the 96-hour test, the apparent heightened sensitivity of the organisms resulting from exposure to low levels of copper in the soft water while the snails were held in culture prior to testing, and the absence of a data notebook that would make it possible to verify the experimental conditions and results all suggest that data from this study should not be used to set freshwater aquatic toxicity criteria for nickel. This is particularly true in light of the fact that the LC50 value for the only other snail species for which acute nickel toxicity data are reported (*Amnicola* sp.) was 12,770 ug/L (adjusted to a hardness of 50 mg/L), a value that is 30 times higher than the LC50 reported by Nebeker et al. for *Physa gyrina*.(\*16) This striking disparity between the LC50 values for the two snail species is an additional reason for excluding the data from the Nebeker et al. study of *Physa gyrina* in calculating the acute water quality criterion for nickel.(\*17) With those data excluded, the freshwater CMC for nickel would be 1400 ug/L (adjusted to a hardness of 100 mg/L as CaCO<sub>3</sub>), and the freshwater CCC would be 160 ug/L (adjusted to a hardness of 100 mg/L as CaCO<sub>3</sub>). Those values (and the corresponding water hardness equation from which they are calculated) should be adopted as the numeric freshwater aquatic life criteria for nickel in the State of California.

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(\*1) See 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water - 1995 Update: Freshwater Aquatic Life Criterion for Nickel, September 1996 (hereinafter "Nickel Criteria Document") at K-3, Table KI.

(\*2) See id.

(\*3) See id., Table K2.

(\*4) See id. at K-1.

(\*5) See id. at K-5, Table K2.

(\*6) See 58 Fed. Reg. 20802, 21017/2 (April 16, 1993).

(\*7) Personal communication from Alan V. Nebeker to Barbara Andon, August 27, 1993 (submitted herewith as Attachment 1).

(\*8) id.

(\*9) Id.

(\*10) There is, of course, no data to indicate whether any feeding that might have occurred affected the toxicity of the test material.

(\*11) See Nebeker, et al., supra, at 807.

(\*12) See id. at 808 Table 1, 809.

(\*13) Id. at 810.

(\*14) See id. at 811 ("The prior acclimation of the test species to very low copper concentrations (less than 0,003 mg/L) also may affect their sensitivity.")- cf 58 Fed. Reg. at 21016 (stating that data must be rejected if the organisms "were previously exposed to substantial concentrations of the test material or other contaminants").

(\*15) Cf 58 Fed. Reg. at 21016 (stating that data must be rejected "if they are from tests that did not contain a control treatment"). Similarly, since the study was not repeated, possible anomalies in the study (such as possible miscalculations in the dosing concentrations) cannot be ruled out.

(\*16) See Nickel Criteria Document at K-4, Table K2; R.L. Rehwoldt, et al., "The Acute Toxicity of Some Heavy Metal Ions Toward Benthic Organisms," Bull. Environ. Contain. Toxicol. 10:291-294 (1973) (static test procedure).

(\*17) Cf 58 Fed. Reg. at 21017/3 ("Acute values that appear to be questionable in comparison with other acute and chronic data for the same species and for other species in the same genus must not be used. For example, if the acute values available for a species or genus differ by more than a factor of 10, rejection of some or all of the values is probably appropriate.").

Response to: CTR-063-001

EPA does not agree that the Nebeker et al. test results should be rejected. EPA does not believe that the question of whether the snails were or were not fed is of overriding importance. Feeding of organisms is not desirable in acute tests because the material in the food may reduce the biological availability of the toxicant, thus reducing its toxicity and raising its LC50, and because feeding is generally not necessary in a short test. Feeding of organisms is necessary in chronic tests, because of their longer duration. EPA does not believe that the feeding of organisms in either an acute or chronic test has any effect on increasing the sensitivity of organisms to the toxicant, and likewise does not believe that feeding of organisms in the Nebeker et al. test, if it had been done (which is not known), would explain the results.

EPA does not expect lab books to be retained for perpetuity and does not consider loss of the original lab books to be grounds for discarding the data.

EPA agrees that *Physa gyrina* appears to be significantly more sensitive than other species. EPA recognizes that in general the chemical characteristics of the lab water affect the toxicity of metals in

ways not taken into account by the hardness normalization. However, EPA does not have information indicating that the characteristics of the (very soft) lab water used in the Nebeker et al. test are so unusual as to be unrepresentative of California waters.

EPA has considered whether the organisms may have been stressed by the chemical characteristics of the lab water. However, subsequent communications with Nebeker revealed that the organisms have been successfully reproducing for years in ponds fed by the same wells that provided the lab water (Alan Nebeker memorandum to Charles Stephan, January 6, 1995). EPA can thus find no reason to believe that the control organisms were stressed.

Consequently, although *Physa gyrina*, as tested by Nebeker et al., is substantially more sensitive than other tested organisms, EPA has not found a good reason to reject the data. The freshwater nickel criterion in the rule is therefore unchanged for the final rule.

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Comment ID: CTR-092-012a  
Comment Author: City of San Jose, California  
Document Type: Local Government  
State of Origin: CA  
Represented Org:  
Document Date: 09/26/97  
Subject Matter Code: C-03b Nickel Aquatic Life  
References: Letter CTR-092 incorporates by reference letter CTR-035  
Attachments? Y  
CROSS REFERENCES C-07b

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Comment: Validity Of Proposed Nickel And Cyanide Criteria On A Statewide Basis

Attachment 1 to this letter is a technical report entitled "Task Report 1: Update and Recalculation of the Freshwater and Saltwater Cyanide Criteria", dated November 5, 1996 and prepared by Tetra Tech, Inc. for the City of San Jose. Attachment 2 to this letter is a technical report entitled "Final Report Recalculation of the Nickel Criteria for South San Francisco Bay", dated November 1, 1995 and prepared by Tetra Tech, Inc. for the City of San Jose. All of the attachments to this letter are incorporated as part of our comments and are being submitted for inclusion in the record for this rulemaking.

EPA has an obligation to consider the most current, scientifically defensible data in this rulemaking. EPA's obligations in this regard are particularly significant in light of its obligations under Executive Order 12866 and the Regulatory Flexibility Act (5 U.S.C.A. 601 et seq.) to consider a full range of cost effective alternatives to promulgation of the proposed Rule.

Although the title of Attachments 1 and 2 suggest that the data submitted relates only to San Francisco Bay, the data in fact relates to the entire state of California, and indicates that less stringent cyanide and nickel criteria than are proposed by the Rule would adequately protect water quality in California. Under the Executive Order 12866 and the Regulatory Flexibility Act, EPA should include consideration of the these less stringent criteria in its Economic Analysis.

Response to: CTR-092-012a

See response to CTR-092-012b.



Subject Matter Code: C-04b Selenium Aquatic Life

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Comment ID: CTR-008-001

Comment Author: San Luis&Delta-Mendota

Document Type: Water District

State of Origin: CA

Represented Org:

Document Date: 09/15/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? N

CROSS REFERENCES

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Comment: Dear Ms. Frankel:

The San Luis & Delta-Mendota Water Authority objects to the freshwater selenium criteria set forth in Environmental Protection Agency's ("EPA") proposed "Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants in the State of California" (Federal Register Vol. 62, #150, pages 42160-42208, Tuesday, August 5, 1997) on the following grounds:

1. The criteria are based on data assembled before 1987 (as reported in EPA 440/5-87-003 "Ambient Water Quality Criteria for Selenium - 1987"). Therefore, the criteria do not take account of more recent data on selenium toxicity.
2. In particular, the freshwater selenium criteria are scientifically inadequate because they fail to take account of the known interference between selenate and sulfate uptake in high sulfate waters like those in the San Joaquin Valley [see, e.g., Ogle and Knight, Arch. Environ. Contam. Toxicol. 30, 274-279 (1996); Williams et al., Arch. Environ. Contam. Toxicol. 27,449-453 (1994); Hansen et al., Arch. Environ. Contam. Toxicol. 25, 72-78 (1993)]. This interference means that criteria based largely on effects observed in the low sulfate waters of Belews Lake, North Carolina, are probably overprotective for the high sulfate waters of the San Joaquin Valley. EPA itself (Federal Register Vol. 62, #150, page 42168, Tuesday, August 5, 1997) explicitly recognizes this inadequacy by stating "Chemical toxicity is often related to certain receiving water characteristics (pH, hardness, etc.) of a water body. Adoption of some criteria without consideration of these parameters could result in the criteria being overprotective."

The proposed California Toxics Rule should not be adopted without adequately addressing the difference for high-sulfate waters. The Rule should also not be adopted if it undercuts EPA's commitment to the cooperative review of appropriate long-term standards in the San Joaquin River Basin.

Response to: CTR-008-001

EPA agrees with the comment that the proposed acute freshwater criteria equation for selenium should not be promulgated, and has decided not to promulgate the proposed freshwater acute criterion, however, not for all of the reasons specified by the commenter. EPA's proposed acute criterion for the California Toxics Rule was revised in 1996 to reflect newer data supporting the additive toxicity of two predominant selenium forms (selenite and selenate) and is expressed as an equation. The acute criterion equation is designed to account for the additive toxicity of selenite and selenate in freshwater ecosystems and relies on assumptions of the relative toxicity and additivity of other forms of selenium since the

separate and combined toxicity of these other forms present in natural aquatic systems is not well defined. In 1996, the revised acute criterion underwent external peer review and was proposed for adoption under the Great Lakes Water Quality Initiative (GLI) (61 FR 58444-58449, November 14, 1996). This proposal has not yet been finalized because EPA is currently responding to public comments, which have called to attention a significant source of uncertainty in the expression of the relative toxicity of selenite and selenate in EPA's proposed acute criteria equation. Specifically, EPA is responding to the comment that the relative acute toxicity of selenite and selenate as expressed by the proposed individual CMCs (185.9 ug/L and 12.8 ug/L, respectively) is not consistent with the weight of toxicological data suggesting the opposite relative toxicity relationship and is an artifact of nuances in the selenate data set (i.e., its relatively small size combined with one extremely sensitive toxicity test result for the amphipod, *Gammarus pseudolimnaeus*).

EPA is currently responding to this comment by conducting additional toxicity tests on the relative toxicity of selenite and selenate to *G. pseudolimnaeus* and other acutely sensitive species. EPA is also updating its acute toxicity database with newer information, including newer data on the potential sulfate dependency of acute selenium toxicity. Therefore, because additional toxicity tests may result in substantial changes in the relative acute toxicity relationship of selenite and selenate that was proposed in the GLI and subsequently in the California Toxics Rule, EPA has chosen defer promulgation of acute, freshwater criteria for selenium until after the new toxicity data have been fully evaluated and incorporated. Further, EPA will consider in its forthcoming update of selenium freshwater acute criteria newer information since 1987 on the importance of sulfate and other factors on selenium freshwater acute toxicity.

EPA disagrees with the commenter that the chronic freshwater selenium criterion of 5 ug/L should not be promulgated as proposed. First, EPA believes that its chronic criterion is scientifically defensible, because having been based on field data, it incorporates principles and effects of bioaccumulation of selenium in aquatic ecosystems which are critical for estimating a long-term (chronic) toxicological threshold for selenium. Second, EPA does acknowledge that since 1987 (the latest revision of the selenium freshwater CCC), additional data are available that might be germane to the freshwater CCC for selenium. However, unlike the acute criterion, where the new data have been collected and almost certainly will change the criterion, EPA can not predict at this time the impact of any new data on freshwater CCC. Currently, EPA is in the early stages of reviewing this data and is addressing technical issues whose impact on the CCC is not easily predicted (e.g., the impact of basing chronic toxicity thresholds on tissue residue concentrations vs. water column concentrations). To facilitate this review of the freshwater CCC, and to address many of the technical issues associated with selenium bioaccumulation and toxicity, EPA conducted a peer consultation workshop in May 1998 with selenium experts external to the Agency to ascertain the degree of scientific basis and consensus on these issues (EPA-822-R98-007).

Regarding the comment that EPA should not promulgate the CCC of 5 ug/L total recoverable selenium because it does not account for sulfate dependency, EPA disagrees. EPA disagrees with this comment because at this time, EPA believes that insufficient data exist to quantify the effect of sulfate on the chronic toxicity of selenium to aquatic life. Specifically, none of the data referenced by the commenter quantify the effect of sulfate dependency on the chronic toxicity of selenium forms to aquatic animals. Rather, they apply to the effect sulfate on selenium acute toxicity and bioaccumulation in aquatic animals, and its toxicity to algae. EPA's assertion of insufficient data on sulfate dependency of chronic toxicity is supported by the opinion of experts at EPA's 1998 peer consultation workshop who concluded: "...insufficient information exists to correlate water quality characteristics (such as sulfate, pH and TOC)" (p. 9 in EPA-822-R-98-007). Furthermore, EPA considers application of sulfate-toxicity relationships based on acute toxicity or bioaccumulation to chronic toxicity to be highly uncertain and

unreliable. This conclusion is also supported by expert opinion, who concluded that toxicity relationships derived from acute toxicity studies cannot be reliably extrapolated to chronic toxicity, owing to the important influence of dietary exposure on selenium chronic toxicity (p. 9 in EPA-822-R-98-007). After EPA's review of the available information and expert opinions, EPA believes that it would be premature to withdraw its proposed CCC of 5 ug/L because it does not address possible effects of sulfate on selenium chronic toxicity.

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Comment ID: CTR-009-005

Comment Author: City of Thousand Oaks

Document Type: Local Government

State of Origin: CA

Represented Org:

Document Date: 09/22/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: At Federal Register page 42170, EPA begins its discussion about the derivation of its proposed Selenium criterion. This criterion is essentially based on a very few site specific field situations, and is applied, generally, to all situations regardless of how dissimilar they may be to the criterion spawning field incidents. The Kesterson Slough/Belews Lake type of problems and aquatic toxicity have not been found in other waters where Selenium is present in elevated concentrations, but that lack the sediment/food-chain conditions of these particular water bodies. Recent investigators found that Selenium water column concentrations were poor predictors of aquatic toxicity, and instead, posit a rationale for sediment-based toxicity criteria that EPA should consider as part of this rulemaking. (Selenium Sediment Toxicity Thresholds and Derivation of Water Quality Criteria for Freshwater Biota of Western Streams, Van Derveer and Canton, Environmental Technology and Chemistry and Selenium Toxicity to Aquatic Life: An Argument for Sediment-Based Water Quality Criteria, Canton and Van Derveer, Environmental Toxicology and Chemistry. Copies enclosed)

Response to: CTR-009-005

EPA derived its CCC for selenium using the Belews lake data in combination with laboratory data because laboratory toxicity data have been shown to consistently underestimate selenium effect levels compared to field situations. This underestimation of adverse effect levels by laboratory toxicity data is believed to be due to the bioaccumulation of selenium in aquatic food webs and subsequent exposure in top predator fish; a phenomenon which occurs in the field but not in routine laboratory tests. EPA acknowledges the conditions at Belews Lake that may differ from those at sites to which the CCC of 5 ug/L is applied. However, as discussed in EPA's response to CTR-058-006, EPA believes that the Belews lake data are reasonably consistent with adverse effect levels observed in other types of ecosystems and are scientifically defensible. For example, Hermanutz et al. (1992) and Schultz and Hermanutz (1990) studied the effects of chronic selenium exposure in large outdoor experimental streams in Minnesota on bluegill and fathead minnow, respectively. Despite the potential effect that the different hydrology of Belews lake and the Minnesota streams might have on selenium effect levels, the two stream studies showed adverse effects at levels similar to those observed in Belews lake (i.e., 10 ug/L). Furthermore, Lemly (1993) exposed bluegill in the laboratory to combined dietary (5.1 ug/g dry weight) and waterborne (4.8 ug/L) selenium and adverse effects including significant mortality in 60

days compared to fish in equivalent warm water exposures. Thus, EPA believes that the similarity between the adverse effect levels associated with Belews lake and the stream and laboratory studies supports the notion that EPA's CCC for selenium can be reasonably applied to other aquatic ecosystems.

Regarding sediment-based criteria, EPA believes that basing the CCC on concentrations of selenium in sediments is premature at this time because of the lack of scientific consensus on this issue and because of the preliminary nature and limited scope of the studies cited by the commenter. This assertion is generally supported by the opinions of experts at EPA's May 1998 peer consultation workshop on selenium who characterize the selenium/sediment toxicity database as sparse and largely limited to observations in western streams (p. 37-38 in EPA-822-R-98-007).

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Comment ID: CTR-016-005

Comment Author: San Francisco Bay RWQCB

Document Type: State Government

State of Origin: CA

Represented Org:

Document Date: 09/25/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: Comments on the Proposed Selenium Freshwater Acute Criteria

The Regional Board supports EPA's efforts to develop an acute criterion for selenium that takes into account the presence of several oxidation states in natural waters, and the different and additive nature of toxicity associated with these different forms. The Board also supports EPA's determination that the existing chronic aquatic life criterion should not be modified to include consideration of different chemical species and that selenium interconverts from one chemical species to another in ambient waters. There are several practical consequences associated with the proposed additive toxicity approach that we would like to address from the perspective of our experience with selenium-related environmental problems in the San Francisco Bay Region.

The first comment is that the bioaccumulative potential of different chemical forms of selenium appears to be precisely the reverse of the toxicity potentials. For example, selenite is much more easily taken up into the food chain (preliminary estimates derived here in the Region are that selenite is about 10 times more bioavailable than selenate) but the proposed toxicity-based calculation method indicates precisely the opposite--that about ten times more selenite than selenate can be in the water column without causing unacceptable effects. The proposed model may work in systems that quickly flush out selenium such as stream segments, but do not accurately reflect conditions where selenium concentrations are elevated and occasionally spike upwards towards levels where acute toxic effects may occur--in the latter, bioaccumulative problems are likely more sensitive environmental endpoints. Thus, as a practical matter, the side-by-side application of the proposed acute and existing chronic criterion could have the unanticipated effect of over regulating selenate- and underregulating selenite-related bioaccumulation problems. For this reason, we recommend not using the proposed toxicity-based approach for a new acute criterion without additional considerations.

Additional considerations that EPA could make before changing the acute criterion to address this

practical problem include (a) reviewing the chronic criterion with the intent of including information to distinguish the bioaccumulative potential (and interconversion) of different chemical forms of selenium; (b) developing an alternative method for the acute criterion that takes into account the effect of short-term increases in selenium in aquatic systems on sensitive ecological indicators such as bird reproductive effects; or (c) developing more detailed guidance on the application of the acute and chronic criteria that would distinguish between aquatic systems potentially stressed with elevated levels of selenium in the food chain and those where such stresses are not a concern and the acute criteria are appropriate indicators of short-term problems.

Response to: CTR-016-005

EPA agrees with the commenter that it would be premature to promulgate the proposed freshwater acute criteria for selenium, and has chosen to defer promulgation of freshwater acute criteria for selenium until such time EPA has completed its evaluation of additional data and response to earlier comments on the proposed CMC equation in (61 FR58444, November 14, 1996. For additional detail on why EPA has chosen to defer promulgation of the freshwater CMC equation, see EPA's response to CTR-008-001.

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Comment ID: CTR-030-005

Comment Author: Utility Water Act Group

Document Type: Trade Org./Assoc.

State of Origin: DC

Represented Org:

Document Date: 09/25/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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## Comment: II. ISSUES NEEDING CLARIFICATION OR MAJOR SUBSTANTIVE CHANGES

### A. EPA's Proposed Selenium Acute Criterion is Technically Deficient

EPA's consideration of the toxicity of selenium has rapidly evolved over the last several years. In the Great Lakes Water Quality Rule (60 Fed. Reg. 15,366 (Mar. 23, 1995)), EPA proposed a selenium acute criterion that failed to consider the differing toxicities of two prevailing types of selenium, selenite and selenate. UWAG and other industry groups challenged the selenium acute criterion, and EPA eventually agreed to a remand of the criterion. The Court, however, ordered that the criterion be vacated and remanded. Following the vacatur, in November 1996 EPA proposed a new Great Lakes selenium acute criterion, adjusted to account for the selenite/selenate differences. UWAG submitted comments on the proposal, which are attached and incorporated into this comment document. (Attachment A). In the California proposal, EPA proposes to apply a selenium acute criterion that is identical to that proposed for the Great Lakes. EPA is still considering the comments it received in response to its revised acute selenium criterion for the Great Lakes - it has not taken final action on the proposal. UWAG therefore believes it would be inappropriate to promulgate the selenium acute criterion for California until the Agency has thoroughly assessed the record for the Great Lakes selenium acute criterion, and has determined appropriate final action on the Great Lakes criterion.

In commenting on the Great Lakes selenium acute criterion, UWAG raised the following points:

- (1) EPA should reexamine and expand the LC50 database underlying the criteria maximum concentration (CMC) for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;
- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;
- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic water under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and organo-selenium will be determined; and
- (6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

All of these arguments apply with equal force to the proposed acute selenium criterion for California. For further elaboration of each of these points, see Attachment A.

Response to: CTR-030-005

EPA agrees with the commenter that it would be premature to promulgate the proposed freshwater acute criteria for selenium, and has chosen to defer promulgation of freshwater acute criteria for selenium until such time EPA has completed its evaluation of additional data and response to earlier comments on the proposed CMC equation in (61 FR58444, November 14, 1996. For additional detail on why EPA has chosen to defer promulgation of the freshwater CMC equation, see EPA's response to CTR-008-001.

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Comment ID: CTR-030-011  
Comment Author: Utility Water Act Group  
Document Type: Trade Org./Assoc.  
State of Origin: DC  
Represented Org:  
Document Date: 09/25/97  
Subject Matter Code: C-04b Selenium Aquatic Life  
References:  
Attachments? Y  
**CROSS REFERENCES**

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Comment: Dear Mr. Morris:

On behalf of the Utility Water Act Group ("UWAG")(\*1), we are writing to comment on EPA's "Proposed Selenium Criterion Maximum Concentration for the Water Quality Guidance for the Great Lakes System," published at 61 Fed. Reg. 58,444 (Nov. 14, 1996). UWAG appreciates the Agency's

decision to extend the comment period(\*2) for the selenium criterion maximum concentration ("CMC"), in light of the important technical issues raised by this proposed rule.

After reviewing the proposal, UWAG has the following recommendations:

- (1) EPA should re-examine and expand the LC50 database underlying the criteria maximum concentration ("CMC") for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;
- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;
- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic waters under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and organo-selenium will be determined; and
- (6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

Each of these recommendations is discussed in greater detail below.

#### 1. THE CALCULATED CMC FOR SELENATE IS INCONSISTENT WITH THE VAST MAJORITY OF THE SCIENTIFIC DATA. THUS, EPA SHOULD REEXAMINE AND EXPAND THE DATABASE UNDERLYING THE CMC FOR SELENATE BEFORE GOING FORWARD.

EPA's proposed equation for calculating a CMC for total selenium relies on CMCs for selenite and selenate that the Agency calculated in the "Ambient Water Quality Criteria for Selenium -- 1987" (EPA 440/5-87-008) (the "1987 Criteria Document") and in the "Great Lakes Water Quality Initiative Criteria Document for the Protection of Aquatic Life in Ambient Water (EPA-8200-B-95-004) (the "1995 Criteria Document"). See 61 Fed. Reg. 58,447. The CMC for selenate, which is fourteen times lower than the CMC for selenite(\*3), is particularly troublesome, given that the overwhelming weight of the toxicological evidence indicates that selenate is less toxic than selenite. See Attachment A to these comments. This is apparent both from the data cited in EPA's 1987 Criteria Document and from numerous published papers in which a given researcher compared selenate and selenite toxicity in paired tests. Looking at the entire EPA database for selenate and selenite for all species where there are LC<sub>50</sub> values for both oxidation states, *Gammarus pseiidolimnaeus* is the only genus with a selenite LC<sub>50</sub>, to selenate LC<sub>50</sub>, ratio of less than one (1). While the ratio for *Gammarus* is 0.024, the range of ratios for all other genera range from 1.46 (for *Daphnia*) to 5.53 (for *A. hypnorum* (snail)).

A review of the CMC for selenate indicates that this anomalous result is caused by a combination of three factors: (1) the inclusion in the LC<sub>50</sub> database for selenate of a Genus Mean Acute Value ("GMAV") of 0.065 mg/l for *Gammarus pseudolimnaeus*; (2) the fact that the database for selenate is relatively sparse (consisting of only eight GMAVS); and (3) the application of EPA's standard statistical technique for calculating CMCS, which produces results that are highly conservative in situations where

data are sparse and there is a substantial gap between the most sensitive species and the next most sensitive species.

UWAG believes that this combination of factors has lead EPA to derive a CMC for selenate that is inconsistent with the vast majority of comparative toxicity data. As two of the peer reviewers who commented on the July 1996, Draft Addendum to the 1987 Water Quality Criteria Document for Selenium (the "Draft Addendum") noted, this result appears questionable at best. See Adams, W.J., "Review of Selenium Water Quality Criteria: Revised" at p. 9 (undated) ("Adams Comments") (Attachment B to these comments); and DeGraeve, G.M., and McIntyre, D.O., "Review of The Freshwater CMC for Selenium: Addendum to Ambient Water Quality Criteria for Selenite -- 1987" at p. 2 (Aug. 16, 1996) (Attachment C to these comments).

For example, Dr. Adams noted that another freshwater amphipod, *Hyalella azteca*, followed the expected pattern of toxicity and was more sensitive to selenite than selenate. Adams Comments at 9. As Dr. Adams notes, one would expect selenate to be less toxic than selenite, because selenate is more chemically stable and less likely to be metabolized as organo-selenium. *Id.*

Several technical concerns with the two studies of *Gammarus pseudolimnaeus* by Brooke, et al., on which the GMAV is based, could have affected the accuracy of the results. First, Brooke et al. did not report the background concentrations of likely contaminants in the City of Superior water used in the tests. Thus, it is not possible to assess whether such contaminants may have affected the test results.

Second, the researchers do not report the actual concentration of selenate (or selenite) during or after the test. Instead, they appear to have made the assumption that no conversion occurred. Such assumptions are inappropriate, as evidenced by EPA's protocol for the Water Effects Ratio procedure, which requires that both the total recoverable and dissolved forms of the metal be measured at the start and end of any static exposure test. U.S. EPA, 1994 Interim Guidance on Determination and Use of Water Effect Ratios for Metals, EPA-823-B-94-001, pp. 55-56.

Third, UWAG questions the propriety of the researchers' decision to prepare their own reference standard solution, which they apparently used both to calibrate their measurement instruments and to prepare the test dilutions. Such a procedure is not standard, and could lead to biased results.

In sum, EPA should not blindly use the Brooke, et al., data for *Gammarus* without further verification, nor should it apply the standard criteria derivation procedure to the available data without first considering the suitability of that procedure in light of the inconsistency between the result obtained and the overwhelming weight of the available evidence. UWAG understands that EPA has commissioned additional acute toxicity tests of three species -- *Gammarus pseudolimnaeus*, *Daphnia magna*, and *Ceriodaphnia dubia* -- with both selenate and selenite. UWAG applauds this effort. We urge the Agency to forego taking any final action on issuance of a selenium CMC for the Great Lakes until those tests are complete and have been subject to review and comment.

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(\*1) UWAG is a voluntary, ad hoc, non-profit, unincorporated group of seventy-three electric utility systems, which own and operate over fifty percent of the nation's total generating capacity. The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association also are UWAG members.

(\*2) 61 Fed. Reg. 66,007 (Dec. 16, 1996).

(\*3) EPA appears to have reversed the CMCs for selenate and selenite in the discussion at 61 Fed. Reg. 58,446, col. 2 (Section B. 1.3.a. and b. of the proposal). In other places in the notice (e.g., 61 Fed. Reg. 58,445, col. 2), EPA correctly states that the calculated CMC for selenite is 185.9 ug/l and the CMC for selenate is 12.82 ug/l.

Response to: CTR-030-011

For reasons specified in the response to CTR-008-001, EPA agrees with the comment that the acute toxicity database for selenate should be reexamined prior to promulgating the proposed acute criterion for selenium. As described in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criterion for selenium and is conducting additional acute toxicity tests on *Gammarus pseudolimnaeus* and two species of daphnids to confirm the relative toxicity of selenite and selenate.

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Comment ID: CTR-030-012

Comment Author: Utility Water Act Group

Document Type: Trade Org./Assoc.

State of Origin: DC

Represented Org:

Document Date: 09/25/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: Dear Mr. Morris:

On behalf of the Utility Water Act Group ("UWAG")(\*1), we are writing to comment on EPA's "Proposed Selenium Criterion Maximum Concentration for the Water Quality Guidance for the Great Lakes System," published at 61 Fed. Reg. 58,444 (Nov. 14, 1996). UWAG appreciates the Agency's decision to extend the comment period(\*2) for the selenium criterion maximum concentration ("CMC"), in light of the important technical issues raised by this proposed rule.

After reviewing the proposal, UWAG has the following recommendations:

- (1) EPA should re-examine and expand the LC50, database underlying the criteria maximum concentration ("CMC") for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;
- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;
- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic waters under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and

organo-selenium will be determined; and

(6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

Each of these recommendations is discussed in greater detail below.

## II. EPA SHOULD ACKNOWLEDGE AND PROVIDE GUIDANCE ON TAKING INTO ACCOUNT THE MODERATING EFFECTS OF SULFATE LEVELS ON SELENIUM TOXICITY.

The available evidence suggests that the toxicity of selenium to certain taxa decreases as sulfate concentrations increase. This relationship may be expected, because sulfur and selenium are chemically similar and follow many of the same physical, chemical, and biological pathways. Stadtman, T.C., 1974. Selenium Biochemistry. *Science*. 183:915-922. Thus, sulfur seems to directly compete with selenium at the molecular level.

For example, the relationship between sulfate concentrations and selenate toxicity was examined in a paper by Ogle and Knight (1996). The authors compiled all of the published data from acute toxicity tests on *Daphnia magna* in which sulfate was measured. They found a highly significant correlation (r-square value = 0.84) using untransformed data.<sup>(\*4)</sup> This strong correlation clearly indicates that the toxicity of selenate decreases as the concentration of sulfur increases.

In its proposed addenda to the 1987 Criteria Document, EPA acknowledges that sulfate may decrease the toxicity of selenate and selenite.<sup>(\*5)</sup> But UWAG believes that this issue specifically warrants more prominent discussion in the preamble to any final rule published by EPA. UWAG urges EPA to advise states, as part of this rulemaking, to consider the potential mitigating effects of sulfate on selenium toxicity, and to take those effects into account when establishing their own criteria.

In both the Draft Addendum and the September 1996 Addendum,<sup>(\*6)</sup> EPA also says that the Water Effects Ratio ("WER") procedure for deriving site-specific criteria can be used to derive appropriate criteria in situations where sulfate levels affect selenium toxicity. While UWAG agrees that such a procedure could be an appropriate mechanism for taking into account the moderating effects of sulfate, it is not clear how EPA anticipates the WER procedure would be applied.

For example, would it be applied to develop site-specific CMCs for selenate and selenite respectively, which could then be used in EPA's equation? Or does EPA expect that the WER procedures would somehow be applied to examine the effect of sulfate on the toxicity of the mixture of several selenium forms? If the latter, it is not clear how the procedure would work, since application of the WER typically involves comparison of the toxicity of a given pollutant in source waters with toxicity exhibited in the laboratory tests on which the generic criterion is based. Because EPA's proposed selenium CMC is based not on toxicity tests of mixtures, but instead on an equation that relies on calculated CMCs based on laboratory tests of two distinct selenium oxidation states, EPA should explain how the WER should be applied in this situation.

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<sup>(\*1)</sup> UWAG is a voluntary, ad hoc, non-profit, unincorporated group of seventy-three electric utility systems, which own and operate over fifty percent of the nation's total generating capacity. The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association also are UWAG members.

(\*2) 61 Fed. Reg. 66,007 (Dec. 16, 1996).

(\*4) An even higher correlation would be expected if the data were log-transformed (the procedure EPA uses when examining the relationship between metal hardness and acute toxicity).

(\*5) Draft Addendum at p. 3-6; U.S. EPA, "The Freshwater CMC for Selenate: Addendum to Ambient Water Quality Criteria for Selenium -- 1987" (Sept. 30, 1996) ("September 1996 Addendum") at p. 6.

(\*6) See July 1996 Draft Addendum at p. 3-6; September 1996 Draft Addendum at p.6.

Response to: CTR-030-012

For the reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criteria for selenium. EPA is currently generating and evaluating additional toxicity data (including those that evaluate sulfate dependency of acute toxicity) to facilitate its review of the acute criterion for selenium.

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Comment ID: CTR-030-013

Comment Author: Utility Water Act Group

Document Type: Trade Org./Assoc.

State of Origin: DC

Represented Org:

Document Date: 09/25/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: Dear Mr. Morris:

On behalf of the Utility Water Act Group ("UWAG")(\*1), we are writing to comment on EPA's "Proposed Selenium Criterion Maximum Concentration for the Water Quality Guidance for the Great Lakes System," published at 61 Fed. Reg. 58,444 (Nov. 14, 1996). UWAG appreciates the Agency's decision to extend the comment period(\*2) for the selenium criterion maximum concentration ("CMC"), in light of the important technical issues raised by this proposed rule.

After reviewing the proposal, UWAG has the following recommendations:

- (1) EPA should re-examine and expand the LC50 database underlying the criteria maximum concentration ("CMC") for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;
- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;

- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic waters under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and organo-selenium will be determined; and
- (6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

Each of these recommendations is discussed in greater detail below.

### III. EPA SHOULD ACKNOWLEDGE AND PROVIDE GUIDANCE FOR DEALING WITH SITUATIONS WHERE SIMPLE ADDITIVITY DOES NOT OCCUR

EPA has not provided any guidance to the states on how to determine whether something less (or greater) than simple additivity might be occurring. While EPA notes in the September 1996 Addendum at p. 6 that the WER procedure might be used to account for "possible deviations from additivity," it does not explain how the WER could be used to accomplish this. For the reasons discussed above, it is not clear how the WER would be adapted for use in this context, where effects of a mixture under actual instream conditions are being compared to effects of separate metal oxidation states in laboratory tests.

UWAG believes that EPA has an obligation both to provide a more reasoned basis for its assumption that simple additivity occurs, and to explain what and how available procedures may be used to develop defensible criteria in situations where such additivity may not be occurring.

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(\*1) UWAG is a voluntary, ad hoc, non-profit, unincorporated group of seventy-three electric utility systems, which own and operate over fifty percent of the nation's total generating capacity. The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association also are UWAG members.

(\*2) 61 Fed. Reg. 66,007 (Dec. 16, 1996).

Response to: CTR-030-013

For the reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criteria for selenium.

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Comment ID: CTR-030-014  
Comment Author: Utility Water Act Group  
Document Type: Trade Org./Assoc.  
State of Origin: DC  
Represented Org:  
Document Date: 09/25/97  
Subject Matter Code: C-04b Selenium Aquatic Life  
References:

Attachments? Y  
CROSS REFERENCES

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Comment: Dear Mr. Morris:

On behalf of the Utility Water Act Group ("UWAG")(\*1), we are writing to comment on EPA's "Proposed Selenium Criterion Maximum Concentration for the Water Quality Guidance for the Great Lakes System," published at 61 Fed. Reg. 58,444 (Nov. 14, 1996). UWAG appreciates the Agency's decision to extend the comment period(\*2) for the selenium criterion maximum concentration ("CMC"), in light of the important technical issues raised by this proposed rule.

After reviewing the proposal, UWAG has the following recommendations:

- (1) EPA should re-examine and expand the LC50 database underlying the criteria maximum concentration ("CMC") for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;
- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;
- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic waters under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and organo-selenium will be determined; and
- (6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

Each of these recommendations is discussed in greater detail below.

#### IV. EPA SHOULD ACKNOWLEDGE AND PROVIDE GUIDANCE FOR DISTINGUISHING BETWEEN ORGANIC FORMS OF SELENIUM AND ELEMENTAL SELENIUM.

EPA proposes to employ an equation for calculating a CMC for total selenium, in part to address the potential toxicity of certain organo-selenium forms, which EPA says may be more toxic than selenate or selenite. EPA proposes to "assume that half of the measured or derived concentration of 'other' selenium forms is as toxic as selenate and half is as toxic as selenite." 61 Fed. Reg. 58,446. This proposal is troubling because it suggests that EPA may intend to allow states to "derive" organo-selenium concentrations by (1) measuring total selenium, selenate, and selenite; (2) subtracting the amount of selenite and selenate from the amount of total selenium; and (3) assuming that the difference is all organo-selenium, which EPA assumes is always at least as toxic as selenite or selenate.

Yet recent reviews of selenium cycling data show that some of that "other" selenium is likely to be elemental selenium, especially in anaerobic waters under reducing conditions. Maier, K.J. and A.W.

Knight. 1994: Ecotoxicity of selenium in freshwater systems. *Reviews of Environmental Contamination and Toxicology*. 134:31-48. Because of its insolubility and affinity for anoxic sediments, elemental selenium is far less bioavailable and, hence, less toxic than other selenium forms.

EPA's assumptions regarding the toxicity of organo-selenium forms clearly are based on a very limited amount of data on certain organic selenium forms. EPA has no data showing that either elemental selenium, or organic forms of selenium other than those for which data are provided in the proposal, are as or more toxic than selenite or selenate. Thus, EPA should specify that only measured amounts of the organic selenium forms for which it has sufficient toxicity data are to be included in the calculation. Equally important, EPA should specify that elemental selenium should be excluded from the calculation.

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(\*1) UWAG is a voluntary, ad hoc, non-profit, unincorporated group of seventy-three electric utility systems, which own and operate over fifty percent of the nation's total generating capacity. The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association also are UWAG members.

(\*2) 61 Fed. Reg. 66,007 (Dec. 16, 1996).

Response to: CTR-030-014

For the reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criteria for selenium.

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Comment ID: CTR-030-015  
Comment Author: Utility Water Act Group  
Document Type: Trade Org./Assoc.  
State of Origin: DC  
Represented Org:  
Document Date: 09/25/97  
Subject Matter Code: C-04b Selenium Aquatic Life  
References:  
Attachments? Y  
CROSS REFERENCES

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Comment: Dear Mr. Morris:

On behalf of the Utility Water Act Group ("UWAG")(\*1), we are writing to comment on EPA's "Proposed Selenium Criterion Maximum Concentration for the Water Quality Guidance for the Great Lakes System," published at 61 Fed. Reg. 58,444 (Nov. 14, 1996). UWAG appreciates the Agency's decision to extend the comment period(\*2) for the selenium criterion maximum concentration ("CMC"), in light of the important technical issues raised by this proposed rule.

After reviewing the proposal, UWAG has the following recommendations:

(1) EPA should re-examine and expand the LC50 database underlying the criteria maximum concentration ("CMC") for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;

- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;
- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic waters under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and organo-selenium will be determined; and
- (6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

Each of these recommendations is discussed in greater detail below.

#### V. EPA SHOULD CLARIFY THAT THE PROPORTION OF SELENITE, SELENATE, AND ORGANO-SELENIUM FORMS ARE TO BE DETERMINED INSTREAM, UNDER FULLY MIXED CONDITIONS.

EPA's proposal does not specifically discuss where in the waterbody the determination should be made as to the relative amounts of selenite, selenate, and organo-selenium present. Because water quality criteria are designed to protect aquatic organisms from plausible exposures instream,<sup>(\*7)</sup> it seems logical that states would make this determination under fully mixed instream conditions<sup>(\*8)</sup>.

While the proposal does not discuss this point, on p. 58,448 it refers to deriving the acute criteria for selenium "depending on the relative proportions of the various forms of selenium in a facility's discharge." EPA has provided no explanation or support for making the determination on a discharge-by-discharge basis, nor would such an approach be consistent with the purpose of EPA's water quality criteria. Moreover, such an approach appears inconsistent with EPA's statements about the potential for chemical conversion of different selenium forms in ambient waters and the effects of water chemistry on various selenium forms. See 61 Fed. Reg. 58,446. Thus, an approach which requires determination of relative proportions instream, under the exposure conditions that are likely to occur, would seem the more technically sound and logically consistent approach in most cases.

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(\*1) UWAG is a voluntary, ad hoc, non-profit, unincorporated group of seventy-three electric utility systems, which own and operate over fifty percent of the nation's total generating capacity. The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association also are UWAG members.

(\*2) 61 Fed. Reg. 66,007 (Dec. 16, 1996).

(\*7) See, e.g., U.S. EPA, Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (1985).

(\*8) UWAG recognizes that, in some cases, the concentrations of various selenium forms instream may

be so low as to make accurate analysis infeasible. In such cases, it may be more appropriate to allow for testing of the different selenium forms at the discharge point, as long as factors that are likely to affect selenium chemistry instream are taken into account.

Response to: CTR-030-015

For the reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criteria for selenium. When EPA finalizes its freshwater acute criterion for selenium, EPA will consider providing additional guidance on the determination of the fractions of total selenium that exist in various forms.

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Comment ID: CTR-030-016

Comment Author: Utility Water Act Group

Document Type: Trade Org./Assoc.

State of Origin: DC

Represented Org:

Document Date: 09/25/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: Dear Mr. Morris:

On behalf of the Utility Water Act Group ("UWAG")(\*1), we are writing to comment on EPA's "Proposed Selenium Criterion Maximum Concentration for the Water Quality Guidance for the Great Lakes System," published at 61 Fed. Reg. 58,444 (Nov. 14, 1996). UWAG appreciates the Agency's decision to extend the comment period(\*2) for the selenium criterion maximum concentration ("CMC"), in light of the important technical issues raised by this proposed rule.

After reviewing the proposal, UWAG has the following recommendations:

- (1) EPA should re-examine and expand the LC50 database underlying the criteria maximum concentration ("CMC") for selenate, which as currently derived is inconsistent with the vast majority of the available toxicity data for selenate and selenite;
- (2) EPA should acknowledge and provide guidance for taking into account the effect of varying sulfate levels on selenium toxicity;
- (3) EPA should acknowledge and provide guidance for dealing with situations where simple additivity does not occur;
- (4) EPA should acknowledge and provide guidance for distinguishing between organic forms of selenium and elemental selenium, which may be found in anaerobic waters under reducing conditions;
- (5) EPA should provide guidance on where in the waterbody the proportions of selenate, selenite, and organo-selenium will be determined; and

(6) EPA should avoid making unfounded assumptions about the effect of potential selenium bioaccumulation on the CMC, and should delete from its final guidance or rule any discussion of unproven methodologies taking such bioaccumulation into account.

Each of these recommendations is discussed in greater detail below.

**VI. EPA'S ASSUMPTIONS REGARDING THE POTENTIAL EFFECTS OF SELENIUM "BODY BURDENS" ON THE ACUTE TOXICITY OF SELENIUM ARE NOT SUPPORTED BY SOUND SCIENCE, AND SHOULD BE DELETED FROM ANY FINAL RULE OR ADDENDUM EPA ULTIMATELY ISSUES.**

In its proposal, EPA says that it is not proposing to amend the 304(a) criteria document for acute or chronic selenium embodied in the EPA document entitled "Ambient Water Quality Criteria for Selenium -- 1987" (EPA 440/5-87-0008). 61 Fed. Reg. 58,445, col. 1. Thus, EPA says, it does not intend to respond to any comments on that document. Yet on the same page, EPA also says that it is proposing to incorporate into the 1987 Criteria Document an addendum(\*9) reflecting its new proposed approach for calculating a selenium CMC. 61 Fed. Reg. 58,445, col. 3. UWAG believes that EPA should clarify whether or not it intends by this rulemaking to affect the national criteria guidance document. If so, EPA should provide potentially interested persons appropriate notice and an opportunity to comment on the implications of applying this approach beyond the Great Lakes.

UWAG agrees with EPA's decision not to go forward with any proposal based on the theory, set forth in the Draft Addendum and the September 1996 Addendum, that fish exposed to organic selenium may carry a "body burden" that makes them more sensitive to acute selenium exposure. We agree that there are no hard data to support this theory and, thus, reliance on it would be indefensible. Although elevated bioaccumulation of selenium occurring as a result of long-term exposure has been associated with reproductive impairment and mortality in some environments, EPA has provided no technical support for the notion that a certain level of selenium "body burden" predisposes an aquatic organism to greater, or lesser, sensitivity to acute exposures.

Furthermore, even if there were some theoretical or experimental basis for the hypothesis that a "body burden" of selenium increases an organism's sensitivity to acute effects, there is no rational basis for its application to a Great Lake. Great Lakes waters typically contain undetectable concentrations of selenium. Low background concentrations, combined with the enormous size of the Great Lakes and the migratory nature of Great Lakes fish, do not provide the same opportunity for bioaccumulation which might theoretically exist in small, well-mixed water bodies. This premise is confirmed by actual selenium levels in Great Lakes fish, which do not contain elevated concentrations of selenium (Schmitt and Brumbaugh, 1990).(\*10) A "body burden" model is therefore particularly inappropriate for the Great Lakes.

In the same vein, we agree with EPA's decision not to propose Guidance implementing an unsupported theory that pollutants should be placed in one of three categories, based on their potential to bioconcentrate and bioaccumulate, and that this potential be taken into account in deriving criteria. The theories contained in this section of the Addendum amount to pure speculation, supported by little or no empirical data. The relationship between body burdens and toxic effects is very controversial, and there is no scientific consensus that bioaccumulation per se results in adverse effects (e.g., Chapman, 1996).(\*11) For example, Reash et al. (1996)(\*12) showed that bluegills exposed to water selenium concentration, much higher than EPA's criterion continuous concentration ("CCC") of 5 ILglf resulted in elevated bioaccumulation of selenium but these "body burdens" did not cause mortality or reproductive impairment in the population. Moreover, the presence of additional pollutants which contribute to the

entire "body burden" of pollutants in an organism makes the relationship between tissue levels of one pollutant and adverse effects quite unclear. Heinz (1996) summarized these concerns when discussing the significance of selenium residues in birds:

Selenium's ability to interact with other environmental contaminants, especially other elements, also sometimes complicates an interpretation of toxic thresholds in tissues of birds . . . the reader needs to be aware that such interactions exist."

In summary, EPA's theory that a "body burden" of selenium could increase an organism's sensitivity to acute selenium exposure is interesting scientifically, but EPA currently has no mechanism to link the two processes. Furthermore, this concept makes little sense from an exposure viewpoint. Bioaccumulation occurs over a much longer period in an organism's life cycle relative to acute effects. Hence, UWAG strongly recommends that EPA keep the distinctions between acute and chronic exposure/effect unambiguous. Therefore, UWAG urges EPA to delete this discussion from any guidance or Addendum it issues for any selenium CMC.

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(\*1) UWAG is a voluntary, ad hoc, non-profit, unincorporated group of seventy-three electric utility systems, which own and operate over fifty percent of the nation's total generating capacity. The Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association also are UWAG members.

(\*2) 61 Fed. Reg. 66,007 (Dec. 16, 1996).

(\*9) It is not clear whether the September 1996 Addendum to which EPA refers is a draft or final document. If it is not a draft, then EPA's use of that document in its current form would appear to run contrary to the Agency's statements that the sections of the Addendum dealing with "body burden" and BAF/BCF issues are not being proposed for comment and will not be included in either the Great Lakes Guidance or the addendum to the criteria document. See 61 Fed. Reg. 58445, col. 1, 58446, col. 2. For the sake of clarity, EPA should provide the public with the specific version of any addendum that it proposes to apply in any context.

(\*10) Schmitt, C.J., and W.G. Brumbaugh. 1990. National contaminant biomonitoring program: concentrations of arsenic, cadmium, copper, lead, mercury, selenium, and zinc in U.S. freshwater fish. Archives of Environmental Contamination and Toxicology 19:731-747.

(\*11) Chapman, P.M. 1996. Is bioaccumulation useful for predicting impacts? Paper presented at 1996 meeting of the Society of Environmental Toxicology and Chemistry, Washington, D. C.

(\*12) Reash, R.J., T. Lohner, K.V. Wood, and R. Leville. 1996, Selenium in fish inhabiting a fly ash receiving stream: implications for national water quality criteria, Paper presented at 1996 meeting of the Society of Environmental Toxicology and Chemistry, Washington, D. C.

(\*13) Heinz, G. H. 1996. Selenium in birds. pp. 447-458 in W.N. Beyer, G. H. Heinz, and A.W. Redmond -- Norwood (eds), Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations. SETAC Special Publication Series. Lewis Publishers, New York. 494 pp.

Response to: CTR-030-016

For the reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed

freshwater acute criteria for selenium.

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Comment ID: CTR-051-002

Comment Author: Cal. RWQCB Central Valley Reg.

Document Type: State Government

State of Origin: CA

Represented Org:

Document Date: 09/26/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? N

CROSS REFERENCES

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Comment: Selenium

In 1996, the Regional Board amended the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, updating the selenium control program in the San Joaquin River watershed. The amendment contains water quality objectives and an implementation timetable for the San Joaquin River and numerous water bodies in the Grassland area. It was finalized earlier this year and has been forwarded to US EPA for approval. If approval of the 1996 amendments is not obtained before promulgation of the final Toxics Rule, the current federally recognized objectives will remain in place indefinitely. This will unnecessarily complicate a control program that is already complex in nature. Therefore, US EPA is urged to approve the 1996 amendment and recognize it as the appropriate selenium control effort for the affected water bodies.

Response to: CTR-051-002

The commenter expressed concerns that the selenium control program and implementation timetable contained in the 1996 amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) would be overridden by the CTR. The commenter also expressed concerns regarding the selenium criteria contained in the CTR and the potential for complications that could result from having state and federal criteria for the same waterbodies. EPA disagrees with these concerns.

First, it should be noted that already there are federal selenium criteria in place for parts of San Joaquin River, Salt Slough, Mud Slough (north), etc. These criteria were promulgated as part of the NTR on December 22, 1992. (57 Fed.Reg. 60848,60921, December 22, 1992.) The current CTR action does not change the NTR standards for those waters.

For the other named waterbodies subject to the 1996 Basin Plan amendments (Appendix 40), EPA is promulgating selenium criteria as part of the CTR. EPA has not yet approved the 1996 amendments, and in the absence of EPA-approved, site-specific criteria, EPA must promulgate criteria for toxic pollutants, including selenium, to meet the requirements of CWA section 303(c)(2)(B).

As with other site-specific criteria, if EPA approves the State's site-specific criteria for selenium for San Joaquin River, Salt Slough, Mud Slough (north), etc., EPA can undertake rulemaking to stay the the applicable selenium criteria in the CTR as well as the NTR. In the meantime, where site-specific criteria have already been adopted by the State in accordance with State law, but not yet acted upon by EPA,

such State-adopted criteria are in effect under State law. If those criteria are more stringent than applicable federal (CTR or NTR) criteria, those would be the controlling criteria for CWA purposes even without a stay of the applicable CTR (federal) criteria and would thus be implementable by the State. (This would not be affected by the so-called "Alaska Rule" which EPA proposed July 9, 1999, 64 Fed.Reg. 37072. See p. 37076.) This is the case with the site-specific criteria for selenium adopted by the State for the San Joaquin River, Salt Slough, Mud Slough (north), etc. Since the State must use the most stringent criteria in effect for its water quality programs, the 1996 Basin Plan site-specific selenium criteria remain in effect notwithstanding the CTR and NTR fresh water aquatic life criteria for selenium. Moreover, the selenium control program and implementation timetable will continue to apply to the State's site-specific criteria.

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Comment ID: CTR-058-005

Comment Author: Western States Petroleum Assoc

Document Type: Trade Org./Assoc.

State of Origin: CA

Represented Org:

Document Date: 09/26/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: 4. Acute Selenium Criteria. EPA's assumption that the toxicities of all forms of selenium are additive is not adequately supported.

In the Great Lakes Initiative rulemaking, at pp 61 FR 58444 and 58446, EPA states that new data indicate that all forms of selenium are additive, and therefore takes that conclusion into account in setting the CMC for selenium without any further discussion.

The basis provided by EPA to support this conclusion consists of studies reported by Hamilton and Buhl (1990) and Maier et al. (1993) [at p. 61 FR 58446]. Interestingly, these reports more accurately suggest that mixtures of different selenium forms may not always reflect "additive" effects in the classic sense where the effect of two chemicals is equal to the sum of the effects of the individual chemicals applied alone. Instead, these two studies suggest that the combined effect can be substantially less than or somewhat greater than the "simple additivity" which EPA assumes and on which it bases its proposed equation. Moreover, the 1987 criteria document data do not support the additivity assumption made by EPA.

EPA should either abandon its stated assumption or provide a scientifically defensible explanation for basing its assumption upon the two studies cited as authority.

Response to: CTR-058-005

For the reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criteria for selenium. Therefore, this comment is no longer applicable to the final rule. During its review of the acute criterion, EPA will be generating additional data on the additive toxicity of different selenium forms to sensitive aquatic organisms.

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Comment ID: CTR-058-006

Comment Author: Western States Petroleum Assoc

Document Type: Trade Org./Assoc.

State of Origin: CA

Represented Org:

Document Date: 09/26/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? Y

CROSS REFERENCES

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Comment: 5. Chronic Selenium Criterion, SF Bay. WSPA does not support the choice of a freshwater criterion for SF Bay, Suisun Bay, San Pablo Bay and adjacent waters.

The proposed rule makes no attempt to defend the choice of a 5 ug/L freshwater criterion for selenium in these marine waters. This approach is arguably arbitrary and capricious. EPA says, more or less, we set this site-specific criterion in these waters in a previous rulemaking and we won't change. EPA should defend the choice of a criterion based on freshwater data for these waters, and stakeholders should be allowed to comment on the basis for this approach once they can see and evaluate EPA's attempt to justify it.

Furthermore, we dispute the 5 ug/L freshwater chronic criterion, which we understand to be based on the anomalous data of the Belews Lake, North Carolina study. We know of no other study where such a low threshold of concern was supported and challenge the Agency to cite any. Belews Lake is a lake with a very little flushing which arguably will not model many or most of the reaches of water in California to which EPA wants this criterion to apply (specifically, river reaches as well as the San Francisco/San Pablo/Suisun Bay system). We do not know what sort of mechanisms may occur in Belews Lake to convert selenium from one form to a more toxic form. We do not know if this transformation takes several steps. Additionally, we do not know whether these mechanisms would occur in the more common well-flushed reaches to which EPA seeks to apply the criterion here in California. EPA should justify both the value of 5 ug/L and the use of a freshwater criterion in marine waters.

Response to: CTR-058-006

EPA promulgated the freshwater CCC of 5 ug/l for San Francisco Bay, Suisun Bay, San Pablo Bay, and adjacent waters as part of the National Toxics Rule [NTR](57 FR 60848-60921, December 22, 1992). EPA disagrees that this approach is arbitrary and capricious. EPA explained its rationale for this decision in response to comments for the NTR (57 FR 60898, December 22, 1992). The purpose of today's rule is to promulgate criteria that fill the gap created when previous State criteria were invalidated as a result of State litigation. The rule is not intended to change or supersede any criteria previously promulgated for California in the NTR, as amended (Administrative Stay of Federal Water Quality Criteria for Metals and Interim Final Rule, Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance-Revision of Metals Criteria, 60 FR 22228, May 4, 1995). The freshwater CCC for selenium is re-printed in the text of the CTR for the convenience of the user.

EPA disagrees with the commenter that the Belews Lake data are "anomalous" and are therefore not appropriate for application to California waters. The selenium effects data of Belews lake are supported

by other more recent data indicating adverse effects on aquatic organisms at comparable levels. For example, in a year-long study of selenium effects on aquatic life in outdoor experimental streams, Hermanutz et al. (1992) report statistically significant reductions in adult bluegill survival during the final 98-d exposure period to 10 ug/L selenium (introduced as sodium selenite) and complete mortality at 30 ug/L during the same exposure period. Hermanutz et al. (1992) also report statistically significant reductions in embryo hatch and higher incidence of developmental abnormalities at 10 ug/L and 30 ug/L compared to controls. This level (10 ug/L) is the same as that associated with unacceptable effects in the Belews lake study upon which the freshwater CCC is based. A chronic test conducted by Schultz and Hermanutz (1990) on the effect of selenium on fathead minnow in the same outdoor experimental streams is also consistent with results from the Belews Lake data. Specifically, Schultz and Hermanutz (1990) report statistically significant differences in the incidence of developmental abnormalities (lordosis and edema) in larvae from fish exposed in 10 ug/L streams compared to controls. In a laboratory study, Lemly (1993) exposed bluegill exposed to combined dietary (5.1 ug/g dry weight) and 4.8 ug/L waterborne selenium and reported that a combination of elevated selenium and low temperature resulted in reduced feeding, depletion of body lipids and significant mortality in 60 days (termed winter stress syndrome) compared to fish in equivalent warm water exposures.

The Belews lake data and supporting studies used to derive the freshwater CCC for selenium indicate that adverse effects on bluegill occurred at about 10 ug/L (as was also observed in experimental streams by Hermanutz et al., 1992) and that bluegill were unaffected at concentrations of 5 ug/L or below. Therefore, EPA believes that the similarity between the adverse effect levels associated with Belews lake and those of Hermanutz et al. (1992), Schultz and Hermanutz (1990), and Lemly (1993), which involved very different exposure systems, demonstrates that the Belews lake data are not "anomalous" as the commenter stated and can be reasonably extrapolated to other types of waterbodies. Finally, EPA notes that because these and other new data have become available since EPA's publication of the aquatic life criteria for selenium in 1987, EPA is currently reviewing this new data for potentially revising as appropriate its 304(a) criteria for selenium.

#### References:

Lemly, A.D. 1993. Metabolic stress during winter increases the toxicity of selenium to fish. *Aquatic Toxicology*, 27:133-158.

Hermanutz, R.O., K.N. Allen, T.H. Roush and S.F. Hedtke. 1992. Effects of elevated selenium concentrations on bluegills, *Lepomus macrochirus*, in outdoor experimental streams. *Environ. Toxicol. Chem.* 11(2):217-224.

Schultz, R. and R. Hermanutz. 1990. Transfer of toxic concentrations of selenium from parent to progeny in the fathead minnow (*Pimephales promelas*). *Bull. Environ. Contam. Toxicol.* 45:568-573.

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Comment ID: CTR-060-007

Comment Author: San Diego Gas and Electric

Document Type: Electric Utility

State of Origin: CA

Represented Org:

Document Date: 09/26/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? N

## CROSS REFERENCES

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Comment: PROVISIONS SDG&E DOES NOT SUPPORT

As described in the following comments SDG&E does not support the following provisions:

Selenium acute criteria is technically deficient

This rule proposes to adopt the proposed revised Great Lakes acute selenium criterion. EPA has yet to respond to comments submitted on this criterion during a previous comment period. Until such time as EPA reviews and responds to the comments submitted previously on this proposed criterion, it would be premature for EPA to adopt the criterion as proposed in the CTR.

Response to: CTR-060-007

EPA agrees with the comment that it should not promulgate its proposed acute freshwater criterion for selenium until after it completes its response to comments on a previous proposal that relies on the same criterion. For additional reasons specified in the response to CTR-008-001, EPA is not promulgating its proposed freshwater acute criteria for selenium.

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Comment ID: CTR-103-001

Comment Author: Fish and Wildlife Service

Document Type: Federal Government

State of Origin: CA

Represented Org:

Document Date: 10/10/97

Subject Matter Code: C-04b Selenium Aquatic Life

References:

Attachments? N

CROSS REFERENCES

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Comment: The U.S. Environmental Protection Agency (EPA.) recently received a letter, directed to your attention, from Daniel G.Nelson (Executive Director of the San Luis & Delta-Mendota Water Authority) dated September 15, 1997. Mr. Nelson's letter presented an objection to proposed freshwater selenium criteria recently announced by EPA (California Toxics Rule; Federal Register Vol. 62 (150):42160-42208, August 5, 1997). Mr. Nelson asserts in his letter that the proposed "... freshwater selenium criteria are scientifically inadequate because they fail to take account of the known interference between selenate and sulfate uptake in high sulfate waters like those in the San Joaquin Valley...." Mr. Nelson then requests that EPA delay adoption of proposed water-quality criteria for selenium, pending review of the sulfate-interference issue.

The U.S. Fish and Wildlife Service (Service) recently reviewed our copy of Mr. Nelson's letter and does not see a scientifically substantive basis for justifying the delay and further review that Mr. Nelson requests. Sulfate-interference does not appreciably affect selenium bioaccumulation in real-world environments and that has been known for at least 60 years.

Dr. Joseph Skorupa, of my environmental contaminants staff, has recently reviewed the issue of sulfate-interference and its relevance to establishment of freshwater selenium criteria and has concluded

that fish and wildlife toxicity thresholds for waterborne selenium are not sulfate dependent (Skorupa, in press). Mr. Nelson supports his view that sulfate-interactions should be an important regulatory consideration by citing recent laboratory bench studies (Hansen et al. 1993; Williams et al. 1994; Ogle and Knight 1996). Such studies often suffer from the so-called lab-to-field-dilemma (Landis and Yu 1995:28) because they are very simplified and environmentally unrealistic and cannot be extrapolated to the real world. The authors of the studies that Mr. Nelson cites are clearly aware of this important dilemma.

For example, Hansen et al. (1993:77) wrote:

"Thus, at this time, it does not appear that we have sufficient evidence to justify the consideration of sulfate as a factor in the regulation of Se in aquatic environments.

Williams et al. (1994:452) wrote:

"At present, there is little information available that allows us to assess how relevant this study's conclusions will be in natural waters containing a complex assemblage of selenium species.

Ogle and Knight (1996:278) reported that in the region of 5 ug/L waterborne selenium (the critical threshold region recognized in the California Toxics Rule):

"...the differences [in selenium bioaccumulation and toxicity] between extremely different sulfate concentrations are not significant.....

There is a clear record of highly relevant field data supporting Hansen et al.'s and Williams et al.'s cautions against extrapolation of their lab results. Field data show that simplistic selenate-sulfate lab bench results do not extrapolate well to real environments (Skorupa, in press). Realworld data unanimously support the conclusion that toxicity thresholds for selenium are not sulfate dependent. In the absence of any new field data to the contrary, the objection raised in Mr. Nelson's letter must be viewed as inapplicable..

The findings of Dr. Skorupa's review can be summarized as follows:

As early as the 1930's (e.g., Hurd-Karrer 1937, 1938) competitive uptake interactions between selenate and sulfate had already been confirmed experimentally. In the same era it had also already been demonstrated that sulfate-interference did not apply to any form of environmental selenium other than selenate, and that the field significance of sulfate-interference was negligible. Sixty years ago, Beath (1937) concluded that the "...sulfur-selenium antagonism theory has not been found generally applicable to farm and range practices [for ameliorating selenium toxicity to range animals] of the Rocky Mountain region." Thus, although recent experiments cited by Mr. Nelson (Hansen et al. 1993; Williams et al. 1994; Ogle and Knight 1996) provide useful information corroborating earlier work, it is inaccurate for Mr. Nelson to suggest that recent studies provide any fundamentally new conceptual insights not already known by 1987 when EPA derived the 5 ug/L chronic criterion for selenium.

Twenty years ago, Birkner (1978) came to essentially the same conclusion for aquatic habitats that Beath (1937) had reported for open range habitats. Birkner surveyed 30 freshwater sites in Colorado and Wyoming for waterborne, sediment, and foodchain selenium content. The sites that Birkner surveyed included levels of dissolved sulfate that ranged from 5-9,611 mg/L. Statistical analyses of his data led Birkner to conclude that levels of dissolved sulfate did not influence the level to which selenium is bioaccumulated by aquatic organisms.

The lack of sulfate dependency for selenium bioaccumulation in the real world was affirmed once again in the late 1980's and early 1990's. This time the Service collected eggs of waterbirds from agricultural evaporation ponds in California that varied in dissolved sulfate concentrations from 2,000-100,000 mg/L. Selenium concentrations in the bird eggs, which are directly related to the contamination of aquatic foodchains at each sampling site, were strongly predictable from waterborne concentrations of selenium regardless of variable sulfate concentrations that spanned three orders of magnitude (Skorupa, in press). The Service's failure to find a sulfate-interference effect for bioaccumulation of selenium in bird eggs, was corroborated by studies of aquatic invertebrates (the food supply for birds) at the same sites by the California Department of Water Resources (John Shelton, unpubl. data). Combining Birkner's (1978) results with the results from California evaporation ponds, no sulfate-interference effect could be detected in the real world for dissolved sulfate concentrations spanning from 5-100,000mg/L! Furthermore, the field-verified toxic threshold point of 3-4 ug/L waterborne selenium for birds at the high-sulfate ponds in California showed excellent correspondence with the field-verified toxic threshold point of 2-5 ug/L for fish residing in the low-sulfate waters of Belews Lake, North Carolina (Skorupa, in press).

Finally, a comprehensive review of the best documented case studies of selenium poisoning in nature revealed that 7 of 12 real-world toxic episodes occurred at sites with high-sulfate waters (Skorupa, in press). This rich body of real-world data on selenium toxicity to fish and wildlife affirmatively, and unequivocally, supported the conclusion that toxic thresholds for selenium are not sulfate dependent.

Why are simple laboratory bench studies contradicted by field data? Bench studies confirm that high-sulfate waters can reduce bioaccumulation of selenate, but not eliminate it. Thus, even in the face of high concentrations of dissolved sulfate, over time, functionally significant amounts of waterborne selenate are nonetheless taken up by biota and transformed to other forms of environmental selenium that are not subject to sulfate-interference. Those other forms of selenium are far more bioaccumulative than selenate, are free of any interference from sulfate and, over time, come to dominate the bioaccumulation process (e.g., Besser et al. 1989). Recent 48-hr-96-hr lab bench experiments are simply too short in duration and too simple in design to mimic this progression from selenate-dominated water to a complex mixture of multiple chemical species of selenium that characterizes the ecotoxicology of selenium in the real world.

For example, drainage water in the San Joaquin Valley of California was found to contain selenium as selenate, selenite, and selenomethionine (Se-Meth) in a ratio of approximately 18:3:1 (Besser et al. 1989). Bioconcentration factors for periphyton, however, showed a reverse ratio of about 1:6:120 (Besser et al. 1989). Thus, the approximate ratio of selenium uptake from selenate, selenite, and Se-Meth would be 18:18:120. Therefore, only about 11 percent (18/156) of bioaccumulated selenium in the periphyton would be taken up directly from the inventory of dissolved selenate. Under these circumstances, even if a sulfate-interference effect as high as 50 percent were occurring it would have only about a 5 percent ( $0.5 \times 0.11$ ) inhibitory impact on overall bioaccumulation of selenium. At toxic threshold exposures in the region of 2-5 ug/L waterborne selenium, a 5 percent effect would be very negligible in absolute terms. Even this example probably overestimates the contribution of selenate to bioaccumulation of selenium because it does not account for the cumulative loading of predominantly non-selenate species of selenium into aquatic sediments, which is another major bioaccumulation pathway that further devalues the relative importance of dissolved selenate selenium. It is quite plausible that in real aquatic environments even where concentrations of dissolved sulfate are low, only a minute proportion of selenium bioaccumulation is due to direct uptake of selenate selenium.

Much of the technical information presented in this letter was also presented to the scientific consultants

retained b the San Luis & Delta-Mendota Water Authority during a meeting with Dr. Skorupa on July 19, 1995. If Mr. Nelson possesses fundamentally new data that are unequivocally relevant to the real-world, by all means the data should be evaluated by EPA. The studies that Mr. Nelson cites in his letter do not, however, constitute such data.

Questions regarding this letter may be directed to Drs. Joseph Skorupa or Steven Schwarzbach by contacting them at (916)-979-2110.

Response to: CTR-103-001

EPA agrees with the commenter that by itself, the current state of the science on the sulfate dependent toxicity of various selenium forms is not adequate justification to delay promulgation of freshwater selenium criteria in the CTR. However, EPA has chosen not to promulgate acute freshwater criteria for selenium for the reasons stated in EPA's response to CTR-008-001. EPA has chosen to proceed with promulgation of the freshwater CCC for selenium for the reasons stated in EPA's response to CTR-008-001. EPA will consider additional data on sulfate dependency of selenium toxicity, including those cited by the commenter, during its review of freshwater selenium aquatic life criteria.

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