Rationale For Proposed Changes To Select Water Quality Standards For The Inorganic Toxic Chemicals (NAC 445A.144) Related To Aquatic Life Beneficial Use

Prepared by:
Nevada Division of Environmental Protection
Bureau of Water Quality Planning

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STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Kenny C. Guinn, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

PREFACE

September 2006

TO: GENERAL PUBLIC

FROM: NEVADA DIVISION OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER QUALITY PLANNING (NDEP-BWQP)

SUBJECT: ***NAC 445A.144 Standards for toxic materials applicable to designated waters.***

RE: CHANGES MADE TO FINAL DRAFT OF PROPOSED CHANGES TO SELECT WATER QUALITY STANDARDS FOR THE INORGANIC TOXIC CHEMICALS (NAC 445A.144) RELATED TO AQUATIC LIFE BENEFICIAL USE

OVERVIEW

The Nevada Division of Environmental Protection, Bureau of Water Quality Planning (NDEP-BWQP) is proposing to amend the water quality regulation NAC 445A.144 Standards for toxic materials applicable to designated waters. The proposed revisions involve updating select water quality standards for the inorganic toxic chemicals contained in NAC 445A.144 related to protection of aquatic life and are based on guidance provided by the U.S. Environmental Protection Agency (EPA) in the most recent publication of national recommended water quality criteria (May 2005). The national recommended criteria include: previously published criteria that have been revised from earlier criteria; previously published criteria that are unchanged; and newly calculated criteria.

Public workshops were conducted by NDEP-BWQP on May 23, 2006 in Carson City, on May 25, 2006 in Las Vegas, and on June 1, 2006 in Elko, to present the draft rationale for the proposed water quality regulation changes and to discuss the proposed actions. NDEP-BWQP received nine formal comment letters to the proposed actions and draft rationale. Formal comments were submitted by the following:

-- City of Las Vegas letters dated June 14, 2006 and June 28, 2006

-- City of Henderson letters dated June 15, 2006 and June 29, 2006

-- Truckee Meadows Water Reclamation Facility letter dated June 16, 2006

-- Humboldt River Basin Water Authority letter dated June 16, 2006

-- Southern Nevada Water Authority letter dated June 16, 2006

-- Nevada Mining Association letter dated June 16, 2006

-- AngloGold Ashanti (Nevada) Corporation letter dated June 19, 2006

-- Clark County Water Reclamation District letter dated June 23, 2006

-- Southern Nevada Water System letter dated July 5, 2006

CHANGES TO DRAFT RATIONALE FOR PROPOSED CHANGES TO SELECT AQUATIC LIFE WATER QUALITY STANDARDS

Based on input provided during the public workshops and the subsequent discussion and documentation that were presented in the formal comment letters submitted by the aforementioned entities, the proposed regulation revision petition was finalized. The following revisions were made to the draft rationale and the proposed actions that had been presented at the public workshops.

Proposed Aluminum Aquatic Life Criteria

NDEP-BWQP had proposed to add a 1-hour average (acute) and a 96-hour average (chronic) aluminum aquatic life criteria to NAC 445A.144. The proposed acute and chronic criteria were 750µg/l and 87µg/l, respectively. NDEP-BWQP has withdrawn the proposed aluminum aquatic life criteria contained in the draft rationale document. In reviewing and evaluating what other states have done in regards to adopting an aluminum aquatic life standard, it was revealed that the recommended acute and chronic criteria were developed based on inaccurate data and inappropriate interpretation of toxicity test results. Scientific peer review of the aluminum standards indicated that there were enough inconsistencies within the toxicity tests and between studies that the data upon which the aquatic life criteria were developed were questionable and appropriateness of the proposed aluminum criteria was debatable. The test conditions under which the chronic aluminum criterion was derived (pH of 6.5 to 6.6 and water hardness values of <50mg/l $CaCO_3$) would generally not be applicable to water quality conditions of surface waters in Nevada.

NDEP-BWQP will continue to monitor the scientific literature and EPA's evaluations of aluminum toxicity. An aluminum water quality standard to protect aquatic life will be proposed when more scientifically-defensible criteria are developed and recommended by EPA, or as developed by other justifiable and appropriate studies.

Proposed Chloride Aquatic Life Criteria

Chloride aquatic life criteria of 860mg/l (1-hour average) and 230mg/l (96-hour average) had been proposed to be included in NAC 445A.144. The proposed chloride aquatic life criteria have been deferred at this time. Most of the major river systems and surface waters in northern Nevada already have a chloride beneficial use standard (BUS) as well as anti-degradation standards.

Adopting an additional chloride standard would most likely only create confusion during interpretation and application of the chloride water quality standards.

The nature of southern Nevada waters, particularly those of the Colorado Basin, which are subject to an arid climate and continual drought conditions, have resulted in these waters having high inherent salinity levels. As such, freshwater fish, invertebrates and plants have evolved to survive in relatively harsh natural conditions and consequently, it would be more appropriate to develop site-specific chloride aquatic life water quality criteria for southern Nevada waters based on the water chemistry and aquatic life species present in these waters.

Applicable requirements for State adoption of federally promulgated water quality criteria for pollutants vary depending upon the toxicity of the pollutant. The requirements imposed by the Clean Water Act (CWA) Section 303(c)(2)(B) for adoption of numerical criteria published per Section 304(a) of the Act applies only to the 126 priority toxic pollutants as designated by EPA pursuant to CWA Section 307(a). The list of priority pollutants does not include aluminum or chloride. Consequently, there is no statutory requirement associated with the CWA for adopting recommended criteria for non-priority pollutants. Guidance provided by EPA suggests that numeric criteria can be developed, if deemed necessary, for the non-priority pollutants, which are based on sound scientific rationale that cover sufficient parameters to protect designated uses of a waterbody.

Proposed Selenium Aquatic Life Criteria

In the draft rationale of proposed actions to amend NAC 445A.144, it was proposed to remove the existing selenium 1-hour average (acute) aquatic life criteria of 20 µg/l. This was based on the aquatic life criteria values published by EPA's May 2005 publication of national recommended water quality criteria. NDEP-BWQP has reconsidered this proposed action and has elected to retain the existing 20 µg/l selenium aquatic life acute criteria value; thereby maintaining criterion to protect against short-term and long-term effects. Revised freshwater aquatic life criteria for selenium which have been developed for EPA are currently being scientifically and peer reviewed. When EPA finalizes the guidance for selenium aquatic life water quality criteria, NDEP-BWQP will evaluate the recommendations and, as necessary, update the selenium water quality standards contained in NAC 445A.144 for protection of aquatic life.

The revised proposed changes by NDEP-BWQP to select water quality criteria contained in NAC 445A.144 related to aquatic life beneficial use are shown in Attachment 1. The proposed actions to NAC 445A.144 are tentatively scheduled to be considered by the State Environmental Commission (SEC) on September 6, 2006 at a public hearing in Reno, Nevada. Further information about the location and time of the hearing are available at http://sec.nv.gov/main/hearing.

ATTACHMENT 1

Explanation – Matter in ***italics*** is new; matter in brackets [~~omitted material~~] is material to be omitted

NAC 445A.144 Standards for toxic materials applicable to designated waters.

1. Except as otherwise provided in this section, the [~~following~~] standards for toxic materials ***prescribed in subsection 2*** are applicable to the waters specified in NAC 445A.123 to 445A.127, inclusive, and 445A.145 to 445A.225, inclusive. ***The following criteria apply to this section:***

(a) If the standards are exceeded at a site and are not economically controllable, the commission will review and ***may*** adjust the standards for the site.

(b) If a standard does not exist for each designated beneficial use, a person who plans to discharge waste must demonstrate that no adverse effect will occur to a designated beneficial use. If the discharge of a substance will lower the quality of the water, a person who plans to discharge must meet the requirements of NRS 445A.565.

(c) If a criterion is less than the detection limit of a method that is acceptable to the Division, laboratory results which show that the substance was not detected will be deemed to show compliance with the standard unless other information indicates that the substance may be present.

2. The standards for toxic materials are:

Chemical	Municipal or Domestic Supply [1] (µg/l)	Aquatic Life [1,2] (µg/l)	Irrigation [1] (µg/l)	Watering of Livestock [1] (µg/l)
INORGANIC CHEMICALS [3]				
Antimony	146 [a]	-	-	-
Arsenic	50 [b]	-	100 [c]	200 [d]
[~~Arsenic (III)~~]	-	-	-	-
1-hour average	-	[~~342~~ [a,g]] ***340*** [g,h]	-	-
96-hour average	-	[~~180~~ [a,g]] ***150*** [g,h]	-	-
Barium	2,000 [b]	-	-	-
Beryllium	0 [a]	-	100 [c]	-
[hardness <75 mg/l]	-	-	-	-
[hardness >= 75 mg/l]	-	-	-	-
Boron	-	-	750 [a]	5,000 [d]
Cadmium	5 [b]	-	10 [d]	50 [d]
1-hour average	-	[~~{0.85exp{1.128 ln(H) 3.828}~~ [a,g]] ***(1.136672-[ln(hardness)(0.041838)])* e*** [(1.0166[ln(hardness)] - 3.924) g,h]	-	-
96-hour average	-	[~~{0.85exp{0.7852 ln(H) 3.490}~~ [a,g]] ***(1.101672-[ln(hardness)(0.041838)])* e*** [(0.7409[ln(hardness)] - 4.719) g,h]	-	-
Chromium (total)	100 [b]	-	100 [d]	1,000 [d]
Chromium (VI)	-	-	-	-
1-hour average	-	[~~15~~ [a,g]] ***16*** [g,h]	-	-
96-hour average	-	[~~10~~ [a,g]] ***11*** [g,h]	-	-
Chromium (III)	-	-	-	-
1-hour average	-	[~~{0.85exp{0.8190 ln(H)+3.688}~~ [a,g]] ***(0.316) * e*** [(0.8190[ln(hardness)] + 3.7256) g,h]	-	-
96-hour average	-	[~~{0.85exp{0.8190 ln(H)+1.561}~~ [a,g]] ***(0.860) * e*** [(0.8190[ln(hardness)] + 0.6848) g,h]	-	-
Copper	-	-	200 [d]	500 [d]
1-hour average	-	[~~{0.85exp{0.9422 ln(H) 1.464}~~ [a,g]] ***(0.960) * e*** [(0.9422[ln(hardness)] - 1.700) g,h]	-	-
96-hour average	-	[~~{0.85exp{0.8545 ln(H) 1.465}~~ [a,g]] ***(0.960) * e*** [(0.8545[ln(hardness)] - 1.702) g,h]	-	-
Cyanide	200 [a]	-	-	-
1-hour average	-	22 [~~(a)~~] ***h***	-	-
96-hour average	-	5.2 [~~(a)~~] ***h***	-	-
Fluoride	-	-	1,000 [d]	2,000 [d]

Chemical	Municipal or Domestic Supply [1] (µg/l)	Aquatic Life [1,2] (µg/l)	Irrigation [1] (µg/l)	Watering of Livestock [1] (µg/l)
Iron ***96-hour average***	-	~~{1,000 [a]}~~ ***1,000 [h]***	5,000 [d]	-
Lead	50 [a,b]	-	5,000 [d]	100 [d]
1-hour average	-	~~{0.50exp{1.273 ln(H) 1.460}[a,g]}~~ ***(1.46203-[ln(hardness)(0.145712)])* e [(1.273[ln(hardness)] - 1.460) g,h]***	-	-
96-hour average	-	~~{0.25exp{1.273 ln(H) 4.705}[a,g]}~~ ***(1.46203-[ln(hardness)(0.145712)])* e [(1.273[ln(hardness)] - 4.705) g,h]***	-	-
Manganese	-	-	200 [d]	-
Mercury	2 [b]	-	-	10 [d]
1-hour average	-	~~{2.0 [a,g]}~~ ***1.4 [g,h]***	-	-
96-hour average	-	~~{0.012 [a]}~~ ***0.77 [g,h]***	-	-
Molybdenum	-	19 [e]	-	-
Nickel	13.4 [a]	-	200 [d]	-
1-hour average	-	~~{0.85exp{0.8460 ln(H)+3.3612}[a,g]}~~ ***(0.998) * e [(0.8460[ln(hardness)] + 2.255) g,h]***	-	-
96-hour average	-	~~{0.85exp{0.8460 ln(H)+1.1645}[a,g]}~~ ***(0.997) * e [(0.8460[ln(hardness)] + 0.0584) g,h]***	-	-
Selenium	50 [b]	-	20 [d]	50 [d]
1-hour average	-	20 [a]	-	-
96-hour average	-	- 5.0 ~~[a]~~ ***[h]***	-	-
Silver ***1-hour average***	-	~~{0.85exp{1.72 ln(H) 6.52}[a,g]}~~ ***(0.85) * e [(1.72[ln(hardness)] - 6.59) g,h]***	-	-
Sulfide (undissociated hydrogen sulfide) ***96-hour average***	-	~~{2.0 [a]}~~ ***2.0 [h]***	-	-
Thallium	13[a]	-	-	-
Zinc	-	-	2,000 [d]	25,000 [d]
1-hour average	-	~~{0.85exp{0.8473 ln(H)+0.8604}[a,g]}~~ ***(0.978) * e [(0.8473[ln(hardness)] + 0.884) g,h]***	-	-
96-hour average	-	~~{0.85exp{0.8473 ln(H)+0.7614}[a,g]}~~ ***(0.986) * e [(0.8473[ln(hardness)] + 0.884) g,h]***	-	-

Chemical	Municipal or Domestic Supply [(1)] (µg/l)	Aquatic Life [(1,2)] (µg/l)	Irrigation [(1)] (µg/l)	Watering of Livestock [(1)] (µg/l)
ORGANIC CHEMICALS				
Acrolein	320[a]	-	-	-
Aldrin	0[a]	3.0[a]	-	-
Chlordane	0[a]	2.4[a]	-	-
24-hour average	-	0.0043[a]	-	-
2,4-D	100[a,b]	-	-	-
DDT & metabolites	0[a]	1.1[a]	-	-
24-hour average	-	0.0010[a]	-	-
Demeton	-	0.1[a]	-	-
Dieldrin	0[a]	2.5[a]	-	-
24-hour average	-	0.0019[a]	-	-
Endosulfan	75[a]	0.22[a]	-	-
24-hour average	-	0.056[a]	-	-
Endrin	0.2[b]	0.18[a]	-	-
24-hour average	-	0.0023[a]	-	-
Guthion	-	0.01[a]	-	-
Heptachlor	-	0.52[a]	-	-
24-hour average	-	0.0038[a]	-	-
Lindane	4[b]	2.0[a]	-	-
24-hour average	-	0.080[a]	-	-
Malathion	-	0.1[a]	-	-
Methoxychlor	100[a,b]	0.03[a]	-	-
Mirex	0[a]	0.001[a]	-	-
Parathion	-	-	-	-
1-hour average	-	0.065[a]	-	-
96-hour average	-	0.013[a]	-	-
Silvex (2,4,5-TP)	10[a,b]	-	-	-
Toxaphene	5[b]	-	-	-
1-hour average	-	0.73[a]	-	-
96-hour average	-	0.0002[a]	-	-
Benzene	5[b]	-	-	-
Monochlorobenzene	488[a]	-	-	-
m-Dichlorobenzene	400[a]	-	-	-
o-Dichlorobenzene	400[a]	-	-	-
p-Dichlorobenzene	75[b]	-	-	-
Ethylbenzene	1,400[a]	-	-	-
Nitrobenzene	19,800[a]	-	-	-
1,2-dichloroethane	5[b]	-	-	-
1,1,1-trichloroethane (TCA)	200[b]	-	-	-
Bis (2-chloroisopropyl) ether	34.7[a]	-	-	-
Chloroethylene (vinyl chloride)	2[b]	-	-	-
1,1-dichloroethylene	7[b]	-	-	-
Trichloroethylene (TCE)	5[b]	-	-	-
Hexachlorocyclopentadine	206[a]	-	-	-
Isophorone	5,200[a]	-	-	-
Trihalomethanes (total) [f]	100[b]	-	-	-
Tetrachloromethane (carbon tetrachloride)	5[b]	-	-	-
Phenol	3,500[a]	-	-	-
2,4-dichlorophenol	3,090[a]	-	-	-

Chemical	Municipal or Domestic Supply (1) (µg/l)	Aquatic Life (1,2) (µg/l)	Irrigation (1) (µg/l)	Watering of Livestock (1) (µg/l)
Pentachlorophenol	1,010[a]	-	-	-
1-hour average	-	exp{1.005 (pH)-4.830}[a]	-	-
96-hour average	-	exp{1.005 (pH)-5.290}[a]	-	-
Dinitrophenols	70[a]	-	-	-
4,6-dinitro-2-methylphenol	13.4[a]	-	-	-
Dibutyl phthalate	34,000[a]	-	-	-
Diethyl phthalate	350,000[a]	-	-	-
Dimethyl phthalate	313,000[a]	-	-	-
Di-2-ethylhexyl phthalate	15,000[a]	-	-	-
Polychlorinated biphenyls (PCBs)	0[a]	-	-	-
24-hour average	-	0.014[a]	-	-
Fluoranthene (polynuclear aromatic hydrocarbon)	42[a]	-	-	-
Dichloropropenes	87[a]	-	-	-
Toluene	14,300[a]	-	-	-

Footnotes ~~{and References}~~

(1) Single concentration limits and 24-hour average concentration limits must not be exceeded. One-hour average and 96-hour average concentration limits may be exceeded only once every 3 years. See reference a.

~~{(2) Hardness (H) is expressed as mg/l $CaCO_3$.}~~

(2) Aquatic life standards apply to surface waters only; "hardness" is expressed as mg/L $CaCO_3$; and "e" refers to the base of the natural logarithm whose value is 2.718.

~~{(3) If a criterion is less than the detection limit of a method that is acceptable to the division, laboratory results which show that the substance was not detected will be deemed to show compliance with the standard unless other information indicates that the substance may be present.}~~

~~{(4) If a standard does not exist for each designated beneficial use, a person who plans to discharge waste must demonstrate that no adverse effect will occur to a designated beneficial use. If the discharge of a substance will lower the quality of the water, a person who plans to discharge waste must meet the requirements of NRS 445A.565.}~~

~~{(5)}~~ ***(3)*** The standards for metals are expressed as total recoverable, unless otherwise noted.

References

a. U.S. Environmental Protection Agency, Pub. No. EPA 440/5-86-001, Quality Criteria for Water (Gold Book) (1986).

b. Federal Maximum Contaminant Level (MCL), 40 C.F.R. §§ 141.11, 141.12, 141.61 and 141.62 (1992).

c. U.S. Environmental Protection Agency, Pub. No. EPA 440/9-76-023, Quality Criteria for Water (Red Book) (1976).

d. National Academy of Sciences, Water Quality Criteria (Blue Book) (1972).

e. California State Water Resources Control Board, Regulation of Agricultural Drainage to the San Joaquin River: Appendix D, Water Quality Criteria (March 1988 revision).

f. The criteria for trihalomethanes (TTHMs) is the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform). See reference b.

g. This standard applies to the dissolved fraction.

h. U.S. Environmental Protection Agency, National Recommended Water Quality Criteria, May 2005.

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Summary of Comments Received on "Draft Rationale for Proposed Changes to Select Water Quality Standards for the Inorganic Toxic Chemicals (NAC 445A.144) Related to Aquatic Life Beneficial Use" and Responses to the Comments

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Summaries of the formal comments submitted regarding the aforementioned proposed revisions to water quality regulation NAC 445A.144 are presented below. Comments that were received on topics of like nature were collectively summarized. The Nevada Division of Environmental Protection, Bureau of Water Quality Planning (NDEP-BWQP) responses to the comments are presented after the summarized comments as general responses rather than as individual responses to each comment letter.

Formal comments were submitted by the following:

-- City of Las Vegas letters dated June 14, 2006 and June 28, 2006

-- City of Henderson letters dated June 15, 2006 and June 29, 2006

-- Truckee Meadows Water Reclamation Facility letter dated June 16, 2006

-- Humboldt River Basin Water Authority letter dated June 16, 2006

-- Southern Nevada Water Authority letter dated June 16, 2006

-- Nevada Mining Association letter dated June 16, 2006

-- AngloGold Ashanti (Nevada) Corporation letter dated June 19, 2006

-- Clark County Water Reclamation District letter dated June 23, 2006

-- Southern Nevada Water System letter dated July 5, 2006

Questions that were raised during the public workshops and the answers provided are also included below.

Persons desiring a copy(s) of one or more of the formal comments letters may contact Sam Stegeman, Supervisor, Water Quality Standards at NDEP-BWQP, 901 South Stewart Street, Suite 401, Carson City, Nevada 89701-5249 or call (775) 687-9451, or E-mail sstegema@ndep.nv.gov.

City of Las Vegas
City of Henderson

Proposed Aluminum Aquatic Life Standards (1-hr average: 750 µg/l and 96-hr average 87 µg/l):

Total aluminum standard for the Las Vegas Wash is inappropriate considering aluminum is present in significant concentrations in Las Vegas Valley soils. Additionally, wastewater treatment plants perform acute whole effluent toxicity testing (WET) routinely on a monthly basis and chronic WET periodically and results have demonstrated that effluents are not toxic to daphnia or fathead minnows.

Total aluminum concentrations in the Wash as well as tributaries and seeps to the Wash are consistently above the proposed standards, in particular the proposed 96-hour average standard.

Wastewater treatment plants rely on the addition of aluminum sulfate (alum) prior to final filtration to treat for phosphorus and to meet the Total Maximum Daily Load imposed by NDEP in National Pollutant Discharge Elimination System (NPDES) permits. Adoption of an aluminum standard would limit or possibly eliminate the use of alum for this purpose.

Proposed Chloride Aquatic Life Standards (1-hr average: 860 mg/l and 96-hr average 230 mg/l):

Chloride levels in Colorado River basin are already high due to environmental conditions. Chloride concentrations in Las Vegas Wash and major tributaries and seeps to the Wash are consistently above the proposed standards, in particular the proposed 96-hour average standard.

Adoption of proposed chloride standards would limit wastewater treatment plants efficiency in treating for phosphorus removal and odor control using ferric chloride. The proposed chloride standards could necessitate the incorporation of expensive reverse osmosis treatment at the plants prior to discharge and possible banning of chloride-discharging water softeners in the Las Vegas Valley, possibly in combination with incorporation of water softening at the Southern Nevada Water System (SNWS) water treatment plants.

Iron Aquatic Life Standard (existing total iron criterion of 1,000 µg/l):

The existing iron aquatic life standard is outdated and needs to be updated. Iron is not considered a priority pollutant and EPA has not yet revised its 30-year old standards recommendation.

Comments suggested that iron aquatic life criteria should be expressed as a dissolved concentration rather than as a total concentration.

City of Las Vegas and City of Henderson willing to work with NDEP-BWQP in developing a more appropriate iron aquatic life criterion that would better reflect the environmental conditions of southern Nevada waters.

Molybdenum Aquatic Life Standard (existing total molybdenum criterion of 19 µg/l):

The existing molybdenum aquatic life standard lacks any scientific justification and is not an accurate assessment of molybdenum toxicity.

NDEP-BWQP should consider deleting the molybdenum criterion for the existing standards until a scientifically justified standard can be developed. New standard should be established for the toxic form, rather than for total molybdenum. Both of these southern Nevada purveyors would like to work with NDEP-BWQP in developing an appropriate molybdenum criterion.

Proposed Language Preceding the Table of Standards in NAC 445A.144:

Several concerns were noted regarding the regulatory language contained in sections (a), (b), and (c) preceding the table. The concerns were related to the intent of the language as currently written could be subject to misinterpretation. Suggested revisions/changes to the regulatory language were forwarded to NDEP-BWQP.

Southern Nevada Water Authority (SNWA)

Proposed Chloride Aquatic Life Standards (1-hr average: 860 mg/l and 96-hr average 230 mg/l):

Chloride levels in the Las Vegas Wash and tributaries and seeps to the Wash are consistently above the proposed standard. Additionally, chloride concentrations in the lower reaches of the Virgin and Muddy Rivers exceed the proposed 230 mg/l chloride chronic standard. Also expressed concern that if volume of flow in Wash is reduced (due to transport of treated wastewater directly to Lake Mead), trying to meet proposed chloride standard will be even more difficult.

Due to environmental conditions specific to Colorado Basin, feel that site-specific standards for chloride, aluminum, iron, and molybdenum would be more logical and practical. Southern Nevada Water Authority offered to provide assistance to NDEP-BWQP in pursuing development of the above.

Clark County Water Reclamation District (CCWRD)

Iron Aquatic Life Standard (existing total iron criterion of 1,000 µg/l):

The current iron aquatic life standard contained in NAC 445A.144 is outdated and needs to be updated. Since iron is not considered a priority pollutant by EPA, adoption of this generic standard is inappropriate. Suggest that a dissolved water quality standard should be developed for iron.

CCWRD offered to from a Task Force charged with collecting and integrating the most recent and best available scientific information to develop a dissolved standard for iron.

Proposed Chloride Aquatic Life Standards (1-hr average: 860 mg/l and 96-hr average 230 mg/l):

Chloride is a natural mineral salt that is ubiquitous throughout the Colorado River basin. In addition, widespread use of water softeners throughout Las Vegas Valley tends to increase the already elevated natural background concentrations of chloride.

Chloride is not a priority pollutant and, at concentrations routinely measured in effluent and receiving waters, poses no hazard to resident aquatic organisms. This conclusion was confirmed by a recent comprehensive multi-year study of potential chronic toxicity performed by CCWRD, the City of Las Vegas, and the City of Henderson. The study was reviewed and accepted by NDEP in 2004.

To meet proposed chloride standards, may necessitate the installation and operation of reverse osmosis treatment systems to remove chloride salts. Such treatment systems are expensive, energy-intensive and, worst of all, produce a concentrated brine solution that creates a more hazardous and complicated disposal problem.

CCWRD offered to be instrumental in forming a Task Force to develop more appropriate site-specific water quality criteria for chloride.

Proposed Aluminum Aquatic Life Standards (1-hr average: 750 µg/l and 96-hr average 87 µg/l) :

EPA's recommended aluminum criteria were based on experimental conditions that are not typical of ambient conditions found in the natural aquatic environment of Nevada. Regulation of aluminum based on total recoverable levels is a poor measure of potential aquatic toxicity since total recoverable aluminum is not bioavailable.

CCWRD and other wastewater treatment facilities throughout the state routinely apply liquid alum to reduce turbidity and phosphorous concentrations in discharge effluents. Such treatment is essential for ensuring effective disinfection and lower nutrient loads prior to discharge. The proposed water quality standards for aluminum would preclude this common and effective management tool to control eutrophication in Nevada surface waters.

Truckee Meadows Water Reclamation Facility

Proposed Chloride Aquatic Life Standards (1-hr average: 860 mg/l and 96-hr average 230 mg/l):

The proposed chloride standard could affect wastewater treatment operations, resulting in unnecessary costs to the public. The environmental validity of the standard was questioned since it was developed based on toxicity testing done using sodium chloride, when other cations which are usually associated with chloride such as potassium, calcium, and magnesium can be more toxic to aquatic life than sodium.

Proposed Aluminum Aquatic Life Standards (1-hr average: 750 µg/l and 96-hr average 87 µg/l) :

The science behind development of the aluminum standard, in particular, the chronic criteria of 87 ug/l, was critiqued, and the regulation of aluminum based on total recoverable concentrations was questioned because this would not be the fraction of bioavailable aluminum that would be toxic to aquatic life.

Nevada Mining Association

Proposed Aluminum Aquatic Life Standards (1-hr average: 750 µg/l and 96-hr average 87 µg/l) :

Supports NDEP's proposal to regulate aluminum but believes aluminum aquatic life criteria should be 825 µg/l (1-hr) and 122 µg/l (96-hr) rather than EPA's criteria of 750 µg/l (1-hr) and 87 µg/l (96-hr).

General Comment:

Would like to see water quality standards be based on the aquatic species present in Nevada waters and requested that they be able to provide input on this matter.

AngloGold Ashanti (Nevada) Corp.

Selenium Aquatic Life Criteria (1-hr average: 20 µg/l and 96-hour average 5.0 µg/l):

Suggested that language be added to NAC 445A.144 (as a footnote) that when EPA finalizes the selenium guidance for the chronic selenium criterion based on fish tissue concentrations, the regulated community could follow the guidance for meeting water quality standards.

Proposed Cadmium Hardness-Dependent Aquatic Life Criteria Equations:

Provided information that was done for the State of Colorado Department of Public Health and Environment (DPHE) involving revising the EPA recommended hardness-dependent equations for cadmium aquatic life criteria. Suggested that NDEP consider adopting the Colorado revised cadmium aquatic life criteria equations. Would like to see language included in NAC 445A.144 that would provide for site-specific and species-specific application of these acute and chronic cadmium equations where appropriately and adequately supported.

Proposed Chloride Aquatic Life Standards (1-hr average: 860 mg/l and 96-hr average 230 mg/l):

Chloride is characterized by EPA as a "non-priority pollutant" and not a "toxic pollutant" and therefore, questioned whether the proposed chloride standards are necessary. Suggested that adoption of the proposed chloride criteria be deferred at this time until NDEP-BWQP can better assess the distribution chloride concentrations in Nevada surface waters and whether aquatic life health is being impacted by elevated chloride levels. If new chloride aquatic life criteria are determined to be necessary, a literature review should be undertaken to establish the best acute and chronic criteria for Nevada waters, based on the species present in Nevada surface waters.

Proposed Aluminum Aquatic Life Standards (1-hr average: 750 µg/l and 96-hr average 87 µg/l) :

Suggested that NDEP collect more data on the chemistry of aluminum in Nevada waters to make better assessment of whether aluminum standards are necessary. If aluminum aquatic life standards are deemed necessary, then NDEP-BWQP should review the assessment of aluminum standards that was done for the State of Colorado.

General Comment:

Would like to see language included in NAC 445A.144 that would allow the regulated community the option to develop site-specific water quality standards for parameters based on the observed aquatic species and in-stream conditions using approved Nevada and EPA methodologies.

Humboldt River Basin Water Authority

Comment 1: Options for adopting EPA promulgated standards.

NDEP-BWQP should clarify how waterbodies that did not have aquatic life present or unique water chemistry were determined and would necessitate modified criteria for site-specific conditions. NDEP-BWQP should state rationale for assuring erroneous and inappropriate criteria are not enacted.

Comment 2: Replacing the word "will" and replacing it with "may" in the language of Section (a) associated with NAC 445A.144.

NDEP-BWQP should state rationale for this proposed change.

Comment 3: The phrase "economically controllable" as contained in NAC 445A.144 should be defined.

The phrase "economically controllable" should be defined in the regulation. If the phrase is not defined, regulatory decisions as to when exceeded standards are "economically controllable" may be deemed arbitrary.

Comment 4: State Environmental Commission (SEC) review of standards for a site.

The proposed change implies that the choice to adjust standards at sites where standards are exceeded and are not economically controllable would be left to the discretion of the commission. The criteria that the commission will use to determine when the standards will be reviewed and adjusted should be defined in the regulation such that arbitrary decisions are not made.

NDEP-BWQP RESPONSES TO COMMENTS

Proposed Aluminum Aquatic Life Criteria

NDEP-BWQP has withdrawn the proposed aluminum aquatic life criteria contained in the draft rationale document. In reviewing and evaluating what other states have done in regards to adopting an aluminum aquatic life standard, it was revealed that the recommended acute and chronic criteria were developed based on inaccurate data and inappropriate interpretation of toxicity test results. Scientific peer review of the aluminum standards indicated that there were enough inconsistencies within the toxicity tests and between studies that the data upon which the aquatic life criteria were developed were questionable and the appropriateness of the proposed aluminum criteria was debatable. The test conditions under which the chronic aluminum criterion was derived (pH of 6.5 to 6.6 and water hardness values of <50 mg/l $CaCO_3$) would generally not be applicable to water quality conditions of surface waters in Nevada.

NDEP-BWQP will continue to monitor the scientific literature and EPA's evaluations of aluminum toxicity. An aluminum water quality standard to protect aquatic life will be proposed when more scientifically-defensible criteria are developed and recommended by EPA, or as developed by other justifiable and appropriate studies.

Proposed Chloride Aquatic Life Criteria

Chloride aquatic life criteria of 860mg/l (1-hour average) and 320mg/l (96-hour average) had been proposed to be included in NAC 445A.144. The proposed chloride aquatic life criteria have been deferred at this time. Most of the major river systems and surface waters in northern Nevada already have a chloride beneficial use standard (BUS) as well as anti-degradation standards. Adopting an additional chloride standard would most likely only create confusion during interpretation and application of the chloride water quality standards.

As suggested in the comments, NDEP-BWQP will continue to monitor chloride water quality to better assess the distribution chloride concentrations in Nevada surface waters and whether aquatic life health is being impacted by elevated chloride levels. If new chloride aquatic life criteria are determined to be necessary, a literature review should be undertaken to establish the best acute and chronic criteria for Nevada waters, based on the species present in Nevada surface waters.

The nature of southern Nevada waters, particularly those of the Colorado Basin, which are subject to an arid climate and continual drought conditions, have resulted in these waters having high inherent salinity levels. As such, freshwater fish, invertebrates and plants have evolved to survive in relatively harsh natural conditions and consequently, it would be more appropriate to develop site-specific chloride aquatic life water quality criteria for southern Nevada waters based on the water chemistry and aquatic life species present in these waters.

Proposed Selenium Aquatic Life Criteria

In the draft rationale of proposed actions to amend NAC 445A.144, it was proposed to remove the existing selenium 1-hour average (acute) aquatic life criteria of 20 µg/l. This was based on the aquatic life criteria values published by EPA's May 2005 publication of national recommended water quality criteria. NDEP-BWQP has reconsidered this proposed action and has elected to retain the existing 20 µg/l selenium aquatic life acute criteria value; thereby maintaining criterion to protect against short-term and long-term effects. Revised freshwater aquatic life criteria for selenium which have been developed for EPA are currently being scientifically and peer reviewed. When EPA finalizes the guidance for selenium aquatic life water quality criteria, NDEP-BWQP will evaluate the recommendations and, as necessary, update the selenium water quality standards contained in NAC 445A.144 for protection of aquatic life.

Existing Iron and Molybdenum Aquatic Life Criteria

NDEP-BWQP agrees that the appropriateness and applicability of the existing aquatic life standards for iron (1000 µg/l) and molybdenum (19 µg/l) is questionable. However, the recommendation to simply revise the existing water quality standards to values which are more readily attainable or to simply delete an outdated standard may at face value appear to be an easy remedy, but the regulatory process that must be followed to revise or downgrade an existing standard can be a very difficult and lengthy process.

Although there is some benefit in having water quality standards for toxics and other metal pollutants listed in one regulation which are then applied statewide, as is the case with NAC 445A.144, this structure of "one-size fits all" standards does not allow the different physical, chemical, or biological characteristics of individual waterbodies in various regions of the State to be considered when applying the standards. This problem is only compounded when the EPA national recommended water quality criteria which have been developed based on laboratory test conditions are adopted. A more logical approach would be to revise or amend the aquatic life standards for a specific body of water or group of waters within a region that would reflect the aquatic life species present and account for the corresponding water quality characteristics.

Proposed Cadmium Hardness-Dependent Aquatic Life Criteria Equations

NDEP-BWQP is reviewing the work that was completed for Colorado Department of Public Health and Environment (DPHE) involving revisions to the acute and chronic hardness-based aquatic life criteria equations for cadmium. NDEP-BWQP has also learned that the amended cadmium aquatic life criteria were submitted by Colorado DPHE and were approved by EPA Region 8 in August 2005. Whether the revisions made by Colorado to the national recommended criteria equations would be applicable to Nevada waters and acceptable to EPA Region 9 is currently being investigated. Before the revised equations could be proposed as Nevada water quality standards, NDEP-BWQP would have to conduct public workshops and provide the opportunity for comments on the modified cadmium aquatic life criteria. In the interim, NDEP-BWQP will further review whether the Colorado revised cadmium acute and chronic criteria would be applicable to Nevada as state-wide surface water standards or more relevant to specific waterbodies within the State.

Development of Site-Specific Water Quality Standards

The development of site-specific water quality standards for parameters based on the observed aquatic species and in-stream conditions using approved EPA methodologies has always been an option for the regulated community and water purveyors.

NDEP-BWQP has generally adopted EPA recommended numeric criteria in State water quality standards because it is the most straightforward approach to satisfy the statutory requirements of the Clean Water Act. However, this does not preclude NDEP-BWQP's willingness to work with interested parties in development of numeric criteria for specific surface waters based on resident aquatic species and in-stream conditions and state-of-science toxicity data that would be protective of the corresponding beneficial uses of the surface waters. The Nevada Revised Statute (NRS) 445A.520 provides the State Environmental Commission (SEC) discretionary authority to adopt standards that vary from recognized criteria when supported by appropriate studies.

Proposed Language Preceding the Table in NAC 445A.144

The comments regarding the regulatory language (Sections a, b, and c) preceding the table of standards in NAC 445A.144 are duly noted. The sentence from NAC 445A.144, Section (a) has been changed to "If the standards are exceeded at a site and are not economically controllable, the commission **will review and may adjust** the standards for the site".

The proposed change was intended to keep the language consistent with what is contained in the Nevada Revised Statutes (NRS) which provides the State Environmental Commission (SEC) discretionary authority in establishing standards to be protective of the beneficial uses of a waterbody. Per NRS 445A.520, Standards of Water Quality, Section 3:

> *The commission may establish standards for individual segments of streams or for other bodies of surface water which vary from standards based on recognized criteria if such variations are justified by the circumstances pertaining to particular places, as determined by biological monitoring or other appropriate studies.*

The language contained in the proposed Section (b) and Section (c) of NAC 445A.144 are the current existing footnotes (3) and (4) which have been associated with the table since 1985. The issues raised in the comments, however, indicate that there may be a need to clarify in more specific terms the intent of the language preceding the table of standards. The merit of this issue will be addressed in the immediate future through a series of public workshops to scope the need for proposed changes and the corresponding revisions that would be made to the regulatory language associated with NAC 445A.144.

Humboldt River Basin Water Authority Comments

Comment 1: Options for adopting EPA promulgated standards.

As noted in your comment, adoption of EPA nationally recommended 304(a) criteria is the approach that most states follow in setting water quality standards for toxic pollutants. States, at their option, may derive protective numeric criteria that are specific to a particular waterbody and thus replace the statewide numeric standards for a specific waterbody. This is Option (2) which was referred to in the draft rationale document. Other entities who commented on the proposed aquatic life criteria have offered to work with NDEP-BWQP and provide the resources necessary to pursue derivation of site-specific standards which may also be considered and determined to be appropriate for regional or state waterbodies. NDEP-BWQP is agreeable to participating in such a working group effort with the Humboldt River Basin Authority, if desired, to pursue development of aquatic life water quality standards more specific to the waters of the Humboldt River Basin.

Comment 2: Replacing the word "will" and replacing it with "may" in the language of Section (a) associated with NAC 445A.144.

The Humboldt River Basin Water Authority's comment has been noted and the sentence from NAC 445A.144, Section (a) has been changed to "If the standards are exceeded at a site and are not economically controllable, the commission **will review and may adjust** the standards for the site".

The proposed change was intended to keep the language consistent with what is contained in the Nevada Revised Statutes (NRS) which provides the State Environmental Commission (SEC) discretionary authority in establishing standards to be protective of the beneficial uses of a waterbody. Per NRS 445A.520, Standards of Water Quality, Section 3:

> *The commission may establish standards for individual segments of streams or for other bodies of surface water which vary from standards based on recognized criteria if such variations are justified by the circumstances pertaining to particular places, as determined by biological monitoring or other appropriate studies.*

Comment 3: The phrase "economically controllable" as contained in NAC 445A.144 should be defined.

The Humboldt River Basin Water Authority's comment regarding the need to define the phrase "economically controllable" is duly noted. Comments from other entities that were submitted to NDEP indicated a need to clarify in more specific terms the intent of the regulatory language preceding the table of standards. The merit of this issue will be addressed in the future through a series of public workshops to scope the need for proposed changes and the corresponding revisions that would be made to the regulatory language associated with NAC 445A.144. At that time, the need for the above mentioned definition will be considered.

Comment 4: State Environmental Commission (SEC) Review of Standards

As explained in the aforementioned responses, the new proposed language of NAC 445A.144, Section (a) has been changed as noted to be consistent with NRS language. NDEP feels that with this proposed revision the original intent of the language contained in the regulation still exists; such that for some unforeseen consequence, if an SEC approved regulation resulted in standards being exceeded at a site and compliance was not economically feasible, then the SEC would have the option to resolve the problem when supported by appropriate materials for the site-specific standards adjustment.

Summary of Questions and Answers from Public Workshops "Draft Rationale for Proposed Changes to Select Water Quality Standards for the Inorganic Toxic Chemicals (NAC 445A.144) Related to Aquatic Life Beneficial Use"

Workshop - Carson City, May 23, 2006

COMMENTS and REPSONSES:

For individual metal criteria equations, where do you get the hardness value and what hardness value do you use?

Answer: The lab calculates and reports the hardness in each sample analyzed and if we only receive the calcium and magnesium data, we calculate the hardness. The dissolved hardness value is used in the criteria equations.

Regarding mercury, is the current standard based on total mercury and the proposed change based on dissolved mercury?

Yes.

Have you looked at any data for the proposed aluminum and chloride standards?

NDEP-BWQP currently monitors chloride levels in most of the streams sampled but not aluminum. Chloride levels have been below the proposed standards for the most part, except those waters at the tail end of a system, like the Humboldt Drain and Lower Carson. Southern Nevada waters have high salinity levels. We have looked at the USGS NAWQA data and aluminum levels in the samples in this database have been ok for aluminum.

For the impaired waterbodies that were taken from the 2004 listings, was outside data used?

No, just our data was used in the evaluation, but it would be nice to see outside data also used.

Regarding the existing arsenic(III) water quality standard, do you do speciation analysis?

No.

Regarding aluminum, what does the 1-hour and 96-hour relate to?

They relate to the duration of exposure of that aquatic life can be exposed to aluminum without effects. Both are averages.

What beneficial use standards are being evaluated for aluminum?

Only an aquatic life standard is being proposed in this petition?

Are you aware of any controversy over the aluminum standard from your sampling?

NDEP-BWQP hasn't thoroughly assessed aluminum levels in Nevada surface waters as this metal is not currently included in the analysis of our routine water chemistry samples. The proposed aluminum standards were published in 1988. NDEP-BWQP is aware that some states have adopted the recommended aluminum criteria while others have not.

Is the aluminum standard based on total aluminum?

EPA has recommended that the aluminum aquatic life criteria be based on total recoverable aluminum.

There is controversy over the aluminum standard. Would it be helpful to NDEP to send documentation on this controversy?

Yes, additional information on the aluminum standards would aid NDEP-BWQP in evaluating whether the proposed standards are appropriate for Nevada waters.

WORKSHOP - Las Vegas, May 25, 2006

COMMENTS and RESPONSES:

Tributaries to Las Vegas Wash are exceeding the proposed water quality standard for Selenium, how are dischargers in the Las Vegas valley supposed to address this.

The selenium aquatic life standards should be the discharge permit limits. If tributaries are determined to be impaired for selenium, then NDEP-BWQP would investigate development of a TMDL for these waters.

The treatment plants treat for phosphorus removal by adding alum or ferric chloride. The proposed aluminum and chloride standards could limit the use of either. What will NDEP's position be on this issue?

This issue has not been considered in proposing the standards. Before addressing the question, would need input from permit writers on how the proposed standards would affect permit limits and waste load allocations that are already in place.

The hardness-dependent equations are only good up to a hardness of 400. Hardness values in the Las Vegas Wash are generally over 400. Are the equations still to be used.

EPA guidance indicates that when the hardness of the water is above 400 mg/l, a water-effect-ratio (WER) procedure should be used to account for the high hardness.

High molybdenum levels have recently been detected in some southern Nevada waters. Is the existing molybdenum standard applicable to these waters.

The detection of high molybdenum levels in some of the southern Nevada waters is a consequence of NDEP-BWQP recently adding molybdenum to suite of metals analyzed in water samples. At this time, the existing molybdenum aquatic life standard contained in NAC 445A.144 would be applicable state-wide.

WORKSHOP - ELKO, JUNE 1 2006

COMMENTS and RESPONSES:

How does NDEP deal with sampling frequency for chronic criteria for 96 hour sample?

NDEP-BWQP compares grab sample analyses to the 96-hour criteria because this is how our current state-wide monitoring sampling is set up. If there was a serious issue with exceeding 96-hour criteria, we would set up a more intensive sampling program to evaluate the 96-hour criteria. EPA guidance would be consulted to evaluate how many samples should be taken and at what time intervals should they be taken over the 96-hour period.

The proposed cadmium aquatic life criteria are restrictive. In Colorado, less restrictive criteria were proposed for certain areas and adopted based on updated information. Would NDEP be interested in this information.

NDEP-BWQP is unaware of the work that was done in Colorado that involved revising the EPA recommended cadmium criteria. Information on this would be helpful in evaluating whether the revised criteria would be applicable to Nevada surface waters.

For the selenium criteria, at this time is it a water column or fish tissue number and does regulated community have a choice in what standard has to be met?

The proposed selenium aquatic life criteria proposed in this petition are the existing criteria which are water column values. EPA has been working on new selenium criteria which are based on fish tissue concentrations, but until these criteria are published, they will not be proposed for adoption.

Why did the mercury standard raise from 0.012 to 0.77, when we all know the toxicity of mercury?

The proposed mercury chronic criteria of 0.77 µg/l is EPA's most recent recommendation for a national criterion value. The existing 0.012 µg/l standard was a Gold Book standard which was adopted by NDEP. Since the Gold Book value was published, EPA has revised the mercury chronic criteria based on updated toxicity test results.

Would the EPA chloride criteria be applicable to Nevada waters which are found in arid climates and are saline in nature? Are the species used in the development of the standard the same as those species found in our climate?

The proposed chloride aquatic life criteria values were based on values published by EPA as nationally recommended criteria. It is doubtful that these criteria account for the characteristics of Nevada waters. Development of chloride criteria based on the aquatic species present and in-stream chemical conditions may be a better approach for adopting chloride standards if determined to be necessary.

Rationale For Proposed Changes To Select Water Quality Standards For The Inorganic Toxic Chemicals (NAC 445A.144) Related to Aquatic Life Beneficial Use

September 2006

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Introduction

Under Section 303 of the Clean Water Act, States and authorized tribes have the responsibility for establishing surface water quality standards that protect the designated uses of a water body and provide a basis for controlling discharges or releases of pollutants. The Nevada Division of Environmental Protection, Bureau of Water Quality Planning (NDEP-BWQP) is proposing revisions to the water quality standards related to the aquatic life beneficial use for the inorganic chemicals contained in NAC 445A.144, "Standards for Toxic Materials Applicable to Designated Waters". Water quality standards contained in NAC 445A.144, which are referred to as the **Toxics Standards**, were last amended, in part, in 1995. For the ease of discussion throughout this document, any "standard" described by a beneficial use actually refers to the "water quality standard" associated with the describing beneficial use.

This proposal presents the proposed revisions to update only the aquatic life water quality standards for just the inorganic chemicals prescribed in NAC 445A.144. These proposed revisions are based on new or revised water quality criteria that have been recommended by the U.S. Environmental Protection Agency (EPA) for protection of aquatic life. No changes to the other water quality standards contained in NAC 445A.144 are proposed at this time. NDEP will update the inorganic chemicals standards for municipal and domestic supply, irrigation, and watering of livestock beneficial uses, and the organic chemicals standards at a later date.

During the public review process of proposed regulation changes, stakeholders and entities who may be affected by the proposed changes are afforded the opportunity to address their individual concerns and participate in the regulatory adoption process. Proposed changes to the aquatic life water quality standards would not be effective until acted upon by the State Environmental Commission (SEC) and EPA approval. Any changes are then added to the Nevada Administrative Code (NAC). Any new or revised standards for the toxic chemicals would not be incorporated as permit effluent limits until the proposed standards are incorporated into the NAC regulations. The NDEP Director can require existing effluent permit limits to be updated when the standards limits become effective; however, past practice has been to adjust the effluent limits at the time of permit renewal.

Background

Per authorization of the Clean Water Act (Section 304(a)), EPA routinely publishes new or revised water quality criteria that reflect the latest scientific information regarding concentrations of specific chemicals or levels of parameters in water that should not be exceeded to protect aquatic life and human health. These water quality criteria, collectively referred to as the 304(a) criteria, are guidance to be used by States and Tribes in developing enforceable water quality standards. Once new or revised 304(a) criteria are published by EPA, States and Tribes have three options to adopt the new or revised numeric water quality criteria into their standards. These options are: (1) adopt the

recommended 304(a) criteria; (2) adopt the 304(a) criteria modified to reflect water conditions of particular places; or (3) adopt criteria derived using other scientifically defensible methods that are sufficient to protect the designated uses of the waters (EPA Water Quality Standards Handbook: Second Edition, EPA-823-B-94-005a, August 1994).

NDEP has generally followed option (1) for adopting and/or revising water quality standards. Utilizing the numeric guidance provided by EPA has been the most straightforward approach to satisfy the statutory requirements of the Clean Water Act. However, this does not preclude the option to develop site-specific numeric criteria that are relevant to a particular body of water and which reflect the local conditions such as the aquatic species present or unique water chemistry.

EPA generally believes that five years from the date of publication of new or revised water quality criteria is a reasonable time by which States and Tribes should take action to review their water quality standards and incorporate the new or revised water quality criteria into their standards. This period is intended to accommodate those States and Tribes that have begun a triennial review and wish to complete the actions they have underway, deferring adoption of the new or revised 304(a) criteria until the next triennial review.

EPA's current recommended ambient water quality criteria for the protection of aquatic life have been recently published in National Recommended Water Quality Criteria, May 2005. This guidance includes previously published criteria that have been revised form earlier criteria; previously published criteria that are unchanged; and newly calculated criteria. The EPA aquatic life criteria guidance generally includes freshwater and saltwater acute and chronic numerical limits. The acute number is established to be protective of aquatic life at short-term exposures to high concentrations of pollutants. The chronic number is established to protect the aquatic life at long-term exposures to low concentrations of pollutants. The acute and chronic criteria provide the magnitude or concentration of a pollutant that is allowed in ambient waters before adverse effects occur. Additionally, the duration and frequency of exposure to a pollutant must also be considered. For aquatic life criteria, the duration is the period of time over which the instream concentration of the pollutant is averaged. One hour is the maximum period for acute criteria. For chronic criteria, 96-hours or four days is the maximum period over which to average the exposure. How often the criteria can be exceeded without adversely affecting aquatic life is defined as the frequency. The allowable frequency of exceedance for both the acute and the chronic criteria is usually established as not more than once every three years. It is not until the water quality criteria are adopted by a State as water quality standards that they become enforceable regulatory maximum acceptable pollutant concentrations.

The majority of the aquatic life standards contained in NAC 445A.144 consist of a 1-hour average (acute) limit and a 96-hour average (chronic) limit. These standards were

adopted based on previous criteria recommended by EPA for protection of freshwater aquatic life. As footnoted to the table (NAC 445A.144), the one-hour average and 96-hour average concentration limits can be exceeded only once every 3 years.

Nevada Water Quality Standard Regulations

NAC 445A.144 is the water quality regulation containing standards for toxic materials and other pollutants that are applicable on a statewide basis to surface waters contained in the Nevada water quality regulations and to other waters per the tributary rule as described in NAC 445A.145. Toxic material is defined in NAC 445A.110 as "…any pollutant or combination of pollutants which will on the basis of information available to the administrator, cause an organism or its offspring to die or suffer any disease, behavioral abnormality, cancer, genetic mutation, physiological malfunction, including a malfunction in reproduction, or physical deformation, if that pollutant or combination of pollutants is discharged and exposed to or assimilated by the organism, whether directly from the environment or indirectly through food chains."

Chemical standards have been tabulated in NAC 445A.144 for four (4) categorical uses of a water body. These four uses include municipal or domestic supply, protection of aquatic life, irrigation, and watering of livestock. Specific water quality standards for individual inorganic chemicals and organic chemical compounds are provided in the table (NAC 445A.144) to protect the aforementioned designated uses. Although there is some benefit in having water quality standards for toxics and other metal pollutants listed in one regulation which are then applied statewide, this structure of "one-size fits all" standards does not allow the different physical, chemical, or biological characteristics of individual waterbodies in various regions of the state to be considered when applying the standards.

As previously mentioned, in this proposal, NDEP is only considering revising the state-wide aquatic life water quality standards for the inorganic contaminants which are the chemicals listed initially in the table. At this time, NDEP is not proposing to change the municipal or domestic supply, irrigation, or watering of livestock standards for the inorganic chemicals nor any of the organic chemical water quality standards.

Aquatic Life Standards

The inorganic chemicals contained in the toxics table are primarily metals except for a couple of chemical compounds – cyanide and sulfide. It is EPA's (Office of Water) recommendation that dissolved metal concentrations be used to set and measure compliance with aquatic life water quality standards because the dissolved fraction more closely approximates the bioavailable fraction of metal in the water column than does the total recoverable metal concentrations (Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria, October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water). This recommendation is based on the fact that a primary mechanism for water column toxicity of pollutants to

aquatic life is adsorption at the gill surface, which requires metals to be in the dissolved form.

"Dissolved metals" is operationally defined as that metal in a solution that passes through a 0.45 micron filter. This can include individual and complexed metal ions, colloids, and particulate metals that are small enough to pass through the filter. In comparison, the total recoverable method is a measurement of the dissolved metals fraction plus that portion of solid metals that can easily dissolve under ambient conditions. This method is intended to measure metals in water that are or may easily become environmentally active, while not measuring metals that are expected to settle out and remain inert. Although EPA has recommended that aquatic life standards for metals be expressed in the dissolved form, the criteria for some contaminants (cyanide, iron, molybdenum, selenium, and sulfide) contained in NAC 445A.144 are evaluated based on total recoverable concentrations.

Numerical national water quality criteria promulgated for the protection of aquatic life are derived following the principles and methodology as outlined in EPA's *Guidelines for Deriving Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* ([Guidelines] Stephan et al. 1985). When a hardness-toxicity relationship exists for a metal, the corresponding acute and chronic criteria are expressed as a function of water hardness as an equation. Hardness serves as a general surrogate for those water chemical parameters such as pH, alkalinity, and ionic strength, which can affect the toxicity of certain metals. In general, at lower hardness values, the more restrictive the criteria. The metals whose aquatic life criteria that are expressed as a function of hardness in the water column are **cadmium**, **chromium (+3)**, **copper**, **lead**, **nickel**, **silver**, and **zinc**. The other metals aquatic life criteria recommended by EPA are single-value concentration limits.

For the aforementioned metals, an aquatic life criterion equation is derived following EPA's Guidelines (Stephan et al. 1985) which is expressed as:

$$\text{Aquatic Life Criterion} = (\text{Conversion Factor}) * e^{(\text{pooled slope value}[\ln(\text{hardness}) + \text{y intercept term})}$$

In the above equation, "e" is the base of the natural logarithm, with a numerical value of 2.718. The term "CF" refers to the recommended Conversion Factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

The specific numerical values for substitution into the above hardness relationships to calculate the acute and chronic aquatic life criteria for the seven (7) hardness-dependent metals are shown below in Table 1. These values were derived from the available toxicity databases available for each metal following the principles set forth in the *Guidelines for Deriving Numerical Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (Stephan et al., 1985) and published in the EPA National Recommended Water Quality Criteria, May 2005.

Table 1. Values for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent.

	Acute Criteria		Conversion Factor
	pooled slope	y intercept	CF
Cadmium	1.0166	-3.924	1.136672 – [ln (hardness)(0.041838)]
Chromium +3	0.8190	3.7256	0.316
Copper	0.9422	-1.700	0.960
Lead	1.273	-1.460	1.46203 – [ln (hardness)(0.145712)]
Nickel	0.8460	2.255	0.998
Silver	1.72	-6.52	0.85
Zinc	0.8473	0.884	0.978

	Chronic Criteria		Conversion Factor
	pooled slope	y intercept	CF
Cadmium	0.7409	-4.719	1.101672 – [ln (hardness)(0.041838)]
Chromium +3	0.8190	0.6848	0.860
Copper	0.8545	-1.702	0.960
Lead	1.273	-4.705	1.46203 – [ln (hardness)(0.145712)]
Nickel	0.8460	0.0584	0.997
Silver	--	--	--
Zinc	08473	0.884	0.986

Most of the data used to develop these hardness equations for deriving aquatic life criteria for metals were in the range of 25 mg/l to 400 mg/l as $CaCO_3$, and the formulas are therefore most accurate in this range. In the past, EPA generally recommended that 25 mg/l as $CaCO_3$ be used as the lower default hardness value in deriving freshwater aquatic life criteria for metals when the hardness value of the water body was below 25 mg/l as $CaCO_3$. However, use of this approach has often resulted in criteria that may not be fully protective. Therefore, EPA has recommended that for waters with a hardness of less than 25 mg/l as $CaCO_3$, the criteria should be calculated using the actual hardness of the water body.

When the hardness is greater than 400 mg/l, other options are described in EPA guidance documents to calculate the criteria values. These other options include using a water-effect ratio procedure to account for the high hardness values. However, the majority of surface waters in Nevada, except for some southern Nevada waters, have hardness levels less than 400 mg/l as $CaCO_3$.

A comparison of the existing and the proposed revised/updated aquatic life standards for the metals and inorganic chemical compounds contained in NAC 445A.144 is shown in Table 2. Not all of the metals listed in NAC 445A.144 have aquatic life standards. Just those inorganic chemicals (metals and compounds) that have aquatic life standards are shown in the following table. As noted in the table, the aquatic life criteria are expressed as either the dissolved fraction or the total recoverable fraction of the metal or chemical in the water column. The overall change in the criteria; whether more or less restrictive or no change, between the proposed revised/updated compared to existing, is shown in the table.

Table 2. Comparison of Existing and Proposed Revised/Updated Aquatic Life Criteria for Metals and Inorganic Compounds

Chemical	Existing Aquatic Life Criteria (µg/l)	Chemical	Proposed Aquatic Life Criteria (µg/l)	Change in Criteria
Arsenic (III) 1-hour average (Dissolved) 96-hour average (Dissolved)	 342 180	Arsenic 1-hour average (Dissolved) 96-hour average (Dissolved)	 340 150	Slightly More Restrictive
Cadmium 1-hour average (Dissolved) 96-hour average (Dissolved)	 $(0.85)*e^{(1.128[\ln(hardness)]-3.828)}$ $(0.85)*e^{(0.7852[\ln(hardness)]-3.49)}$	Cadmium 1-hour average (Dissolved) 96-hour average (Dissolved)	 $(1.136672-[\ln(hardness)(0.041838)]) * e^{(1.0166[\ln(hardness)]-3.924)}$ $(1.101672-[\ln(hardness)(0.041838)]) * e^{(0.7409[\ln(hardness)]-4.719)}$	More Restrictive
Chromium (VI) 1-hour average (Dissolved) 96-hour average (Dissolved)	 15 10	Chromium (VI) 1-hour average (Dissolved) 96-hour average (Dissolved)	 16 11	Similar
Chromium (III) 1-hour average (Dissolved) 96-hour average (Dissolved)	 $(0.85)*e^{(0.819[\ln(hardness)]+3.688)}$ $(0.85)*e^{(0.819[\ln(hardness)]+1.561)}$	Chromium (III) 1-hour average (Dissolved) 96-hour average (Dissolved)	 $(0.316)*e^{(0.819[\ln(hardness)]+3.7256)}$ $(0.86)*e^{(0.819[\ln(hardness)]+0.6848)}$	More Restrictive
Copper 1-hour average (Dissolved) 96-hour average (Dissolved)	 $(0.85)*e^{(0.9422[\ln(hardness)]-1.464)}$ $(0.85)*e^{(0.8545[\ln(hardness)]-1.465)}$	Copper 1-hour average (Dissolved) 96-hour average (Dissolved)	$(0.96)*e^{(0.9422[\ln(hardness)]-1.700)}$ $(0.96)*e^{(0.8545[\ln(hardness)]-1.702)}$	Slightly More Restrictive

Table 2 (continued). Comparison of Existing and Proposed Revised/Updated Aquatic Life Criteria for Metals and Inorganic Compounds

Chemical	Existing Aquatic Life Criteria (µg/l)	Chemical	Proposed Aquatic Life Criteria (µg/l)	Change in Criteria
Cyanide [Free] 1-hour average (Total) 96-hour average (Total)	22 5.2	Cyanide [Free] 1-hour average (Total) 96-hour average (Total)	22 5.2	Similar
Iron (Total)	1,000	Iron (Total) 96-hour average	1,000	Similar
Lead 1-hour average (Dissolved) 96-hour average Dissolved)	$(0.50)*e^{(1.273[\ln(hardness)]-1.46)}$ $(0.25)*e^{(1.273[\ln(hardness)]-4.705)}$	Lead 1-hour average (Dissolved) 96-hour average (Dissolved)	$(1.46203-[\ln(hardness)(0.145712)] * e^{(1.273[\ln(hardness)]-1.460)}$ $(1.46203-[\ln(hardness)(0.145712)]) * e^{(1.273[\ln(hardness)]-4.705)}$	Less Restrictive
Mercury 1-hour average (Dissolved) 96-hour average (Total)	2.0 0.012	Mercury 1-hour average (Dissolved) 96-hour average (Dissolved)	1.4 0.77	Slightly More Restrictive Less Restrictive
Molybdenum (Total)	19	Molybdenum (Total)	19	Similar
Nickel 1-hour average (Dissolved) 96-hour average (Dissolved)	$(0.85)*e^{(0.846[\ln(hardness)]+3.3612)}$ $(0.85)*e^{(0.846[\ln(hardness)]+1.1645)}$	Nickel 1-hour average (Dissolved) 96-hour average (Dissolved)	$(0.998)*e^{(0.846[\ln(hardness)]+2.255)}$ $(0.997)*e^{(0.846[\ln(hardness)]+0.0584)}$	More Restrictive

Table 2 (continued). Comparison of Existing and Proposed Revised/Updated Aquatic Life Criteria for Metals and Inorganic Compounds

Chemical	Existing Aquatic Life Criteria (µg/l)	Chemical	Proposed Aquatic Life Criteria (µg/l)	Change in Criteria
Selenium 1-hour average (Total) 96-hour average (Total)	20 5	Selenium 1-hour average (Total) 96-hour average (Total)	20 5	Similar
Silver (Dissolved)	$(0.85)*e^{(1.72[\ln(hardness)]-6.52)}$	Silver 1-hour average (Dissolved)	$(0.85)*e^{(1.72[\ln(hardness)]-6.59)}$	Similar
Sulfide (undissociated hydrogen sulfide) (Total)	2.0	Sulfide (undissociated hydrogen sulfide) 96-hour average (Total)	2.0	Similar
Zinc 1-hour average (Dissolved) 96-hour average (Dissolved)	$(0.85)*e^{(0.8473[\ln(hardness)]+0.8604)}$ $(0.85)*e^{(0.8473[\ln(hardness)]+0.7614)}$	Zinc 1-hour average (Dissolved) 96-hour average (Dissolved)	$(0.978)*e^{(0.8473[\ln(hardness)]+0.884)}$ $(0.986)*e^{(0.8473[\ln(hardness)]+0.884)}$	Less Restrictive

Discussion

A summary of the proposed revised/updated aquatic life criteria for the inorganic chemicals shown above in Table 2 is provided below. Graphs comparing the existing and proposed criteria for those metals with aquatic life criteria which are expressed as a function of water hardness are shown in Figures 1 through 7.

Arsenic

The revised/updated aquatic life criteria recommended by EPA for arsenic are for the total fraction of arsenic in the water column rather than just the arsenic (III) fraction as is the case with the existing standards. The proposed revised/updated criteria are slightly more restrictive and are expressed in terms of dissolved arsenic in the water column. The proposed updated 1-hour average and 96-hour average water quality criteria for arsenic are 340 µg/l and 150 µg/l, respectively, compared to the existing criteria values of 342 µg/l (1-hour average) and 180 µg/l (96-hour average).

Cadmium

As was mentioned above, cadmium is one of the metals whose aquatic life criteria are dependent on the hardness of the water. The proposed equations for calculating the revised/updated aquatic life 1-hour and 96-hour criteria are shown in Table 2. A major difference between the existing and the proposed criteria is the conversion factor to express the criteria as the dissolved fraction. The conversion factor in the revised equations is an algebraic expression involving the hardness of the water body rather than a single numerical value. Figure 1 compares the existing and the proposed revised/updated cadmium aquatic life water quality criteria as a function of water hardness for both the 1-hour and 96-hour criteria. As shown in the plots, the updated equations result in more restrictive cadmium aquatic life criteria. The cadmium aquatic life standards would be applicable to the dissolved fraction of cadmium in the water column.

Chromium (VI)

The revised/updated EPA recommended 304(a) aquatic life criteria for chromium (VI) are similar to the existing 1-hour and 96-hour values. The recommended acute limit increases from 15 µg/l to16 µg/l and the chronic limit increases from 10 µg/l to 11 µg/l. The aquatic life criteria would be applicable to the dissolved form of chromium (VI) in the water column.

Chromium (III)

The proposed revised/updated hardness-dependent equations for chromium (III) result in aquatic life criteria which are more restrictive than the existing limits. This is illustrated in Figure 2 which compares the existing and proposed 1-hour and 96-hour aquatic life criteria as a function of water body hardness values. The chromium (III) limits to protect aquatic life would apply to the dissolved fraction of the metal in the water column.

Copper

As shown in Figure 3, the revised/updated equations for determining copper aquatic life criteria as a function of water hardness result in acute and chronic values that are slightly more restrictive than the corresponding criteria calculated using the existing equations. Both the 1-hour and 96-hour values to protect aquatic life are expressed in terms of the dissolved fraction of copper in the water column.

Cyanide

The cyanide 1-hour and 96-hour aquatic life criteria of 22 µg/l and 5.2 µg/l, respectively, have not been changed in EPA's most recent publication of recommended aquatic life criteria. The recommended cyanide concentrations are expressed as ug free cyanide (as CN) per liter. Under Section 307 (a) of the Clean Water Act, EPA has interpreted "cyanides" as contained in the list of toxic pollutants to include cyanide compounds (EPA Adminstrative Determination: EPA Clarifies that Ferric Ferrocyanide is one of the "Cyanides" in the Clean Water Act's List of Toxic Pollutants, EPA-821-F-03-012, September 2003). The cyanide aquatic life protective values are applicable to the total recoverable portion of the "free" cyanide in the water column and not just the dissolved fraction of "free" cyanide present.

Iron

The iron aquatic life criteria of 1000 µg/l has not been revised in EPA's most recent publication of recommended aquatic life criteria values. However, in the most recent update, the iron aquatic life criterion is recommended as a chronic value (96-hour average). Previously, the iron value has been interpreted as a single-value criteria. The iron aquatic life criteria would apply to the total concentration of iron in the water body.

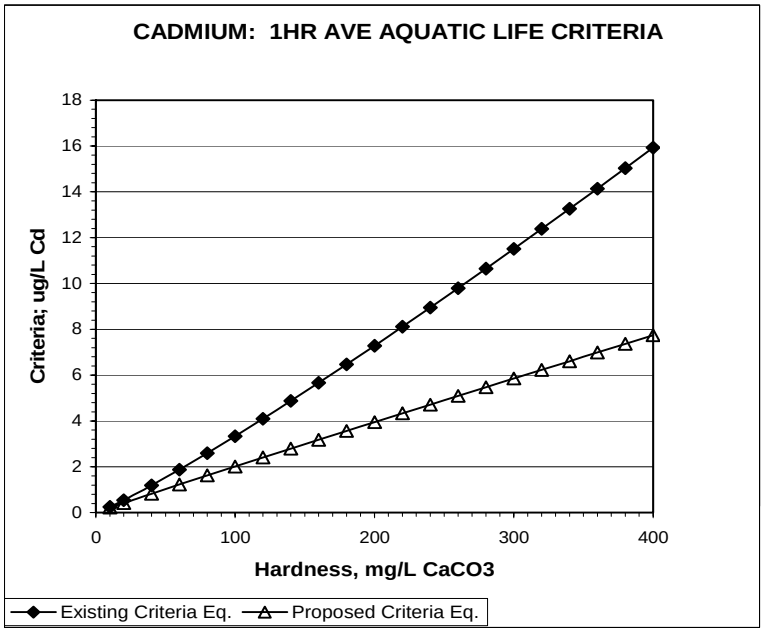
Lead

The proposed revised/updated aquatic life criteria for lead which are hardness-dependent were shown above in Table 2. As can be seen, the exponential term in the new proposed equations have not changed from the existing equations, but the conversion factor terms in the new equations are an algebraic expression rather than a numerical value. The conversion factor expressions take into account the hardness of the water body, similar to the conversion factors proposed for the cadmium aquatic life criteria. The aquatic life criteria for lead would be applicable to the dissolved fraction of the metal available in the water column. With the above described revisions, the new 1-hour and 96-hour aquatic life criteria for lead are less restrictive than the existing criteria. This is illustrated in Figure 4.

Figure 1. Cadmium Aquatic Life Criteria.

CADMIUM
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	0.25	0.21
20	0.54	0.42
40	1.19	0.83
60	1.87	1.23
80	2.59	1.62
100	3.33	2.01
120	4.10	2.40
140	4.87	2.79
160	5.66	3.18
180	6.47	3.56
200	7.29	3.95
220	8.11	4.33
240	8.95	4.71
260	9.80	5.09
280	10.65	5.47
300	11.51	5.85
320	12.38	6.23
340	13.26	6.61
360	14.14	6.98
380	15.03	7.36
400	15.92	7.74



CADMIUM
96-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	0.16	0.05
20	0.27	0.08
40	0.47	0.13
60	0.65	0.17
80	0.81	0.21
100	0.96	0.25
120	1.11	0.28
140	1.26	0.31
160	1.39	0.34
180	1.53	0.37
200	1.66	0.40
220	1.79	0.43
240	1.92	0.45
260	2.04	0.48
280	2.16	0.50
300	2.28	0.53
320	2.40	0.55
340	2.52	0.57
360	2.64	0.60
380	2.75	0.62
400	2.86	0.64

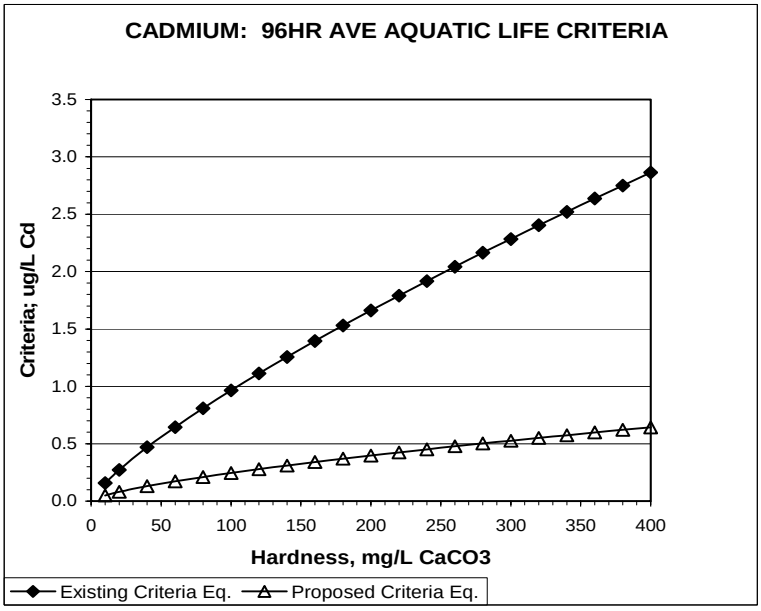
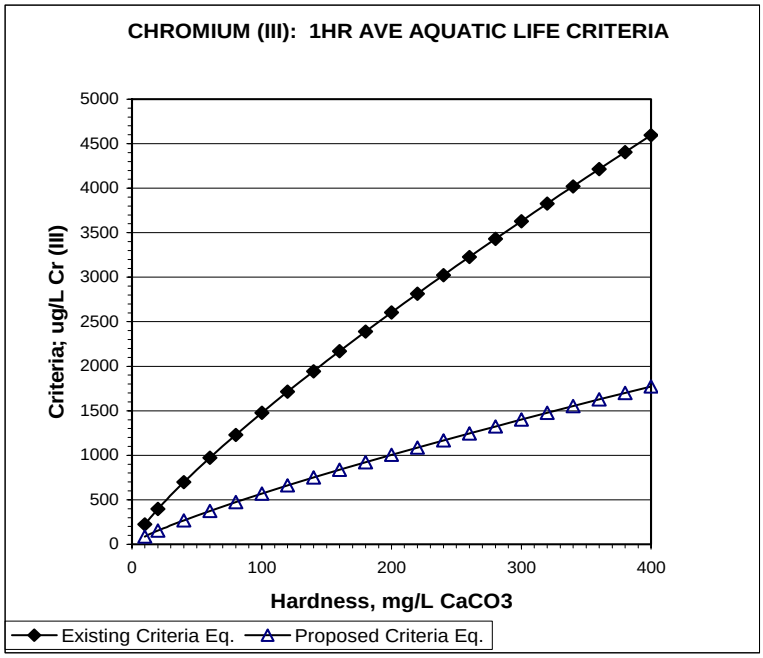


Figure 2. Chromium (III) Aquatic Life Criteria.

CHROMIUM (III)
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	224	86
20	395	152
40	697	269
60	971	375
80	1229	475
100	1476	570
120	1714	662
140	1944	751
160	2169	837
180	2389	922
200	2604	1005
220	2815	1087
240	3023	1167
260	3228	1246
280	3430	1324
300	3630	1401
320	3827	1477
340	4021	1552
360	4214	1627
380	4405	1700
400	4594	1773



CHROMIUM (III)
96-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	27	11
20	47	20
40	83	35
60	116	49
80	147	62
100	176	74
120	204	86
140	232	98
160	259	109
180	285	120
200	310	131
220	336	141
240	360	152
260	385	162
280	409	172
300	433	182
320	456	192
340	479	202
360	502	212
380	525	221
400	548	231

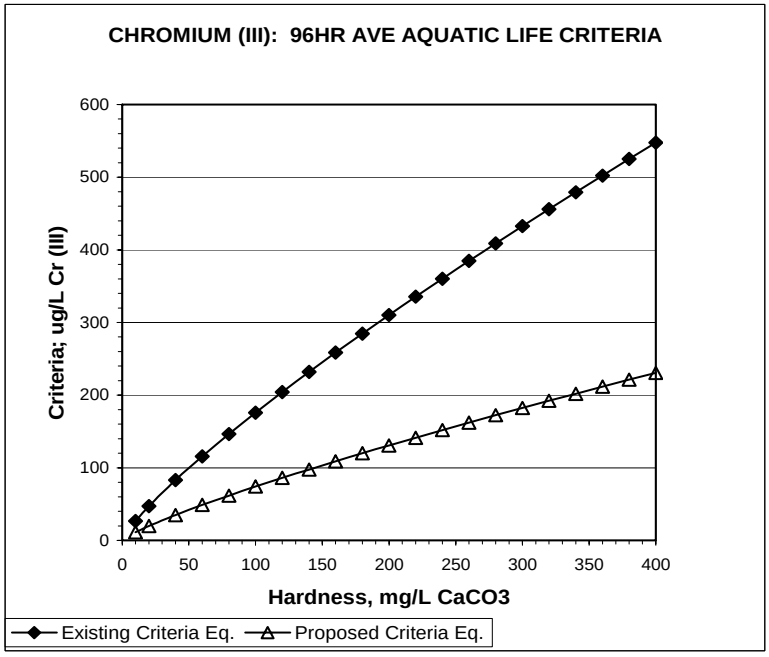
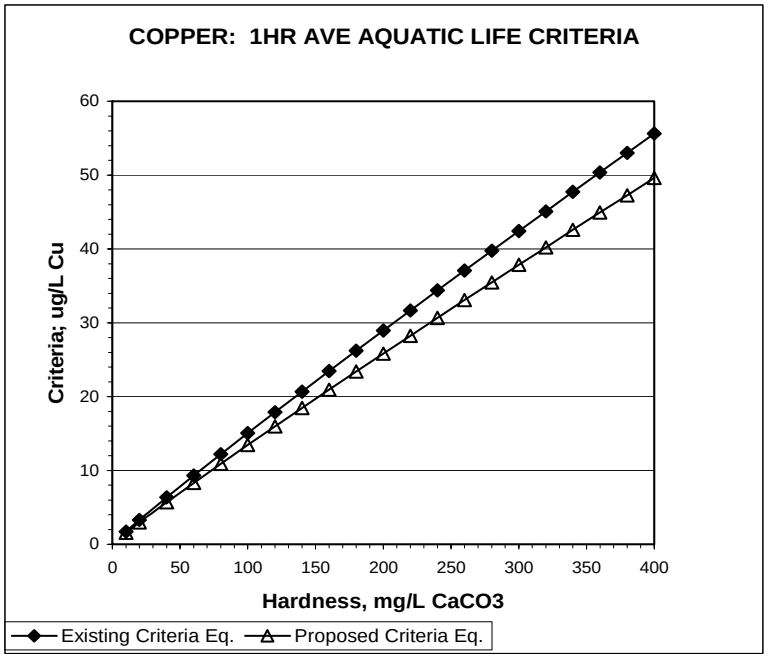


Figure 3. Copper Aquatic Life Criteria.

COPPER
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	1.72	1.54
20	3.31	2.95
40	6.35	5.67
60	9.31	8.31
80	12.21	10.89
100	15.07	13.44
120	17.89	15.96
140	20.69	18.45
160	23.46	20.93
180	26.21	23.38
200	28.95	25.82
220	31.67	28.25
240	34.38	30.66
260	37.07	33.06
280	39.75	35.46
300	42.42	37.84
320	45.08	40.21
340	47.73	42.57
360	50.37	44.93
380	53.00	47.28
400	55.63	49.62



COPPER
96-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	1.41	1.25
20	2.54	2.26
40	4.59	4.09
60	6.50	5.79
80	8.31	7.40
100	10.05	8.96
120	11.74	10.47
140	13.40	11.94
160	15.02	13.38
180	16.61	14.80
200	18.17	16.19
220	19.71	17.57
240	21.24	18.92
260	22.74	20.26
280	24.23	21.59
300	25.70	22.90
320	27.15	24.20
340	28.60	25.48
360	30.03	26.76
380	31.45	28.02
400	32.86	29.28

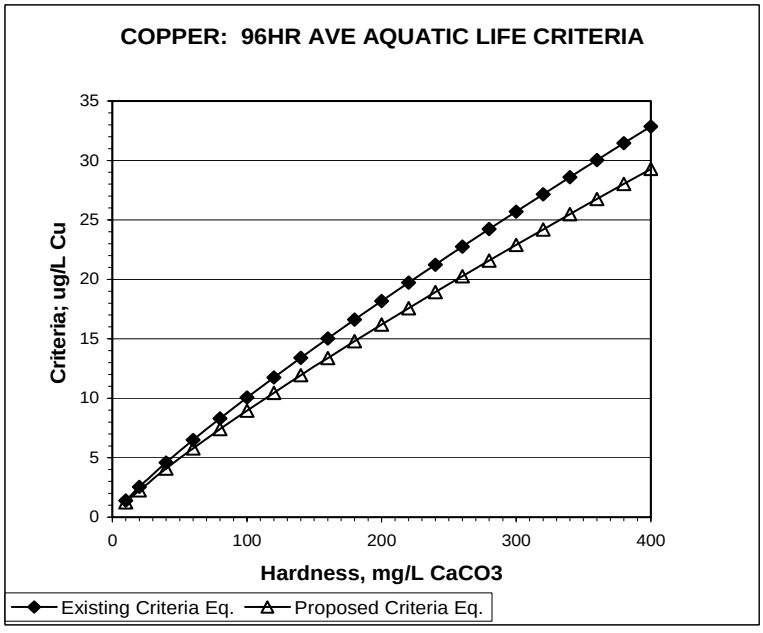
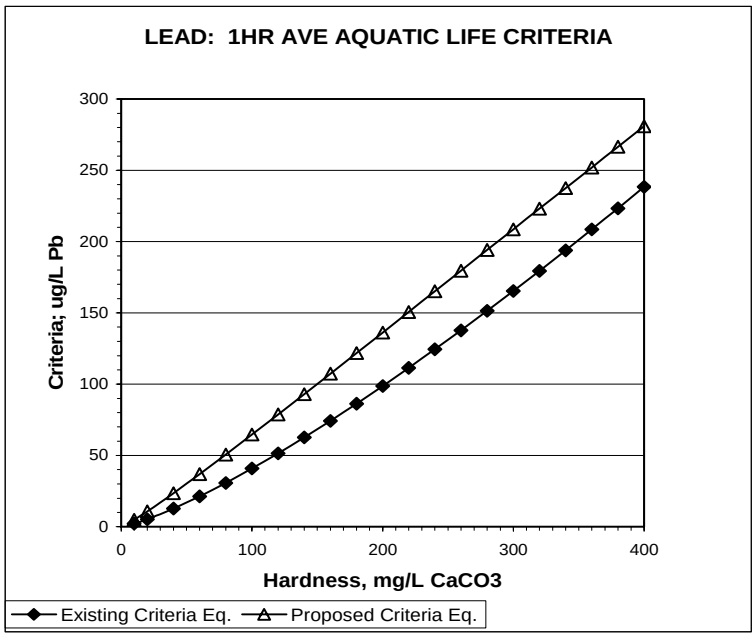


Figure 4. Lead Aquatic Life Criteria.

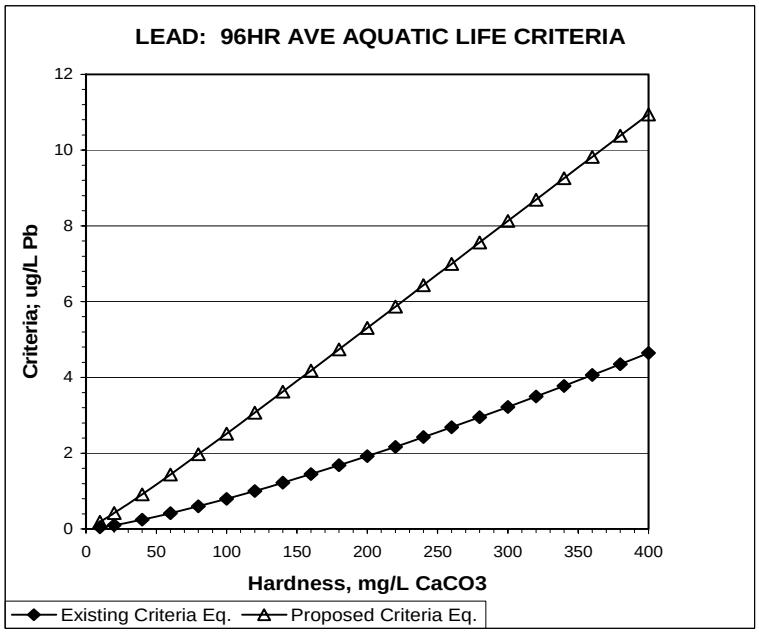
LEAD
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	2.18	4.91
20	5.26	10.79
40	12.72	23.51
60	21.31	36.88
80	30.73	50.61
100	40.82	64.58
120	51.49	78.72
140	62.65	92.97
160	74.26	107.31
180	86.27	121.70
200	98.65	136.14
220	111.38	150.61
240	124.43	165.10
260	137.77	179.59
280	151.40	194.09
300	165.30	208.58
320	179.46	223.07
340	193.85	237.54
360	208.48	252.00
380	223.34	266.43
400	238.41	280.85



LEAD
96-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	0.04	0.19
20	0.10	0.42
40	0.25	0.92
60	0.42	1.44
80	0.60	1.97
100	0.80	2.52
120	1.00	3.07
140	1.22	3.62
160	1.45	4.18
180	1.68	4.74
200	1.92	5.31
220	2.17	5.87
240	2.42	6.43
260	2.68	7.00
280	2.95	7.56
300	3.22	8.13
320	3.50	8.69
340	3.78	9.26
360	4.06	9.82
380	4.35	10.38
400	4.65	10.94



Mercury

The proposed revised/updated mercury aquatic life limits are expressed in terms of dissolved mercury in the water column. The proposed 1-hour average value of 1.4 µg/l is slightly more restrictive than the existing criteria of 2.0 µg/l. For the chronic mercury aquatic life standard, a criteria value of 0.77 µg/l has been proposed to be adopted as the 96-hour average compared to the existing criteria of 0.012 µg/l. The proposed/revised 96-hour average mercury criterion would be applicable to the dissolved concentration of mercury in the water column compared to the existing 96-hour average chronic value which applies to the total concentration of mercury in the water column. This proposed less restrictive 96-hour average criteria allows almost 65 times as much dissolved mercury to be present in the water column than formerly allowed before an exceedance occurs. The proposed revised mercury aquatic life criteria values do not account for mercury uptake via the food chain.

Molybdenum

The existing molybdenum water quality standard for the protection of aquatic life is 19 µg/l. This value was recommended by the California Water Resources Control Board in 1988 and was based on scientific studies published from 1970 to 1980. Molybdenum is not considered a toxic pollutant by EPA and consequently, an updated aquatic life value was not contained in the recent publication of recommended water quality criteria for protection of aquatic life. It is proposed to retain the 19 µg/l molybdenum value as a single-value aquatic life water quality standard. This standard would apply to the total concentration of molybdenum in a water body.

Nickel

The toxicity of nickel to aquatic life varies depending on the hardness of the water. Proposed updated/revised equations for exposure to nickel at 1-hour and 96-hour intervals were shown in Table 2. A comparison of the proposed and existing hardness-dependent nickel aquatic life criteria is shown in Figure 5. As shown, the proposed updated/revised nickel aquatic life values are more restrictive than the existing criteria. The nickel aquatic life limits would be applicable to the dissolved fraction of nickel in the water column.

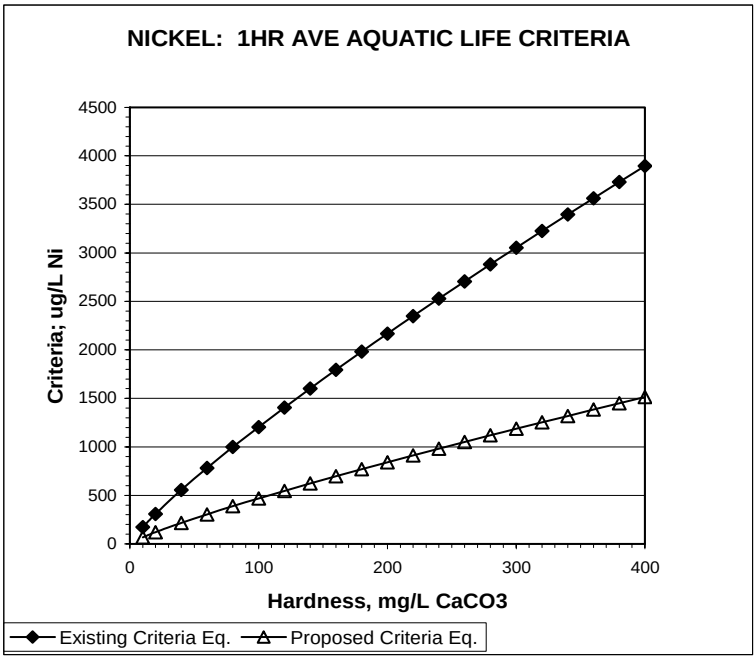
Selenium

The existing selenium water quality criteria for protection of aquatic life consists of an 1-hour average (acute) value of 20 µg/l and a 96-hour average (chronic) value of 5 µg/l. In the recent publication of EPA's recommended criteria for developing water quality standards to protect aquatic life, only a chronic value is recommended which is similar to the existing value. NDEP-BWQP has elected to retain both the existing acute and chronic criteria to protect against short-term and long-term effects. The selenium aquatic

Figure 5. Nickel Aquatic Life Criteria.

NICKEL
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	172	67
20	309	120
40	555	216
60	783	304
80	998	388
100	1206	468
120	1407	546
140	1602	622
160	1794	697
180	1982	770
200	2167	842
220	2349	912
240	2528	982
260	2705	1051
280	2880	1119
300	3054	1186
320	3225	1253
340	3395	1319
360	3563	1384
380	3730	1449
400	3895	1513



NICKEL
96-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	19	7
20	34	13
40	62	24
60	87	34
80	111	43
100	134	52
120	156	61
140	178	69
160	199	77
180	220	86
200	241	93
220	261	101
240	281	109
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280	320	124
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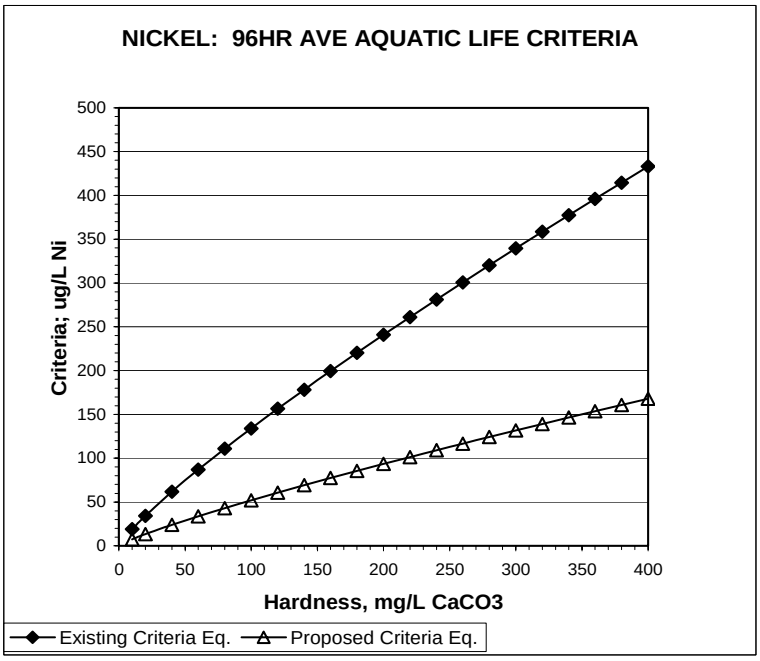
340	377	146
360	396	154
380	415	161
400	433	168



life criteria would be applicable to the total recoverable portion of selenium in the water body.

EPA is currently evaluating and reviewing new selenium aquatic life criteria that have been developed. The recommended selenium criteria for protection of aquatic life may change when EPA publishes final guidance for the new selenium criteria values.

Silver

As shown above in Table 2, the updated/revised hardness-dependent criteria equation proposed for silver to protect aquatic life is similar to the existing hardness-dependent equation. The corresponding proposed aquatic life criteria values for silver as a function of water hardness would be similar to the existing values as shown in Figure 6. The updated/revised silver aquatic life criteria would be expressed as a 1-hour average rather than as a single-value, as is the case now. A chronic water quality criteria to develop a 96-hour average silver water quality standard has not been recommended at this time by EPA. The proposed silver aquatic life standard would be applicable to the dissolved fraction of the metal in a water body.

Sulfide (undissociated hydrogen sulfide)

The water quality standard for sulfide to protect aquatic life is expressed in terms of undissociated hydrogen sulfide. This is due to the toxicity of sulfide to aquatic life being primarily from hydrogen sulfide (H_2S) rather than from hydrosulfide (HS^-) or sulfide (S^{2-}) ions. EPA has recommended that concentrations in excess of 2.0 µg/l undissociated hydrogen sulfide would constitute a long-term hazard to aquatic life. It is proposed to retain the 2.0 µg/l undissociated hydrogen sulfide aquatic life standard, but to propose this value as a 96-hour average standard, rather than as a single-value standard in NAC 445A.144. This standard would apply to the total fraction of sulfide in the water column.

Zinc

The revised/updated acute and chronic hardness-dependent criteria for zinc that have been recommended by EPA (see Table 2) results in water quality standards that are less restrictive than the existing aquatic life standards. This is illustrated in Figure 7 which shows the proposed 1-hour and 96-hour zinc aquatic life criteria as a function of water hardness values. The zinc water quality criteria to protect aquatic life would be applicable to the dissolved fraction of zinc in the water body.

Figure 6. Silver Aquatic Life Criteria.

SILVER
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	0.07	0.06
20	0.22	0.20
40	0.71	0.67
60	1.43	1.34
80	2.35	2.19
100	3.45	3.22
120	4.72	4.40
140	6.15	5.74
160	7.74	7.22
180	9.48	8.84
200	11.37	10.60
220	13.39	12.48
240	15.55	14.50
260	17.85	16.64
280	20.27	18.90
300	22.83	21.28
320	25.51	23.78
340	28.31	26.40
360	31.24	29.12
380	34.28	31.96
400	37.44	34.91

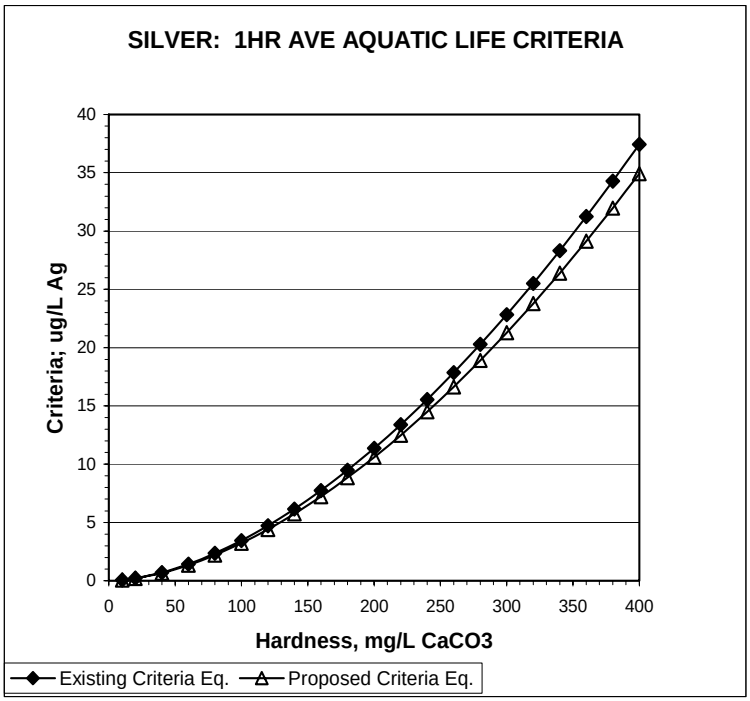
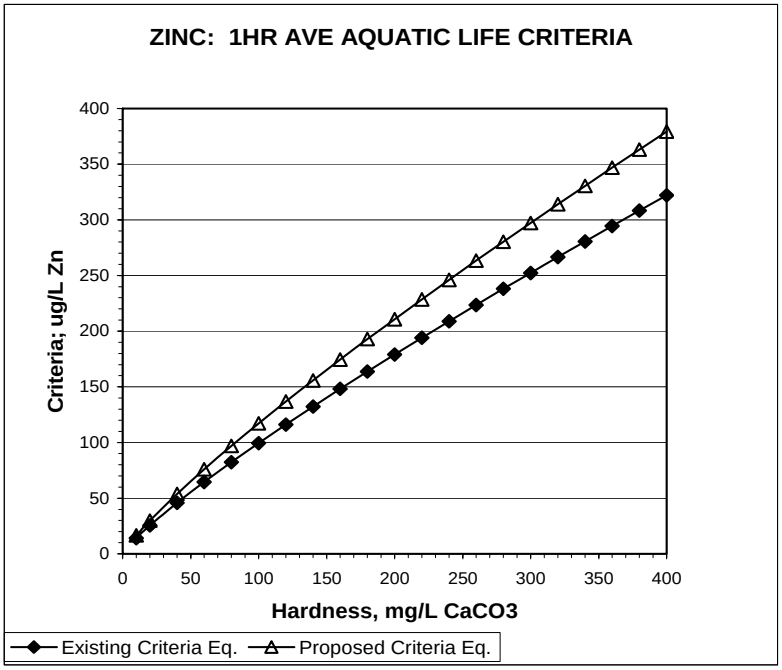


Figure 7. Zinc Aquatic Life Criteria.

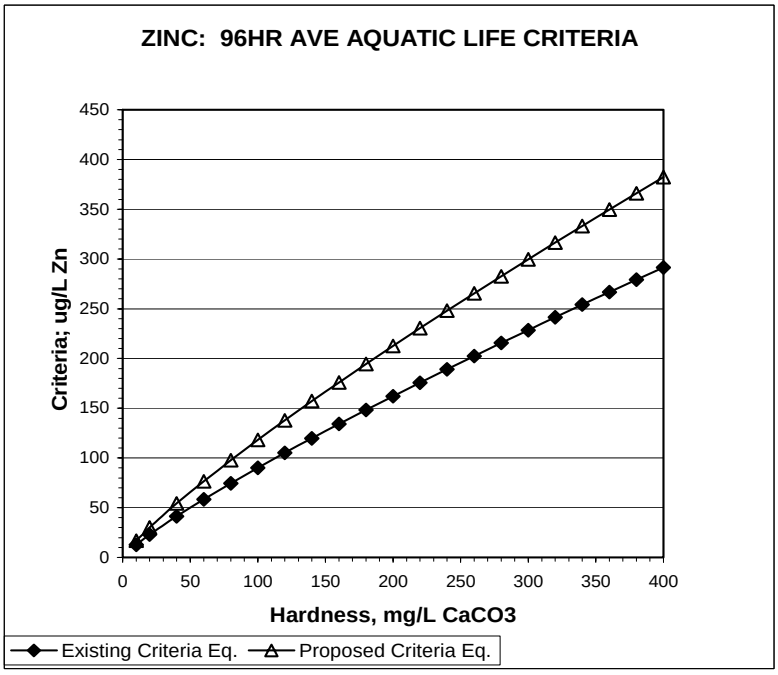
ZINC
1-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	14	17
20	25	30
40	46	54
60	65	76
80	82	97
100	99	117
120	116	137
140	132	156
160	148	175
180	164	193
200	179	211
220	194	229
240	209	246
260	224	263
280	238	280
300	252	297
320	267	314
340	281	331
360	294	347
380	308	363
400	322	379



ZINC
96-HOUR AVERAGE
AQUATIC LIFE CRITERIA

Hardness	"Existing" Criteria Formula	"Proposed" Criteria Formula
10	13	17
20	23	30
40	41	54
60	58	77
80	75	98
100	90	118
120	105	138
140	120	157
160	134	176
180	148	194
200	162	213
220	176	230
240	189	248
260	202	265
280	216	283
300	229	300
320	241	317
340	254	333
360	267	350
380	279	366
400	292	382



Assessment of Aquatic Life Criteria

The proposed revisions to the water quality criteria for select inorganic chemicals related to the aquatic life beneficial use, as outlined in this document, reflect the most recent criteria that have been published by EPA for protection and/or propagation of aquatic life. These new criteria result in revised aquatic life protective values which are more restrictive for cadmium, chromium (III), and nickel. Proposed changes to the aquatic life criteria for arsenic, chromium (VI), copper, and silver are relatively minor, and the level of protection provided by the updated/revised criteria remains about the same as the existing criteria values. Proposed updated/revised aquatic life criteria for lead and zinc are less restrictive based on the most recent numeric 304(a) criteria guidance provided by EPA. Aquatic life criteria which have not changed include iron, selenium, molybdenum, cyanide, and sulfide.

A question that is often asked when water quality standards are revised is after the chemistry of a particular water body is evaluated, will the water quality meet the new or revised numeric water quality criteria. Every 2 years, NDEP develops a 303(d) List that identifies those waters which are not in compliance with particular numeric water quality standards. Based on past 303(d) Lists that have been compiled, attainment of the aquatic life water quality standards for iron, copper, and zinc has been a continual issue in numerous waters. The levels of the other metals have generally been below analytical method detection limits or if above detectable limits, have not exceeded aquatic life standards as continuously as the above mentioned 3 metals. A summary of river basins with non attainment status of the iron, copper, and zinc aquatic life water quality standards based on the 303(d) listing compiled in year 2004 is shown in Table 3. Additionally, the water bodies that were listed in 2004 for mercury and selenium levels above the applicable aquatic life criteria values are also included in Table 3.

Since the iron aquatic life standard has not been revised, attainment of this standard will continue to be difficult. Exceedance of the iron standard will continue until an updated iron aquatic life criteria is developed, or NDEP-BWQP can show that aquatic life uses are not impaired at iron levels above 1000 µg/l using site-specific biological and chemistry data for Nevada streams and rivers. As shown in Table 3, all of the major river basins had waters with iron levels above the 1000 ug/l aquatic life standard.

Table 3. Summary of River Basins with Non-Attainment Status of Water Quality Standards for Metals Related to Aquatic Life Beneficial Use (based on NDEP 2004 303(d) List).

Waters With Non-Attainment Status By River Basin (based on NDEP 2004 303(d) List)								
Aquatic Life Criteria	Carson Basin	Colorado Basin	Humboldt Basin	Incline Creeks	Snake Basin	Truckee Basin	Walker Basin	Total
Iron	14	6	11	3	4	1	5	44
Copper	1	0	0	0	3	0	0	4
Zinc	7	0	2	7	6	5	0	27
Mercury	6	0	0	0	0	2	0	8
Selenium	0	2	4	0	0	0	0	6

Copper values have been above the aquatic life standards for several water bodies within the Snake River Basin and for one water body within the Carson River Basin. The non-attainment status of these water bodies are most likely due to historic copper mining activities having occurred in areas where these waters are located. Since the proposed revised/updated copper aquatic life criteria, as discussed in this document, are more restrictive than the existing criteria, a comparison of the copper levels in the samples that were collected from these water bodies and used to compile the 2004 303(d) List would still result in them being listed as impaired for non-attainment of the copper aquatic life criteria. Recently, Total Maximum Daily Loads (TMDLs) have been developed by NDEP to address the high copper values in the above mentioned waters, and it is hoped with time that these TMDLs will help to reduce the elevated copper levels in these waters.

Attainment of the dissolved zinc aquatic life standards has been a problem for a number of water bodies as shown in Table 3. However, when the dissolved zinc concentrations were compared to the total recoverable concentrations in water samples analyzed, it was found that the dissolved numbers were often greater than the total recoverable numbers in many instances. NDEP contemplated that this anomaly may have been related to the

filters used to filter the water samples in the field. New filters from another manufacturer have recently been used by NDEP during sampling activities and more recent analytical laboratory results have shown dissolved zinc concentrations to be less than the total recoverable concentrations. As more water bodies are sampled for metals and the new filters are used to filter the samples, NDEP will be able to more reliably evaluate whether the zinc aquatic life standards are being attained.

To evaluate the effect of revising the zinc aquatic life criteria, the dissolved zinc concentrations in samples used to compile the 2004 303(d) list were compared to the proposed revised/updated zinc aquatic life criteria. This evaluation showed that the most noticeable difference would be in the Carson River Basin. As shown in Table 3, seven water bodies within this basin are listed for non-attainment of the zinc aquatic life criteria. When the dissolved zinc levels in the Carson River samples were compared to the revised/updated zinc aquatic life criteria, only two waters in the Carson River Basin were determined to have a non-attainment status. For the other river basins shown in the table, one less water body in the Incline Creeks and one less water body in the Truckee River Basin would be listed for zinc aquatic life impairments when the proposed revised/updated zinc criteria values were evaluated. The number of waters listed for non-attainment of the zinc aquatic life criteria in the Humboldt River Basin and in the Snake River Basin remained unchanged when the dissolved zinc concentrations in the samples collected from these basins, used to compile the 2004 303(d) list, were compared to the proposed revised/updated zinc aquatic life criteria.

Exceedance of the mercury aquatic life standards (the allowable concentrations of mercury in the water column which will not harm aquatic life) has occurred in some of the Nevada water bodies monitored by NDEP. The water bodies shown in Table 3 for non-attainment of the mercury aquatic life standards are in the Carson River Basin and in the Truckee River Basin. The waters listed in the Carson Basin for non-attainment of the mercury aquatic life criteria include the lower Carson River from New Empire (east of Carson City) down to Lahontan Reservoir and all waters downstream of Lahontan Reservoir to the Carson Sink. These waters were included on the 2004 303(d) List for mercury impairments because the lower Carson River is on the National Priorities List (Superfund) due to mercury contamination from historic mining activities and the Nevada State Health Division has issued a mercury fish consumption advisory for these waters. Mercury levels in the Carson River upstream of Lahontan Reservoir, which includes three reaches, have been below the current 1-hour aquatic life criteria of 2.0 ug/l but well above the current 96-hour criteria of 0.012 ug/l. When the mercury levels in the samples used to compile the 2004 303(d) List were compared to the proposed revised/updated mercury aquatic life criteria, only one reach of the Lower Carson would be categorized as impaired for exceeding the mercury aquatic life criteria. However, due to the fish consumption advisory issued for these waters, they would still be included on the impaired water bodies list for mercury contamination.

The waters in the Truckee River Basin which are included in Table 3 for non-attainment of the mercury aquatic life criteria are two different reaches of Steamboat Creek which is a tributary to the Truckee River. The Steamboat Creek waters were listed as impaired due to mercury levels in these water bodies exceeding the current mercury 96-hour aquatic life criteria of 0.012 ug/l. When compared to the revised/updated mercury 96-hour criteria, the mercury levels in the samples collected from the Steamboat Creek waters from October 1, 1997 to September 30, 2003 (2004 303(d) List evaluation period) were below the proposed 96-hour criteria limit of 0.77 ug/l, and the waters would no longer be considered impaired for exceedance of the mercury aquatic life criteria.

Waters in the Humboldt River and Colorado River basins were included on the 2004 303(d) list for exceedance of the selenium aquatic life water quality standards. These waters included the North Fork Humboldt River and its tributaries in the Independence Mountain range and the Virgin River from the Nevada-Arizona stateline to Lake Mead. The selenium impairments in these two basins were based on the selenium levels in the water samples being greater than the current selenium 96-hour average aquatic life criteria of 5 ug/l. Since the numerical limit of the revised/updated selenium 96-hour aquatic life criteria has not changed, these water bodies would still continue to be in exceedance of the chronic selenium aquatic life protective value.

SUMMARY

The proposed revisions to water quality regulation NAC 445A.144 was shown in Attachment 1 which was included in the preface material to this rationale document.

The proposed regulation revision petition that will be presented to the SEC regarding select changes to the aquatic life water quality standards for the inorganic chemicals and compounds, as described in this document, was finalized based on formal review comments and suggestions made by the public regarding the proposed alternatives and draft rationale that was presented by NDEP-BWQP personnel at public workshop meetings. The formal comments received regarding the proposed actions and draft rationale, and the corresponding changes that were made by NDEP-BWQP were summarized in the preface material to this document.