contaminated material would be dispersed outside the CAD site during placement and would not eventually be capped.

If water column release for a given material and operational scenario is unacceptable, control measures could be considered to reduce the potential for water column effects, or other dredging equipment and placement techniques could be considered. Control measures could include use of a submerged discharge point, submerged diffuser, tremie pipe, hopper dredge pumpdown or similar equipment. The use of geotextile bags within barges to contain contaminated sediments may also be a possible option.

Cap Design

The composition and dimensions (thicknesses) of the components of a cap can be referred to as the cap design. Most capping projects conducted to date have used sediments for caps. Such materials are inert and provide a physical barrier for isolation of the contaminated sediment from the benthic environment as well as a chemical barrier in that they provide sorption sites to reduce potential flux of contaminants in any water moving upward into the cap. Other materials such as geotextiles, armor stone, etc. can be considered as a component of cap design for physical isolation or to resist bioturbation or erosion processes.

The cap design should account for chemical isolation, bioturbation, erosion, and consolidation. A 20 cm thickness for chemical seal is the largest defined by prior testing. Bioturbation thickness is on the order of 40 to 50 cm based on the biological community observed at the Bay Farm borrow area. Evaluations of bioturbation thickness would have to be done for the benthic communities likely to colonize any site under consideration. Detailed evaluations of erosion and consolidation will have to be conducted or reviewed. However, a cap thickness of 3 to 4 feet would be reasonable for purposes of the draft EIS. For final design, capping thickness tests could be considered and a more detailed examination of the erosion potential of the capping material should be conducted.

For a multi-user site which would have intermediate caps placed prior to final capping, consideration should be given to the requirements for the intermediate cap design as compared to the final cap. For example, the intermediate cap would not necessarily be required to withstand as extreme a storm event as the final cap used for site closure.

Stability Against Erosion

The deposit of contaminated dredged material must be stable against excessive erosion and resuspension of material prior to placement of the cap. The cap material must be stable against long-term erosion for the required cap thickness to be maintained. The potential for resuspension and erosion is dependent on bottom current velocity, potential for wave induced currents, sediment particle size, and sediment cohesion. Site selection criteria as described above would normally result in a site with low bottom current velocity and little potential for erosion. If a depression or borrow pit is used, the site geometry would tend to shelter the material within the depression from erosive forces to some degree.

Monitoring Program

A monitoring program should be developed as a part of the project design. The main objectives of monitoring would normally be: a) to ensure that the contaminated sediment is placed as intended and with acceptable levels of contaminant release, b) to ensure that the cap is placed as intended and the required capping thickness is maintained, and c) to ensure that the cap is effective in isolating the contaminated material from the environment. The monitoring plan should include a more intensive effort during and shortly after the initial placement operations to ensure that the site conditions have been properly accounted for. A declining level of effort could be considered for subsequent operations if conditions are similar and no problems are encountered. The objectives of the monitoring effort and any remedial actions to be considered as a result of the monitoring should be clearly defined as a part of the overall project design (Palermo, Fredette, and Randall 1992).

The selected components of a monitoring plan should be given in the draft EIS and later negotiated with EPA and the State. At a minimum, these components should include:

- Plume monitoring during contaminated material placement
- Pre, intermediate, and post contaminated material placement surveys
- Intermediate and post capping surveys
- Cores down through the cap into the contaminated sediments taken immediately after capping and periodically thereafter

Considerations for Multiple Use Sites

The CAD alternative for the Bay is intended for repetitive disposal operations from the same project (multi-use), or for operations from a variety of projects (multi-user). Siting a borrow pit or natural depressional feature for use by multiple projects has been proposed for several regional areas and is an efficient approach to CAD. There will be special considerations for design and operation of such sites.

Scheduling operations for a multiple use site must be carefully coordinated between projects to ensure that site capacity is efficiently utilized and allowable time periods between placement operations or interim cap placement are appropriate. The long term capacity of the site to include placement of the final cap must be determined and must consider the allowable fill elevation for the site. Each placement operation for contaminated sediment at a multi-use site must be separately evaluated for potential water column impacts and the appropriate time period allowed until the next placement operation or interim capping operation. The physical sediment characteristics for each project must be evaluated in light of the potential effect on subsequent placement from later projects. Monitoring of site fill elevation, consolidation of the fill, and benthic recolonization between placement operations will be especially important for multiple use sites.

C. Experiences with CAD in Other Regions and Internationally

CAD as a disposal method has been used at several sites and is being actively considered at several more. CAD sites which have been constructed include a demonstration site on the Duwamish River in the Seattle District, the One Tree Island Marina Project in the Seattle District, and the Rotterdam 1st Petroleum Harbor site in the Netherlands. Other constructed CAD projects include a site in Belgium and a sand mining borrow pit near Portland Harbor. CAD has also been studied as an alternative for numerous sites to include several in the New York Harbor area, the Everett Homeport project in Puget Sound, and the Bay Farm borrowpit in San Francisco Bay.

A CAD project is now under construction in the Port of Los Angeles, and this project is the first to be implemented in California. The CAD site is constructed inside and adjacent to the main breakwater in LA Harbor and is known as the Shallow Water Habitat site. Materials placed in the site include contaminated materials from channel deepening within LA Harbor and contaminated materials from the Marina del Ray Project. Subaqueous dikes were first constructed using suitable quarry run materials from Catalina Island. Contaminated sediments from the harbor were placed by surface release at the site. Materials from the Marina del Ray Project were placed at the site using geotextile bags, the first demonstration of this technology as an application for capping. All contaminated materials have been successfully placed within the subaqueous dikes, and the dikes have performed as intended. The entire site is now being capped with clean material from the harbor deepening placed at a thickness of approximately 12 feet.

D. Applicability of CAD in San Francisco Bay

At the conceptual level, the same considerations for CAD apply in San Francisco Bay as in any other large estuarine setting. Embayments, dead end channels, borrow pits, and natural depressions could be considered as CAD sites within the Bay. Areas with water depths too deep for submerged aquatic vegetation could be considered as potential sites for a constructed subaqueous fill. Such a fill could be constructed, used for placement of contaminated sediments and finally capped to an elevation conducive to establishing seagrasses, etc. In such way, the completed CAD site could be beneficially used.

Although the institutional, regulatory, and public interest aspects of CAD siting within San Francisco Bay are unique, the technical aspects are similar to such a siting in any large estuarine setting.

E. Potential Environmental Impacts Associated with CAD

Construction and/or utilization of a CAD site within San Francisco Bay will have potential environmental impacts. The specific impacts and the degree of impact will depend on present site conditions and final site design. However, the general categories of impacts may include:

a. Potential water quality impacts due to changes in circulation, dissolved oxygen, or salinity patterns resulting from the filling of an existing pit or the construction of a subaqueous fill. Filling a borrow pit would restore the bottom elevations to conditions prior to excavation of the pit, and little change in such patterns in areas surrounding the site should be expected. However, construction of a subaqueous fill would result in a mound-like feature with shallower water depths as compared to surrounding areas, and some effect on circulation or salinity patterns may be expected. Localized wave climates may be similarly affected.

b. Potential water column impacts due to release of contaminated sediments during placement and prior to capping. Such releases from normal open water placement operations are limited to a small fraction of the sediment placed. For a CAD site with provisions for lateral confinement and appropriate care during placement, the releases will likely be much smaller than that for normal open water placement. Tests and models are available to predict the potential for release.

c. Potential short term destruction of biological communities. The use of a borrow pit or construction and use of a subaqueous fill may result in the short term destruction of biological communities now at the site due to burial.

d. Potential long term changes in biological communities. There may be potential changes in biological communities which will recolonize the site as compared to those now present due to changes in water depths, differences in bottom sediment characteristics, or changes in circulation or salinity patterns. Recolonization normally occurs within a matter of weeks following open water placement of dredged material. Depending on the frequency of use of the site, the community structure may be in a periodic state of flux during the active life of the site. Following site closure, a more mature community structure may be reached. If the site design allows for creation of shallow water habitat for submerged aquatic vegetation, or other such habitat, the net long term change would be beneficial.

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APPENDIX H

Federal and State Water Quality Criteria and Objectives

Appendix H-1

Federal Water Quality Criteria for Freshwater, Saltwater, and Human Health (40 CFR Part 131)

federal register

Tuesday
December 22, 1992

Part II

Environmental Protection Agency

40 CFR Part 131

Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance Final Rule

A		B		C		D	
		FRESHWATER		SALTWATER		HUMAN HEALTH (10^{-6} risk for carcinogens)	
						For Consumption of:	
#) COMPOUND	CAS Number	Criterion Maximum Conc. d (ug/L) B1	Criterion Continuous Conc. d (ug/L) B2	Criterion Maximum Conc. d (ug/L) C1	Criterion Continuous Conc. d (ug/L) C2	Water & Organisms (ug/L) D1	Organisms Only (ug/L) D2
1 Antimony	7440360					14 a	4300 a
2 Arsenic	7440382	360 m	190 m	69 m	36 m	0.018 a,b,c	0.14 a,b,c
3 Beryllium	7440417					n	n
4 Cadmium	7440439	3.9 e,m	1.1 e,m	43 m	9.3 m	n	n
5a Chromium (III)	16065831	1700 e,m	210 e,m			n	n
b Chromium (VI)	18540299	16 m	11 m	1100 m	50 m	n	n
6 Copper	7440508	18 e,m	12 e,m	2.9 m	2.9 m		
7 Lead	7439921	82 e,m	3.2 e,m	220 m	8.5 m	n	n
8 Mercury	7439976	2.4 m	0.012 i	2.1 m	0.025 i	0.14	0.15
9 Nickel	7440020	1400 e,m	160 e,m	75 m	8.3 m	610 a	4600 a
10 Selenium	7782492	20	5	300 m	71 m	n	n
11 Silver	7440224	4.1 e,m		2.3 m			
12 Thallium	7440280					1.7 a	6.3 a
13 Zinc	7440666	120 e,m	110 e,m	95 m	86 m		
14 Cyanide	57125	22	5.2	1	1	700 a	220000 a,j
15 Asbestos	1332214					7,000,000 fibers/L k	
16 2,3,7,8-TCDD (Dioxin)	1746016					0.000000013 c	0.000000014 c
17 Acrolein	107028					320	780
18 Acrylonitrile	107131					0.059 a,c	0.66 a,c
19 Benzene	71432					1.2 a,c	71 a,c
20 Bromoform	75252					4.3 a,c	360 a,c
21 Carbon Tetrachloride	56235					0.25 a,c	4.4 a,c
22 Chlorobenzene	108907					680 a	21000 a,j
23 Chlorodibromomethane	124481					0.41 a,c	34 a,c
24 Chloroethane	75003						
25 2-Chloroethylvinyl Ether	110758						
26 Chloroform	67663					5.7 a,c	470 a,c
27 Dichlorobromomethane	75274					0.27 a,c	22 a,c

A			B		C		D	
			FRESHWATER		SALTWATER		HUMAN HEALTH (10^{-6} risk for carcinogens)	
							For Consumption of:	
(#)	COMPOUND	CAS Number	Criterion Maximum Conc. d (ug/L) B1	Criterion Continuous Conc. d (ug/L) B2	Criterion Maximum Conc. d (ug/L) C1	Criterion Continuous Conc. d (ug/L) C2	Water & Organisms (ug/L) D1	Organisms Only (ug/L) D2
28	1,1-Dichloroethane	75343						
29	1,2-Dichloroethane	107062					0.38 a,c	99 a,c
30	1,1-Dichloroethylene	75354					0.057 a,c	3.2 a,c
31	1,2-Dichloropropane	78875						
32	1,3-Dichloropropylene	542756					10 a	1700 a
33	Ethylbenzene	100414					3100 a	29000 a
34	Methyl Bromide	74839					48 a	4000 a
35	Methyl Chloride	74873					n	n
36	Methylene Chloride	75092					4.7 a,c	1600 a,c
37	1,1,2,2-Tetrachloroethane	79345					0.17 a,c	11 a,c
38	Tetrachloroethylene	127184					0.8 c	8.85 c
39	Toluene	108883					6800 a	200000 a
40	1,2-Trans-Dichloroethylene	156605						
41	1,1,1-Trichloroethane	71556					n	n
42	1,1,2-Trichloroethane	79005					0.60 a,c	42 a,c
43	Trichloroethylene	79016					2.7 c	81 c
44	Vinyl Chloride	75014					2 c	525 c
45	2-Chlorophenol	95578						
46	2,4-Dichlorophenol	120832					93 a	790 a,j
47	2,4-Dimethylphenol	105679						
48	2-Methyl-4,6-Dinitrophenol	534521					13.4	765
49	2,4-Dinitrophenol	51285					70 a	14000 a
50	2-Nitrophenol	88755						
51	4-Nitrophenol	100027						
52	3-Methyl-4-Chlorophenol	59507						
53	Pentachlorophenol	87865	20 f	13 f	13	7.9	0.28 a,c	8.2 a,c,j
54	Phenol	108952					21000 a	4600000 a,j
55	2,4,6-Trichlorophenol	88062					2.1 a,c	6.5 a,c
56	Acenaphthene	83329						

(#)	COMPOUND	CAS Number	B FRESHWATER Criterion Maximum Conc. d (ug/L) B1	Criterion Continuous Conc. d (ug/L) B2	C SALTWATER Criterion Maximum Conc. d (ug/L) C1	Criterion Continuous Conc. d (ug/L) C2	D HUMAN HEALTH (10^{-6} risk for carcinogens) For Consumption of: Water & Organisms (ug/L) D1	Organisms Only (ug/L) D2
57	Acenaphthylene	208968						
58	Anthracene	120127					9600 a	110000 a
59	Benzidine	92875					0.00012 a,c	0.00054 a,c
60	Benzo(a)Anthracene	56553					0.0028 c	0.031 c
61	Benzo(a)Pyrene	50328					0.0028 c	0.031 c
62	Benzo(b)Fluoranthene	205992					0.0028 c	0.031 c
63	Benzo(ghi)Perylene	191242						
64	Benzo(k)Fluoranthene	207089					0.0028 c	0.031 c
65	Bis(2-Chloroethoxy)Methane	111911						
66	Bis(2-Chloroethyl)Ether	111444					0.031 a,c	1.4 a,c
67	Bis(2-Chloroisopropyl)Ether	108601					1400 a	170000 a
68	Bis(2-Ethylhexyl)Phthalate	117817					1.8 a,c	5.9 a,c
69	4-Bromophenyl Phenyl Ether	101553						
70	Butylbenzyl Phthalate	85687						
71	2-Chloronaphthalene	91587						
72	4-Chlorophenyl Phenyl Ether	7005723						
73	Chrysene	218019					0.0028 c	0.031 c
74	Dibenzo(a,h)Anthracene	53703					0.0028 c	0.031 c
75	1,2-Dichlorobenzene	95501					2700 a	17000 a
76	1,3-Dichlorobenzene	541731					400	2600
77	1,4-Dichlorobenzene	106467					400	2600
78	3,3'-Dichlorobenzidine	91941					0.04 a,c	0.077 a,c
79	Diethyl Phthalate	84662					23000 a	120000 a
80	Dimethyl Phthalate	131113					313000	2900000
81	Di-n-Butyl Phthalate	84742					2700 a	12000 a
82	2,4-Dinitrotoluene	121142					0.11 c	9.1 c
83	2,6-Dinitrotoluene	606202						
84	Di-n-Octyl Phthalate	117840						
85	1,2-Diphenylhydrazine	122667					0.040 a,c	0.54 a,c

A			B		C		D	
			FRESHWATER		SALTWATER		HUMAN HEALTH (10^{-6} risk for carcinogens)	
							For Consumption of:	
(#)	COMPOUND	CAS Number	Criterion Maximum Conc. d (ug/L) B1	Criterion Continuous Conc. d (ug/L) B2	Criterion Maximum Conc. d (ug/L) C1	Criterion Continuous Conc. d (ug/L) C2	Water & Organisms (ug/L) D1	Organisms Only (ug/L) D2
86	Fluoranthene	206440					300 a	370 a
87	Fluorene	86737					1300 a	14000 a
88	Hexachlorobenzene	118741					0.00075 a,c	0.00077 a,c
89	Hexachlorobutadiene	87683					0.44 a,c	50 a,c
90	Hexachlorocyclopentadiene	77474					240 a	17000 a,j
91	Hexachloroethane	67721					1.9 a,c	8.9 a,c
92	Indeno(1,2,3-cd)Pyrene	193395					0.0028 c	0.031 c
93	Isophorone	78591					8.4 a,c	600 a,c
94	Naphthalene	91203						
95	Nitrobenzene	98953					17 a	1900 a,j
96	N-Nitrosodimethylamine	62759					0.00069 a,c	8.1 a,c
97	N-Nitrosodi-n-Propylamine	621647						
98	N-Nitrosodiphenylamine	86306					5.0 a,c	16 a,c
99	Phenanthrene	85018						
100	Pyrene	129000					960 a	11000 a
101	1,2,4-Trichlorobenzene	120821						
102	Aldrin	309002	3 g		1.3 g		0.00013 a,c	0.00014 a,c
103	alpha-BHC	319846					0.0039 a,c	0.013 a,c
104	beta-BHC	319857					0.014 a,c	0.046 a,c
105	gamma-BHC	58899	2 g	0.08 g	0.16 g		0.019 c	0.063 c
106	delta-BHC	319868						
107	Chlordane	57749	2.4 g	0.0043 g	0.09 g	0.004 g	0.00057 a,c	0.00059 a,c
108	4-4'-DDT	50293	1.1 g	0.001 g	0.13 g	0.001 g	0.00059 a,c	0.00059 a,c
109	4,4'-DDE	72559					0.00059 a,c	0.00059 a,c
110	4,4'-DDD	72548					0.00083 a,c	0.00084 a,c
111	Dieldrin	60571	2.5 g	0.0019 g	0.71 g	0.0019 g	0.00014 a,c	0.00014 a,c
112	alpha-Endosulfan	959988	0.22 g	0.056 g	0.034 g	0.0087 g	0.93 a	2.0 a
113	beta-Endosulfan	33213659	0.22 g	0.056 g	0.034 g	0.0087 g	0.93 a	2.0 a

A		B		C		D	
		FRESHWATER		SALTWATER		HUMAN HEALTH (10^{-6} risk for carcinogens)	
						For Consumption of:	
(#) COMPOUND	CAS Number	Criterion Maximum Conc. d (ug/L) B1	Criterion Continuous Conc. d (ug/L) B2	Criterion Maximum Conc. d (ug/L) C1	Criterion Continuous Conc. d (ug/L) C2	Water & Organisms (ug/L) D1	Organisms Only (ug/L) D2
114 Endosulfan Sulfate	1031078					0.93 a	2.0 a
115 Endrin	72208	0.18 g	0.0023 g	0.037 g	0.0023 g	0.76 a	0.81 a,j
116 Endrin Aldehyde	7421934					0.76 a	0.81 a,j
117 Heptachlor	76448	0.52 g	0.0038 g	0.053 g	0.0036 g	0.00021 a,c	0.00021 a,c
118 Heptachlor Epoxide	1024573	0.52 g	0.0038 g	0.053 g	0.0036 g	0.00010 a,c	0.00011 a,c
119 PCB-1242	53469219		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
120 PCB-1254	11097691		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
121 PCB-1221	11104282		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
122 PCB-1232	11141165		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
123 PCB-1248	12672296		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
124 PCB-1260	11096825		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
125 PCB-1016	12674112		0.014 g		0.03 g	0.000044 a,c	0.000045 a,c
126 Toxaphene	8001352	0.73	0.0002	0.21	0.0002	0.00073 a,c	0.00075 a,c
Total No. of Criteria (h) =		24	29	23	27	91	90

Footnotes:

a. Criteria revised to reflect current agency q_1^* or RfD, as contained in the Integrated Risk Information System (IRIS). The fish tissue bioconcentration factor (BCF) from the 1980 criteria documents was retained in all cases.

b. The criteria refers to the inorganic form only.

c. Criteria in the matrix based on carcinogenicity (10^{-6} risk). For a risk level of 10^{-5}, move the decimal point in the matrix value one place to the right.

d. Criteria Maximum Concentration (CMC) = the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1-hour average) without deleterious effects. Criteria Continuous Concentration (CCC) = the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects, ug/L = micrograms per liter

e. Freshwater aquatic life criteria for these metals are expressed as a function of total hardness (mg/L), and as a function of the pollutant's water effect ratio, WER, as defined in §131.36(c). The equations are provided in matrix at §131.36(b)(2). Values displayed above in the matrix correspond to a total hardness of 100 mg/L and a water effect ratio of 1.0.

f. Freshwater aquatic life criteria for pentachlorophenol are expressed as a function of pH, and are calculated as follows. Values displayed above in the matrix correspond to a pH of 7.8.

$CMC = \exp(1.005(pH) - 4.830)$ $CCC = \exp(1.005(pH) - 5.290)$

g. Aquatic life criteria for these compounds were issued in 1980 utilizing the 1980 Guidelines for criteria development. The acute values shown are final acute values (FAV) which by the 1980 Guidelines are instantaneous values as contrasted with a CMC which is a one-hour average.

h. These totals simply sum the criteria in each column. For aquatic life, there are 30 priority toxic pollutants with some type of freshwater or saltwater, acute or chronic criteria. For human health, there are 91 priority toxic pollutants with either "water + fish" or "fish only" criteria. Note that these totals count chromium as one pollutant even though EPA has developed criteria based on two valence states. In the matrix, EPA has assigned numbers 5a and 5b to the criteria for chromium to reflect the fact that the list of 126 priority toxic pollutants includes only a single listing for chromium.

i. If the CCC for total mercury exceeds 0.012 ug/L more than once in a 3-year period in the ambient water, the edible portion of aquatic species of concern must be analyzed to determine whether the concentration of methyl mercury exceeds the FDA action level (1.0 mg/kg). If the FDA action level is exceeded, the State must notify the appropriate EPA Regional Administrator, initiate a revision of its mercury criterion in its water quality standards so as to protect designated uses, and take other appropriate action such as issuance of a fish consumption advisory for the affected area.

j. No criteria for protection of human health from consumption of aquatic organisms (excluding water) was presented in the 1980 criteria document or in the 1986 Quality Criteria for Water. Nevertheless, sufficient information was presented in the 1980 document to allow a calculation of a criterion, even though the results of such a calculation were not shown in the document.

k. The criterion for asbestos is the MCL (56 FR 3526, January 30, 1991).

l. This letter not used as a footnote.

m. Criteria for these metals are expressed as a function of the water effect ratio, WER, as defined in 40 CFR 131.36(c).

CMC = column B1 or C1 value × WER

CCC = column B2 or C2 value × WER

n. EPA is not promulgating human health criteria for this contaminant. However, permit authorities should address this contaminant in NPDES permit actions using the State's existing narrative criteria for toxics.

General Notes:

1. This chart lists all of EPA's priority toxic pollutants whether or not criteria recommendations are available. Blank spaces indicate the absence of criteria recommendations. Because of variations in chemical nomenclature systems, this listing of toxic pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. EPA has added the Chemical Abstracts Service (CAS) registry numbers, which provide a unique identification for each chemical.

2. The following chemicals have organoleptic based criteria recommendations that are not included on this chart (for reasons which are discussed in the preamble): copper, zinc, chlorobenzene, 2-chlorophenol, 2,4-dichlorophenol, acenaphthene, 2,4-dimethylphenol, 3-methyl-4-chlorophenol, hexachlorocyclopentadiene, pentachlorophenol, phenol

3. For purposes of this rulemaking, freshwater criteria and saltwater criteria apply as specified in 40 CFR 131.36(c).

(2) *Factors for Calculating Metals Criteria*

$$CMC=WER\ \exp\{m_A[\ln(\text{hardness})]+b_A\} \cdot CCC=WER\ \exp\{m_C[\ln(\text{hardness})]+b_C\}$$

	m_A	b_A	m_C	b_C
Cadmium	1.128	-3.828	0.7852	-3.490
Copper	0.9422	-1.464	0.8545	-1.465
Chromium (III)	0.8190	3.688	0.8190	1.561
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	3.3612	0.8460	1.1645
Silver	1.72	-6.52	....	....
Zinc	0.8473	0.8604	0.8473	0.7614

Note: The term "exp" represents the base e exponential function.

(c) *Applicability.*

(1) The criteria in paragraph (b) of this section apply to the States' designated uses cited in paragraph (d) of this section and supersede any criteria adopted by the State, except when State regulations contain criteria which are more stringent for a particular use in which case the State's criteria will continue to apply.

(2) The criteria established in this section are subject to the State's general rules of applicability in the same way and to the same extent as are the other numeric toxics criteria when applied to the same use classifications including mixing zones, and low flow values below which numeric standards can be exceeded in flowing fresh waters.

(i) For all waters with mixing zone regulations or implementation procedures, the criteria apply at the appropriate locations within or at the boundary of the mixing zones; otherwise the criteria apply throughout the waterbody including at the end of any discharge pipe, canal or other discharge point.

(ii) A State shall not use a low flow value below which numeric standards can be exceeded that is less stringent than the following for waters suitable for the establishment of low flow return frequencies (i.e., streams and rivers):

Aquatic Life	
Acute criteria (CMC)	1 Q 10 or 1 B 3
Chronic criteria (CCC)	7 Q 10 or 4 B 3
Human Health	
Non-carcinogens	30 Q 5
Carcinogens	Harmonic mean flow

Where:

CMC—criteria maximum concentration—the water quality criteria to protect against acute effects in aquatic life and is the highest instream concentration of a priority toxic pollutant consisting of a one-hour average not to be exceeded more than once every three years on the average;

CCC—criteria continuous concentration—the water quality criteria to protect against chronic effects in aquatic life is the highest instream concentration of a priority toxic pollutant consisting of a 4-day average not to be exceeded more than once every three years on the average;

1 Q 10 is the lowest one day flow with an average recurrence frequency of once in 10 years determined hydrologically;

1 B 3 is biologically based and indicates an allowable exceedence of once every 3 years. It is determined by EPA's computerized method (DFLOW model);

7 Q 10 is the lowest average 7 consecutive day low flow with an average recurrence frequency of once in 10 years determined hydrologically;

4 B 3 is biologically based and indicates an allowable exceedence for 4 consecutive days once every 3 years. It is determined by EPA's computerized method (DFLOW model);

30 Q 5 is the lowest average 30 consecutive day low flow with an average recurrence frequency of once in 5 years determined hydrologically; and the harmonic mean flow is a long term mean flow value calculated by dividing the number of daily flows analyzed by the sum of the reciprocals of those daily flows.

(iii) If a State does not have such a low flow value for numeric standards compliance, then none shall apply and the criteria included in paragraph (d) of this section herein apply at all flows.

(3) The aquatic life criteria in the matrix in paragraph (b) of this section apply as follows:

(i) For waters in which the salinity is equal to or less than 1 part per thousand 95% or more of the time, the applicable criteria are the freshwater criteria in Column B;

(ii) For waters in which the salinity is equal to or greater than 10 parts per thousand 95% or more of the time, the applicable criteria are the saltwater criteria in Column C; and

(iii) For waters in which the salinity is between 1 and 10 parts per thousand as defined in paragraphs (c)(3) (i) and (ii) of this section, the applicable criteria are the more stringent of the freshwater or saltwater criteria. However, the Regional Administrator may approve the use of the alternative freshwater or saltwater criteria if scientifically defensible information and data demonstrate that on a site-specific basis the biology of the waterbody is dominated by freshwater aquatic life and that freshwater criteria are more appropriate; or conversely, the biology of the waterbody is dominated by saltwater aquatic life and that saltwater criteria are more appropriate.

(4) *Application of metals criteria.*

(i) For purposes of calculating freshwater aquatic life criteria for metals from the equations in paragraph (b)(2) of this section, the minimum hardness allowed for use in those equations shall not be less than 25 mg/l, as calcium carbonate, even if the actual ambient hardness is less than 25 mg/l as calcium carbonate. The maximum hardness value for use in those equations shall not exceed 400 mg/l as calcium carbonate, even if the actual ambient hardness is greater than 400 mg/l as calcium carbonate. The same provisions apply for calculating the metals criteria for the comparisons provided for in paragraph (c)(3)(iii) of this section.

(ii) The hardness values used shall be consistent with the design discharge conditions established in paragraph (c)(2) of this section for flows and mixing zones.

(iii) The criteria for metals (compounds #1–#13 in paragraph (b) of this section) are expressed as total recoverable. For purposes of calculating aquatic life criteria for metals from the equations in footnote M. in the criteria matrix in paragraph (b)(1) of this section and the equations in paragraph (b)(2) of this section, the water-effect ratio is computed as a specific pollutant's acute or chronic toxicity values measured in water from the site covered by the standard, divided by the respective acute or chronic toxicity value in laboratory dilution water. The water-effect ratio shall be assigned a value of 1.0, except where the permitting authority assigns a different value that protects the designated uses of the water body from the toxic effects of the pollutant, and is derived from suitable tests on sampled water representative of conditions in the affected water body, consistent with the design discharge conditions established in paragraph (c)(2) of this section. For purposes of this paragraph, the term acute toxicity value is the toxicity test results, such as the concentration lethal to one-half of the test organisms (i.e., LC50) after 96 hours of exposure (e.g., fish toxicity tests) or the effect concentration to one-half of the test organisms, (i.e., EC50) after 48 hours of exposure (e.g., daphnia toxicity tests). For purposes of this paragraph, the term chronic value is the result from appropriate hypothesis testing or regression analysis of measurements of growth, reproduction, or survival from life cycle, partial life cycle, or early life stage tests. The determination of acute and chronic values shall be according to current standard protocols (e.g., those published by the American Society for Testing Materials (ASTM)) or other comparable methods. For calculation of criteria using site-specific values for both the hardness and the water effect ratio, the hardness used in the equations in paragraph (b)(2) of this section shall be as required in paragraph (c)(4)(ii) of this section. Water hardness shall be calculated from the measured calcium and magnesium ions present, and the ratio of calcium to magnesium shall be approximately the same in standard laboratory toxicity testing water as in the site water.

(d) *Criteria for Specific Jurisdictions—*

(1) *Rhode Island, EPA Region 1.*

(i) All waters assigned to the following use classifications in the Water Quality Regulations for Water Pollution Control adopted under Chapters 46-12, 42-17.1, and 42-35 of the General Laws of Rhode Island are subject to the criteria in paragraph (d)(1)(ii) of this section, without exception:

6.21 Freshwater	6.22 Saltwater:
Class A........................	Class SA
Class B........................	Class SB
Class C........................	Class SC

(ii) The following criteria from the matrix in paragraph (b)(1) of this section apply to the use classifications identified in paragraph (d)(1)(i) of this section:

Use classification	Applicable criteria
Class A Class B waters where water supply use is designated	These classifications are assigned the criteria in: Column D1—all
Class B waters where water supply use is not designated; Class C; Class SA; Class SB; Class SC	Each of these classifications is assigned the criteria in: Column D2—all

(iii) The human health criteria shall be applied at the 10^{5} risk level, consistent with the State policy. To determine appropriate value for carcinogens, see footnote c in the criteria matrix in paragraph (b)(1) of this section.

(2) *Vermont, EPA Region 1.*

(i) All waters assigned to the following use classifications in the Vermont Water Quality Standards adopted under the authority of the Vermont Water Pollution Control Act (10 V.S.A., Chapter 47) are subject to the criteria in paragraph (d)(2)(ii) of this section, without exception:

Class A
Class B
Class C

(ii) The following criteria from the matrix in paragraph (b)(1) of this section apply to the use classifications identified in paragraph (d)(2)(i) of this section:

Use classification	Applicable criteria
Class A Class B waters where water supply use is designated	This classification is assigned the criteria in: Column B1—all Column B2—all Column D1—all
Class B waters where water supply use is not designated Class C	These classifications are assigned the criteria in: Column B1—all Column B2—all Column D2—all

(iii) The human health criteria shall be applied at the State-proposed 10^{-6} risk level.

(3) *New Jersey, EPA Region 2.*

(i) All waters assigned to the following use classifications in the New Jersey Administrative Code (N.J.A.C.) 7:9–4.1 et seq., Surface Water Quality Standards, are subject to the criteria in paragraph (d)(3)(ii) of this section, without exception.

N.J.A.C. 7:9–4.12(b): Class PL
N.J.A.C. 7:9–4.12(c): Class FW2
N.J.A.C. 7:9–4.12(d): Class SE1
N.J.A.C. 7:9–4.12(e): Class SE2
N.J.A.C. 7:9–4.12(f): Class SE3
N.J.A.C. 7:9–4.12(g): Class SC
N.J.A.C. 7:9–4.13(a): Delaware River Zones 1C, 1D, and 1E
N.J.A.C. 7:9–4.13(b): Delaware River Zone 2
N.J.A.C. 7:9–4.13(c): Delaware River Zone 3
N.J.A.C. 7:9–4.13(d): Delaware River Zone 4
N.J.A.C. 7:9–4.13(e): Delaware River Zone 5
N.J.A.C. 7:9–4.13(f): Delaware River Zone 6

(ii) The following criteria from the matrix in paragraph (b)(1) of this section apply to the use classifications identified in paragraph (d)(3)(i) of this section:

Use classification	Applicable criteria
PL (Freshwater Pinelands), FW2	These classifications are assigned the criteria in: Column B1–all except #102, 105, 107, 108, 111, 112, 113, 115, 117, 118. Column B2—all excep #105, 107, 108, 111, 112, 113, 115, 117, 118, 119, 120, 121, 122, 123, 124, and 125. Column D1–all at a 10^{-6} risk level except #23, 30, 37, 38, 42, 68, 89, 91, 93, 104, 105; #23, 30, 37, 38, 42, 68, 89, 91, 93, 104, 105, at a 10^{-5} risk level. Column D2—all at a 10^{-6} risk level except #23, 30, 37, 38, 42, 68, 89, 91, 93, 104, 105; 23, 30, 37, 38, 42, 68, 89, 91, 93, 104, 105, at a 10^{-5} risk level.
PL (Saline Water Pinelands), SE1, SE2, SE3, SC	These classifications are assigned the criteria in:

federal register

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Part IV

Environmental Protection Agency

40 CFR Part 131

Stay of Federal Water Quality Criteria for Metals; Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance—Revision of Metals Criteria; Final Rules