VALUE(S) ADDED 7-24-85

FACT SHEET REVISED 9-13-85

VALUE(S) REMOVED _____

SURFACE WATER QUALITY
STANDARD DOCUMENTATION

Aluminum

The attached fact sheet which was prepared for the rulemaking process contains a sentence under Remarks which does not appear in the promulgated standards. The original proposal for the standard did not contain the remark and for that reason, the remark was not included.

Date: October 10, 1984

Surface Water Quality
Standard Documentation

Chemical: Aluminum

C.A.S, No.(s): NA

Basis (Human/Aquatic): Aquatic

Standard by Water Classification:

	ug/l	Notes
Classes AA,AA-s;A;A-s;B;C	100, ionic*	I
Class D		
Classes SA;SB;SC;I		
Class SD		

Remarks: *The aluminum standard is the lower concentration of either the 100 ug/l (ionic) or the highest aluminum concentration that will not result in precipitation of aluminum compounds in ambient surface waters.

Summary of Information

1. Freeman, R.A. and W.H. Everhart. 1971. Toxicity of aluminum hydroxide complexes in neutral and basic media to rainbow trout. Transactions of American Fisheries Society 100(4): 644-658.

   -chronic effects and mortalities were found at 0.52 mg/l aluminum.
   -no effects at 0.05 mg/l.
   -chronic effects were also found in the presence of suspended aluminum

2. Biesinger, K.E. and G.M. Christensen, 1972. Effects of various metals on survival, growth, reproduction and metabolism of Daphnia magna. Journal of the Fisheries Research Board, Canada. 29: 1691.

   -in a chronic test 16 percent reproductive impairment was found at 0.32 mg/l aluminum.

3. Burrows, W.D. 1977. Aquatic aluminium: chemistry; toxicology, and environmental prevalence. CRC Critical Reviews in Environmental Control. June 1977, pp. 167-216.

   -in this review article the author concluded that the aluminum ion causes toxicity but freshly precipitated aluminium hydroxide also causes chronic toxicity.
   -fluoride and sulfate ions will cause insignificant enhancement of aluminum solubility at high and low pH; in most natural waters with pH 6.8-8.5 neither flouride nor sulfate will be present in significant concentrations to enhance the solubility of aluminum.

4. Driscoll, C.T., Jr., J.T. Baker, J.J. Bisogoni,Jr. and C.L. Schofield. 1980. Effect of aluminum speciation on fish in dilute acidified waters. Nature 284: 161-164.

-aluminum complexation with organic ligands eliminates toxicity and measurement of total aluminum may lead to substantial overestimate of aluminum toxicity.

5. Baker, J.P. and C.L. Schofield. 1982. Aluminum toxicity to fish in acidic waters. Water, Air, and Soil Polution 18:289-309.

-aluminum in excess of 0.1 mg/l for white suckers or 0.2 mg/l for brook trout resulted in reductions of survival and growth at all pH levels.

-aluminum was most toxic in oversaturated solutions in pH levels 5.2-5.4: the authors suggest the toxicity was caused by precipitation and coagulation of aluminum hydroxide on gill surfaces or adsorption and nucleation of aluminum polymers at surface interfaces.

Standard Derivation

Recommended standard for ionic aluminum may be derived as follows. Using data from Freemon and Everhart (1971), the geometric mean of the no effect concnetration of 0.05 mg.1 and the lowest effect concentration of 0.5 mg/1 results in a value of 0.158 mg/1. Applying a factor of 0.2 to the chronic Daphnia concentration of 0.32 mg/1 results in a value of 0.064 mg/1. The geometric mean of 0.158 mg/1 and 0.064 mg/1 is about 0.1 mg/1. Therefore, the recommended standard for all freshwater classes except D is 100 ug/1.

Numerous authors have concluded that aluminum toxicity is not only due to ionic aluminum but also can be caused by aluminum precipitate. If aluminum solubility is different in wastewater effluents and receiving waters there must be assurance that concentrations of aluminum allowed in wastewater effluents will not result in precipitation of aluminum in receiving waters.