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SECONDARY VALUES FOR BARIUM

A search was conducted for information on the toxicity of barium to fish and aquatic life using the ECOTOX database (re-checked in March 2007).

Fish and Aquatic Life Secondary Values

To derive an acute toxicity criterion for aquatic life, acute toxicity test results are required for at least one species in each of eight different families. Specific requirements and the data available to meet these requirements are found in Table 1. Following a search for information on the toxicity of barium to fish and other aquatic life, it was determined that data are available to meet only four out of the eight requirements. However, because data are available for a Daphnid species, it was possible to calculate secondary values for barium.

Cold Water

To calculate a secondary acute value (SAV), the lowest genus mean acute value (GMAV) in the database is divided by the secondary acute factor (SAF; an adjustment factor corresponding to the number of satisfied requirements).

SAF for four out of eight requirements met = 7.0

Lowest GMAV = 21,541 μg/L (*Daphnia magna*)

SAV = GMAV/SAF
= 21,541 / 7.0
= 3,077.29 μg/L

Secondary chronic value (SCV) = SAV/secondary acute to chronic ratio (SACR)
= 3,077.29 / 18
= **170.96 μg/L**

Warm Water Sportfish, Warm Water Forage Fish, Limited Forage Fish and Limited Aquatic Life

The lowest GMAV in the cold water database is for an invertebrate (*Daphnia magna*). Because invertebrate species do not drop out of the database for Warm Water Sportfish, Warm Water Forage Fish, Limited Forage Fish, or Limited Aquatic Life designated waters, the secondary values will be the same for these water bodies as for cold water designated water bodies.

Table 1. Requirements for calculation of an acute toxicity criterion for protection of aquatic life for barium, and corresponding acute toxicity data.

Species Name	Common Name	Duration/ Endpoint	Value µg/L	Reference #[a]	Source
1. At least one salmonid fish in the family Salmonidae, in the class Osteichthyes.					
2. At least one non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important warmwater species.					
3. At least one planktonic crustacean (e.g., cladoceran, copepod).					
Daphnia magna	**water flea**	**48-h/EC50**	**32,000**	**2**	**ECOTOX**
Daphnia magna	**water flea**	**48-h/EC50**	**14,500**	**3**	**ECOTOX**
Species Mean Acute Value (SMAV):			21,541		
4. At least one benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish).					
Gammarus pulex	**scud**	**96-h/LC50**	**238,000**	**1**	**ECOTOX**
5. At least one insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge).					
6. At least one fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions.					
Gambusia affinis	**western mosquitofish**	**96-h/LC50**	**6,950,000**	**4**	**ECOTOX**
Gambusia affinis	**western mosquitofish**	**96-h/LC50**	**1,080,000**	**4**	**ECOTOX**
SMAV:			2,739,708		
7. At least one organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca).					
Tubifex tubifex	**tubificid worm**	**96-h/EC50**	**33,650**	**5**	**ECOTOX**
8. At least one organism from a family in any order of insect or any other phylum not already represented in subdivisions 1 through 7.					

[1]Vincent, M.J.D. and B. Penicaut. 1986. Comparative studies on the toxicity of metal chlorides and of a synthetic organic

molluscicide, N-trityl-morpholine, upon two aquatic amphipods. Ann. Rech. Vet. 17(4):441-446.
[2]Khangarot, B.S. and P.K. Ray. 1989. Investigation of correlation between physicochemical properties of metals and their toxicity to the water flea, *Daphnia magna* Straus. Ecotoxicology and Environmental Safety 18(2):109-120.
[3]Biesinger, K.E. and G.M. Christensen. 1972. Effects of various metals on survival, growth, reproduction and metabolism of *Daphnia magna*. J. Fish. Res. Board Can. 29:1691-1700.
[4]Wallen, I.E., W.C. Greer, and R. Lasater. 1957. Toxicity to Gambusia affinis of certain pure chemicals in turbid waters. Sewage Ind. Wastes 29(6):695-711.
[5]Khangarot, B.S. 1991. Toxicity of metals to a freshwater tubificid worm, *Tubifex tubifex* (Muller). Bull. Environ. Contam. Toxicol. 46:906-912.

HUMAN HEALTH

To calculate a criteria or secondary value for the protection of human health, it is first necessary to determine if the substance has been shown to be carcinogenic (which will result in the calculation of a human cancer criteria or secondary value) or not (which will result in the calculation of a human threshold criteria or secondary value). Barium is currently classified as "D", not classifiable, by the U.S. EPA (IRIS). An oral reference dose (RfD; IRIS) is available, but I was unable to find a BAF, or a BCF or log Kow with which to calculate a BAF; therefore it is not possible to calculate a human threshold secondary value for this substance at this time. (search conducted March 2007)