Lake Elsinore & San Jacinto Watersheds Authority

City of Lake Elsinore • City of Canyon Lake • County of Riverside
Elsinore Valley Municipal Water District • Santa Ana Watershed Project Authority

Proposed Alum Applications Will Not Cause Toxicity to Fish or Other Aquatic Organisms In Canyon Lake or Lake Elsinore

1) Aluminum sulfate (*aka* "Alum") is an EPA-approved pesticide[1] commonly used throughout the United States, including California, to prevent the growth of nuisance algae. There have been no reported incidents of fish kills or other evidence of aquatic toxicity as a result of these lake restoration activities.[2]

2) When applied in lakes, alum rapidly binds with phosphorus to form a non-toxic mineral particle called aluminum phosphate. This reaction is usually complete within a few hours and the resulting particles slowly settles to the bottom after just a day or two.

3) Initially, the aluminum phosphate particles form a thin layer only 1-2 mm thick. Eventually, the particles are incorporated back into the soil.[3] Aluminum is the third most abundant element in the Earth's crust.[4] And, each pound of lake bottom sediment already contains somewhere between ½ and 1 ounce of aluminum.

4) EPA guidance indicates that aluminum "is substantially less toxic" at higher pH and hardness levels.[5]. EPA recommends that site-specific tests be performed to evaluate the potential toxic effects of aluminum for waterbodies, like Canyon Lake and Lake Elsinore, with naturally high pH and hardness.

5) Recent laboratory tests, using sample water collected from Canyon Lake, showed no evidence of alum-induced toxicity to fish (Figures 1 & 2) or invertebrate organisms (Figures 3 & 4).[6] These toxicity tests were performed using sensitive freshwater species recommended by EPA. And, the laboratory tested aluminum concentrations considerably higher than those likely to occur as a result of the proposed alum application to Canyon Lake.

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[1] Federal Insecticide, Fungicide and Rodenticide Act ("FIFRA") 7 U.S.C. §136 et. seq. (1996); CAS #10043-01-3 http://iaspub.epa.gov/sor_internet/registry/substreg/searchandretrieve/advancedsearch/externalSearch.do?p_type=CASNO&p_value=10043-01-3

[2] Dr. Barry Moore (Washington State University); citing Cooke, et al, in Facts About Lake Alum Applications (Appendix A); A review of the scientific literature prepared for the Big Bear Municipal Water District. 2004.

[3] Lamb, D.S. and G.C. Bailey. Acute and chronic effects of alum to midge larva. Bulletin of Environmental Contamination and Toxicology. 27(1):59-67. 1981.

[4] See: http://en.wikipedia.org/wiki/Aluminium citing a number of independent sources stating that aluminum comprises approximately 80,000 ppm (8%) of the material making up the Earth's solid crust.

[5] See: http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm (U.S. EPA's National Recommended Water Quality Criteria; Footnote S). In context, pH higher than 6.5 and hardness > 10 mg/L.

[6] GEI Consultants, Inc. - Ecological Division; Denver, CO. Water Effects Ratio Study for Canyon Lake. Draft 3/6/13

6) California has not yet adopted an official water quality standard for aluminum. However, EPA has approved such standards in other western states.[7] To prevent aquatic toxicity, short-term exposure to aluminum should not exceed 8.8 mg/L and prolonged exposure should not exceed 1.3 mg/L where the average hardness is approximately 200 mg/L.[8] Note: aluminum makes up only 10% of the alum product by weight. So, when an alum dose of 10 mg/L is applied to the lake, the resulting aluminum concentration will be only 1 mg/L.

7) In 2004, 700,000 gallons of liquid alum was applied to 1,550 acres of Big Bear Lake without any adverse effect to fish, aquatic organisms, birds or other wildlife. However, Big Bear did observe a 90% reduction in Chlorophyll-a (algae) and 90% improvement in water clarity in the month following the alum application.[9]

8) EPA's Ambient Water Quality Criteria for Aluminum is frequently cited to support the claim that aluminum may be toxic to aquatic organisms at concentrations at low as 87 ppb. EPA's original recommendation was based on a single east coast study where water hardness was exceptionally low (<10 mg/L).[10] At the time (1988), EPA did not yet have sufficient data to develop appropriate hardness adjustments like those routinely applied to other trace metals such as copper and lead. This problem was subsequently remedied in an EPA-funded study prepared by the Arid West Water Quality Research Project (AWWQRP) in May of 2006.[11] AWWQRP's study was the basis for the new aluminum standards EPA recently approved in Colorado and New Mexico. Using the CO/NM method to adjust for the higher hardness (>200 mg/L) routinely seen in Canyon Lake and Lake Elsinore, the safe level of aluminum is 12-15x higher than the original water quality criteria EPA published in 1988. By 1992, when the National Toxics Rule was adopted, EPA elected to ignore the 1988 guidance and declined to establish any water quality standard for aluminum.[12] EPA made the same decision when the California Toxics Rule was enacted in 2000.[13] In light of EPA's recent decisions in Colorado and New Mexico, the 1988 Water Quality Criteria document should no longer be used to characterize the risk of aluminum toxicity in lakes and streams with relatively high hardness.

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[7] See, for example, U.S. EPA-Region VI (Carol L. Campbell, Asst. Regional Administrator; Office of Ecosystems Protection and Remediation). Letter to Peter Butler, Chairman of the Colorado Water Quality Control Commission Approving the 2010 Revisions to the Basic Standards and Methodologies for Surface Water. August 4, 2011. (Ref.: 8EPR-EP). EPA also approved a similar water quality standard for aluminum in the state of New Mexico.

[8] Colorado Dept. of Public Health and Environment - Water Quality Control Commission. Regulation No. 31: Basic Standards and Methodologies for Surface Water (5 CCR 1002-31). See Table IV: Table Value Standards for Selected Hardnesses. Available at: http://www.colorado.gov/cs/Satellite/CDPHE-WQCC/CBON/1251590910709

[9] Godwin-Saad, Erika. Big Bear Lake 2004 Full-Scale Alum Application. Final Report to the Santa Ana Regional Water Quality Control Board. Big Bear Municipal Water District. June, 2005. (See pg. 8 and pg. 20)

[10] Buckler, D.R; et al. Influence of pH on the toxicity of aluminum and other inorganic contaminants to East Coast striped bass. Water Air and Soil Pollution. Vo. 35, No. 1-2 (Sept., 1987) pp. 97-106.

[11] Arid West Water Quality Research Project. Evaluation of the EPA Recalculation Procedure in the Arid West Technical Report. May, 2006. The same highly-regarded laboratory that prepared the AWWQRP study also performed the recent toxicity tests for alum using water samples collected from Canyon Lake. The laboratory, then called Chadwick Ecological Consultants, merged with GEI, Inc. in 2006 and is still based in Denver, CO.

[12] U.S. EPA. 57 Fed. Reg. 246, 60848 (Dec. 22, 1992); aka "National Toxics Rule"

[13] U.S. EPA. 65 Fed. Reg. 97, 31682 (May 18, 2000); aka "California Toxics Rule"

Figure 1:

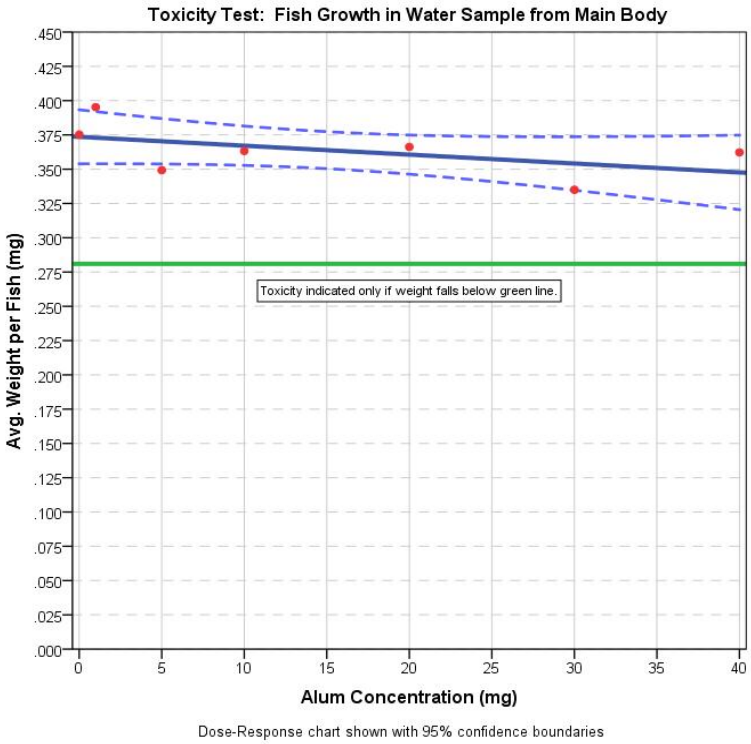

Figure 2:

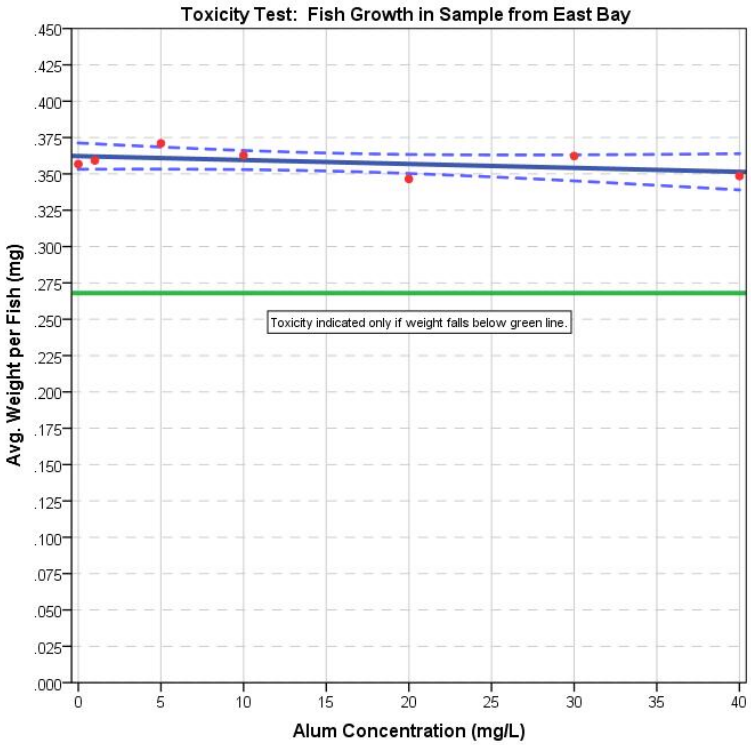

Figure 3:

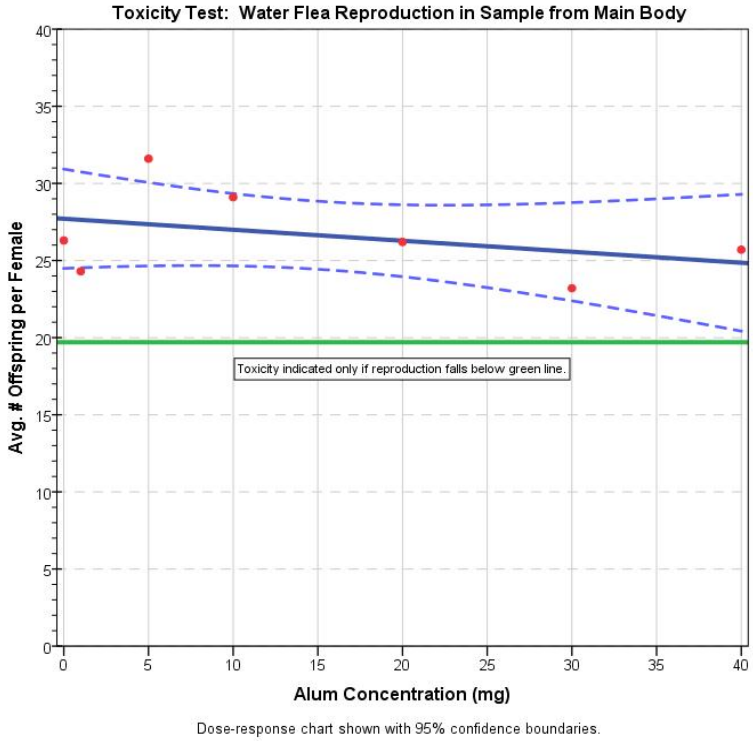

Figure 4: