

What is Alum and How Does it Work?

Alum (aluminum sulfate) is a nontoxic liquid that is commonly used in water treatment plants to clarify drinking water. Its use in lakes began in the early 1970's and is used to reduce the amount of phosphorus in the water. Lower amounts of phosphorus lead to lower amounts of algae and the symptoms associated with poor water quality. Alum is most often used to control phosphorus release from the lake bottom sediments (internal loading). Research has shown that even when external sources of phosphorus from the surrounding watershed are lowered, the internal cycling can continue to support significant nuisance algal blooms.



Alum is applied to lakes using specialized equipment and barges that ensure the precise placement of the material in the lake. On contact with the water, the liquid alum forms a fluffy aluminum hydroxide precipitate called floc. Aluminum hydroxide (the principle ingredient of common antacids such as Maalox) binds with the phosphorus to form an aluminum phosphate compound. The compound is insoluble in water and the bound phosphorus can no longer be used to fuel the algae. As the floc settles, phosphorus and particles are removed from the water column leaving the lake noticeably clearer. The floc then forms a thin layer on the bottom that binds the phosphorus as it leaches out of the bottom sediments during internal loading events. The floc layer keeps the phosphorus from entering the overlying water and makes it unavailable to the algae. The result is a reduction in the frequency and intensity of nuisance algal boom, rather than the total elimination of all algae.



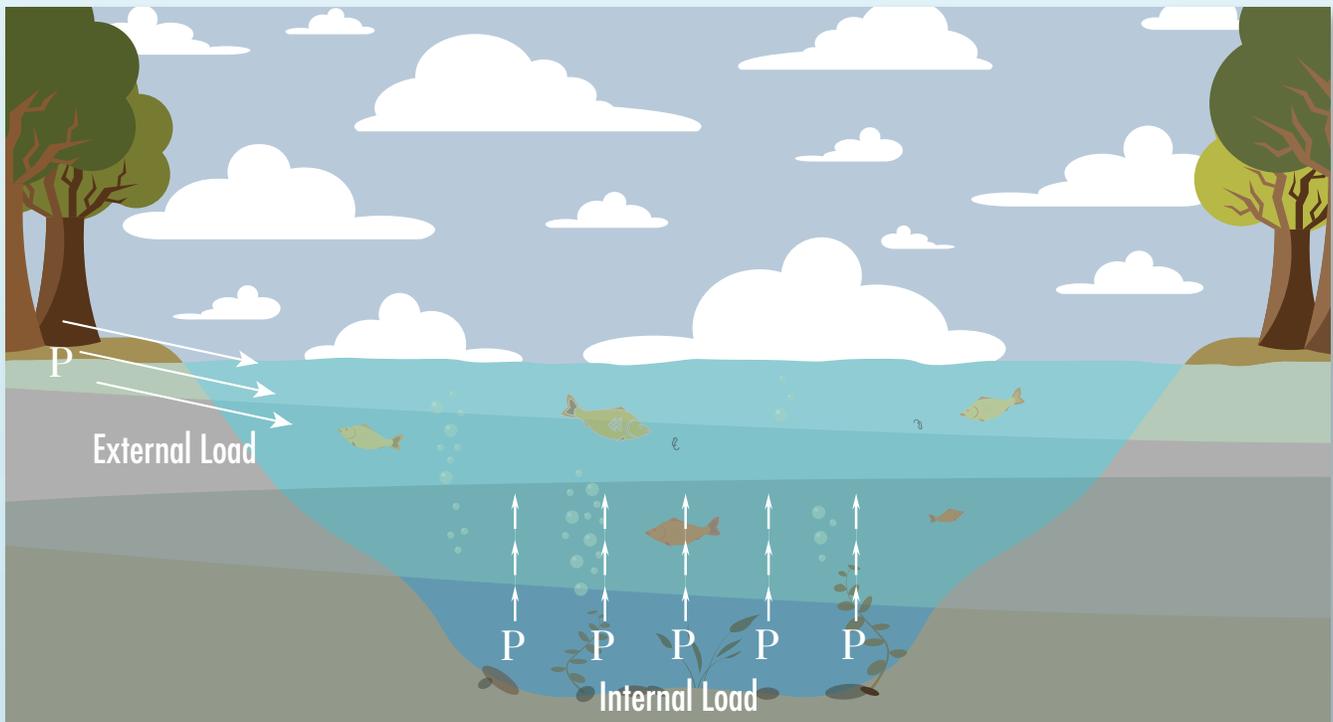
Where Does All of This Phosphorus Come From?

Phosphorus enters lakes from two sources. Phosphorus entering the lake from outside sources are called external sources. These sources originate in the watershed and are either directly rinsed into the lake or flow to a stream that enters the lake. Common external sources include lawn fertilizers, septic systems, agricultural practices, stormwater, soil erosion and geese: anything that causes phosphorus to enter the lake from the watershed.



Once the external source of phosphorus enters the lake, it is deposited in the lakebed and is recycled back into the water column. This is the second source of phosphorus and it originates from within the lake itself. This is called an internal source and these inputs are most common during the summer and winter when water oxygen concentrations are low or zero near the bottom. This condition causes changes in the chemistry of the lakebed that lead to the phosphorus leaching out of the sediment and into the water.

Both external and internal sources of phosphorus are important in managing lake water quality. The relative contribution of each source must be understood and measured to design the best solution for any given lake. External sources can be measured in the water entering the lake or estimated from models of the surrounding watershed. Internal sources are determined by collecting lakebed sediment samples (cores) and measuring the amount phosphorus available to leach out into the water.



Is Alum Safe?

Alum has been repeatedly shown to be safe for humans. Alum is a common food additive and has also been used for decades to clean our drinking water before consumption. HAB uses the exact same drinking water certified alum when performing a lake improvement application. Aluminum is a main ingredient of alum, is the third most abundant element in the earth's crust and naturally occurs in lake sediments. Virtually all food, water, air and soil contain aluminum and the average adult consumes 7-9 milligrams of aluminum every day. The FDA supports the safe use of alum as a food additive and a single dose of Maalox contains 400 milligrams of aluminum itself. Alum use in lakes results in an especially low exposure to aluminum as very low amounts of aluminum are added during an application and the alum remains undissolved in the lake sediments.



How Does an Alum Application Affect Fish and Plants?

Aluminum is considered a non-essential metal because fish and other aquatic life do not need it to function. There is a large body of scientific literature documenting the safe use of alum in lake environment conditions, which has allowed the North American Lake Management Society to fully endorse its use (NALMS, 2017). Even with its known safety, HAB goes the extra step to monitor and confirm the environmental safety of the lake during and after our applications. EPA is also recognizing an increased level of safety with aluminum in lake systems. Based on research that occurred since the criteria was set in 1988, EPA is suggesting new lake criteria that is four times higher (EPA, 2017). Thus, alum use in lakes is safe for fish, and we commonly see large improvements in the fishery due to increased water clarity and habitat.



Alum is also harmless to plants. In fact, the improved water clarity after an alum application typically results in an increase of aquatic plants in the lake. This is a benefit to the lake as the plants allow the lake to function naturally, provide important habitat for fish and other aquatic organisms, increase lake oxygen concentrations, stabilize the lakebed and reduce sediment resuspension, reduce shoreline erosion and help prevent the lake from returning to an algae-dominated state. However, some may consider plants a nuisance around docks, beaches and in boating corridors. HAB encourages all lakes to have an active plant management plan. This is especially true for lakes that have been cleaned by an alum application. Contact HAB for a list of qualified lake managers that can help prepare the best aquatic plant management plan for your lake.

