

Environment and Toxicology

CMA research conducted in a variety of academic and private laboratories indicates that negative environmental and toxicological impacts are highly unlikely from its use as a deicer. Of the information collected it can be said that:

1. Concentrations used to deice roads have little to no toxic effects on grass, trees or roadside vegetation;
2. Has little to no toxic effects on aquatic species, including vertebrates and invertebrates;
3. Does not mobilize pre-existing heavy metals;
4. Does not increase algae, periphyton or phytoplankton biomass;
5. Is unlikely to cause problems in treatment plants receiving CMA in storm water runoff;
6. Is unlikely to have significant negative impacts on dissolved oxygen in receiving water;
7. Has low acute mammalian toxicity with effects similar or less severe than those of sodium chloride.

BIODEGRADABILITY

The chemical oxygen demand (COD) of CMA was determined using EPA Method 410.1:

COD = 0.75 g O₂/g

The biological oxygen demand (BOD) of CMA was determined using EPA approved dilution methods (Hach). The 20-day incubation BOD value at 10°C is reasonably similar to the COD value suggesting that biological oxidation progresses to the endpoint in 20 days.

BOD₂₀ @ 2°C = 0.40
 BOD₂₀ @ 10°C = 0.67

AQUATIC TOXICITY

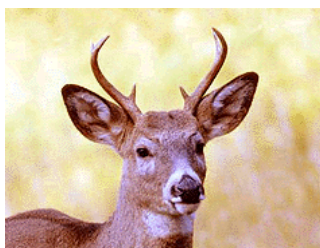
EPA method 600/4-85-013 was used for measuring the acute toxicity of CMA to freshwater and marine organisms. No mortality was observed at any test level. Based on these study results CMA can be considered to be relatively harmless under generally recognized criteria for assessing acute aquatic toxicity.

Species	Exposure	LC50
Daphnia	48 hours	>1000 mg/L
Rainbow Trout	96 hours	>1000 mg/L

Environmental Impact CMA Versus Road Salt		
Environmental Impact	CMA	Salt (NaCl)
Soils	Biodegradable in soil. No adverse effect on soil compaction and strength. Increases soil permeability	Sodium may accumulate in soil Breaks down soil structure, increases erosion. Causes soil compaction which decreases permeability.
Vegetation	Little or no adverse effect. May stimulate roadside plant growth. Acetate ion is the most abundant organic acid metabolite found in nature.	Osmotic stress and soil compaction harm root systems. Spray causes foliage dehydration damage. Many plant species are salt sensitive.
Groundwater	Poor mobility in soil, unlikely to reach groundwater. Ca, Mg increases water hardness.	Mobile Na and Cl ions readily reach groundwater. Increases Na and Cl concentrations in well water along with alkalinity and hardness.
Surface Water	Potential for oxygen depletion through biological oxygen demand(BOD) at concentration greater than 100 ppm in closed systems. Decomposes in 5 days at 20°C, 10 days at 10°C, 100 days at 2°C.	Causes density stratification in ponds and lakes which can prevent reoxygenation. Increases runoff of heavy metals and nutrients through increased erosion.

	Will not stimulate algae growth.	
Aquatic Life	Less toxic to trout than salt. Minimal effect on trout eggs up to 5 times expected maximum runoff concentration of 1000 ppm. No effect on food chain (zooplankton, daphnia, bluegill, and fathead minnows) up to up to 1000 ppm.	Monovalent Na, Cl ions stress osmotic balance. Toxic levels: Na 500 ppm stickleback, Cl 400 ppm trout.
Human/Mammalian	Mild skin and eye irritant. Vinegar odor. Acute oral LD50 in rats greater than 5000 mg/kg. Essentially nontoxic.	Sodium linked to heart disease, hypertension. Cl causes unpleasant taste in drinking water. Mild skin and eye irritant. Acute Oral LD50 in rats approximately 3000 mg/kg. Slightly toxic. Contributes to winter road kills of wildlife.
Water Treatment Plants	No significant increase in BOD or impact on bacterial activity.	No significant impact at expected concentrations.
Air Pollution	Can reduce sand use and resulting particulate emissions.	Can reduce sand use and resulting particulate emissions.

Wildlife Conservation



When sodium chloride is used as a deicer, it can result in roads becoming salt licking stations for wild animals, particularly deer. CMA has been used in deer management areas of Scandinavia to prevent road accidents. In Finland, CMA mixed with sand at rates of 18-24 pounds per ton (15-20 kilograms per cubic meter) kept sand from freezing. Additionally this CMA rate was sufficient to deter reindeer from roadways. CMA has the aroma of vinegar, which does not appeal to animals.