



## MAG Environmental and Safety Considerations

MAG is less irritating to the skin, unlike calcium chloride, is not noticeably exothermic (generates heat) when it first comes in contact with moisture. Magnesium chloride is unlikely to irritate the skin or burn the skin when it contacts moist skin surfaces.

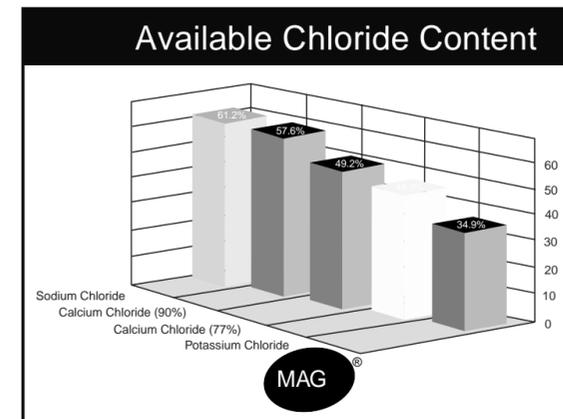
MAG corrodes metal surfaces less. Tests show MAG to be significantly less corrosive than calcium chloride and sodium chloride on steel, tin and aluminum.

MAG is safer around vegetation. When used as directed, MAG is safer to use around plants and bushes. In fact, magnesium chloride is used as an ingredient in fertilizer.

MAG is safer on concrete. Tests by the Strategic Highway Research Program, Washington D.C., using 3% solutions (representative dilution of ice melting brines) show that calcium chloride caused 26 times and sodium chloride caused 63 times the amount of concrete spalling than MAG.

MAG is safer for use around animals and humans. MAG is much less toxic than calcium chloride, potassium chloride and sodium chloride based on data provided by the U.S. Department of Health and Human Services. In fact, a form of MAG is used as a mineral supplement in some farm animal feedstocks.

MAG is environmentally friendlier. On a pound for pound basis, MAG contains approximately 22%, 29%, 39%, and 43% less chlorides than potassium chloride, calcium chloride (90%), calcium chloride (77%) and sodium chloride respectively, while still maintaining its effectiveness. The application of MAG results in significantly less chloride runoff and pollution than potassium chloride, calcium chloride and sodium chloride.



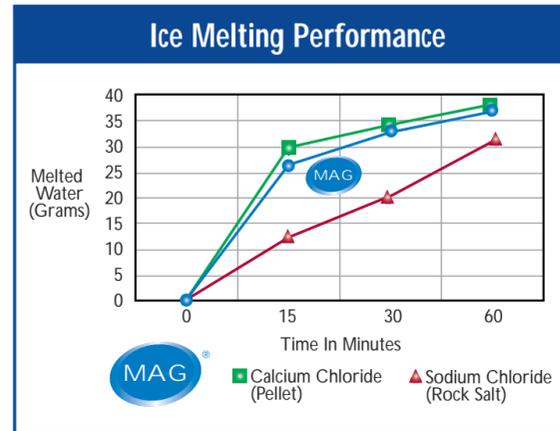
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# THE HIGH PERFORMANCE ICE MELT Safer for the Environment



## MAG® Ice Melting Performance Compares Favorably With Calcium Chloride

Ice melting performance is measured not only by the speed of the melting action but also by the quantity of melted water produced per unit of ice melter used. The following graph compares the ice melting performance of MAG, calcium chloride and sodium chloride.



The tests were performed by the Swedish VTI by spreading 10 grams of each ice melter evenly over an icy surface at 21°F, well within the performance range of sodium chloride. As the temperature drops, the performance of sodium chloride should degrade appreciably as it reaches its practical minimum melting point of +6°F.

As seen by these tests, MAG is a highly effective ice melter comparing favorably with calcium chloride. When considering that MAG is significantly less toxic, less corrosive, safer on concrete, safer to handle, leaves no residue and has less chlorine, MAG is clearly the total ice melter. There is no other ice melter on the market today that compares with MAG.

## Comparison of Practical & Eutectic Melting Points of Selected Ice Melter Chemicals

Ice Melter	Eutectic Temp °F	Practical Temp °F
Calcium Chloride	-59	-25
<b>MAG</b>	<b>-27</b>	<b>-13</b>
Rock Salt (Halite)	-6	+20
Urea	+11	+25
Potassium Chloride	+12	+25
Calcium Magnesium Acetate	-3.75	+25

Data obtained from literature, labeling and known scientific data



## MAG® As An Ice Melter

MAG is the best total ice melter. Compared to calcium chloride and sodium chloride (Rock Salt), MAG is less corrosive towards metal surfaces, creates less concrete spalling, is less toxic, and is environmentally safer.

The principal characteristics of MAG compared to calcium chloride and sodium chloride are:

	MAG	Calcium Chloride	Sodium Chloride
Toxicity mg/kg (LD <sub>50</sub> ) <sup>1</sup>	<b>8100</b> <i>(Low Toxicity)</i>	1000 <i>(Relatively High Toxicity)</i>	3000 <i>(Medium Toxicity)</i>
Concrete Spalling/Chipping <sup>2</sup>	<b>3.5g</b>	92.3g	223g
Ice Melting Effectiveness at 21°F <sup>3</sup>			
After 15 minutes	<b>27g</b>	30g	12g
After 60 minutes	<b>36g</b>	38g	32g
Residue	<b>Clear Liquid</b>	Oily-Like Liquid Film	Dry White Powder
Corrosion—Steel (mils/year) <sup>4</sup>	<b>9.5</b>	19.6	22.9
Corrosion—Aluminum (mils/year) <sup>5</sup>	<b>.375</b>	3.0	1.5
Corrosion—Tin (mils/year) <sup>6</sup>	<b>2.1</b>	13.9	17.9
Chloride Content	<b>34.9%</b>	57.6% (pellet) 49.2% (flake)	61.2%
Effective Melting Temperatures	<b>-13°F</b>	-25°F	+20°F

Notes:

- Data from U.S. Dept. of Health and Human Services, *Registry of Toxic Effects of Chemical Substances* — The larger the number, the less toxic the chemical. The data for MAG is for magnesium chloride hexahydrate, the data for calcium chloride is for calcium chloride anhydrous.
- Concrete frost testing by Strategic Highway Research Program, Washington D.C. Concrete weight loss after 15 freeze/thaw cycles using 3% solution of water and ice melting compound.
- Results of ice melting tests performed by Swedish VTI. 10 grams of ice melter were spread evenly on an icy surface. After specified period of time, melted water was drained and measured.
- Exposed to a 3% magnesium chloride solution for 10 days by University of Utah, Department of Metallurgy.
- Exposed to a 150 g/l brine for 22 days by Kali Forchungs Institute (Germany).
- Exposed to a 150 g/l brine (160 g/l brine for MAG) for 120 days by Kali Forchungs Institute.

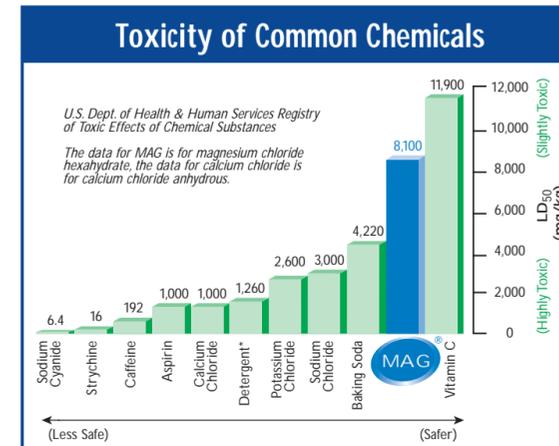
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## MAG® Is Much LESS Toxic Than Salt and Calcium Chloride

Accidental ingestion by pets, animals and children is a concern to all of us. MAG is much safer than all other popular ice melting chemicals because of its very low toxicity. The following is a chart of common chemical substances (and a few not so common) and their LD<sub>50</sub> (Lethal Dose 50%) levels.



\*Sodium Dodecylbenzene Sulfonate

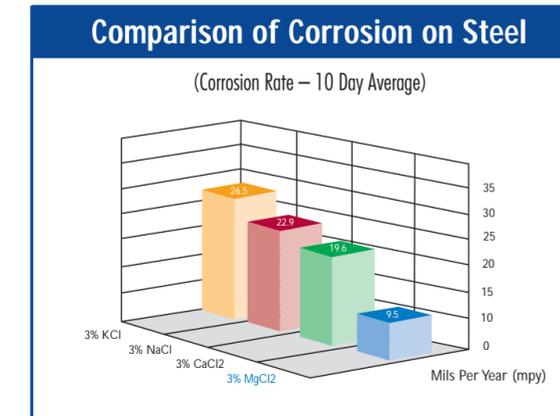
[LD<sub>50</sub> is the amount of a substance (in mg per kg of body weight) expected to kill 50% of the test animals in a controlled study. The larger the LD<sub>50</sub> number the less toxic the material.]

As shown by the data, MAG is less toxic than baking soda and table salt, chemicals we ingest on a daily basis. When compared to other ice melting chemicals, MAG is much less toxic and much safer to use around animals, pets and humans.

## Safer for People, Pets, Concrete and the Environment

## MAG® Is Less Corrosive Than Other Ice Melters

MAG is commonly used in the workplace. As this chart shows, MAG is less corrosive on steel which can affect work equipment, piping, building infrastructure and more. MAG makes an altogether safer work environment.

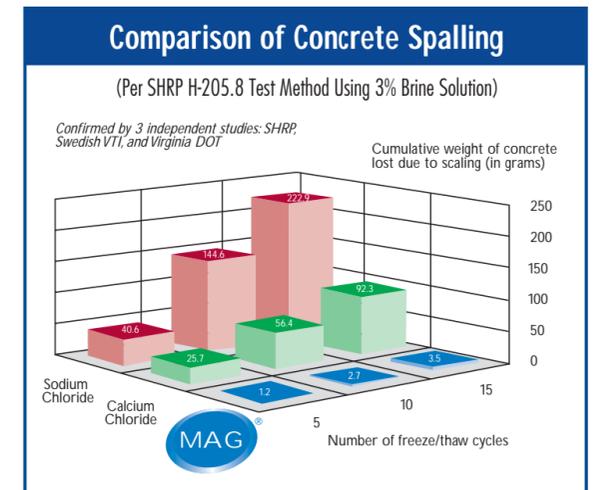


Data from University of Utah, Dept. of Metallurgical Engineering, Dr. Charles H. Pitt, Professor of Metallurgy. As shown by this data, a 3% magnesium chloride solution is less than 50% as corrosive towards steel as the next leading de-icer, at equal concentration.



## MAG® Is Less Damaging to Concrete Than Calcium Chloride and Sodium Chloride

All ice melting chemicals lower the freezing point of water and increase the number of freeze/thaw cycles. As a result of water repeatedly freezing and expanding, concrete surfaces will tend to spall, scale or break into small chips. New concrete surfaces and concrete of poor quality are particularly vulnerable to spalling. (Ice melting chemicals should not be used on concrete less than one year old.) As shown below in tests performed by the Strategic Highway Research Program (SHRP), National Research Council, Washington, D.C., the use of MAG as an ice melter resulted in significantly less concrete spalling than calcium chloride or sodium chloride.



3% test concentrations of brine were used since ice melter brine typically dilutes itself to this level soon after it is applied. After 15 freeze/thaw cycles, the use of sodium chloride resulted in over 63 times and calcium chloride resulted in over 26 times the amount of concrete loss than MAG.

