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Deicers

Deicers are often used on concrete roadways and walkways to create a safer surface for vehicles and pedestrians by melting snow and ice. There are many factors to consider when selecting a deicer for use. These factors include cost, lowest temperature of effectiveness, and potential effects on surrounding materials and vegetation. The composition of the deicer dictates the temperature at which it will be able to melt snow and ice.

Deicers work through a phenomenon called freezing point depression in which the freezing point of a solution (water with deicer) is lowered compared to that of the pure solvent (water).

The composition also dictates the effects on the materials. There is no single deicer composition that has no potential harmful effects on any material, so the selection must be made with an understanding of the surrounding environment as well as consideration for cost and temperature effects.

How do deicers work?

Deicers work through a phenomenon called freezing point depression in which the freezing point of a solution (water with deicer) is lowered compared to that of the pure solvent (water). At most temperatures encountered in the U.S., a small amount of liquid water is always in equilibrium with the ice, meaning that the ice is not 100 percent frozen. Generally, there is a thin liquid film on the surface of the ice. As the deicer dissolves in this liquid water, the freezing point is lowered, leading to increasing dissolution of the solid ice. The degree of freezing point depression is related to the concentration on a molar basis (rather than mass basis) as well as solubility in water. This is why the lowest typical use temperature varies with different deicers.

How do the different deicing chemicals differ from one another?

The varying deicing chemicals differ from one another on the basis of cost, lowest typical use temperature, and effect on surrounding materials and vegetation. The materials that may be present where deicers are used are concrete, asphalt, stone, mortar, steel, aluminum, and copper. Prior to selecting a deicer, it is important to identify which materials may come into contact with deicer solutions and to understand potential deleterious effects on these materials.

The following table describes some properties and potential effects on materials and vegetation. This table is not intended to be exhaustive but rather provide some guidance for further study or evaluation if warranted.

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Deicers (CONTINUED)

Material	Relative cost	Common uses	Lowest Typical Use Temperature	Potential Effects on Surrounding Materials
Sodium chloride [rock salt, halite]	$	Roadways, sidewalks	15°F	■ Corrosive to most metals ■ Damaging to many types of vegetation ■ Can cause salt scaling degradation of concrete
Calcium chloride	$$	Roadways, sidewalks	-22°F	■ Corrosive to most metals but less so than sodium chloride ■ Somewhat harmful to vegetation but less so than sodium chloride ■ Can cause salt scaling degradation of concrete
Magnesium chloride	$$	Roadways, sidewalks	5°F	■ Corrosive to most metals but less so than sodium chloride ■ Somewhat harmful to vegetation but less so than sodium chloride ■ Can cause a greater degree of salt scaling degradation of concrete than sodium or calcium chloride
Calcium magnesium acetate [CMA]	$$$	Roadways, sidewalks	20°F	■ Somewhat corrosive to most metals, although substantially less so than sodium chloride ■ Many CMA deicers are sold as blends with chloride salts, so the package should be checked prior to use ■ Can cause a greater degree of salt scaling degradation of concrete than sodium or calcium chloride ■ Not expected to harm vegetation
Potassium acetate or sodium acetate	$$$$	Airports	-15°F	■ Somewhat corrosive to most metals but substantially less so than sodium chloride ■ May cause alkali-silica reaction in concrete and subsequent degradation of the concrete ■ May refreeze because of hygroscopic nature (pulls moisture from the air), which may limit effectiveness
Urea	$$	Airports	18°F	■ Typically low corrosivity to steel ■ Can cause environmentally assisted cracking (also called stress corrosion cracking) of copper ■ May cause damage to vegetation ■ Can cause nitrogen pollution to waterways
Glycols (ethylene glycol, propylene glycol)	$$$$	Airports	~-40 to -30°F	■ Generally not corrosive to metals ■ Ethylene glycol is toxic to humans and animals ■ Environmental disposal concerns

Deicers (CONTINUED)

The following is a partial list of references with useful information on deicers and potential effects on construction materials:

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