

A GUIDE TO EUTECTIC VS. EFFECTIVE TEMPERATURES

When it comes to using deicing chemicals, success depends on science and experience. Solid deicers must go into solution/form brine before they can melt ice. Deicers are used to prevent ice from bonding to the surface or to regain bare surface conditions by breaking an ice-to-pavement bond. Deicers have to lower the freeze point of water to do that. Here are some key terms to learn when trying to understand the science behind the strategy:

EUTECTIC TEMPERATURE

The lowest temperature that a deicing chemical in solution can melt ice before the solution freezes.

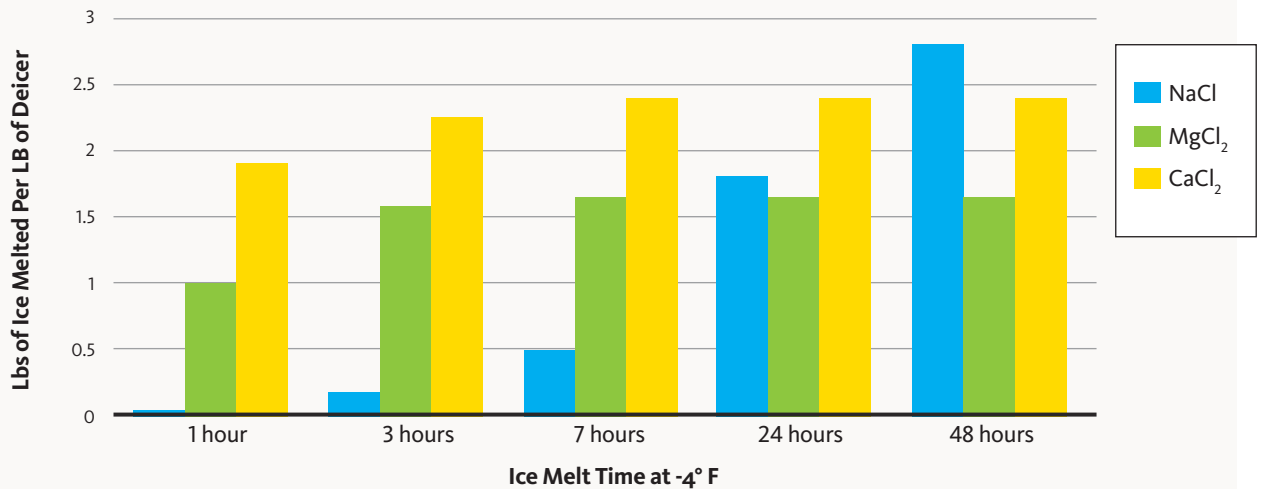
EFFECTIVE TEMPERATURE

The lowest temperature at which the results and the time required to achieve them justify the costs.

Why such a difference? The effective temperature is higher largely based on the varied melting speed and capacity deicers produce when going into solution relative to pavement temperature and moisture.

Melting Speed (the speed at which deicers melt ice): Endothermic deicers (absorb heat to go into solution) melt slower and are less effective at lower temperatures [e.g., sodium chloride (NaCl)]. Exothermic deicers (produce heat when going into solution) melt faster at lower temperatures [e.g., calcium chloride (CaCl₂) and magnesium chloride (MgCl₂)].

Melting Capacity (the amount of ice a deicer can melt in a specified period of time): At lower temperatures, MgCl₂ and CaCl₂ produce greater melting capacity in a shorter time. As pavement temps increase above 15° F, NaCl can equal or outperform them.



(Courtesy of Scott Koefod, *Fundamentals of Liquid Deicer Performance*, 2018)

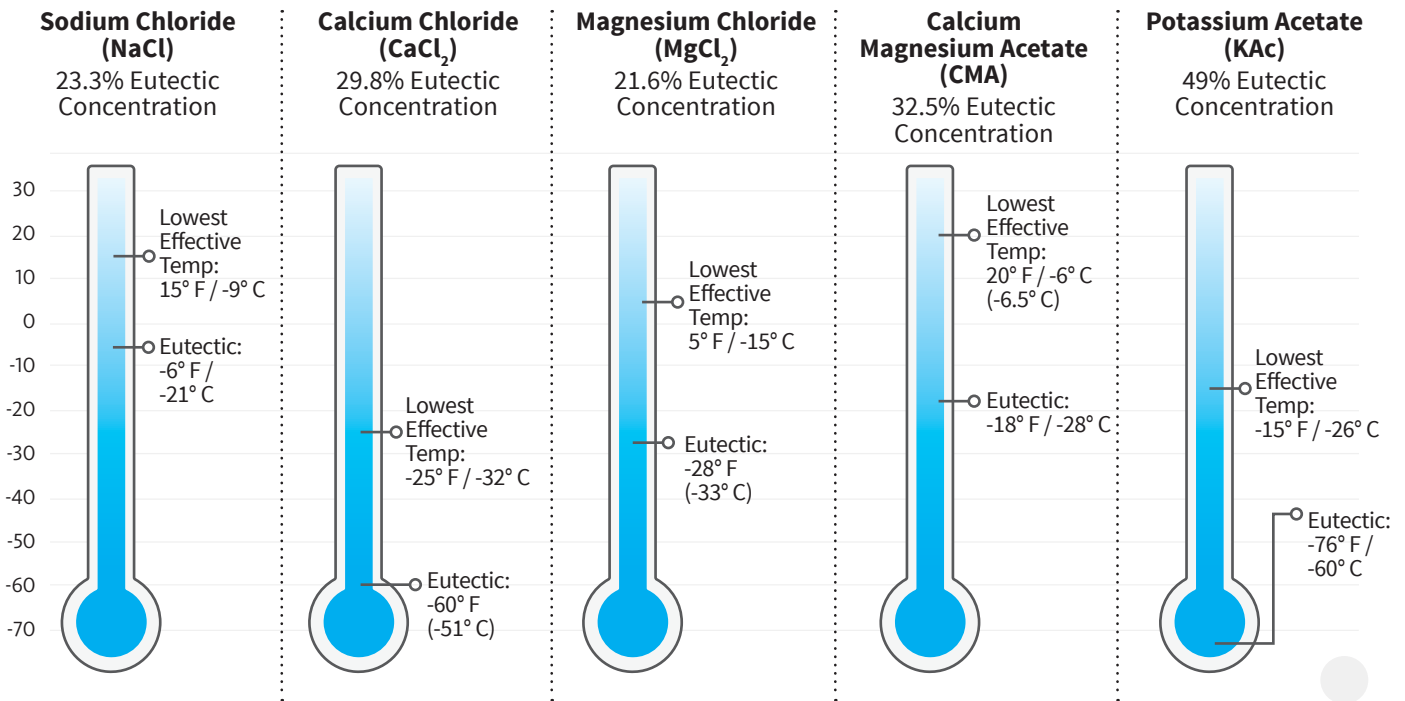
Applying the science of deicers relative to performance goals/time to achieve them, weighing situational variables like dilution/cycle times and factoring in material cost makes the effective temperature the pivotal consideration in developing an efficient and cost effective material strategy.

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A GUIDE TO EUTECTIC AND EFFECTIVE TEMPERATURES



TEAR OUT AND SAVE

While all deicers will work up to 32°F pavement temperature, it is commonly agreed that for most purposes salt becomes the most practical solution above 15°F when weighing melting capacity/speed/cost.

The deicer's concentration (ratio of active ingredient by weight to water) at its eutectic temperature is the **eutectic concentration**. The lower the concentration, the higher temperature at which the solution will freeze. Higher concentrations will fall out of suspension. It is a misconception that the lower a deicer's eutectic temperature the more effective it is. Calcium magnesium acetate has a lower eutectic temperature than sodium chloride but offers less melting capacity at lower temperatures.

Pavement Temperature (°F/°C)	MELT CAPACITY	MELT SPEED
	Lbs. of ice melted by 1 lb. of salt	Dry salt melt times
30 / -1	46.3	5 minutes
25 / -4	14.4	10 minutes
20 / -7	8.6	20 minutes
15 / -9	6.3	1 hour
10 / -12	4.9	Dry salt is ineffective
5 / -15	4.1	
0 / -18	3.7	
-6 / -21	3.2	

Effective Temperature:
Lowest temperature where results justify the amount of salt/cost + time to achieve goals

Source: Pam Buckley, Sustainability Manager, Douglas Dynamics