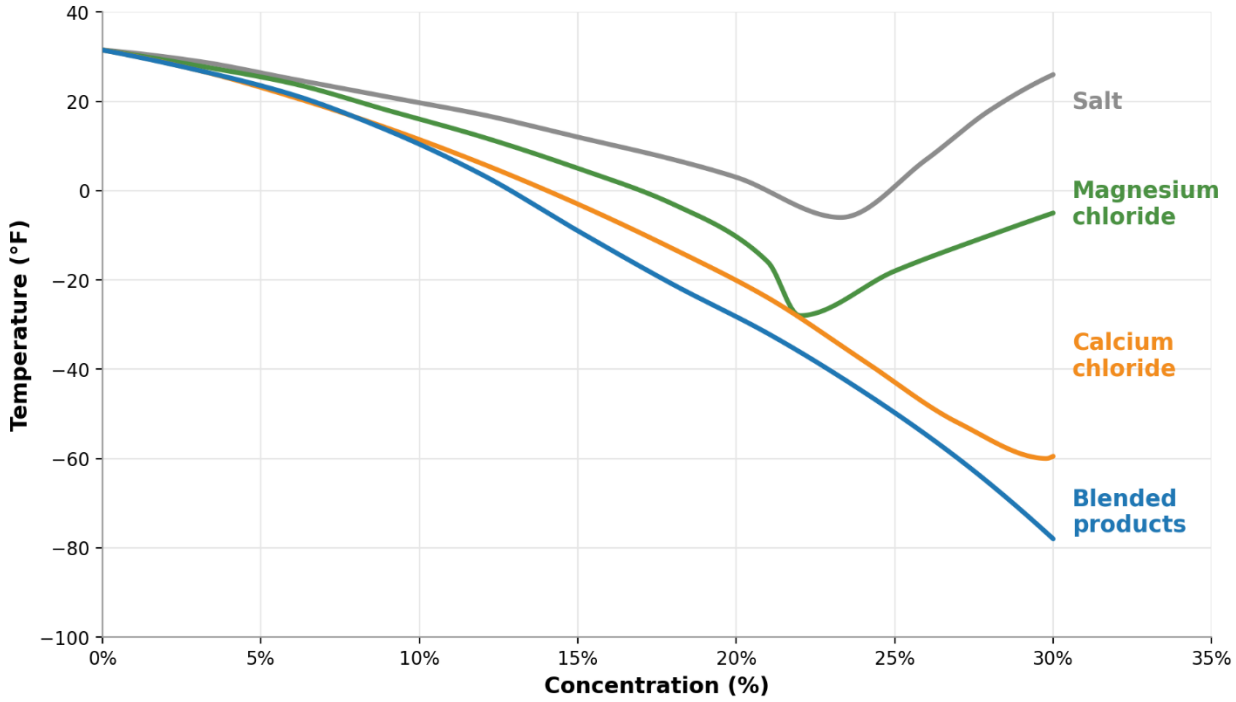
Every Brine Has a Sweet Spot

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If you've attended a winter maintenance seminar in the past several years, odds are you've seen The Curve Image once or twice. You know the one… it has all the curvy lines and science-y chemical names, and concentration and temperature, and so much information! It's a lot to take in, and truth be told, we've eliminated it from several of our own workshops because it is just so much. But at the root of the Fabled Curve Image is some valuable information, and it can, in fact, be an instrumental tool in moving from traditional materials like rock salt and sand to increasingly popular and effective materials like mag chloride or blended products. So we put our heads together to try and simplify the whole thing. Drum roll please….



*Visual representation only and referencing eutectic temperatures.
Actual performance and effective temperatures vary based upon conditions. This chart is not scientifically precise.

Wait… but there's still curves and chemical names and data… We know, we know but before you cry foul here's what we really want you to take away from this chart: every brine has a sweet spot, whether it's a rock salt-turned-brine brine, magnesium chloride, calcium chloride, or another blended product. Follow any one of these curves from left to right. As the concentration of material increases, the temperature where that solution can remain liquid (and doing its work) gets colder, until we reach the bottom of the curve. That's the

sweet spot, or what we call the eutectic point. **Beyond that point, adding more chemical doesn't help… the temperature at which it would freeze actually starts climbing back up again. Over-concentrating doesn't just waste product; it can leave you with a solution that performs worse at low temperatures than if you'd stopped at the sweet spot.**

For regular salt brine, like is formed when rock salt meets moisture and brines up, that sweet spot is about 23.3% salt, where the solution can theoretically stay liquid down to around -6°F. Other chemicals have different sweet spots and can remain liquid at lower temperatures than salt. Magnesium chloride bottoms out colder, around -28°F at roughly 21–22% concentration. Calcium chloride goes colder still; its eutectic point sits around -60°F near 29.8% concentration. That's one reason we may use these products instead of, or in addition to, sodium chloride.

The practical takeaway is this: don't assume more product automatically buys you more performance. And remember: the eutectic point is based on laboratory temperatures, not working temperatures like you have out on the roads. Just because a solution can theoretically remain liquid at a certain temperature does not mean it will effectively perform at that temperature on the road. Pavement temperature, precipitation, wind, application rate, timing, traffic, plowing, and other conditions all matter. The actual effective temperature is likely much higher than the eutectic temperature.

So what does this mean when we're anti-icing?

With anti-icing, we're getting the chemical onto the pavement before snow or ice has a chance to bond to it. We start with a properly concentrated liquid and apply the right amount for the expected conditions.

In ideal anti-icing scenarios, your storm strategy is put into place well before the precipitation starts, and you may have applied anti-icing materials a day or two before (24-72 hours). This gives the brine plenty of time to dry, leaving the anti-icing chemical behind on the pavement.

Then precipitation arrives. That moisture redissolves the chemical and forms brine on the pavement. Remember, salt does its melting work in solution, as brine, not as a dry crystal.

That's our head start. The anti-icing material is already there when the precipitation arrives, helping prevent or weaken that snow-and-ice bond before it develops.

As precipitation continues and melting occurs, more water enters that brine. Dilution is normal and expected. What matters is how much water is being added, how cold the pavement is, and how much anti-icing material is available.

And here's where this chart becomes useful: the colder the pavement, the less dilution that brine can tolerate before it begins to freeze. **Picture your brine's concentration sliding left along its curve as it dilutes: the colder the pavement, the less room you have to slide before you cross back into the freezing zone.**

A light or short-duration event may not dilute our treatment enough to require additional material. A heavier or longer event may. That's why we watch pavement temperature, precipitation, and road conditions and adjust our treatment as the storm develops.

What if we're deicing?

The same chemistry still applies.

If we're applying dry rock salt, it needs moisture to dissolve and form brine before it can do its melting work. If we're applying liquid during the storm, we're already supplying that brine.

Either way, once we're dealing with accumulated snow and ice, **we shouldn't ask salt to do all the work**. We mechanically remove as much snow and slush as practical, apply the appropriate amount of deicer for the conditions, monitor pavement temperature, and retreat when needed.

At lower pavement temperatures, sodium chloride has less working range. That's where another chloride or a blended product may be appropriate.

But don't choose a product simply because its curve goes lower. Field effectiveness, speed of action, pavement temperature, precipitation, application rate, timing, and plowing all matter. For instance, **blended products may have a deeper curve, working down to extremely low temperatures.** That doesn't mean a blended product has no eutectic point; it means the true sweet spot for that product is colder than what might have been tested at any given concentration. But if a particular blended product fetches a premium purchase price, requires additional storage or application strategy, consider the additional "wiggle room" it provides you in treating at lower effective temperatures relative to the increased costs and demands of the material before determining if the blend belongs in your toolbox. Not all materials will make sense for your individual operations, but it's likely expanding

your available materials beyond straight dry rock salt and sand will have positive impact to your operations.

So the takeaway from this chart of fabled lore is simple: **every chemical must become a brine to work, and every brine has a sweet spot**. For some chemicals, like Magnesium Chloride or Calcium Chloride, or blended products, that sweet spot is going to occur at a lower temperature, allowing you to treat effectively at lower temperatures. But regardless, once you hit that sweet spot for any given material, more chemical isn't automatically better; past that sweet spot point it can work against you. Know your pavement temperature, start with the right concentration and product, and adjust your treatment as conditions change.