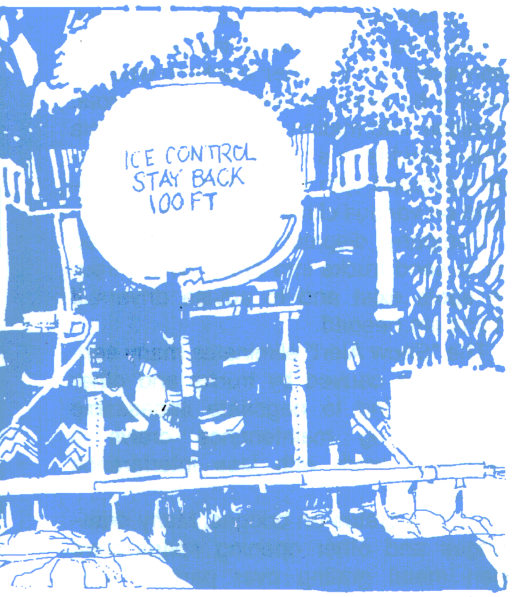
9/ ANTI-ICING



"Iowa found salt brine with its eutectic temperature of -6°F, works as well as liquid $CaCl_2$. Liquid calcium chloride is extremely expensive at 63 cents/gallon compared to salt at 6 cents/gallon."
—Tom Donahey, Director of Maintenance Programs, IADOT

A relatively new weapon in the snowfighter's arsenal in North America is anti-icing. But it has a long history of keeping European roads safe and passable.

Anti-icing measures take place before a precipitation event to prevent the formation or development of bonded snow and ice on the road surface. Research has shown that timely applications of anti-icing materials can cut the cost of maintaining a safe road surface by 90% over the cost of deicing. Anti-icing chemicals are applied in liquid form (brine) to road surfaces just before a snow or ice storm. Liquid sodium chloride (NaCl) is the most effective choice for anti-icing above 15°F.

Anti-icing has many advantages.

- Anti-icing returns road surfaces to normal faster, resulting in fewer accidents and delays.
- Salt needs moisture to be effective. Applying brine jumpstarts the melting process.
- Brine sticks to the road surface. It will not be as easily blown off the road by wind or traffic so material is more efficiently used.
- If the storm is delayed, salt residue remains on the road ready to begin work when precipitation begins.
- Crews can begin treatment in advance of a storm. Because anti-icing prevents the bonding of snow and ice to pavement, snowfighters have less work to maintain safe roadways as the storm progresses.
- Increased efficiency results in use of less deicer and manpower, therefore lowering the cost of maintaining safe road conditions. The use of less deicing materials also minimizes environmental concerns.

Products available for use in an anti-icing program are sodium chloride, calcium chloride, magnesium chloride, potassium acetate, and calcium magnesium acetate. Each product has its own advantages and disadvantages. The most common material in use is sodium chloride (salt) in the form of a brine made from a mixture of rock salt and water. Salt brine is effective to -6° F and is a proven anti-icing agent in use throughout the snowbelt.

Some agencies use calcium or magnesium chloride in a brine solution which is effective down to -60°F, but is more than six times as expensive than salt, and is more difficult to handle. Also, calcium and magnesium chloride residue on road surfaces can attract moisture at lower relative humidity than salt resulting in dangerous, slippery conditions under certain circumstances.

Salt Brine Manufacture

Salt brine is made by mixing rock salt or solar salt with water. The process is simple: the resulting brine should be approximately 23% NaCl.

The proportion of salt to water is critical to the effectiveness of the brine. Too much or too little salt affects the freeze point depressing qualities of the brine. The proper brine mixture is 23.3% salt content by weight. This is the concentration at which salt brine has the lowest freezing point, -6°F. It is known as the eutectic point. This percentage is measured with a salometer, a specialized hydrometer. Salt is added to the water until a 88.3% measurement on the salometer is obtained. This results in the proper 23.3% salt content.

Commercial brine makers are available at a cost of approximately $4500. Many agencies have made their own brine makers using water tanks and PVC pipe for substantially lower cost. Brine is usually made at the local maintenance facility sites and stored in large tanks in locations convenient for loading into saddle tanks on the sides of the V-box or anti-icing equipment.

Application Equipment

Brine applicators are commercially available for about $1,000. Some agencies have manufactured their own application equipment using large tanks and PVC piping. Some equipment is designed to be loaded onto the bed of spreading trucks, towed behind maintenance equipment or permanently mounted on truck beds. It can be as simple as a gravity fed spraying system with a operator controlled cut-off valve or a more complex

Hydrometer / Salometer Chart for Salt Brine

% Salt	Hydrometer Specific Gravity	Salometer Using 0 - 100%
0	1	0
1	1.007	4
2	1.014	7
3	1.021	11
4	1.028	15
5	1.036	19
6	1.043	22
7	1.051	26
8	1.059	30
9	1.067	33
10	1.074	37
11	1.082	41
12	1.089	44
13	1.097	48
14	1.104	52
15	1.112	56
16	1.119	59
17	1.127	63
18	1.135	67
19	1.143	70
20	1.152	74
21	1.159	78
22	1.168	81
23	1.176	85
24	1.184	89
25	1.193	93
26	1.201	96
27	–	100