

Liquid Applicators to Combat Snow and Ice in Iowa DOT



Introduction

This document is a compilation of the equipment used by the Iowa Department of Transportation in its efforts to combat snow and ice with liquid deicing chemicals. The document is divided into three areas, brine making and storage, prewetting systems and anti-icing and specialty equipment. Each of the areas will provide readers with a historical look at the equipment either purchased from suppliers or developed by maintenance staff to meet the needs of our winter operations. Some of the earlier equipment used to support our use of liquid deicing chemicals is still in use today while some of the newer equipment may be available in only a few locations around the state.

In the early years very little was understood about the equipment needed to support prewetting and anti-icing with liquid deicing chemicals. Now, after 4-5 years of experience with liquid deicers many refinements have been made to existing equipment and advancements by equipment manufacturers have helped push the use of liquid deicers as a key tool for winter operations. Our latest efforts have been in the area of trailers that can be used to support anti-icing operations and new tank configurations in the bed of the truck that will allow us to maximize the amount of liquids and dry materials that can be transported in a truck to meet our needs for anti-icing, prewetting and deicing.

The document is primarily a photo album of past and present equipment used by the Division to support the use of liquid deicing chemicals. Readers should contact a member of the anti-icing planning team to find out more about the equipment contained in this document or the Office of Maintenance Safety at (515) 239-1355.

Table of Contents

Contacts.....	1
Brine Makers.....	4
Prewetters	12
Anti-icing	17
Glossary	34

Anti-ice Planners

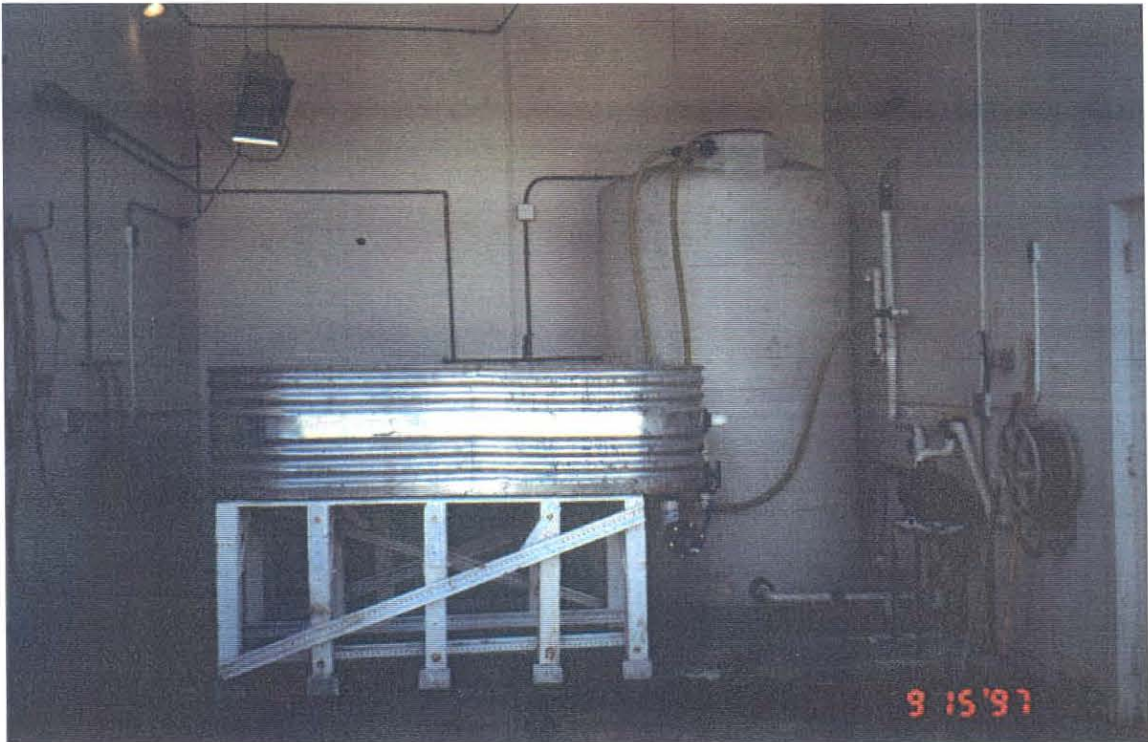
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Type: Homemade brine maker

GPH: 2,000

Connectors (type and size): 1.5 inches water line

How does it clean out: Manual clean out required with shovel and hose

Cost: < \$1,000

Capacity: 500 gallon

Water pressure required: 50 pounds pressure

Dimensions of the unit: 3' x7.5' and 2 units

Electrical requirements: 120 volts

What's it made of: Typical livestock tanks structure built from 4'x4''s and other materials. All plumbing made from common PCV pipe and fittings

Location: Des Moines West



Type: Brine maker (Varitech) Welded plastic with hopper

GPH: 2,000 gallons

Connectors (type and size): 1.5 inch water line

How does it clean out: 4 inch clean out on bottom for flushing

Cost: \$5,500

Capacity: 2,000 gallon

Water pressure required: 50 to 60 psi with 1.5 inch water spray

Dimensions of the unit: 8' x 4'

Electrical requirements: 110 volts

What's it made of: Welded Plastic

Description: In addition a homemade storage bin was added to hold two loader buckets.

Location: Des Moines North



Inside view of Varitech unit – Shows water supply system that percolates water up and through the salt that then overflows as brine into the lower tank.



Type: Brine maker (Sprayer Specialties)

GPH: 3,400 gallons

Connectors (type and size): 2 inch water supply

How does it clean out: 4 inch clean out located at the end of both tanks for flushing – residual must be removed manually

Cost: \$4,000

Capacity: 1,400 gallon for storage underneath

Water pressure required: Operates with plumbing fixtures up to 2 inches

Dimensions of the unit: 11'w x 7'd x 6'h

Electrical requirements: 110/ 220 volts

What's it made of: Tanks are made of plastic with a welded steel frame

Location: Des Moines North



Type: Mobile brine maker using Sprayer Specialties brine making machine and 12 ton trailer with 600 gallon clean water storage tank

GPH: 3,400 gallons

Connectors (type and size): 2 inch

How does it clean out: 4 inch clean out located at the end of both tanks for flushing – residual must be removed manually

Cost: \$4,000

Capacity: 1,400 gallon for storage underneath

Water pressure required: Operates with plumbing fixtures up to 2 inches

Dimensions of the unit: : 11'w x 7'd x 6'h

Electrical requirements: 110/ 220 volts

What's it made of: Tanks are made of plastic out with a welded steel frame

Purpose: Used in locations where water supply may not be sufficient to support water demands. Nurse garages will visit other garages in the area after a storm to refill local brine storage tanks using local salt supply. A fresh water tank is used to supplement water supplies with low pressure.

Location: Albia



Type: Mobile Brine Maker – another example of mounting a Varitech brine maker on a trailer with fresh water supply supplement.

Location: Ames Area Maintenance



Type: External storage with containment

Pump: 5 hp – 220V

Amount of required containment storage area: 110% of largest volume tank

Tank dimensions: 15 foot diameter

Tank costs: \$625

Tank capacity: Typically 2,500 gallon storage tanks made of UV resistant plastic

How to fill the tanks: Fill from the top and if multiple tanks are plumbed together all remaining tanks will fill evenly. Some tanks holding different deicing chemicals may need to be filled from the bottom to aid in circulation of the product unless mechanical agitation is provided.

Construction: Poured concrete wall or block large enough to contain 110% of the volume of the largest tank in containment area if equipped with individual shut-offs.

Location: Des Moines North



Another example of external storage using block wall construction, external lighting and covered pump

Location: Jefferson



Type: Swenson spreader

Cost: \$1,200 to \$1,300

Nozzles: Fan

Description: Tailgate mounted prewetter

Capacity: 120 gallons



Type: Homemade mounted prewetter

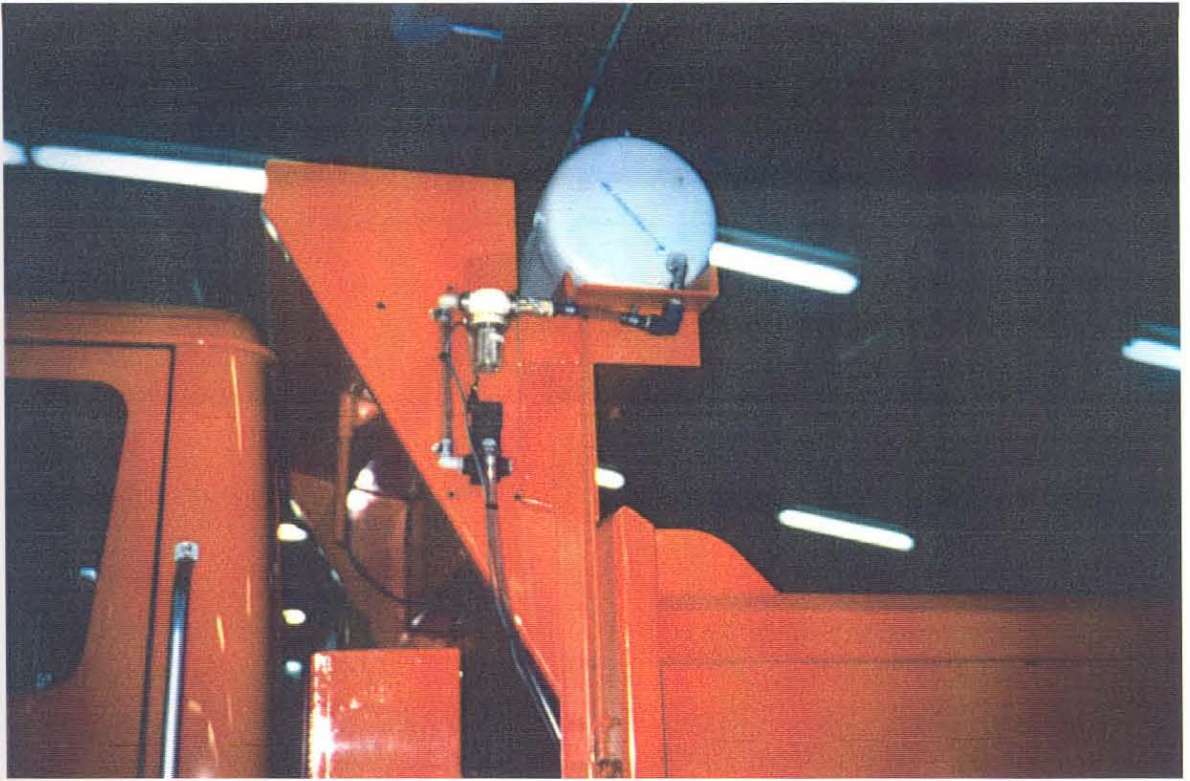
Cost: \$350

Pump: electric

Nozzles: Fan

Ground speed orientation: No

Capacity: 80 gallons



Type: Homemade prewetter

Cost: \$350

Pump: Electric

Nozzles: Fan

Ground speed orientation: No

Description: Made from common PVC pipe with endcaps. System has filtration added in plumbing to collect impurities

Location: Des Moines North

Capacity: 60-80 gallons



Type: Tailgate prewetter – 140 gallons

Cost: \$1,000

Pump: 4 gallons per minute

Nozzles: 2 brass fan nozzles at 1.0 gallon per minute

Description: Current prewet system purchased with new vehicles

Capacity: 140 gallons



Streamer nozzles - Provide traveling public with dry surface on part of the roadway



Fan nozzles – Provide complete coverage of roadway

These photos represent the most commonly used nozzles for direct liquid application to the roadway



Type: Pick-up mounted liquid applicator for frost treatment

Cost: \$400

Pump: Electric

Nozzles: Fan

Ground speed orientation: No

Description: Designed to handle frost on bridges or spot treatment of roadways. Caution to watch weight restrictions on pick-ups. Salt brine weights 10+ pounds per gallon. If this tank were filled to capacity, it would be over weight.



Type: Homemade system utilizing 900 gallons liquids with enough space to carry 6 tons of dry materials. Can be used to support anti-icing, prewetting and deicing in one unit.

Cost: \$1,200

Pump: Ace 180 gpm

Nozzles: Streamer

Ground speed orientation: No but has counter system installed for measuring distribution of materials

Lines and spraybars: One spraybar made of PVC with detachable streamer or spray nozzles

Location: Osceola



Type: Anti-icing (Epoke) First unit used in the state to conduct anti-icing testing

Used in the Des Moines area purchased as part of Iowa's participation in the FHWA Test and Evaluation project 28 on Anti-icing

Capacity: Depends on truck carrying capabilities, 1,800 gallon typical

Cost: \$25,000

Pump: Self contained Hydraulic

Nozzles: Fan

Ground speed orientation: Yes

Description: Unit has two spray bars, one that provides spraying capabilities to two lanes at low speeds while the other assists at higher speeds.

Location: Des Moines West



Type: 1800 gallon slip-in anti-icing unit provide by Sprayer Specialties

Cost: \$6,500

Pump: 114 gpm self loading pump

Nozzles: Fan

Ground speed orientation: Yes – Raven 400

Lines and spraybars: One spray bar with 12 – 36 foot spray capabilities

Location: Des Moines North



Type: Homemade 1800 gallon slip in anti-icing unit

Capacity: 1,850 gallons

Pump: 114 gpm, with manual controls and individual shut-offs

Nozzles: Fan

Number of lanes: 3

System: Slip-in version driven by hydraulic system capable of 60 gallons per lane mile output with no ground speed orientation

Location: Des Moines North



Type: Homemade 900 gallon liquid tank with 6 ton remaining for salt used for anti-icing, prewetting or dry applications as needed

Cost: \$1,200

Pump: 180 gpm

Nozzles: Streamer

Ground speed orientation: No

Description: Can apply salt and brine at the same time. Electric solenoid switch used to separate prewet from anti-ice

Location: Des Moines North



Type: Monroe 1,800 gallon slip-in anti-icing units (current models)

Cost: \$6,500

Pump: 180 gpm

Nozzles: Fan

Ground speed orientation: Yes – Raven 400



Type: Pressurized 1800 gallon, trailer mounted anti-icing unit (2-925 gallon joined tanks)

Cost: \$2,800

Pump: 180 gpm hydraulic pump

Nozzles: Fan or streamer

Trailer sizes: 15 ton with modifications

Ground speed orientation: No

Description: Allows operators to provide pure liquids, combinations of dry materials and liquids or straight materials from one mobile unit with internal driver controls

Location: Colfax



Type: 1,800 gallon anti-icing trailer

Cost: \$3,000

Pump: 180 gpm

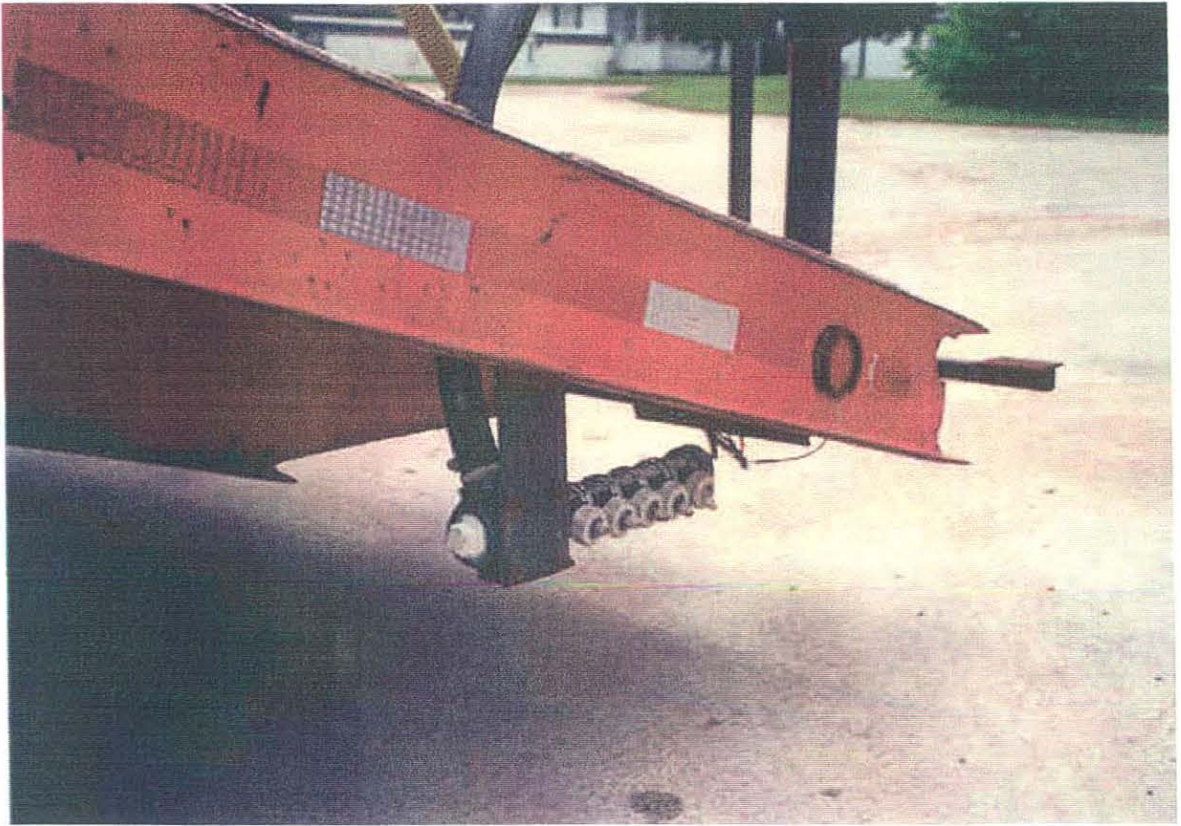
Nozzles: Streamer – 12 – 36 foot capabilities

Trailer sizes: 15 ton

Ground speed orientation: Raven 400

Description: Using existing garage trailer during winter months as anti-icer

Location: Anamosa



Type: Stream nozzles on trailer mounted anti-icing unit

Nozzles: Streamer

Trailer sizes: 15 ton

Description: Close up of nozzles on back of 1,800 gallon anti-icing trailer. Nozzles configured to spray adjacent lanes.

Location: Anamosa



Type: Prototype anti-icing trailer - 2,700 gallon

Cost: \$14,000

Pump: Under consideration

Nozzles: Under consideration

Trailer size:

Ground speed orientation: N/A

Description: This is an experimental trailer to test how much liquid can be effectively and safely pulled behind a truck to support anti-icing efforts

Location: ECITC



Type: 3600 gallon trailer mounted anti-icing unit (4- 925 gallon joined tanks with self loading abilities)

Cost: \$5,000

Pump: 180 gpm hydraulic pump (40 horse power)

Nozzles: Streamer and fan

Trailer size: 40 ton

Ground speed orientation: Yes – Raven 400

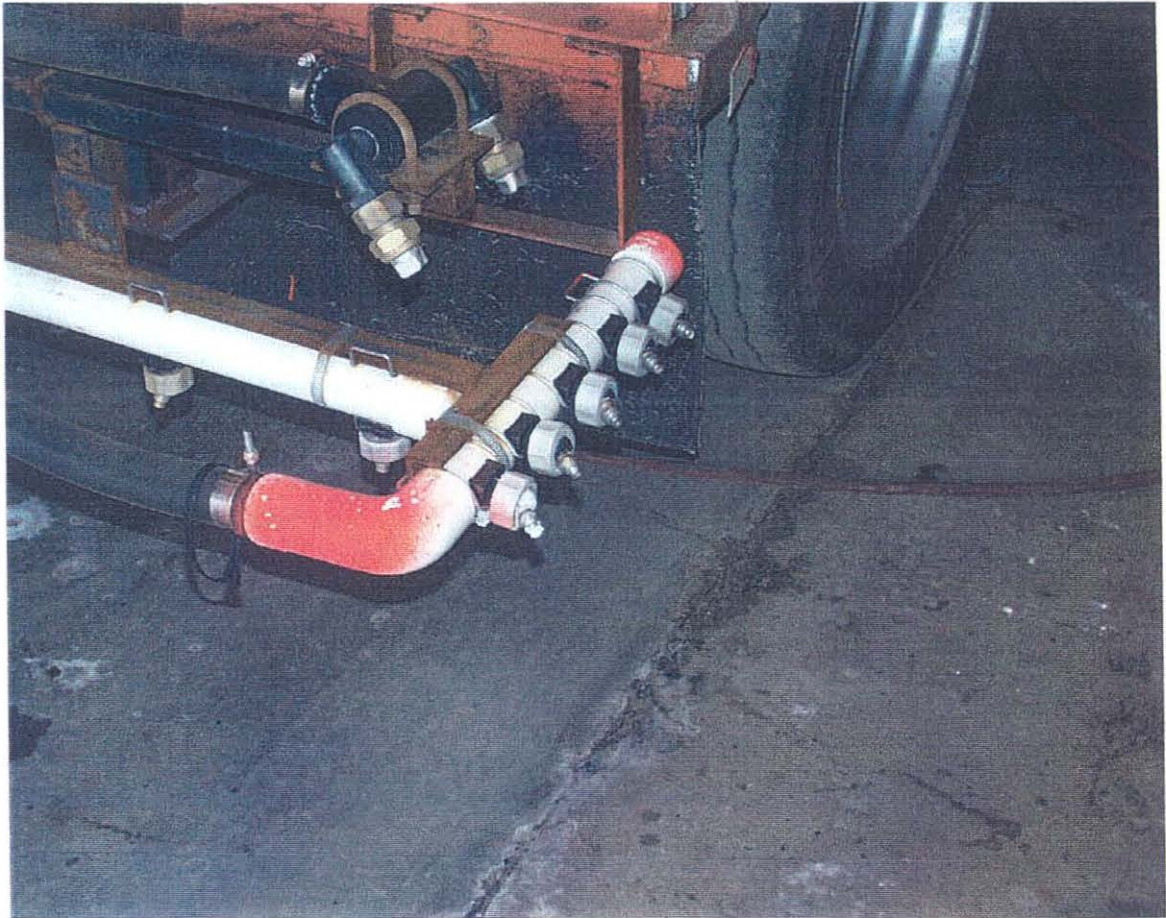
Description: Made in repair shop in Ames.

Location: Des Moines North



Type: 3600 gallon trailer-back view

Nozzles: Streamer



Type: 3600 mobile gallon close up on nozzles

Nozzles: Fan on top and streamer on the bottom

Capable of spraying 12 – 36 foot at a time



Type: 5,000 gallon anti-icing tank/ truck combination

Nozzles: Fan and streamer

Trailer sizes: 5,000 gallon

Ground speed orientation: Yes – Raven 400

Location: De Witt



Type: Nozzle and spraybars for tanker/ truck anti-icer

Nozzles: Fan and streamer

Ground speed orientation: Raven 400



Type: Concept Vehicle

Granular capacity: 7 ton hopper

Liquid capacity: One tank with 725 gallon capacity and two saddle tanks with 125 gallon capacity in each tank

Other features:

- Infrared pavement thermometer by Sprague Industries
- Mirror mount alcohol injection system to boost horse power while reducing exhaust temperatures
- Friction wheel
- Automatic Spreader control
- Emergency braking system that locks brakes when obstructions observed within 3 foot of sensors located on the rear of the truck
- High intensity lighting
- Heated lenses on tail lights and strobes

Glossary of commonly used snow and ice terms

Anti-icing- The snow and ice control practice that attempts to prevent the formation or development of bonded snow and ice by timely applications of a freezing point depressant.

(this does not refer to use of only liquids for anti-icing and does not state that the application needs to be applied several hours in advance. Typically anti-icing is performed by liquid application before precipitation begins but not a requirement if application can be made before the bond forms)

Prewetting- A snow and ice control practice of wetting a dry freezing point depressant before application to the roadway.

Freezing point depressant- Any deicing chemical that lowers the freezing point of water. The most common freezing point depressants used in the U.S. are Sodium Chloride, Calcium Chloride and Magnesium Chloride

Brine- A mixture of water and any chloride in solution (can be sodium, calcium or magnesium chlorides mixed with water and still be a brine)

Deicing- The snow and ice practice of removing bonded snow and ice from the roadway using freezing point depressants or mechanical methods. Typically associated with using freezing point depressants to melt through a layer of snow and ice to get to the underlying surface or by the use of plows or ice blades to remove snow and ice.

Black Ice- A popular term for a very thin, clear layer of ice that forms on the surface of the roadway when the pavement temperature is at 32 degrees F or slightly above and the air temperature is below freezing

Streamer nozzle- Nozzles designed to provide a direct stream of liquid onto the surface of the roadway. The purpose of using these nozzles is that when liquids are applied with these nozzles motorists are still provide a partial roadway that is dry, avoiding a totally liquid surface and reduced traction.

Fan nozzle- A nozzle system designed to spray liquids in a fan pattern that covers the entire surface of the roadway with liquids.