# 30 Years of Experience Applied to Parking Lots

by

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County of Wellington

# WHY AM I PRESENTING THIS TOPIC?

I have been studying the use of Liquid De-icers for Snow and Ice Control for 27 years ! My County has been using liquids for 35 years!

*And*

- We have common enemies !!

*What ???*

- Snow
- Ice
- Traffic (In your case pedestrians, as well as vehicles.)

# A LITTLE INFO ABOUT THE COUNTY

- 1400 lane km of rural highways
- 4 maintenance -2 works garages each
- Winter Budget of $4.5 Million
- Equip. replacement budget of $1.5 Million
- use 5,000 t of white salt
- use 5,000 t of treated orange salt (Thawrox)
- use 30,000 t of sand
- using liquid de-icers since mid 70’s
- used over 7,000,000 ltrs of liquid in the last 6 years

# A LITTLE ABOUT OUR EQUIPMENT

- computerized pre-wet control since 1992
- 26 combination sander/plows all with computerized spreader controls + pre-wet
- 24 of those are 3 in 1 units
- direct liquid units
  - 2 – 8,000 litre on tandem truck c/w plow and wing (3 lanes)
  - 1 – 2,000 litre on 3 tonne pick-up (1 lane)

# WHAT AM I GOING TO TALK ABOUT?

LOTS !!

- EC Code of Practice
- Liquids
- Anti-icing
- Training

# CURRENTLY

- Environment Canada formed a committee called the Multi-stakeholders Working Group on Salt Management who produced
  - A Code of Practice for the Environmental Management of Road Salts
- Who are affected?
  - Any municipality which uses 500 tonnes of salt

  and /or
  - Has vulnerable areas (area adversely impacted by the use of road salts)

  and in the future it may include those that
  - Maintain Parking Lots

# 2001 Environment Canada Report

"Road salts are entering the environment in large amounts and are posing a risk to plants, animals, birds, fish, lake and stream ecosystems and groundwater."

# WHY IS THAT?

- Each year Canada releases 5.2 MILLION TONNES of chloride salts into the environment from road salt
- Of that total, Ontario is responsible for 1.9 MILLION TONNES
- Parking lots account for ??% of that total It was 1st believed that this was 5-10% now 25-35%

# SO WHERE DO WE START?

We'll start with liquids.

**But First:**

lets look at some Chemistry Terms that relate to De-icing products.

# GENERAL CHEMISTRY TERMS

- **Effective Temperature** - Is the lowest temperature in which the cost of the application is justified by the results obtained.
- **Eutectic Temperature** - The temperature at which a liquid freezes in a concentrated solution in laboratory conditions.
- **Viscosity** - The quality or property of a fluid that causes it to resist flow.

# GENERAL CHEMISTRY TERMS

- **Exothermic** - A chemical reaction that gives off heat. Magnesium Chloride ($MgCl_2$) gives off heat which makes it less reliant on air temperature and thus can work at lower range.

- **Endothermic** - A chemical reaction that absorbs heat. Salt absorbs heat but in doing so reduces it's effective operating temperature.

# LET'S GET SOMETHING STRAIGHT!!

**LIQUIDS are :**

- **the most misunderstood**

**and,**

- **the most underutilized**

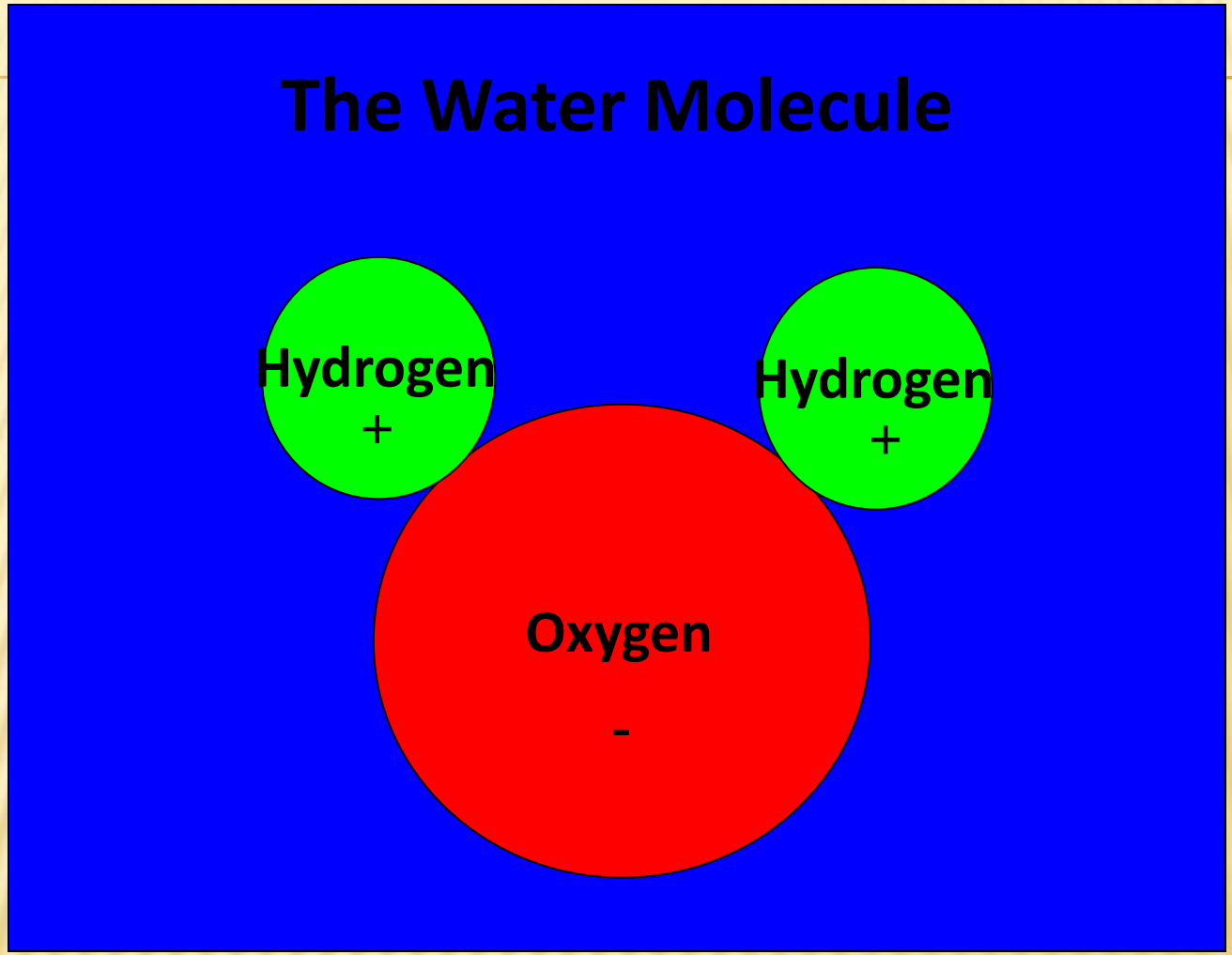
**and,**

- **the most misused tool available to you to fight winter !**

# SO: How Does Water Freeze?

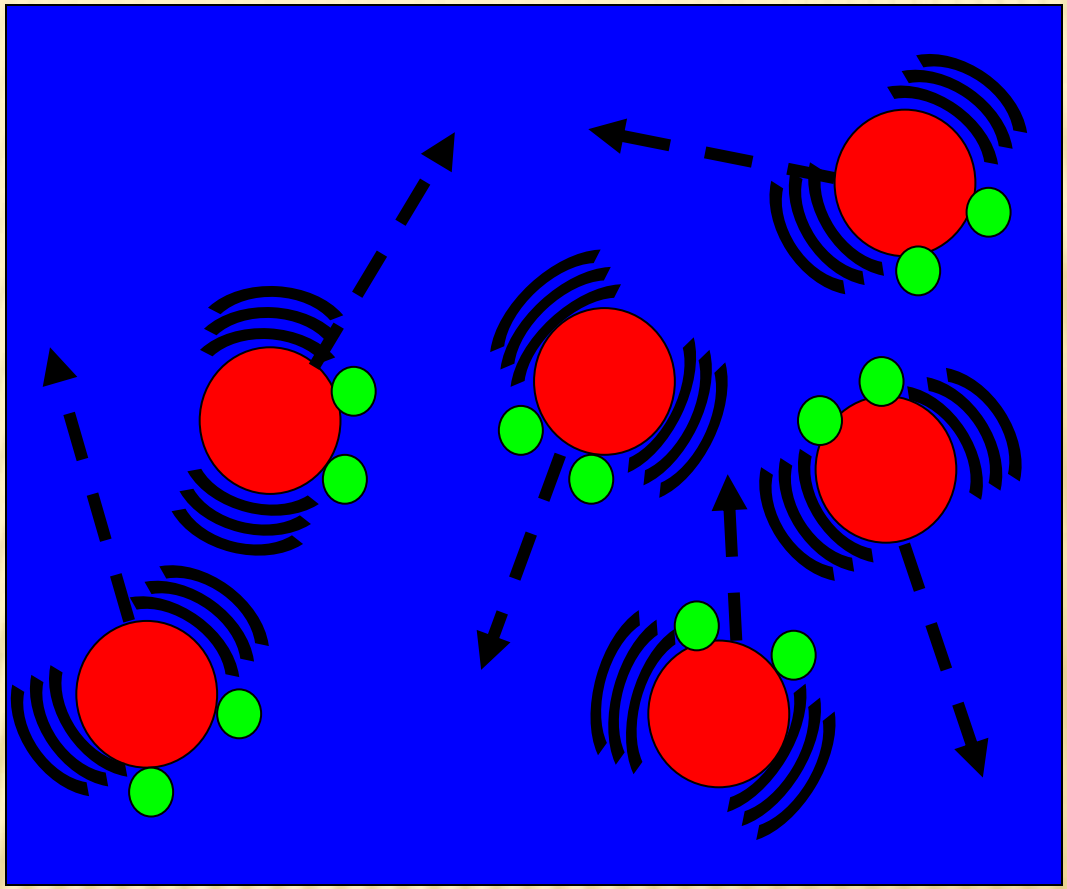
**There are three basic states of water**

- **Vapour (gaseous)**
- **Liquid**
- **Solid (ice crystals)**



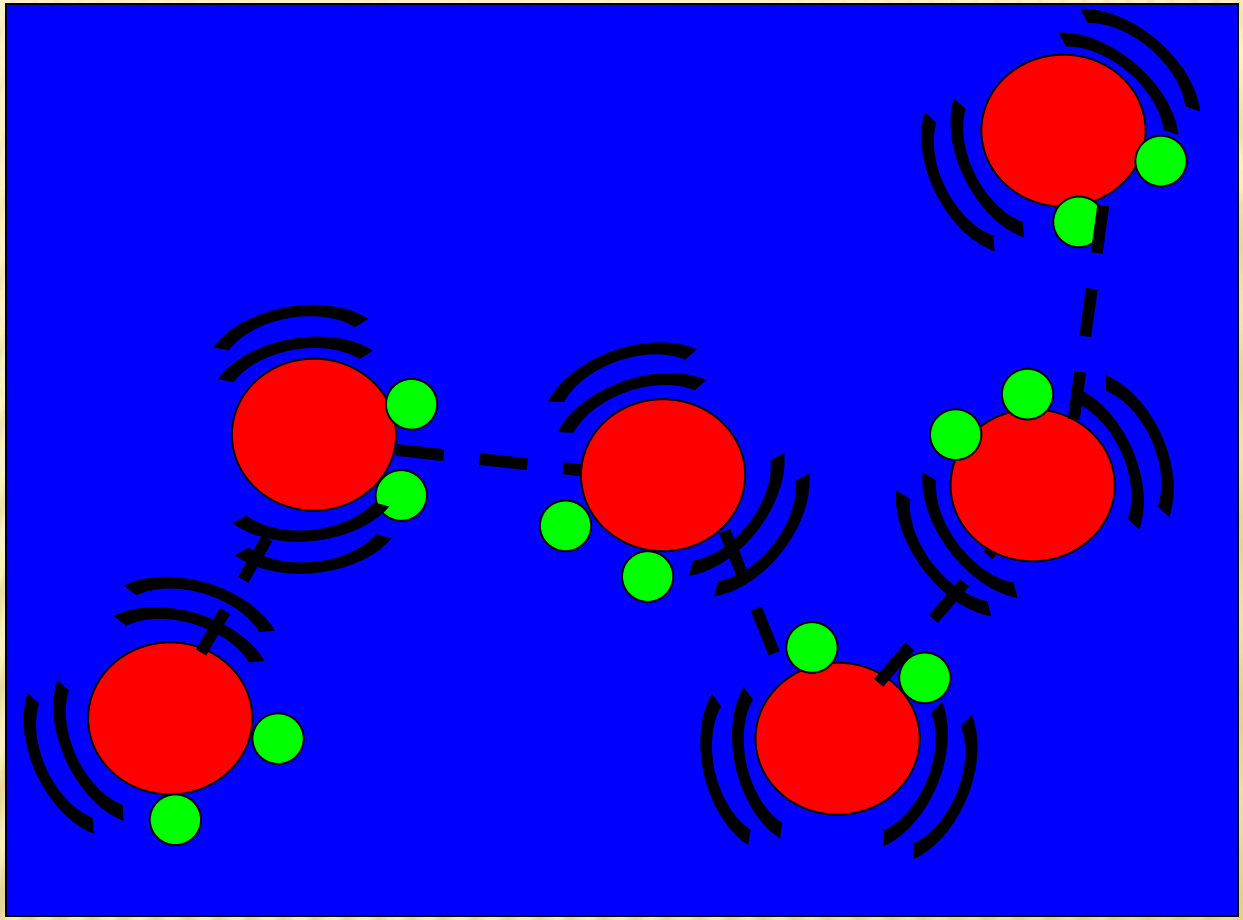

Water ($H^2O$) consists of 1 oxygen atom and 2 hydrogen atoms. The O is negatively charged and H are positive

# Vapour



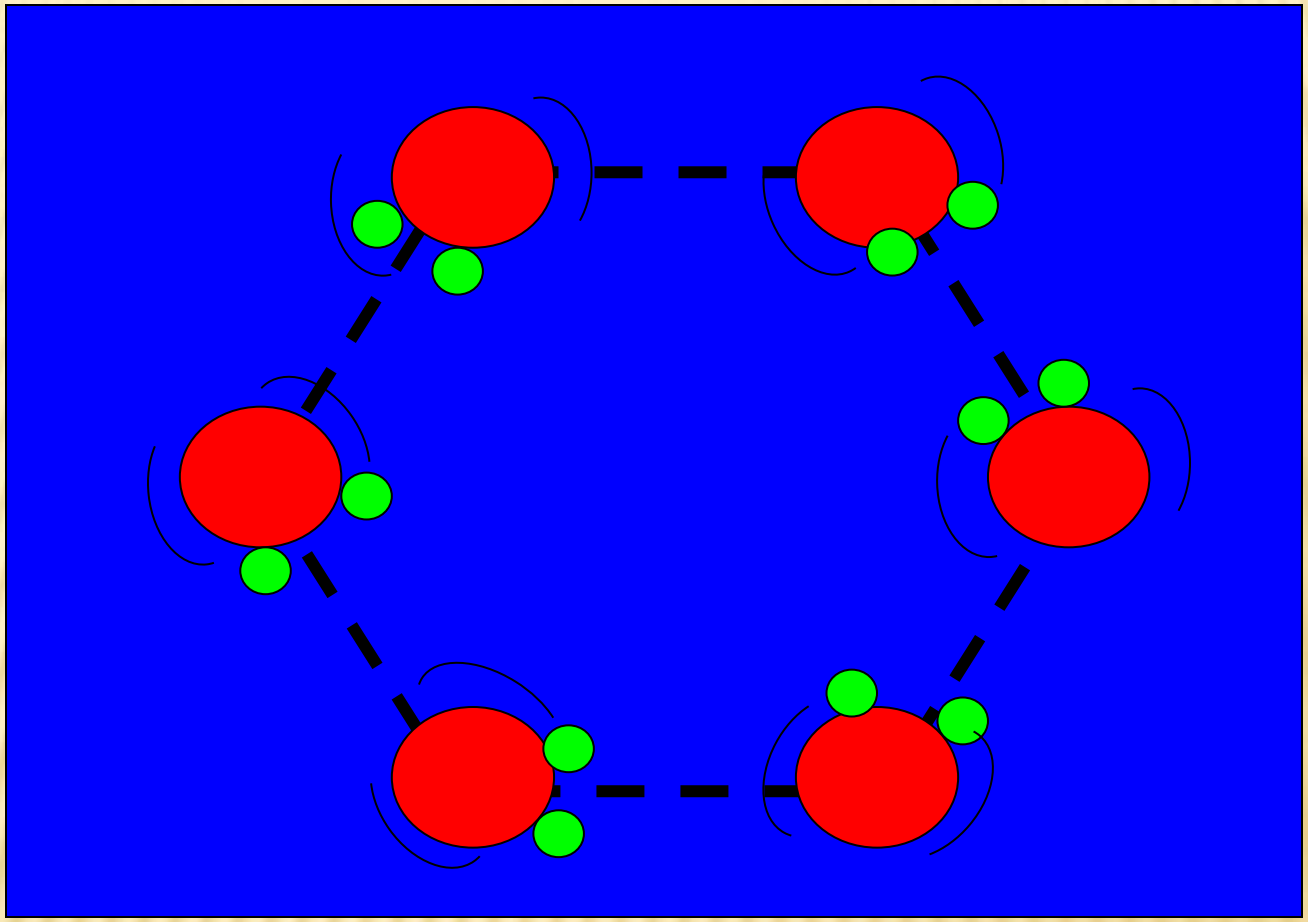
**Water vapour molecules form poor connections as they move about rapidly.  Heat causes water molecules to break down.**

# Liquid (Water)



**Water molecules form loose attractions to each other until heated or cooled, which changes their attraction accordingly.**

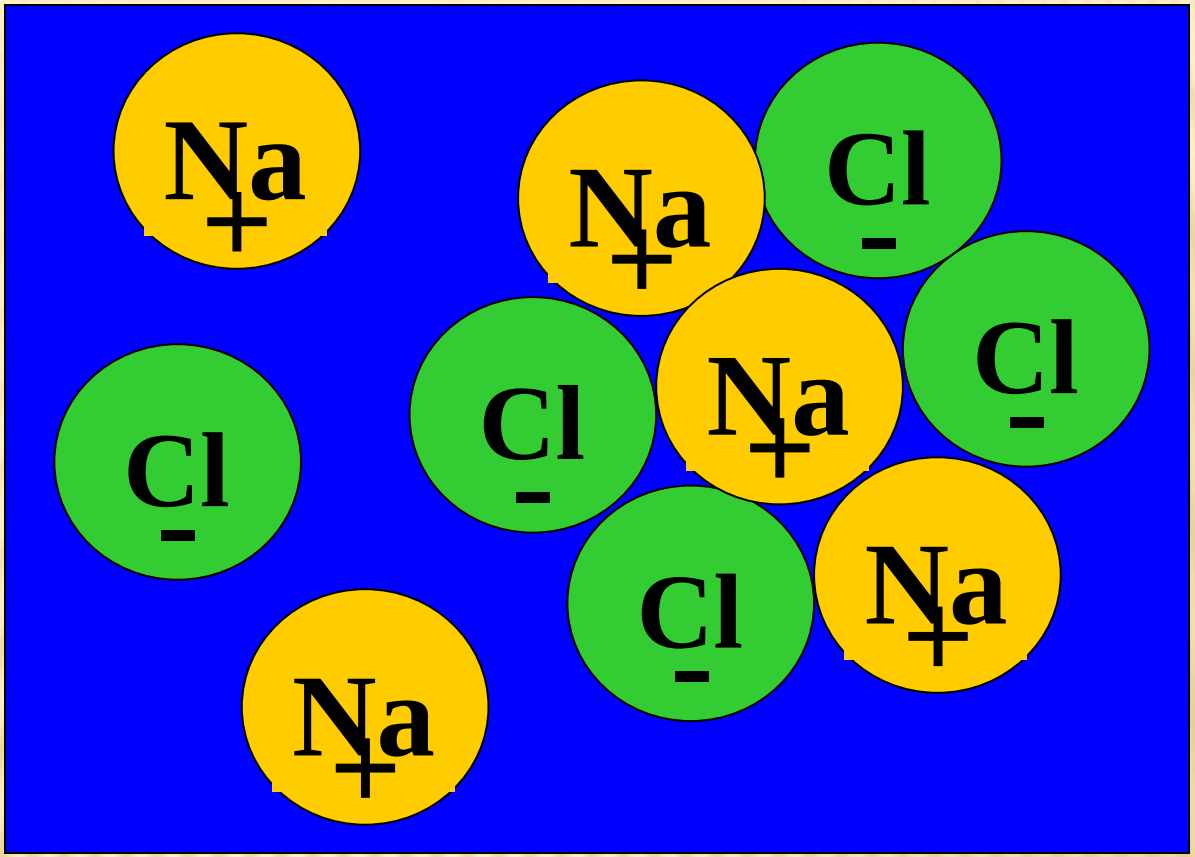
# Ice Crystals



**When water molecules are cooled they move slowly and attach to each other forming these 6 sided (octagonal) ice crystals.**

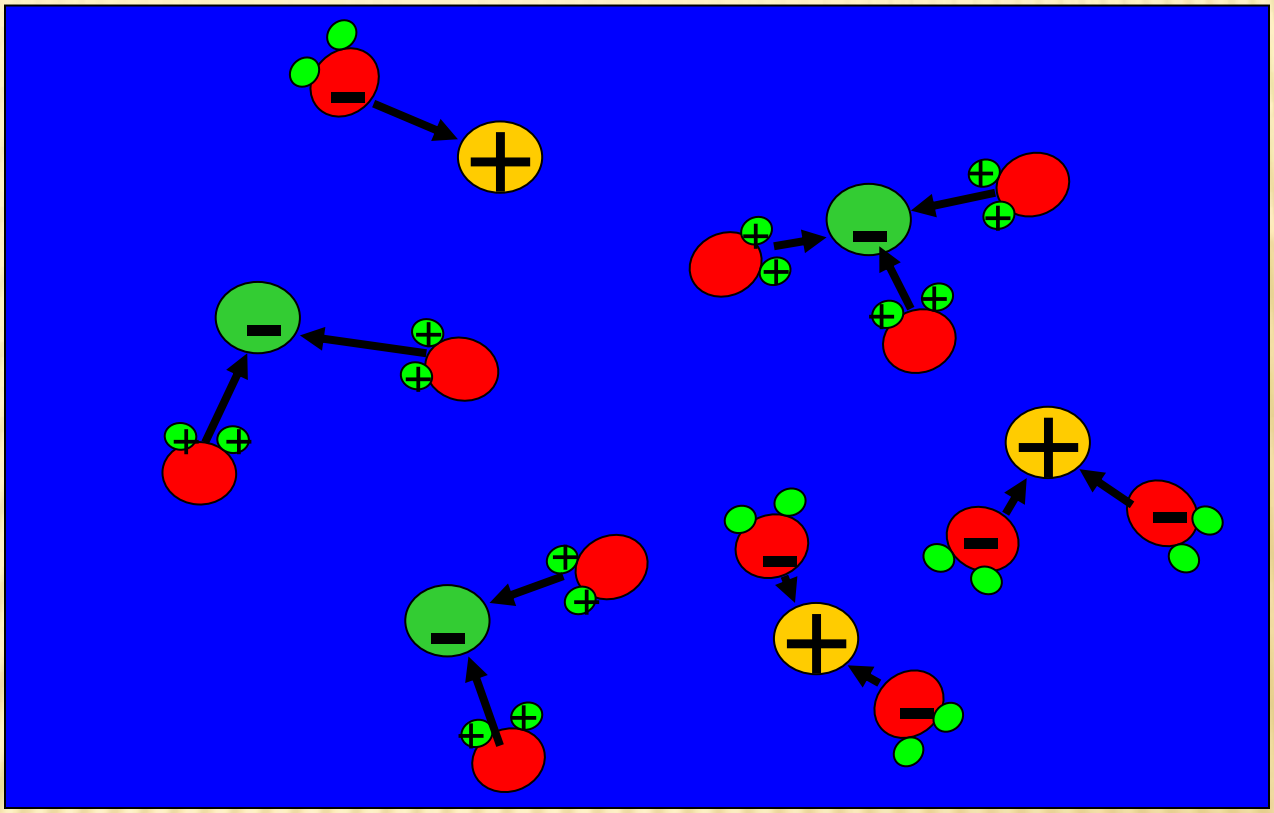
**Freeze-Point-Depressant – Is a material that has been used to prevent precipitation and condensation from freezing as quickly as it otherwise would have. (It is the ability to lower the freezing point of water.)**

# Salt Solution




**Salt (sodium chloride) NaCl is made up of 1 positively charged sodium (Na) atom and 1 negatively charged chloride (Cl) atom. Salt is a freeze-point-depressant.**

# Melting

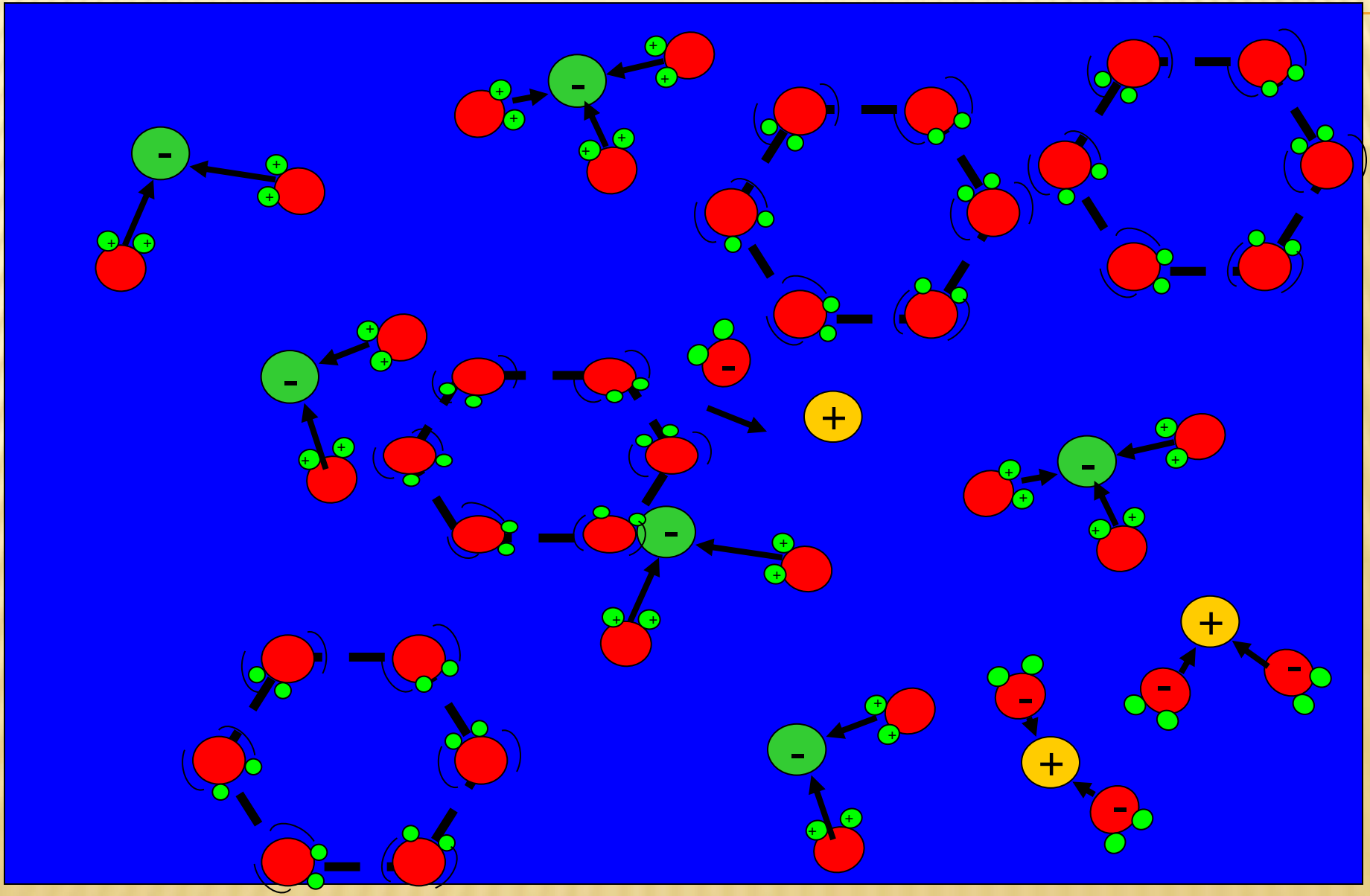


**When salt is applied to snow/ice the positively charged sodium atom attracts the negatively charged oxygen atom and likewise the negatively charges chloride atom attracts the positively charged hydrogen atoms, causing the 6 sided ice crystal to break apart.**

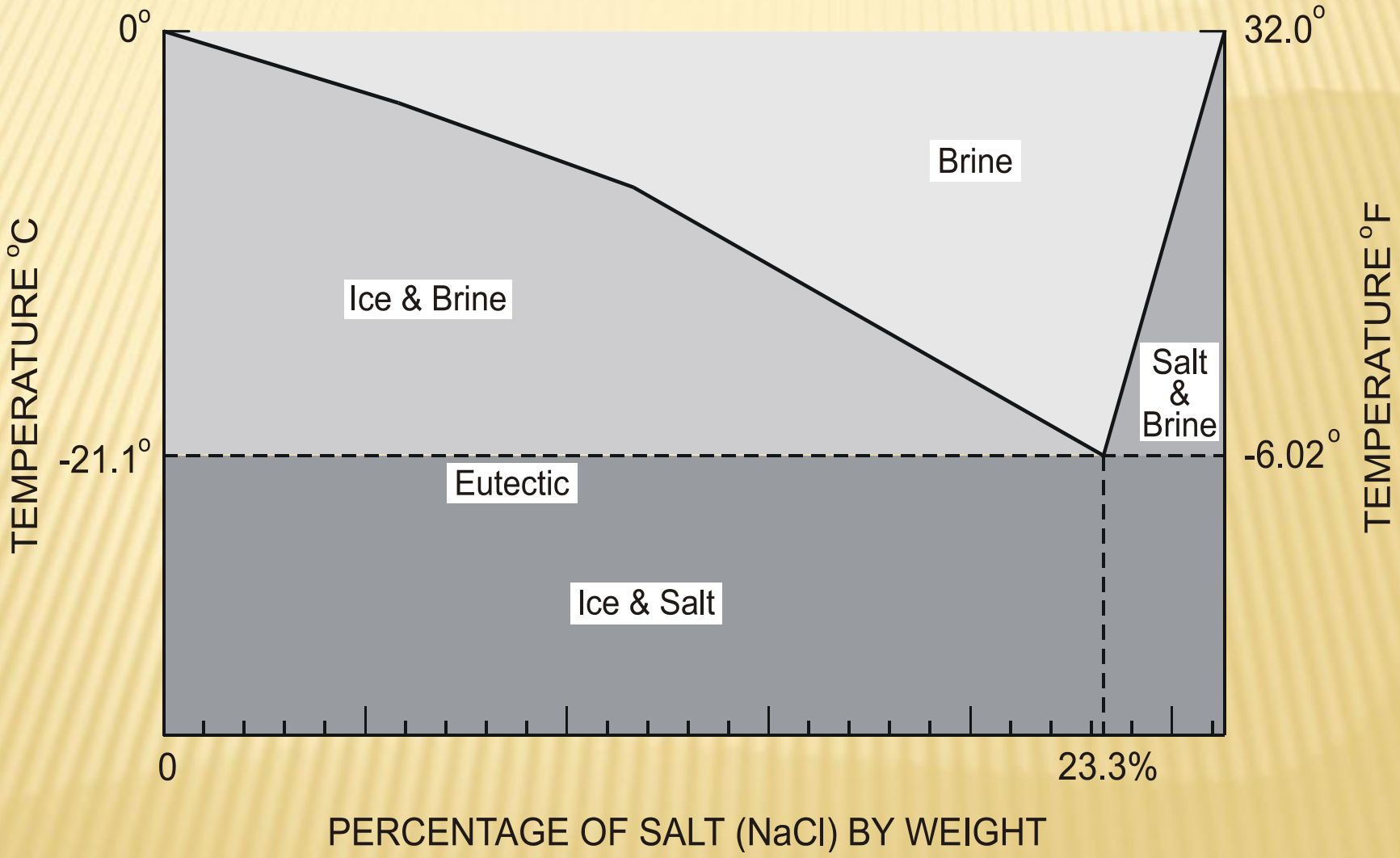
As the salt solution dilutes it looses the magnetic attraction between the different chemicals and ice crystals re-form (refreeze).

The usable working temp. of salt is -8° C that is why we use a liquid deicer with a usable working temp. of -35° C.

# Dilution and Refreeze



# THE EUTECTIC DIAGRAM FOR NACL



# *WHY USE LIQUIDS ?*

- **Once wetted with Liquid *FPD*:**
  - **Salt works faster**
  - **Increases penetration**
  - **Less blow-off**
  - **Less bounce and scatter**
  - **Increased level of service**
  - **Environmental Savings**

# HOW CAN I USE LIQUIDS ?

**There are three basic ways to use liquids:**

1. **Pre-mix**
2. **Pre-wet**
3. **Direct application to the road (anti icing and de-icing)**

# WHAT IS PRE-MIXING ?

*Adding a liquid deicer to your salt before you stockpile it.*

## Advantages

- Better mixing then pre-wet
- No equipment changes
- Up to 25% less salt

# MORE ON PRE-MIXING

## Disadvantages

- Hard to co-ordinate material, stacker, pug mill, loader, and liquid without rain.
- Usually one fill, part fills not economical
- Typically salt is a “just in time” product, not stockpiled **New “Thawrox”**
- Leaching can occur

# PRE-MIXING SALT

# WHAT IS PRE-WETTING?

*The application of a liquid deicer just before the salt hits the road.*

## Advantages

- More liquid can be added than in stockpile
- Increase or decrease liquid application as temp. change
- 25 % savings in salt used

# MORE ON PRE-WETTING?

## Disadvantages

- Computerized/liquid controls costly
- Onboard liquid tanks and pumps
- Site storage of liquids
- More costly in short term but will pay for themselves during the life of the truck
- Additional training required for:
  - Liquids
  - Controllers

# PREWETTING EQUIPMENT


# WHAT IS ANTI-ICING?

*a concept in which a liquid, or a pre-wetted salt, is spread directly onto the pavement before the storm begins.*

## Advantages

- Prevents bonding of snow and /or ice to road

  (Studies have shown it costs 10 times more to break the bond than to prevent the bond.)
- Faster cleanup
- Applied in better weather
- Doesn't get plowed off
- Equipment is fairly easy to make

# MORE ON ANTI-ICING

## Disadvantages

- Need better weather forecasting
- Larger liquid storage tanks

# ANTI-ICING

# ANTI-ICING UNITS


# ANTI-ICING

# SAME ROAD
# DIFFERENT TREATMENTS

**Traditional Treatment**

**Liquid Treatment**

# DE-ICING

*an operation where a deicer is applied to an accumulation of snow, ice, or frost that is bonded to the pavement surface.*

## Advantages of liquids verses solids

- Works much faster than straight salt
- Residual liquid becomes an anti-icing operation
- Improved level of services

## Disadvantages

- Re-active rather than pro-active

# DE-ICING

# SO FACTS ABOUT LIQUIDS ?

- Liquids are already in solution
  - They act more quickly – a strength
  - They dilute more quickly – a weakness
- Never use with rain (except for pre-wetting)
- Never put on top of compact (unless you are using a very hot product)
- More is not better, especially early in the season

# CORROSION CONCERNS

**Because liquids are already in solution:**

- **corrosion quicker than solid chemicals. (if using a liquid that is corrosive)**
- **Major and valid concerns about equipment and infrastructure damage (depends on the liquid)**
- **Some concerns seem to be more perception than reality (misunderstanding)**

# CHEMICAL SLICKNESS

- Know what you are applying
- Equipment is calibrated
- Let the temperature drop before you make that first application
- Be especially careful after long dry spells
- Reduce application rates early in the winter
  - Half rate for first application

# CONCLUSIONS ON LIQUIDS

- Liquids are not for melting snow and ice
  - use them to prevent and/or break the bond instead
- Road surface temperature not air temperature
- We need liquids under the snow – anti-icing gets them there faster
- If we are going to anti-ice, know the limitations as well as the benefits

# MORE CONCLUSIONS

- Use liquids that mix well and stay mixed
- Effective temperature more important than Eutectic.
- The more Viscous the better
- Exothermic liquids better than Endothermic
- Have liquid specific training

# CALIBRATING SPREADERS

- Ensure accurate discharge of material
- Recalibrate at least annually and periodically as required
- Gate setting is tied to calibration
- Ensure gate setting is matched to material being applied

http://www.saltinstitute.org/snowfighting/6-calib.html

# AND FINALLY TRAINING

- Lots out there !
- OGRA has the WMOT Winter Maintenance Operations Training for Operators (2 days)
- Winter Maintenance Operations Training for Supervisors and Patrollers (2 days)
- ½ day Refresher of each of those
- Snow School
- TAC , Salt Institute

# ANY QUESTIONS?

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