

Managing Pavement Deicers and Additives



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Salt: Why Do We Need It?

- The public expects it for safe travel
 - 75% of commuting workforce drives to work
 - Motorists travel > 3 trillion miles per year
- Business and commerce depend on auto/truck transportation
 - Trucks carry 75% of freight in the U.S. (Value \$6.2 trillion in 2002)
- Emergency vehicles need access regardless of weather



Salt: What's the Problem?

- Can affect aquatic habitat
 - Slows plant growth
 - Damages the reproductive cycle of fish
 - Reduces diversity
- Can contaminate drinking water sources
 - 5 documented cases that Ohio EPA is working on
- Can affect commerce
 - Irrigation water used by Lake Co nursery affected by road and parking lot runoff



1. Camden, Preble County
2. Vandalia, Montgomery County
3. Springfield, Clark County
4. Athens, Athens County
5. Chardon, Geauga County

Source: Ohio Environmental Protection Agency

THE COLUMBUS DISPATCH



Canadian study showed that the salinity of fresh water sources can be as high as in the ocean during winter thaws.

ODOT paid a settlement to one nursery in Medina County after overspray from road salt applied to I-71 caused damage to trees.

The cases of contaminated drinking water in SW Ohio involve regional open-air salt “warehouses” that supply municipalities with their deicers.

Camden had to abandon the wells it used for its public drinking water supply due to the contamination in that community.

Local Case Study: Chardon Township

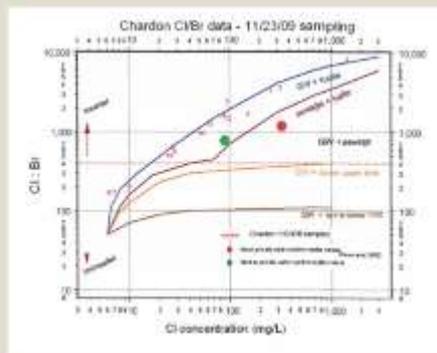
- Contamination of 3 private drinking water wells downgradient of the Township salt storage facility
- Facility in use since 1982
- Use 400-500 tons per season
 - 100 tons at a time maximum
- Use 50-50 mix of salt and cinders
 - Mixing occurred out in open



Ohio Environmental Protection Agency

Chardon Twp salting operations are small and the facility has not been in use all that long when compared to others. By comparison, ODOT District 12 uses 85,000 tons per year. The district covers the snowiest part of Ohio: Cuyahoga, Lake and Geauga Counties. ODOT District 4 purchased 38,400 tons of salt for Mahoning and Trumbull Co for the 2010 winter season. City of Cleveland uses 64,000 tons per year with most suburbs reporting 2,500 to 5,000 tons per year in 2009.

Chardon Twp: Determining the Cause



Groundwater is considered impacted if Cl:Br ≥ 400 .

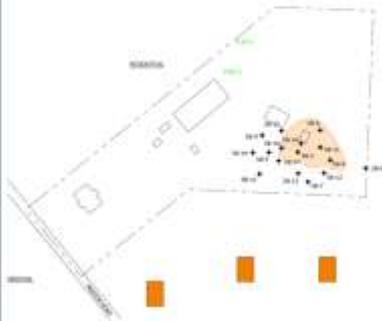
A Cl:Br ratio ≥ 1000 is indicative of roadway deicers.



DDGW ruled out other sources of halite. If source was brine from oil & gas well exploration, groundwater would have also contained petroleum hydrocarbons. If source was water softeners from septic systems, Cl concentration would not have been so high and samples would contain other indicators of sewage. Migration of higher brine content groundwater from deeper aquifers ruled out by the potentiometric surface in the complainant's well (no pressure to push the deeper groundwater up).

Impress upon audience that if the small-scale operations of Chardon Twp can cause this kind of problem, imagine what you'd find if you look at larger operations.

Extent of Soil & Groundwater Contamination



Soil Contamination



Groundwater Contamination

Drawings courtesy of Dargatzis & Nigle





There are no cost-effective methods to remove salt once it has dissolved in runoff or groundwater, thus the focus is on source control through the implementation of best management practices.

The salt storage and usage practices of many communities is regulated under the NPDES municipal storm water program. The permit for small MS4s requires communities to track the type and amount of deicer applied and to reduce or eliminate the discharge of pollutants from salt/additive storage locations and snow disposal yards. This program applies to communities located within urbanized areas of the state.

Ohio EPA has no direct, pro-active regulation of salt usage on commercial properties such as shopping center parking lots. Some MS4s have passed local regulations as a result of the municipal storm water program, but none are known to have in NE Ohio.

Regulated MS4s must conduct employee training on storm water pollution prevention at least once per year.

Salt Storage Practices

- Always store salt under cover
 - Permanent storm-resistant shelter preferred
 - Under a tarp, at minimum
- Location of structure
 - High end of site preferred
 - If not, divert run-on away
 - Door on south or east side preferred
 - Don't place near storm drains or water resources
 - Place on pavement
 - Asphalt preferred over concrete
- Size structure based on usage
 - Half of annual usage



Ohio Environmental Protection Agency

The salt dome seems to be the most common type of storage structure in NE Ohio for mid-to-larger size communities. Salt sheds (like in Chardon Twp) are more common in smaller communities.

If storage shed is on concrete, it must be sealed to prevent corrosion. An asphalt-based sealant is recommended.



Quonset huts provide a lot of room to store not only salt, but additives under cover. Mixing and loading operations can also occur under these structures.

This photo is from the City of Avon, but the City of Athens recently replaced their existing salt storage structure with this type of structure to address a groundwater contamination concern. The total cost of the project was \$250,000 but included remediation costs for contaminated soils around the old storage structure.

City of Massillon reports that a new salt dome costs approximately \$150,000. Quonset hut structures are generally cheaper (\$50,000) but may have higher maintenance costs to replace the cover material.



The opening of salt domes should be covered when not in use. The Turnpike Commission equips their domes with curtains that can be rolled up and down as needed. This dome at the Lake County Blackbrook Service Garage only has a curtain in the off-season.



Store salt in structures that are compatible with salt. Note the corrosion (and subsequent release of salt) from this metal structure at the Madison Township Service Facility in Lake County.



Salt pile stored outdoors, but under cover. However, note condition of parking lot. It's cracked, so groundwater contamination potential exists. Best to also place barrier (like tarp) under the pile in a situation like this.



Loading typically occurs outdoors, but really shouldn't. You will always get spillage in the process. Good housekeeping helps, but it is best to load under cover.



Example of a shelter added to a typical salt dome to allow loading to occur under cover. Photo is from an Indiana Department of Transportation garage courtesy of the Salt Institute.

Good Housekeeping



- Sweep up spilled salt as soon as possible
- Install signage to encourage this behavior
- Keep a broom and dust pan near salt storage structure

Ohio | Environmental Protection Agency

They do sell brooms that attach to Bobcats and trucks if you are looking for a solution that requires less physical labor on your part.

Salt Usage Practices

- **Adopt a sensible salting policy**
 - Identify “no-salt” roadways
 - Apply only on hills, curves and at intersections
- **Application rate should be based on weather conditions**
 - Remember...salt is of limited effectiveness below 15 F

Snowfighting Guidelines	
The following chart is a guideline to consider various types of storms. Local conditions and policies will be the final determining factor.	
Condition 1 Temperature Below 15° Precipitation Heavy snow or freezing rain Road Surface Dry	1/2 inch or more apply salt at 200 Super tons per mile. If snow or sleet conditions and accumulation, place and salt immediately. If freezing rain, apply salt at 200 lb per two lane mile. If rain continues, distribute, or apply salt at 200 lb per two lane mile. Increase salt using groundbrake.
Condition 2 Temperature Below 15° or falling Precipitation Heavy snow or freezing rain Road Surface Wet or Slippy	Apply salt at 400-600 lb per two lane mile, depending on accumulation rate. As unusual conditions and accumulation occur, increase salt application. If freezing rain, apply salt at 200-400 lb per two lane mile. Consider plowing and deicing procedures as warranted.
Condition 3 Temperature Below 20° or falling Precipitation Dry Snow Road Surface Dry	Plow as much as possible. Do not apply salt. Continue to plow and push to check for wet patches or icy spots. Treat these with heavy salt application.
Condition 4 Temperature Below 15° Precipitation Heavy snow or freezing rain Road Surface Dry	Apply salt at 400-600 lb per two lane mile, as required. If snow or sleet continues and accumulation, place and salt immediately. If temperatures start to rise, apply salt at 500-600 Super tons per mile. Salt for salt to last before plowing. Continue until a safe pavement is observed.
Condition 5 Temperature Below 15° Precipitation Snow or freezing rain Road Surface Accumulation or packed snow or ice	Apply salt at 400-600 Super tons per mile, or salt treated alternatives at rate of 1000 to 2000 lb per two lane mile. Allow water or ice to freeze evenly on slushy snow. Repeat application and plowing as necessary.

From the Salt Institute's Snowfighters' Handbook

City of South Euclid reports a 30% reduction in salt usage due to sensible salting.

Training “snowfighters” on these policies and practices is an important piece of the puzzle.

Other Ways to Minimize Salt Usage

- **Calibrate spreading equipment**
 - Each spreader must be calibrated individually
 - Calibrate often
 - Computerized systems available to control spread rate based on vehicle speed
- **Pre-treat roadways with anti-icing agents**
 - 25-33% less salt content vs. straight salt
- **Use other deicing materials**
 - A number of communities use beet juice to reduce salt usage
 - Sand or cinders is most common additive
 - Alternative deicers include CaCl and CMA, but all have their own issues



Calcium Magnesium Acetate (CMA) is the most environmentally-friendly alternative to standard road salt, but it costs 8-10 times more than NaCl. A Ca:Mg of 3:7 was found to be the most effective for deicing in a 1985 study by Schenk.

CaCl works at lower temperatures, but will have the same problems as NaCl. MgCl₂ contains 17 to 56% more Cl ion than NaCl.

A Word About Additives



- Use of sand or cinders is counterproductive for a municipal storm water program
 - Study in WI indicates that when traffic is present, sand quickly blows off pavement and into drainage system
 - Increases the need to sweep streets and clean out catch basins and drainage ditches.
 - Disposal of materials removed from the MS4 must be managed properly.
 - Street sweepings are a solid waste and cannot be used as cinders without first receiving approval for beneficial reuse from Ohio EPA

More Words About Additives

- Not all “cinders” are created equal
 - Fly ash must be tested to determine if it is non-toxic
 - Use TCLP to determine potential environmental impacts
 - Unweathered slag produces a leachate that is harmful to aquatic life



TCLP = Toxicity Characteristic Leaching Protocol.

DSW rescinded the policy that was in place to determine if fly ash is non-toxic. DSW is working with DSIWM to develop a replacement policy, but it is still in the works. Currently, DSW is reviewing these matters on a case-by-case basis, but needs to see TCLP-type data to evaluate the situation. Often, the suppliers of fly ash have done soil testing, but not TCLP testing. Regardless, it's the responsibility of the municipality to ensure the additive is not causing a problem to the environment.

Henrietta Twp in Lorain County was cited by Ohio EPA for open dumping of solid waste when they mixed bottom ash from an Oberlin College power plant with their road salt.



Mixing operations for salt and additives should also not occur outdoors (although this is the norm). Mixing operations have been occurring on this property for decades. Note the residual salt even though this photograph was taken in October before the salting season began for the year.

If mixing must occur outdoors, it is best to conduct it on a paved surface. This allows easier, more complete clean-up.



Communities typically store additives outside of the salt storage structure due to lack of space. However, even “clean” additives like sand typically contain some salt to prevent clumping and freezing in chunks. So, additives should also be stored under cover at all times when not in use. Also, be cognizant of the impacts to groundwater. They should also be stored on pavement.



Additive under cover, but not on a paved surface. So, better, but still not perfect.



Beet juice set up in the City of Willoughby. Secondary containment for the storage tank is recommended. There should be emergency and mechanical shut-off valves. Note the installation of a guardrail to protect the tank from truck traffic.

Chardon Twp: Temporary Measures for 2011



- Still determining a permanent solution, but for now...



Tarped cinder pile

Paved area around salt shed with asphalt



The Township has committed to building a larger salt storage structure that can house the salt, additive and mixing operations under cover, but the trustees are still determining costs. Ohio EPA expects more permanent solutions to be in place by the 2011-2012 salting season. We are still trying to work through this voluntarily, so no formal enforcement action has yet taken place.

The Township is cooperating with homeowners impacted by the problem to help them get an acceptable source of drinking water, however the agency has not been privy to the financial arrangements.

Chardon Twp: Temporary Measures for 2011



No more than 50 tons of salt on hand at a time to allow all storage under roof.

Mix cinders and salt under roof of shed. Keep mixture under roof.



Chardon Twp: Temporary Measures for 2011



Berm to keep run-on out of dome and salty runoff out of storm drainage system



An additional berm is needed on the other side of the shed (not shown). Salt-impacted runoff is still discharging to surface waters on that side.

Snow Storage Yards

- Emerging storm water issue
- Locate away from water resources and provide vegetated buffers
- Berm to promote on-site infiltration and retention
- Stockpile at low end and work to high end
 - Will melt in opposite direction – natural dam will form



City of Chardon found oil & grease concentrations were as high as 90 mg/L in the runoff from this snow storage yard in the Spring of 2010. By comparison, Ohio water quality standards are 10 mg/L chronic and 12 mg/L acute.

For More Information



The Salt Institute

www.saltinstitute.org

- Snowfighters' Handbook
- The Salt Storage Handbook
- Salt and Highway Deicing Newsletter

Ohio EPA Northeast District Office

www.epa.ohio.gov

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US EPA

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>

Road Salt Application and Storage Fact Sheet