



Winter Road Maintenance

Municipal Separate Storm Sewer System (MS4) Program

The selection of deicing substances is an issue that involves careful balance between economics, safety and environmental concerns. When it comes to the nation's roadways, public safety is considered the primary concern. Road salt is the most commonly used deicing substance, but it has some negative consequences such as corrosivity to both vehicles and building structures (i.e., bridges, overpasses and highway ramps). Road salt is harmful to both ornamental and agricultural vegetation, and salt runoff has potential to lead to elevated chloride concentrations in lakes and rivers.

Alternative deicers have been explored for use in Michigan by the Michigan Department of Transportation (MDOT) and road maintenance agencies due to the potential negative impacts of road salt. Various road maintenance agencies and citizens have contacted the Michigan Department of Environment, Great Lakes, and Energy (EGLE) regarding the use of alternative deicing substances, especially agricultural by-products (ABP), including sugar beet waste.

Municipal Separate Storm Sewer System (MS4) permittees are responsible for developing a program for winter road maintenance which reduces the discharge of polluting substances.

Road Salt/Sand Application and Storage

While the application of salt and sand is often necessary to protect public safety, there are measures that can be implemented to mitigate the environmental impact. Salt and sand applied to improve traction must be prevented from entering MS4s and surface waters of the state to the maximum extent practicable.

When applying anti-icing or deicing materials, operators must be aware of local areas that are sensitive to salt and implement appropriate buffer zones and/or choose alternative deicers.

These areas may include:

- Groundwater recharge areas
- Areas with shallow water tables
- Sources of drinking water
- Salt-sensitive vegetative communities
- Wetlands, rivers, streams, ponds and lakes
- Salt-sensitive agricultural areas
- Salt-sensitive habitats for wildlife species at risk

Best Management Practices (BMPs) for salt/sand application include:

- Develop a road salt management plan that establishes salt reduction goals to be met through the use of effective BMPs.
- Adjust frequency and amount of application based on site-specific conditions.
- Routinely calibrate devices which control the rate of material application.
- Utilize devices on trucks that accurately measure road surface temperature so the right amount of salt and/or sand can be applied at the right time.
- Place barriers in site-specific locations (along streams) where appropriate and practical to route material away from watercourses.
- Reduce plowing speed to more efficiently target material applications.
- Stop side cast sweeping within 50 feet of structures over water.

Salt/sand storage practices:

- Solid salt must be stored on an impervious surface and must be enclosed or covered to prevent a discharge to sanitary sewer, surface water, or groundwater.
- The storage area must be at least 50 feet from a designated wetland or the shore or bank of any lake or stream.
- Structures providing storage and containment for solid salt located within a 100-year floodplain need to be designed and constructed to remain effective during a 100-year flood.
- Load salt in covered areas, or during good weather, if possible, to reduce material loss.
- After loading, immediately sweep spills.
 - Comply with Part 5 Rules, Management or Spillage of Oil and Polluting Materials promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, (Rules 324.2001 through 324.2009 of the Michigan Administrative Code) for spill/leak containment.
- A [Pollution Incident Prevention Plan](#) must be prepared if a facility has greater than 5 tons of solid salt or salt/sand mixture. The requirement applies not only to “pure” products but also to mixtures containing greater than one percent solid salt.

Brine storage practices:

- Quantities of 1,000 gallons or more of liquid salt (brine) must be stored in a double walled tank, or in a single walled tank with secondary containment.
- Comply with Part 5 Rules, Management or Spillage of Oil and Polluting Materials (Rules 324.2001 through 324.2009 of the Michigan Administrative Code) for spill/leak containment.
- A [Pollution Incident Prevention Plan](#) must be prepared if a facility has greater than 1,000 gallons of brine. The requirement applies not only to “pure” products but also to mixtures containing greater than one percent liquid salt.

Agricultural Byproduct Deicers

Deicing products derived from Agricultural Byproduct Deicers (ABP) have the potential to adversely affect water quality if allowed to enter surface waters.

These products often contain high levels of organic materials which exert a high biochemical oxygen demand (BOD) when broken down by microorganisms in an aquatic environment. This results in reduced in-stream levels of dissolved oxygen (DO), which is necessary for the survival of aquatic life. Fish kills, impaired biological communities, and noxious growths of bacterial slimes can result from elevated BOD and reduced levels of DO in streams and lakes.

Some ABP deicers have the potential to greatly impact DO concentrations in surface waters, as they may contain many times the amount of BOD found in strong wastes like raw sewage. To illustrate, one organic deicer contains 210,000 milligrams per liter (mg/l) of BOD (as measured through a five-day test called BOD₅) according to its manufacturer, whereas strong untreated domestic waste typically contains about 400 mg/l of BOD₅. Unpolluted ambient surface waters contain around 2 to 3 mg/l of BOD₅.

The effect of BOD from deicers on a given stream's DO concentrations depends on the chemical and physical characteristics of the water body. Many of Michigan's rivers and streams have relatively low slopes and low velocities, which makes them especially susceptible to DO impacts from elevated BOD. Deicers may have different degradation rates and may affect DO levels to varying degrees.

ABP deicers may also contain nutrients that can harm water quality. Increased concentrations of pollutants like phosphorus can cause noxious plant growths and contribute to low levels of DO. ABP deicers can contain heavy metals that may be toxic to aquatic life at sufficient concentrations. Solids in the deicing materials may negatively affect aquatic life habitat if they enter a surface water.

The introduction of deicers into water bodies can result in adverse impacts on aquatic resources; therefore, proper management and handling practices are critical to prevent their discharge into surface waters.

Regulations Regarding Discharges of Deicing Substances

EGLE is charged with protecting and conserving the water resources of the state. Part 31, Water Resources Protection, of the Natural Resources Environmental Protection Act, 1994 PA 451, as amended (NREPA), provides the legal framework for EGLE's role in water quality protection. If a scenario developed where surface or groundwater resources were impaired due to a deicing application, Part 31, Water Resources Protection, of the NREPA, authorizes EGLE to take action against the responsible party.

Groundwater Discharge Permit Program:

The controlled application of deicing products to roads is authorized by Rules 323.2204 and 323.2210 of Part 22 Rules, Groundwater Quality. Under these rules, deicing products may be used (i.e. discharged to the ground) without a groundwater discharge permit so long as various conditions are met. These conditions include:

- The discharge shall not be, or is not likely to become, injurious;
- The discharge shall not cause runoff to, ponding on, or flooding of adjacent property, shall not cause erosion, and shall not cause nuisance conditions.

Municipal Separate Storm Sewer System (MS4) Permit Program:

The Michigan Department of Transportation (MDOT) and more than 300 urbanized municipalities have coverage under the MS4 permit program. These permits include pollution prevention criteria that require the permittee to:

- Construct, operate, and maintain its streets, roads, highways, parking lots, and other permittee-owned or operated impervious infrastructure in a manner which reduces the discharge of pollutants into the MS4 and the surface waters of the state, including pollutants related to snow removal practices.
- Require that salt and sand applied for improved traction be prevented from entering MS4s and receiving streams to the maximum extent practicable.

EGLE's [Chloride and Sulfate Water Quality Values Implementation Plan](#) provides background on the development of the Water Quality Value for chloride and next steps for implementation. Section 5. Chloride in Storm Water Discharges focuses on strategies to reduce road salt application while continuing to provide safe travel conditions for the public.

Other site-specific and pollutant-specific requirements of MS4 permits may apply to winter road maintenance activities. For example, many MS4 permits have special conditions related to impaired water bodies (i.e. areas where Total Maximum Daily Loads (TMDL) have been developed). If a TMDL has been developed due to elevated chloride levels, additional winter road maintenance BMPs and a monitoring program would need to be implemented.

Conclusion

The selection of deicers is a policy decision that involves the careful balance of many considerations. This decision is the responsibility of road maintenance agencies. Environmental concerns are among many factors that road maintenance agencies need to consider. As such, this document does not recommend the use of any type of deicer over another but instead provides water protection information that should be considered as part of the deicing/pre-icing product selection process and related management practices.

Resources for Road Agencies

Michigan Winter Maintenance Manual – Promoting Safe Roads and Clean Water was developed by the “Great Lakes Regional Water Program” in 2013. This program was a partnership of United States Department of Agriculture and Land Grant Colleges and Universities. The manual explains how innovations in deicing materials and equipment can reduce salt usage and minimize the need for post-winter maintenance activities such as catch basin cleaning.

The [Clear Roads Research Program](#) brings together transportation professionals and researchers from around the country to drive innovation in the field of winter maintenance. By evaluating materials, equipment and methods in real-world conditions, the program identifies the most effective techniques and technologies to save agencies money, improve safety and increase efficiency. The website provides training resources for plow operators and supervisors, including modular classroom training materials that any state or local agency can customize. Clear Roads makes these materials available for free to any state or local public agency. Clear Roads also provides [research webinars](#) which are available on demand.

The National Cooperative Highway Research Program developed a comprehensive report entitled [“Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts”](#) in 2007. This project also involved the development of a Material Selection Decision Tool that can be downloaded from the webpage above.

MDOT studied the economical, safety, and environmental issues associated with deicing substances and pre-wetting agents. In 2002, MDOT published a report titled SPR-1418 Agricultural By-Products for Anti-icing and Decing Use in Michigan. This report may be downloaded from [MDOT’s Complete List of SPR-II Research Projects](#) webpage.

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