DEICERS

POTENTIAL ADVERSE IMPACTS OF DEICERS WITH A FOCUS ON AGRICULTURAL BY-PRODUCT DEICERS ON WATER RESOURCES

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. Alternative deicers have been explored for use in Michigan by the Michigan Department of Transportation (MDOT) and road maintenance agencies for the past several years due to the potential negative impacts of road salt. Like any deicing substance, use of road salt has some negative consequences such as corrosivity related to both vehicles and building structures (i.e. bridges, overpasses and highway ramps), it is harmful to both ornamental and agricultural vegetation, and in certain areas salt runoff has potential to lead to unacceptable chloride concentrations in lakes and rivers.

Various road maintenance agencies and citizens have contacted the Michigan Department of Environmental Quality (MDEQ) regarding potential environmental impacts of deicing substances, especially agricultural by-products (ABP), which include beet waste (de-sugared molasses). This document offers information regarding potential water quality impacts of ABPs. It also provides information on pertinent water quality regulations implemented by the MDEQ's Water Resources Division.

Q: Does guidance exist that will help road maintenance agencies evaluate and select pre-icing and deicing substances that could help mitigate environmental impacts to surface and ground waters?

- 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 guidance is available online at: **www.trb.org/TRBNet/ProjectDisplay. asp?ProjectID=883**
  This project also involved the development of a Material Selection Decision Tool that can be downloaded from the webpage above.
  This is a publication of the Transportation Review Board of the National Academies. These academies bring together committees of experts in areas of scientific and technological endeavor. These experts serve pro bono to address critical national issues and give advice to the federal government and the public. A representative from the United States Environmental Protection Agency participated in this project.

- MDOT has been studying the economical, safety, and environmental issues associated with deicing substances and pre-wetting agents. In 2002, MDOT published a report regarding their evaluation of anti-icing compounds developed from ABPs. Their published information can be found online at:
  https://mdotjboss.state.mi.us/SpecProv/getDocumentById.htm?docGuid=d3a73d6c-0b73-4159-82f4-6f1b4f5d86db
  In their report, MDOT recommends that agencies considering implementing anti-icing should "contact those agencies currently practicing anti-icing to determine how to get started: What equipment, budget, and materials are required; the process of dealing with the public; and training needs for its own agency personnel. A successful anti-icing program needs the buy-in of all participants."

Q: Are ABPs, including beet pulp, proven to be environmentally-friendly alternatives for use in deicing activities when considering potential discharges to surface waters?

De-icing products derived from ABPs 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 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 that BOD from deicers may have 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 so 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 de-icing materials may negatively affect aquatic life habitat if they enter a surface water.

Adverse impacts on aquatic resources can occur if deicers enter water bodies. Responsible handling of deicers is necessary to prevent the entry of the de-icing materials into surface waters.

Q: How do the Water Resource Protection regulations regarding discharges to waters apply to deicing substances that are used in Michigan?

The MDEQ is charged with protecting and conserving the water resources of the state. Part 31, Water Resources Protection of the Natural Resources Environmental Protection Act, PA 451 of 1994, as amended provides the legal framework for MDEQ's role in water quality protection. If a scenario developed where surface or groundwater resources were impaired due to a deicing application, Part 31 authorizes the MDEQ to take action against the responsible party. To learn more about Part 31 of NREPA, refer to the guidance document found line at **www.michigan.gov/deq**, select the "News and Events" browser button on the left side of the webpage, then select "Citizen Involvement."

Groundwater Discharge Permit Program:
Deicing substances are often authorized for use in Michigan through Rules 323.2204 and 323.2210 related to Groundwater Quality (Part 22 Rules, Groundwater Quality), which provide for the controlled application of deicing products to roads. 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:

a) The discharge shall not be, or is not likely to become, injurious;

b) The discharge shall not cause runoff to, ponding on, or flooding of adjacent property, shall not cause erosion, and shall not cause nuisance conditions.

National Pollutant Discharge Elimination System (NPDES):
The Michigan Department of Transportation (MDOT) and more than 300 urbanized municipalities have coverage under the NPDES permit program for control of storm water discharges from municipal separate storm sewer systems (MS4). These permits include a 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 so as to reduce 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.

In addition, other site-specific and pollutant specific requirements within the permits can apply to snow and ice-fighting road maintenance activities. For example, the permits have special conditions related to water bodies that are impaired (i.e. areas where Total Maximum Daily Loads have been developed), such as from an overabundance of plant growth.

The permittee is encouraged to use guidance and training materials that are available from federal, state, or local agencies, or other organizations.

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 just one of the 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.