

Chapter 8: Winter Snow and Ice Operations

Groundwater Protection Program

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Chapter 8: Winter Snow and Ice Operations

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INTRODUCTION

Removal of snow and ice from McHenry County **pavement** is essential to both public safety and to the local economy. During winter storm events, the use of pavement deicing chemicals is a widely accepted and, as some would argue, essential means of keeping pavements safe and passable. However, mechanical snow removal is the best method for snow and ice removal. Chemicals should only be used to break the bond between ice and pavement.

Pavement deicing is typically accomplished through the use of road salts. There are a variety of road salts that may be used for deicing, including sodium chloride (NaCl), calcium chloride (CaCl₂), magnesium chloride (MgCl₂), and potassium chloride (KCl). Sodium chloride, or common salt, is by far the most popular roadway deicing chemical because of its reliability, economy, and usability. However, it is also corrosive to vehicles, roadway surfaces and bridges and has been found to have adverse effects on groundwater and environmentally sensitive areas¹.

Contamination by chlorides in groundwater and surface water is a growing concern in McHenry County, as well as across the region. Salt used for pavement deicing is one of the primary sources of this increase². Chloride contamination can be dealt with either *post hoc* in a reactive fashion or a *priori via* a more proactive approach. The former purports to deal primarily with the negative consequences of continued reliance on traditional use and application rates of road salt. The reactive approach, however, is very often more expensive than the proactive prevention³. Once contaminated, restoration of water quality and ecosystems can be very difficult and costly, if not impossible. Therefore, a reduction in salt use is likely the most effective method of reducing the risks of chloride contamination, both economically and technologically.

Effective salt management practices, including: proper application, storage, handling, and a winter snow and ice operations training program can reduce the amount of salt entering the environment. Currently there is no requirement for certification of deicing agent storage facilities, applicators, or for local units of government to require compliance with the Winter Snow and Ice Operations Policy. It is strongly recommended that local governments consider a proactive approach to reducing chloride contamination by implementing and enforcing the practices described below.

¹ Panno, S.V., K.C. Hackley, H.H. Hwang, S. Greenberg, I.G. Krapac, S. Landsberger and D.J. O'Kelly, 2002. Source Identification of Sodium and Chloride Contamination in Natural Waters: Preliminary Results. In Research on Agricultural Chemicals in Illinois Groundwater: Status and Future Directions XII, Proceedings of the 12th Annual Illinois Groundwater Consortium Conference, Makanda, IL, April 22, 2002. Available online <http://www.water-research.net/Waterlibrary/privatewell/nacl.pdf>

² Water softeners are an additional source of chlorides.

³ CMAP Regional Water Supply Plan

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WHO

Local communities (including townships and the county), the Illinois Department of Transportation (IDOT), and the Illinois Tollway Authority are the primary parties responsible for maintaining roadways during winter storm events in McHenry County. IDOT is responsible for maintaining state highways and roadways located within McHenry County; these roadways typically have an U.S. or Illinois state highway route number assigned to them. The Illinois Tollway Authority is responsible for maintaining the short portion of the Northwest Tollway (I-90) located in the southwest corner of McHenry County. McHenry County and the local communities and townships are responsible for maintaining all county and township roadways as well as local streets, including local collector and arterial streets, located within the county. Private snowplow operators are the primary parties responsible for maintaining private roadways and parking areas on commercial, industrial, institutional, office and multiple family properties in McHenry County. Private snowplow operators also maintain some sidewalks and single family properties in McHenry County.

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APPLICATION OF DEICING AGENTS

A well-planned and operated pavement deicing program can assist in mitigating negative environmental effects while reducing the overall costs to maintain pavements during winter storm events. To assist pavement management agencies and private entities in improving their operation practices, McHenry County Water Resources and the McHenry County Division of Transportation have developed a handbook titled ***McHenry County Snow and Ice Control Handbook*** (Appendix A) and a ***Winter Parking Lot and Sidewalk Maintenance Manual*** (Appendix B). The purpose of these field handbooks is to promote an awareness of the tools, best practices, and limitations for snow and ice control. In addition, they encourage progressive changes in snow and ice control practices that will help to reduce pavement deicing chemical usage, use of abrasives, and environmental impacts while meeting the safety and mobility needs of roadway users. McHenry County has also developed a ***flip chart*** (Appendix C) to be kept inside snow and ice removal vehicles.

In addition, the Salt Institute has developed a “sensible salting” program. The guidelines provided by the program cover a variety of topics, including: planning; personnel training, equipment maintenance, spreader calibration, proper storage, proper maintenance around chemical storage areas, and environmental awareness⁴. As part of this “sensible salting” program, the Salt Institute has created a ***Snowfighter’s Handbook*** (Appendix D), which presents the components of the “sensible salting” program along with guidance on how to implement these improved roadway deicing procedures.

The Salt Institute’s ***Snowfighter’s Handbook***, the ***McHenry County Snow and Ice Handbook***, the ***Winter Parking Lot and Sidewalk Maintenance Manual***, and the ***flip chart*** are included as policy recommendations (Section I below) for all entities responsible for snow and ice removal in McHenry County. All entities responsible for snow and ice removal in McHenry County are strongly encouraged to obtain a copy of these handbooks and flip charts as well as to obtain certification for winter snow and ice operations through an annual ***Managing Snow and Ice Control Operations Workshop*** (Appendix E).

Note: A blanket approach will not work for the broad range of conditions McHenry County experiences; different strategies are needed for different regions and different conditions. We encourage you use the tools provided in the handbooks and training session to continue to test, document, and refine your winter snow and ice operations.

⁴ USEPA, 1999

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STORAGE AND HANDLING

Snow and ice removal is an important safety practice during winter. Those instruments in which to remove snow and ice, including pavement deicers (i.e. Salt) and snowplows, on both small and large scale operations are effective measures. However, proper storage and handling of pavement deicers is of the utmost importance for protection of our flora, fauna, and surface and groundwater resources in McHenry County.

Proper storage of road salt supplies is critical to ensure that the environmental impacts of roadway deicing practices are reduced to the maximum extent practicable. When salt is stored outside and uncovered, the pile is left exposed to precipitation from storm events. This causes runoff water to become salt-laden with chloride and sodium ions, thereby negatively impacting the adjacent environment and water sources. Consequently, salt storage facilities are important to the protection of the county's groundwater, surface water, and natural resources.

While it is common for local roadway maintenance agencies to store road salt in covered structures, there are many other small, uncovered salt storage piles throughout the county. Currently, the Illinois Environmental Protection Agency (IEPA) regulates salt storage piles in excess of 50,000 pounds. It is the recommendation of the Groundwater Protection Program Task Force to institute a policy that ***all*** salt storage facilities, both liquid and granular, be regulated by both the county and/or the municipalities of McHenry County. These "small" storage quantities often are a significant contributor to chloride contamination of our groundwater and surface water county-wide.

All salt storage facilities, even the best designed ones, have the potential to contaminate the groundwater and surface waters in McHenry County. Therefore, a Winter Snow and Ice Operations: Deicing Storage and Handling Policy should be adopted by the County and by each unit of government that participates in winter snow and ice operations in McHenry County. It is also essential that the county as well as local units of government require private snowplow operators and business in their jurisdiction to comply with the Winter Snow and Ice Operations: Deicing Storage and Handling policy guidelines outlined below.

As a component of this policy, all snowplow operators and contractors should be required to attend a ***Managing Snow and Ice Control Operations Workshop*** and obtain Level One Certification. These operators and contractors should provide proof of certification to the county and verify that their operations meet the standards as outlined below in Section II. Storage and Section III. Handling.

Improper storage of salts can lead to groundwater contamination.

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TRAINING AND CERTIFICATION

Public and private maintenance personnel typically feel a keen obligation to the traveling public. Proper training for maintenance personnel is vital. It provides the know-how to get the job done and encouragement to perform in a way that brings praise rather than discredit to your organization. The underlying theme of all training sessions should be the “Sensible Salting” concept, which includes:

- Proper covered storage
- Good maintenance of storage areas
- Good equipment maintenance and knowledge of equipment
- Proper spreader calibration
- Proper deicing agent application
- Concern for our environment as well as the public’s safety.

An outline of the suggested training and certification can be found below in Section IV. Training and Certification.

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I. APPLICATION

The **McHenry County Snow and Ice Handbook** (Appendix A), **the Winter Parking Lot and Sidewalk Maintenance Manual** (Appendix B), the Salt Institute's **Snowfighter's Handbook** (Appendix D), and the **flip chart** (Appendix C) are included as policy recommendations for all entities responsible for snow and ice removal in McHenry County. All entities responsible for snow and ice removal in McHenry County are strongly encouraged to obtain a copy of these handbooks and flip charts as well as to obtain certification for winter snow and ice operations through an annual **Managing Snow and Ice Control Operations Workshop** (Appendix E).

Treatment recommendations can also be obtained from maintenance decision support systems (MDSS) through private contractors.

Note: A blanket approach will not work for the broad range of conditions McHenry County experiences; different strategies are needed for different regions and different conditions. We encourage you use the tools provided in the handbooks and training session to continue to test, document, and refine your winter snow and ice operations.

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II. STORAGE

Storage areas have the potential to cause contamination of groundwater and surface water, in addition to environmental damage to flora and fauna. Proper salt storage can be achieved through utilizing a maintenance policy for indoor or outdoor storage.

The following recommendations on snow piles and general deicing chemical storage apply to **ALL permanent and temporary** indoor and outdoor facilities:

Snow Piles

- Store in an area where solids can be recovered after the snow melts.
- Locate snow down-slope from salt and sand storage to prevent the snow melt from flowing through salt and sand storage areas and/or carrying it into the nearest drainage system.
- Avoid pushing snow into lakes, ponds, wetlands, rivers or other natural areas to reduce chemical contamination and increase the amount of solids that can be recovered after the melt.

General: Deicing Chemical Storage

- **Facility Location**
 - Facility should be in close proximity to the area to be salted.
 - Facility should be located outside of floodplains, on impermeable surfaces and on relatively impermeable soils.
 - Facility should not be located in close proximity to surface water features.
 - Storage of deicing agents is prohibited within the minimum setback zone of any potable well⁵.
 - Potable wells other than community wells have a 200-foot circular minimum setback zone.
 - Community wells may have a 200 or 400-foot circular minimum setback zone depending on whether the well uses a confined (200 ft) or unconfined (400 ft) aquifer.
 - Community wells can adopt maximum setback zones (typically 1,000 feet) of up to 2,500 feet. They may be circular or irregular in shape.
 - Facility cannot be located within 200 feet of any/all drywells.
 - Slope should be away from salt storage pile/facility.
 - Salt vulnerable/intolerant natural areas should be avoided to the greatest extent possible. Where they cannot be avoided, specific measures should be included in the design of the storage facility to protect vulnerable areas.
 - Salt vulnerable/intolerant natural areas could include:
 - i. Areas adjacent to salt sensitive vegetation and agricultural operations;

⁵ IEPA Title 35 Part 616, Subpart L

<http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp>

Illinois Environmental Protection Act, Section 3.355 (415 ILCS 5/3.355), Section 14.2 under Title IV: Public Water Supplies <http://www.ipcb.state.il.us/SLR/TheEnvironmentalProtectionAct.asp>

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- ii. Areas draining into a source of drinking water (surface water and groundwater);
 - iii. Areas draining into bodies of water with low dilution, low volume or salt sensitive species; and
 - iv. Areas associated with groundwater recharge zones or shallow water table, with medium to high permeability soils.
- **Facility Specifications**
 - Any roof leaks, tears, or damage to the storage facility should be temporarily repaired during the winter or on an on-going basis to reduce the entrance of precipitation, with permanent repairs being completed prior to the next winter season.
 - Construct floor out of Bituminous Concrete or Portland cement concrete and seal to prevent **salt infiltration**.
 - Ensure the floor or pad has a slope between two percent and five percent to allow any moisture to drain into the collection sump or runoff pond.
 - The floor should be inspected annually for cracks and repaired/resealed as required.
 - Install a plastic liner beneath the storage and loading areas. If these locations are present on pervious pavement, ensure that spilled salt does not migrate through and into nearby groundwater.
- **Site Drainage**
 - The site should be graded to direct drainage away from storage areas and to the maximum extent possible, away from any down gradient groundwater well locations or salt vulnerable areas.
 - Drain storage site runoff via tile ditches or pipes to a collection area, preferably a specially designed sump area or runoff storage pond with a liner, if possible.
 - A Best Management Practice (BMP) with a control restrictor to stop or restrict discharge downstream.
 - Salt-laden water should be collected and properly managed
 - Snow plowed from the site should be directed to areas where melted water will be directed away from groundwater wells, storage area and salt vulnerable areas.
- **Salt Piles**
 - Promote indoor operations where possible.
 - Store where rain, snow, and melt water cannot access it.
 - Store away from lakes, rivers, ditches, storm drains, and wetland edges.
- **Salt Bags**
 - Store away from rain or snow inside of the facility.
 - Dispose of bags properly.
- **Liquid Chemicals**
 - Designers should consult with local environmental regulatory authorities regarding siting and containment requirements for storage facilities.
 - Understand the freezing point of proposed liquid. This physical property will determine if it can be stored outside or if it must be stored inside. Consideration should be given to store salt brine (NaCl) indoors and in double walled containers.

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- Label tanks documenting contents.
- Where practical, secondary containment should be provided through double walled tanks or containment dykes.
- Before installing tanks, check on local visual screening ordinances.
- Periodic inspection of tanks, pumps and pipes/hoses should be carried out and any leaks should be repaired immediately.
- Tanks should be turned off every night.
- **Sand piles**
 - Winter sand is typically mixed with some deicers to prevent freeze-up of the pile. Therefore, sand pile storage should be the same as salt pile storage.
 - Do not use leftover winter sand for other uses. Save sand undercover for next season.

\$ Covering stockpiles protects the salt from wind, rain and snow and reduces waste.

A. Indoor Deicing Chemical Storage

Storing salt and sand/salt mixes indoors is the best policy. Structure designs range from domes, to rectangular sheds or barns, to high arch structures, to elevated silos. *In addition* to the “snow pile” and “general” recommendations from above, the following factors should be taken into consideration when storing pavement deicing chemicals in existing facilities and when siting new facilities:

- **Facility Specifications**
 - **Prevailing winter wind direction** should be noted.
 - Position new buildings and doors, with regard to sheltering loading operations, minimizing snow drifting around doorways, and keeping precipitation out of the storage areas.
 - **Door location and size:**
 - To the most extent possible, doors should be high enough to allow a transport trailer to end dump inside the structure.
 - The entrance to the structure should have a door, curtain or a sufficient overhang to minimize precipitation entering a structure.
 - Where possible, the facility should be generally oriented such that the door is facing away from the prevailing winter wind direction.
 - **Extraneous equipment such as a conveyor system:**
 - A conveyor system can maximize storage space available due to its top-loading capacity.
 - Using a conveyor system will improve traffic flow by separating unloading/loading operations.
 - A conveyor reduces the amount of salt waste from unloading operations.

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- Any salt spilled during the unloading process should be shoveled and/or swept into the unloading pit and run up the conveyor at the end of unloading.
- **Base**
 - Floors of all structures should have low permeability and be constructed of quality strength asphalt or concrete that is sloped away from the center of the storage area for drainage purposes.
 - The base pad inside the storage facility should be flat with the periphery pavement sloped away from the center of the storage area for drainage purposes.
 - Both asphalt and concrete are somewhat permeable and should be sealed to minimize infiltration.
 - The loading pad should be constructed of asphaltic concrete or other low permeability material facade.
- **Roof and Exterior of the storage structure:**
 - Must use materials that prohibit precipitation and moisture from entering the building.
 - Must be constructed of non-corrosive materials that will not interact with de-icing agents placed in the facility.
 - Must be free of gaps that would allow salt or salt impacted drainage to escape.
 - Must prevent dissolved de-icing agents from entering into adjacent soil, surface water, or groundwater.
- **Site Drainage**
 - Direct drainage away from storage facilities and provide for the interception and management of salt impacted drainage.
 - Run-off from the roof must be diverted away from the loading pad and building.
 - Properly locate catch basins with hook-ups to storage areas to avoid directing salt-laden runoff through storm sewers into salt vulnerable watercourses, or directly into the ground through poorly sealed sumps.
 - Any residues left on the floor of the facility at the end of the season should be rinsed into the drain where it will travel to the designated holding facility.
 - If necessary and when appropriate, the detention ponds and holding tanks should be emptied and materials disposed of according to regulations.

B. Outdoor Deicing Chemical Storage:

Storage of salt outdoors may be necessary due to lack of facilities. In addition to the “salt pile” and “general” salt storage recommendations from above, the following factors should be taken into consideration when storing pavement deicing chemicals at existing facilities and when siting new outdoor facilities:

- **Facility Specifications**

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- Base must be constructed of materials capable of containing de-icing agents (i.e. bituminous or concrete pad).
 - Impermeable member/cover must be placed over all storage piles (to protect against precipitation and surface water runoff). The membrane cover must prevent run-off and leachate from being generated by outdoor storage piles.
 - For very small and temporary sites - see Parking Lot and Temporary Storage policies below.
- **Site Drainage**
 - Properly locate catch basins with hook-ups to storage areas to avoid directing salt-laden runoff through storm sewers into salt vulnerable watercourses, or directly into the ground through poorly sealed sumps.
 - If necessary and when appropriate, the detention ponds and holding tanks should be emptied and materials disposed of according to regulations.
 - Surface drainage must be directed to prevent flow through the base of the storage piles. De-icing agents must not be stored where drainage may enter into water supplies, farmlands, or streams.

C. Temporary Storage

Temporary storage of pavement deicing chemicals may be necessary for industrial, commercial, and residential deicing operations. In addition to the “salt pile” and “general” salt storage recommendations from above, the following factors should be taken into consideration when temporarily storing pavement deicing chemicals.

- **Facility Specifications: Salt piles**
 - Should be bordered by curb on two sides to ensure the pile is contained and less likely to be impacted by surface runoff.
 - Should be located away from drains.
 - Should be stored on the highest point in a parking lot so that drainage flows away
 - **Base:** Store deicing agent on a waterproof material to prevent runoff and absorption of moisture from the ground.
 - **Cover:** Keep the deicing/anti-icing agents covered at all times with a waterproof flexible covering to prevent runoff.

Cover salt and salt/sand piles and place them on an impervious pad to limit runoff and infiltration of chlorides.

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III. HANDLING

A primary source of salt entering the groundwater is salt spillage that is either plowed or washed from the maintenance yard, unloading and loading area. Care to minimize spillage and procedures to clean up spilled salt can reduce costly losses and impacts to the flora, fauna, and surface and groundwater.

General Practices

- **Facility Site**
 - Spilled materials should be swept and returned to the pile in a timely manner.
 - Salt and sand/salt mixtures that are spilled outside of storage facilities or within, or adjacent to maintenance yards should be collected and returned to the storage facility as soon as possible following the completion of a storm event.
 - All areas surrounding the storage pile (including but not limited to the loading/unloading pad) must be routinely inspected to determine whether any release of de-icing agents has occurred. Areas to be cleaned as necessary and spilled de-icing agents must be placed back under the protective covering.
 - The integrity of the storage facility and loading pad must be maintained.
- **Loading/Unloading Areas**
 - Where practical to do so, spreaders should be loaded inside the storage structure. When inside loading is not possible, other systems are needed to recover salt spills that occur during loading.
 - When loading spreaders outside of the storage structure, care should be taken to minimize spillage of salt onto the loading pad.
 - Promptly clean up all spills and scattered salt after loading and unloading.
 - Sweep loading areas back into the piles to reduce leaching.
- **Storage Pile**
 - For an outdoor facility, piles must be formed in a conical shape, covered and stored on a paved pad capable of preventing leachate from entering adjacent soil, surface water, or groundwater.
 - Storage piles must be designed and covered to control wind dispersal of the product by means other than wetting.
 - Storage piles must be reshaped into a conical form and covered as necessary to prevent leaching.
- **Pavement Deicing Transport Vehicle**
 - Loading/hauling:
 - Set up and load on a level surface wherever possible.
 - Maintain loading area, keep clear and smooth.
 - Don't overload, avoid spilling on units.
 - Remove loose material from the exterior of the dump body.
 - Fill in side gaps in tailgates or equipment with spill shields where materials can escape and spill out.
 - Tarp all transport vehicles.

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- **Washing:**
 - Prior to washing, the trucks/spreaders should be swept to remove as much of the residual solids as possible; thereby minimizing the amount of dissolved salt and solids in the wash water.
 - All trucks/spreaders should be washed at a location where the wash water can be properly diluted, disposed, and stored for re-use.
 - It is preferable to direct wash water to a storage facility where it can be reused for brine production or sent for disposal. Careful consideration must be given to the ultimate receiver of the wash water.

- **Drainage**
 - Never unfreeze or melt open frozen storm drains with high doses of salt. This practice is toxic to aquatic life in the receiving waters. Use other methods such as heat to open drains.
 - Employ ways to capture any solids before they enter the storm drain systems.
 - Make sure parking lots do not drain through salt storage areas.

Storm drains lead to the nearest lake, river, pond or wetland. They do not go to a treatment plant.

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IV. TRAINING AND CERTIFICATION

Winter Snow and Ice Certification:

All public and private winter maintenance personnel, including, but not limited to:

- counties
- municipality and township public works superintendents, managers, directors, operators, snow-plow operators/deicing applicators
- contractors maintaining private/public walkways and/or parking lots,
- property Managers writing deicing contracts
- educational institutions,
- commercial and industrial facilities,
- distributors of anti-icing/deicing products, and
- others responsible for winter maintenance.

All should attend a “Winter Snow and Ice Removal Workshop” prior to performing any snow or ice removal operations. All operators and applicators should be required to obtain Level One Certification.

Training workshops should be offered annually to all winter maintenance personnel. The University of Wisconsin, the County of McHenry, or American Public Works Association may host training and certification workshops. Certifications from each of these entities will qualify under the Winter Snow and Ice Operations Policy. All operators will be required to display certificate stickers in the window their vehicles. Individuals operating within McHenry County will be required to submit a copy of their certification to the McHenry County Water Resources Manager. An up-to-date list of all of the certified operators will be maintained on the Water Resources website. Operators will be required to renew or be recertified every three years. Refresher courses will be offered annually.

Training Options:

1) Managing Snow and Ice Control Operations: Certification for the Private Sector

- **Who:** All individuals that are not employed by a public agency that are responsible for snow and ice removal operations on parking lots, sidewalks, private drives and private roadways

2) Managing Snow and Ice Control Operations: Certification for Public Sector

- **Who:** Municipal, township, and county supervisors and operators that are responsible for snow and ice removal on public roadways, parking lots, and sidewalks.

3) Winter Snow and Ice Certification for Supervisors: “Train the Trainer”

- **Who:** Municipal, township, county supervisors should attend an abbreviated session on the latest snow and ice removal techniques.

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Suggested Program Outline for Fall Training Sessions

I. Winter Storms

- Understanding winter storms
- How to interpret forecasts

II. Customized Winter Weather Services

- Road weather information systems (RWIS)
- DTN and web forecast services
- Mobile temperature sensors

III. Winter Maintenance Liability

- Liability concerns in winter operations
- Minimizing potential for liability
- On-the-job safety

IV. Snow and Ice Chemicals

- Types of snow and ice conditions on pavement
- Selecting materials and application methods to match conditions
- Using chemicals as a bond breaker
- Salt properties and performance
- Properties and performance of alternative chemicals
- Salt storage, management and environmental impacts

V. Winter Maintenance Management

- Snow plans and operational guidelines
- Crew scheduling
- Public relations
- Planning and managing routes
- Prioritizing operations

VI. State of the Art Winter Road Maintenance

- Effective anti-icing procedures and equipment

- Innovative plow equipment
- Snow fence and living fence
- Public information
- Computerized maintenance decision support
- Computer-based training

VII. Winter Maintenance Best Management Practices

- Policies and procedures
- Application rates
- Equipment
- Field experience

VIII. Blending Salt Brine and Other Chemicals for Pre-wetting and Anti-icing

- Blends and blend performance
- Blending equipment
- Field experience with blends

IX. Contracting for Winter Maintenance

- Winter Maintenance from the contractor's perspective
- Specifying pre-wetting, anti-icing and alternative chemicals
- Best approaches for contracting winter maintenance
- Managing contracts and contractors

X. Buildings and Grounds Winter Maintenance

- Implementing effective winter grounds maintenance
- Using liquid chemicals
- Sidewalks, roads and parking ramps
- New equipment and techniques

XI. Discussion, Questions and Answers

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DEFINITIONS

Pavement: Includes all county, township, municipal, state, and private roadways, sidewalks, parking lots, driveways, and any other salted surface

GENERAL REFERENCES AND ADDITIONAL RESOURCES

Minnesota Winter Parking Lot and Sidewalk Maintenance Manual, June 2006

County of McHenry, Illinois. Groundwater Resources Management Plan, June 2007.

McHenry County Snow and Ice Handbook, September 2009.

The Snowfighter's Handbook. The Salt Institute, Alexandria, Virginia, 1999.

Syntheses of Best Practices Road Salt Management. Transportation Association of Canada. September 2003.

Practical Guide for Storing and Handling Deicing Salt. Salt Institute, www.saltinstitute.org/snowfighting

Referenced Regulations

IEPA Title 35 Part 616, Subpart L

<http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp>

Illinois Environmental Protection Act, Section 3.355 (415 ILCS 5/3.355)

<http://www.ipcb.state.il.us/SLR/TheEnvironmentalProtectionAct.asp>

Training and Technical Assistance

MPCA.

www.pca.state.mn.us/programs/roadsalt.html

Fortin Consulting, Inc

http://www.fortinconsulting.com/winter_training.html