

Best Management Practices (GWMP – pulled from Salt Management Plan)

In the development of a salt management strategy, Best Management Practices must be developed, adopted, practiced and improved upon to realize the desired outcome which is a reduction in salt into the environment while delivering a safe level of service to the public.

Development of Salt Management Plan

The plan should define the key elements of an environmental management program. Commitment to the plan should include accountability, goals, measurement of progress, communication, reporting and its periodic review. This will assure that the Salt Management Plan is a living document that provides for continual improvement.

- **Safety and Mobility:** In the reality of winter storms, the desirable outcomes for this goal are difficult to achieve and at times in conflict with each other. The principle driving force that often decided the hierarchy in the potential conflict is the defined Level of Service (LOS) the agency provides its visitors. The LOS may be different from agency to agency. One agency for example, has less resources at its disposal when fighting a storm than a large state or municipal agency has. In this case, the agency must provide better planning and maximize available resources to match the LOS provided by state, local and municipal agencies. A high level of service provides the greatest degree of safety and mobility for motorists. It allows first responders to provide adequate response times, citizens to carry out their day to day activities and provide a positive visitor experience during the worst times: major winter storms
- **Establishing Goals for Achieving Reduction in the Environmental Impact of Salt:** These Best Management Practices for Salt Management should be seen as tools for managing the impact of winter materials on the environment. Typically, the principal tool most winter maintenance agencies use to achieve a desired level of service is the tried and true operation: plowing and salting. There is an adage that states “that which gets measured, gets done.” Best practices for Salt Management should adhere to this adage. Roadway maintenance operations should measure their salt usage along with other ice control efforts. However, these measurements should be used to recognize trends rather than to develop usage reduction percentages. The dynamic nature of winter storms vary in number, type timing, intensity, duration, type of precipitation and roadway surface, including those in special areas such as bridges, and as a result a percentage reduction would be impossible to project. However, by analyzing trends, goals should be established to lessen the usage of salt and reduce its impact while maintaining the safety and mobility of the public.
- **Selection of types of Winter Materials:** Selection of equipment and materials: Winter operations require specific equipment and materials to obtain the desired LOS. The equipment and materials require activities to properly store, handle and maintain.
- **Types of Winter Materials:** Salt is the primary snow and ice control used by many state, local, and municipal agencies. It is used because it is effective for winter storms in the Mid-Atlantic region, relatively inexpensive, easily stored, and readily available. Salt is primarily used during storms when precipitation has begun to fall. With all of the innovation in winter maintenance over the past 20 years, nothing has stepped up to replace salt in benefit/cost effectiveness and reliability. While it will continue to be the most important material for fighting winter storms for the foreseeable future, agencies should look for ways to minimize its use.

The second most commonly used material by agencies across the country is salt brine (liquid sodium chloride). Salt brine is used by agencies primarily in anti-icing operations prior to storms. It is sprayed on roadways two hours or up to two days prior to the onset of frozen precipitation to prevent snow and ice from bonding to pavements. It is also used to pre-wet salt as salt is spread on highways during deicing operations.

Deicing operations are used when the snow or ice has already accumulated or bonded to the surface of the highway. Deicing involves plowing and spreading salt to remove frozen precipitation from surfaces. Anti-icing and deicing will be explained in greater detail in this document.

Salt brine has several attributes which explain its rising usage. First, it is easily manufactured using a brine maker. Dry salt is dissolved in fresh water and brought to a concentration of 23% brine, then is pumped into storage tanks where it is available for use on roads. Whereas salt begins to lose its effectiveness at 20 degrees F, brine, which has a freeze point of -6 degrees F, continues to work when salt cannot.

Highway agencies in the District of Columbia, Northern Virginia and Maryland also use liquid magnesium chloride (mag). Mag has a freeze point of -32 degrees F and can work in winter storms with very cold pavement temperatures. Mag is generally used to pre-wet salt. Mag is not sprayed on roadways prior to storms. This practice has proven to make roads slippery in certain conditions.

Agencies use abrasives (sand) in their winter operations. This material alone has no snow/ice melting capabilities, but mixed with salt, is effective in providing traction while deicing

- **Snow and Ice Control Equipment:** Purchase and maintain an appropriate variety of equipment to meet the needs of winter operations.

Purchase, modify, and employ the most effective snow fighting equipment we can within the confines of the budget and regional equipment replacement program. Dump trucks equipped with well-maintained front plows can mechanically remove as much snow as possible from highways. Dump trucks equipped with a side wing plow to increase the capability to remove snow. Effective mechanical ability to remove snow equates to less salt needed to maintain a road in safe and passable condition.

Dump trucks should be equipped with stainless steel dump bodies as well as well-maintained salt spreaders that are capable of applying the required amount of salt on roads in an effective pattern that limits material waste.

It is recommended to purchase and employ whenever possible, electronic salt spreading equipment. This equipment can be used to lock in specific application rates that will prevent operators from using more salt than an agency recommends. It can also provide very exact application rates. Finally it can be used in salt data collection after winter storms

Calibrate all salt spreading equipment, regardless of its type, prior to the start of the winter season and check it for accuracy periodically during the season. This is a critical aspect of salt management.

Use other specialty equipment for removal from highways when appropriate. Snow blowers are effective in moving a heavy buildup of snow particularly along shoulders and guard walls. Front end loaders are effective in removing a heavy buildup of snow where plows are not effective. Motor graders may be needed to mechanically remove ice pack from road surfaces. All of these pieces of equipment will lessen the need for salt usage to return a roadway to a serviceable condition. Many highway departments have a motor grader. Consider equipping a motor grader equipped with a front plow, center blade, and scarifying tool bar.

- **Training:** Training is a critical component of salt management and a best practice in winter operations in general.

Provide training in salt management to maintenance managers and front line forces on a regular basis. Many agencies, have a “snow college or snow academy” to accomplish this initiative. The thrust of the training should be on best practices that stress using the least amount of material without jeopardizing levels of service and the safety of the visitor.

Special training initiatives should target specific audiences. Shop or garage managers and frontline supervisors should receive additional training in the science of snow removal operations, effect winter storm management, the material inventory management, the properties of salt and other winter materials, and data collection and analysis.

- **Pre Storm Planning:** Pre storm planning is an effective tool for managing salt usage in a storm and a best practice in winter operations. Effective planning prior to storms will equate to better performance during a storm including more efficient usage of salt.
- **Winter Storm Management:** Weather and Pavement Condition Forecast: A key component of effective winter storm management is good weather and pavement condition forecasting. This is true 48 to 72 hours prior to a storm when planning is taking shape, during a storm as forces react to changing conditions, and during post-storm operations when effective cleanup actions prevent potential safety issues.
- **Anti-Icing Operations:** Anti-icing, a proven, proactive, nationwide winter strategy should be practiced by road maintenance operations whenever appropriate for a storm. Anti-icing involves placing a material, usually a liquid such as salt brine or non-chloride liquid deicer, on roadways anywhere from two hours to two days prior to the onset of precipitation. Anti-icing can also be accomplished with a pre-wetted salt placed on the highways prior to the onset of frozen precipitation. Finally, it can be accomplished with an application of salt as frozen precipitation is first starting to accumulate on the pavement.

- **Winter Storm Operations:** Once a storm begins and precipitation starts to accumulate on road surfaces, begin deicing operations. If a typical winter storm begins with light snowfall an early application of salt needs to be equally light. If a winter storm begins with moderate to heavy snowfall, applications should be adjusted accordingly. Either way, this initial application should be pre-wetted with a liquid deicing material such as salt brine or magnesium chloride. Pre-wetted salt tends to adhere to the pavement, reducing the amount of salt that bounces off the pavement onto the shoulders and into the curb and gutter system. The pre-wetted salt also begins working quicker. The key is to get some material on the road as early as possible to prevent snow or ice from bonding to the highway surface. This will allow for effective plowing and lighter salt applications throughout the remainder of the storm. The old adage “an ounce of prevention is worth a pound of cure” rings true when fighting a winter storm. If a winter storm is associated with very cold pavement temperatures, salt should always be pre-wetted with a liquid deicer to increase its effectiveness. By increasing the effectiveness of salt, less salt is needed.

On multi-lane highways, plow trains should be considered to remove as much snow as possible in one coordinated sweep. Make use of plow trains. If a plow train is effective and the surface is swept clean, minimal salt is needed to keep the road in an acceptable condition until the plow train comes through again. Every effort is made by the train to direct the applications of salt into the areas where plowing has already occurred. Otherwise, trailing trucks could plow off salt just place on the road by lead trucks. Train staff in effective plow train operations, a key element in salt management.

- **Post Storm Operations:** Post storm operations include a variety of tasks including cleaning equipment, stockpile maintenance, and operation reviews.
- **Equipment Cleaning and Maintenance:** Develop plans for equipment cleanup and maintenance after winter storms. Cleaning of snow plows and trucks should occur, whenever possible, inside the facilities designated wash bay of a shop’s facility. Cleaning of salt spreaders should occur in a manner whereby wastewater does not discharge from the site into the storm water system.
- **Operations Review for Continual Improvement:** Review of operation after winter events is an essential best practice in winter operations in general and salt management in particular. Consider having post storm reviews at their shop or garage level for most winter storm and agency-wide reviews for major storms.

Post Storm reviews should concentrate on three key elements. What worked well, what did not work well and, most importantly, opportunities for improvement? The opportunities for improvement lead to best practices. Capture salt usage data for each winter storm event and consider measuring their salt usage in relation to the number of lane miles served and inches of snow. A good formula for measurement is “pounds of salt used per lane mile per inch of snow”. This formula has been used for decades by many road maintenance agencies.

Consider electronic means of collecting salt usage data. Various electronic salt spreader controllers have this capability. At the close of a winter storm, data on salt usage can be downloaded from the spreader and analyzed by shop managers.

- **Salt Spill Prevention:** When loading salt at storage locations, trucks should never be overloaded. If they are, salt can spill from the sides or back of the truck when leaving the maintenance facility or when the truck is on route. Overloading trucks with salt is avoidable and a clear violation of best practices for salt management. If a spill occurs, it must be addressed during a storm if time allows or at the close of the event.

Another best practice is the deployment of tailgate flaps that prevent salt from spilling from the back of dump trucks. These small triangular pieces of metal can be made in-house for a few dollars each, but they can save tons of salt over the course of a winter system. There are times when salt can spill from a truck that was not overloaded. If the auger in a truck's spreader box becomes jammed with a large chunk of salt or debris, the operator may manually have to clear the box. At times the jam is cleared but salt falls to the pavement. At other times, a truck operator may have to raise the dump bed to move material to the rear of the truck. This occurs when salt in the truck bed begins to get low. During this operation, material can spill from the back of the truck to transfer the salt from the bed to the spreader by lifting the bed to a high level. Whenever salt spills from the truck, either from being overfilled or not, it shall be swept up and placed back in the bed of the dump truck. Operators must do this in a safe fashion so as not to endanger themselves or motorists. Effective salt management does not equate with unsafe practices

- **Brine and Liquid Deicer Mixing and Storage Tanks:** To minimize the possibility of leakage and spills from liquid storage tanks, a weekly inspection program shall be implemented during the winter season. Whenever leaks/drips are found, maintenance and repairs should be made as quickly as possible. Until such time the repair is made, the leak shall be contained.
- **Recordkeeping and Annual Reports:** Maintain up-to-date records on salt usage and other winter objectives and performance measures. Records should be kept on all aspects of its winter operations and at all levels of the region.

Records should be kept for each winter event and for each winter season. This will allow for seasonal analysis and the identification of trends. Track personnel, equipment, and material usage as part of the winter operations. Track weather and pavement conditions for each event. The information is summarized in various reports for real time operations status and is post-processed for operations cost estimates. Perform an in-depth analysis of its operations with an emphasis on salt usage, at the close of each season. This analysis should culminate in an annual report. The report should serve as means for learning lessons, identifying trends, and developing recommendations for operation the following winter. The annual report can also be used by an agency's senior management to determine the need for change in policies, procedures, processes and expenditures and to determine any budgetary implications of identified needs.

- **Annual Winter Wrap-Up Meeting:** Conduct annual meetings to review winter operations, deepening understanding of lessons that came out of the post storm reviews, and identifying areas of concern such as salt management, equipment improvements, etc. The annual meeting can be used to identify key opportunities for improvement and set up teams to tackle them over the summer. It is critical that the progress of the team is tracked closely so the efforts come to fruition prior to the following winter.

- **Public Education and Outreach:** Make every effort to provide the public with information concerning its winter operations in general with information concerning its winter storm activities in particular. Consider an annual media briefing to update the radio, television and print media in their area about their winter operations program. Agencies can use this opportunity to review their experience during the past winter, discuss their plans for the upcoming winter and highlight new initiatives. This information is then shared through media outlets with the public.
- **Testing and Evaluation of New Materials, Equipment, and Strategies for Continual Improvement:** Continually strive to improve their winter operations. One way to improve operations is by trying new ideas that pose minimal risk to operations, but have a substantial potential upside. New ideas can be in the form of different winter materials, tweaking existing equipment, deploying a new spreader plow, or trying out new strategies or tactics for fighting storms. Testing and evaluating new ideas can lead to lower salt usage and is definitely a Best Management Practice for salt management. As agencies strive to improve their winter operations in general and salt management in particular, they need to expand their search beyond the individual agencies borders. There are many organizations across the country that are performing research on new winter strategies, testing new materials in laboratories, and testing and evaluations new products on highways and bridges.