

1.0 SALT MANAGEMENT PLANS

This is one in a series of Syntheses of Best Practices related to the effective management of road salt use in winter maintenance operations. This Synthesis is provided as advice to road maintainers for consideration when developing their own Salt Management Plan. The Synthesis is not intended to be used prescriptively but is to be used in concert with the legislation, manuals, directives and procedures of individual road agencies. Syntheses of Best Practices have been produced on Salt Management Plans, Training, Road and Bridge Design, Drainage and Stormwater Management, Pavements and Salt Management, Vegetation Management, Design and Operation of Road Maintenance Yards, Snow Storage and Disposal Sites and, Winter Maintenance Equipment and Technologies. For more detailed information, please refer to TAC's Salt Management Guide – 1999.

INTRODUCTION

In Canada, over \$1 billion is spent annually on winter maintenance to keep roads safe and passable. Snow and ice control is a key part of winter maintenance operations. Road salts (particularly sodium chloride) are the preferred deicing/anti-icing chemicals for maintaining winter roadway safety because of their cost, effectiveness, and ease of handling. Road salt (particularly calcium chloride) is also used to control dust on gravel roads and construction sites during dry weather. Excessive use of salt can have environmental impacts. Recognizing their responsibility to the environment, many road authorities across Canada are taking positive actions towards implementing salt best management practices. The Transportation Association of Canada has published a Salt Management Guide and a series of Syntheses of Best Practices to assist road authorities as they find ways to more effectively manage their salt used in winter maintenance and provide the public with the safe and efficient road systems they expect, while minimizing effects on the environment.

The amount of salt used is a function of local policies, practices, roadway system, funding constraints and weather conditions. Because of the variability of conditions across Canada, salt management initiatives need to be developed and implemented locally by each road authority. Road authorities should be responsible for developing their own salt management plans. This framework has been developed to support road authorities in

their pursuit of best management practices and the preparation of salt management plans. The framework follows an environment management system (EMS) approach.

A successful Salt Management Plan is based on the following principles:

- It is grounded in policy with guiding principles –set and endorsed at the highest level in the organization.
- It is activity based, with each activity being assessed at the outset against clearly established standards and/or objectives to determine how they can be carried out with minimal environmental impact.
- Deficiencies in current operations are identified and corrective action established and implemented.

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- Required actions are documented in policies and procedures and communicated throughout the organization.
- Activities are recorded, monitored, audited and reported periodically to assess progress and identify areas for further improvement.
- Gaps between actions and desired outcomes are identified and corrective actions are developed and implemented, with necessary modifications being made to policies and procedures and appropriate training.
- The cycle begins again and continues on an ongoing basis in the spirit of continual improvement.

Figure 1 illustrates the process.

OBJECTIVE OF A SALT MANAGEMENT PLAN

An agency's salt management plan will provide the vehicle through which each agency commits to implementing salt best management practices as it fulfills its obligation to provide safe, efficient and cost-effective roadway systems. The Plan should contain best management practices to protect the environment from the negative impacts of road salts. The Plan should apply to all winter maintenance personnel – both staff and hired resources/contractors.

COMMITMENT & POLICY

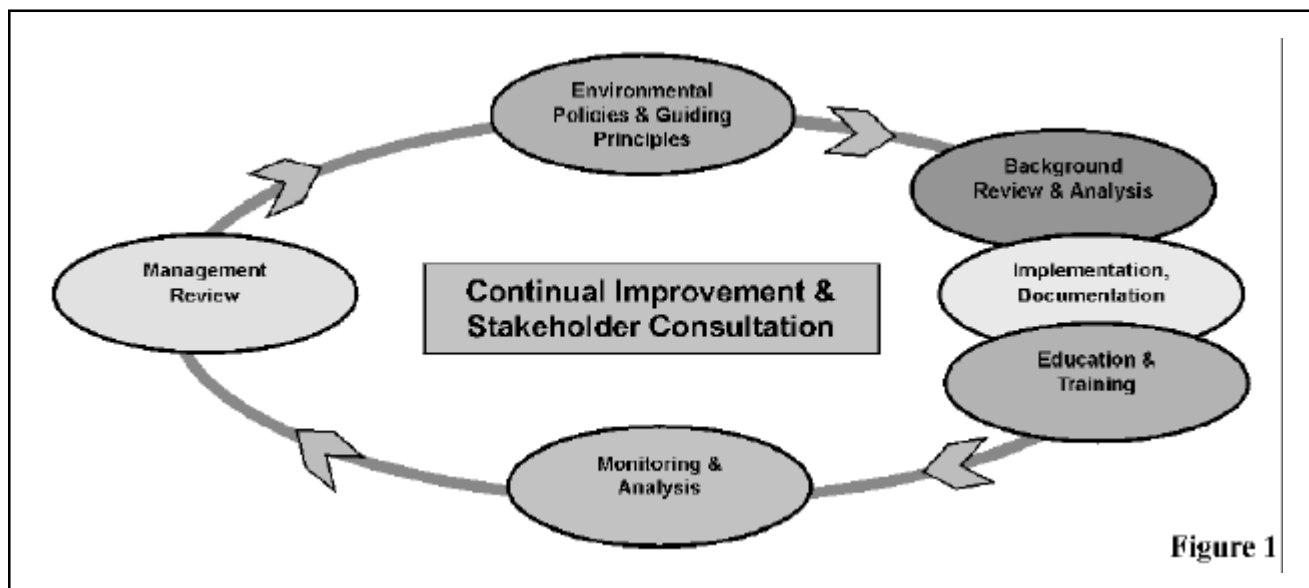
To be effective, the senior management of an agency must commit to developing, implementing and updating its salt management plan. A senior manager who is

responsible and accountable for the implementation of the agency's salt management plan should be appointed. Road agencies should establish a clear road salt management policy endorsed at the highest level of the organization.

GUIDING PRINCIPLES

The salt management plan should be grounded in the following principles:

- i) Safety – In recognition of the importance of effective winter maintenance to the safety of roadway users and maintenance crews, the development and implementation of the salt management plan will make safety the overriding priority.
- ii) Environmental protection – In recognition of the adverse effects that excessive use of road salt can have on the environment, the salt management plan will strive to minimize the amount of road salt entering the environment.
- iii) Continual improvement – Different roadway authorities within Canada are at different stages of implementation of salt best management practices (salt BMPs). The cost of moving towards salt BMPs can be high, and changes must be phased in over time. Therefore the salt management plan must recognize that change will be incremental and ongoing.
- iv) Fiscal responsibility – The salt management plan will need to be within the financial capabilities of each road authority.



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- v) Efficient transportation systems – In recognition of the importance of efficient roadway transportation to Canada’s economy and quality of life, development and implementation of the salt management plan will take into account the effects on transportation system performance.
- vi) Accountability – Each road authority must be responsible and accountable for developing and implementing its salt management plan.
- vii) Measurable Progress – Indicators must be developed to ensure that progress on implementing the salt management plans can be tracked and reviewed.
- viii) Agency-based – The plans must be developed and implemented by each road agency rather than be centrally driven.
- ix) Communication – A communication plan must be developed for communicating internally and externally with key stakeholders.
- x) Knowledgeable and Skilled Workforce – The plans must include regular, comprehensive and effective training for managers, supervisors and operators.

FRAMEWORK FOR A SALT MANAGEMENT PLAN

Each road authority should develop and implement its own salt management plan incorporating the guiding principles set out in this framework. The plan should be results-oriented and contain the following elements.

1. Salt Management Policy and Objectives

The road authority should adopt a salt management policy that commits the organization to measurable improvements in its salt management practices.

The cornerstone of an effective plan is a clear salt management policy endorsed by senior management and communicated to the organization.

2. Situational Analysis

An inventory of current practices must be established to form a benchmark against which progress can be measured. It should contain consistent elements to allow the transportation community to measure and track progress in managing the amount of road salt being placed into the environment on a national basis. The following elements may be considered in an overall situational analysis:

On Road Use:

- Type and amount of chloride freeze point depressant used (all sources including solids, liquids, and abrasive mixes)
- Type and amount of non-chloride freeze point depressant used (all sources including solids, liquids, and abrasive mixes)
- Current application rate for each type of material
- Percentage of fleet with pre-wetting
- Percentage of fleet with liquid only applications
- Percentage of fleet with electronic spreader controls
- Number of road weather information systems (RWIS) installations
- Number of other surface temperature measuring devices (hand-held or vehicle mounted)
- Use of dedicated pavement and/or atmospheric forecasting

Salt Vulnerable Areas:

- Locations of salt vulnerable areas
- Description of winter maintenance practices in the vicinity of salt vulnerable areas (e.g. alternate treatment)

Examples of Possible Salt Vulnerable Areas

- Groundwater recharge areas
- Areas with exposed or shallow water tables with medium to high permeability soils
- Sources of drinking water
- Salt-sensitive vegetative communities
- Salt-sensitive wetlands
- Small ponds & lakes
- Rivers with low flows
- Salt-sensitive agricultural areas
- Salt-sensitive habitats for species at risk

Sand and Salt Storage Sites:

- Number and capacity of storage sites
- Percentage of sand/salt piles covered and type of cover

- Percentage of indoor loading
- Management of drainage from sand/salt mix piles
- Levels of environmental indicators (e.g. chloride levels)
- Percentage of salt in winter sand
- Percentage of sites with washwater treatment
- Existence of a good housekeeping policy, and adherence to the policy

Snow Disposal Sites:

- Number and capacity of disposal sites (permanent and/or temporary)
- Levels of environmental indicators (e.g. chloride levels)
- Percentage of disposal sites with water management systems
- Conformance with existing environmental standards for snow disposal sites
- Existence of a good housekeeping policy and adherence to the policy

Training:

- Percentage and frequency of staff receiving training in best salt management practices broken down into categories (e.g. managers, supervisors and operators)

3. Documentation

Each road authority should have documented policies, procedures and guidelines in the following areas:

- Level of service for each roadway type
- Salt and sand application rates
- Managed sand and salt storage
- Good housekeeping practices for maintenance yards consistent with TAC's Design and Operation of Road Maintenance Yards Synthesis of Best Practices
- Equipment calibration & re-calibration
- Training
- Snow disposal
- Incorporation of salt management consideration into road design and construction
- Salt vulnerable areas

The documentation should be aimed at introducing best salt management practices with both in-house and out-sourced operations.

TAC's Salt Management Guide and Syntheses of Best Practices can be used to supplement in-house procedures and other available documentation on best management practices.

Policies, procedures and guidelines should be clearly documented and communicated throughout the organization.

4. Proposed Approaches

Salt management plans should have clear tasks, schedules with milestones, budget considerations and assigned responsibilities for implementing best salt management practices. The plans should deal with four areas of concern – general road use, salt use in salt vulnerable areas, salt storage, and snow storage and disposal.

The plan can be developed by comparing current practices to best management practices and documenting the gaps. The salt management plan should then focus on closing these gaps. The plan should include pre-season, in-season and post-season actions to be taken to reduce the adverse impacts of road salts. It should also include consideration of equipment, labour, materials and the local climate.

Although not all salt management techniques are applicable to all regions of Canada, the salt management plan should consider strategies for introducing best practices in the four areas of concern.

Where specific technologies are inappropriate, the fact that they were considered and determined to be inappropriate should be explained in the plan. The plans should be results-oriented and measurable with proper commitment of funding and personnel to ensure successful implementation.

The other TAC Syntheses of Best Practices will assist road authorities in assessing these practices.

5. Training

Human behaviour is predicated upon attitudes based on knowledge and experience. Changes in approach require changes in behaviour. A successfully managed salt strategy requires changes in procedures, practices

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and equipment. Success also requires acceptance of the new approaches by managers, supervisors and operators. Each salt management plan should therefore include a comprehensive education program that demonstrates the value of new procedures and ensures that personnel are competent in delivering the new program. The Training Synthesis of Best Practice provides guidance on developing a salt management training program.

The public must also be educated on proposed initiatives and on their role in adjusting driver behaviour to roadway conditions. Each road authority should have a program for informing the public of winter maintenance practices.

Each plan should include a training plan to ensure that workers have the necessary skills and knowledge to implement the plan effectively.

6. *Monitoring, Record Keeping, Reporting & Analysis*

Progress on implementation of the salt management plan can only be confirmed by tracking specific indicators and comparing these to the baseline that was benchmarked at the outset of the program.

Each salt management plan should assign responsibility for monitoring and reporting on implementation of the plan. These results should be reported annually to the senior executive responsible for the salt management plan.

The monitoring and record keeping system should document and assess the indicators identified in the situational analysis. Where there are new issues or activities being implemented as part of the salt management plan, new monitoring initiatives may be required. Any changes from the baseline established in the situational analysis need to be analyzed to assess the degree of progress being made. The analysis should also take into account the type of winter experienced to ensure that realistic conclusions are being drawn. For example, an increase in salt use may be due to an unusually severe winter rather than the failure of a plan. Similarly, a reduction in salt use may be due to a milder than normal winter rather than the successful implementation of a plan. Therefore the analysis must be sufficiently in-depth to account for these variances.

Where there are known releases to the environment being monitored (e.g. stormwater outfalls, water intakes, water treatment plants, monitoring wells, material storage sites or snow disposal sites), then these data should be included in the annual progress report.

Each plan should include monitoring of progress, analysis and reporting of the results to senior management.

7. *Management Review*

Each year, senior management within each administration should review the results of the previous year's salt management actions to confirm that the plan is achieving the desired results and to adjust the next year's salt management plan to respond to shortcomings and new opportunities. Policies and procedures should be updated prior to the next snow and ice control season and communicated to management and operational personnel.

This review should be integrated into the budgetary process to permit timely acquisitions of new equipment and to identify other funding needs.

Progress on implementation of the salt management plan should be communicated to senior management, local politicians, staff and the public.

Each road authority should have an annual review by senior management to confirm that progress is being made, and that corrective action is taken when necessary.

CONCLUSION

Effective road salt management requires dedication to adopting, implementing and refining best management practices. This is not an easy task. It will require a long-term vision, senior management support, dedicated resources, adequate and regular training, perseverance, continual innovation and improvement, and an ability to deal with changing organizational culture and attitudes. It cannot be rushed. Public safety must be maintained as best management practices are implemented. Personnel at all levels of the organization will need to be trained and educated so that maximum benefits are realized.

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