

Salt Institute Newsletter (SHD) Third Quarter 2010

## **Proof's in: salt management protects the environment**

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Recognizing the social imperatives of protecting lives on winter roads threatened by winter snow and ice and the economic imperative of providing reliable roadway access in winter weather to buttress job preservation and growth, snowbelt communities have used a combination of salting and plowing since the first half of the 20th Century. The safety and economic benefits are indisputable and well-documented.

At the same time, the adverse environmental potential of placing road salt in the environment is also well-studied and documented. Back in the 1960s, Salt Institute demonstrated enlightened leadership in propounding its Sensible Salting program – a “best practices” approach of identifying and using only the minimum amount of salt, applied in the right way at the right time to meet the social-economic goals of winter roadway maintenance.



Over the ensuing decades, technology has advanced and new equipment and techniques (e.g. RWIS, anti-icing) have been incorporated into these best practices. And the overall results in terms of reduced environmental impact have sustained the underlying assumption that using these best practices is environmentally protective.

### **New evidence**

Now we have proof. A new and rigorous study by environmental researchers at the University of Waterloo and Environment Canada, co-funded by Salt Institute and Environment Ontario, examined whether the best practices incorporated into Canada's Road Salt Code of Practice actually deliver what they promised: improvement in environmental outcomes. Short answer: salt management delivers improved environmental results.

The study, “Assessing the Efficacy of Current Road Salt Management Programs,” conducted by Dr. Micheal Stone and a team of environmental scientists at the University of Waterloo and Canada's National Water Research Institute, examined how public agency and private sector snowfighters implemented Canada's new, voluntary Code of Practice and whether the new practices reduced chloride inputs and impacts.

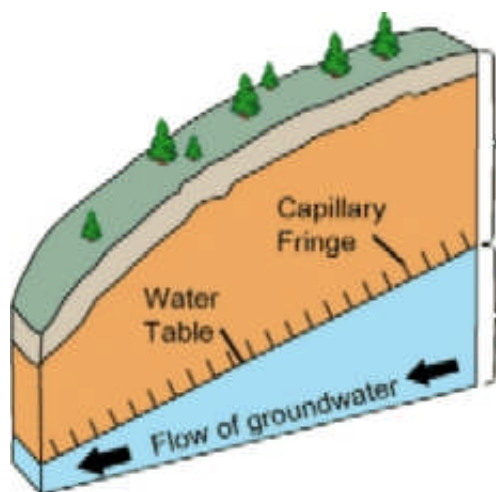
The researchers surveyed salt-using agencies and gathered inputs at a workshop and an International Conference on Road Salt Management held in the Spring of 2009. The survey documented broad adoption of the new Code of Practice. Eighty-nine percent (89%) of the larger municipalities, for example, have created Salt Management Plans, a key indicator. Further evidence: 63% have annual snowfighter training for employees and contract

snowfighters. The Waterloo Report commended the Transportation Association of Canada in developing Syntheses of Best Practice including consistent learning objectives for snowfighter training. The TAC Syntheses are [available free online](#) and represent a valuable resource for snowfighting managers. Salt management plans call for mapping of “salt vulnerable” areas and more than half the jurisdictions have already addressed this step. And jurisdictions with sufficient quantities of snow requiring removal to separate snow disposal sites are giving greater priority to managing those sites.

So, while recognizing a number of opportunities to improve implementation, the progress to date suggests that agencies are able and willing to improve salt management practices and that any identifiable environmental benefits attributable to Code will be magnified as compliance becomes more broadly and deeply established in the years ahead. In short, the survey validates the significance of whatever the outcomes study would discover.

### Outcomes of road salt best practices

Three separate studies of the Waterloo Report examined the effectiveness of best practices to manage chloride in the environment.



A study of groundwater in the shallow “vadose zone” aquifer examined impacts since 2003-2004 when the best practices were initiated. The region had been monitored extensively for salt contamination because it was the recharge area for the metropolitan drinking water aquifer in an area almost wholly dependent on underground water for public drinking water supplies; thus the new data would be compared to those from years before best practices were employed.

The groundwater monitoring data show that chloride levels in the vadose zone at most of the field locations were half the original level before best practices were employed. Half! Only in two locations were loadings higher and, as the Report describes, these were areas with “specific safety concerns (sidewalks adjacent to public schools) [that] resulted in the application of elevated levels of sidewalk deicing salts.” The Report affirms:

“The data indicate that substantial improvement in shallow groundwater quality (specifically Cl<sup>-</sup> concentrations), resulted from the implementation of road salt BMPs. A detailed comparison of the soil core data collected from the unsaturated zone as measured in 2001 and 2008 indicates a significant reduction in average soil Cl concentration occurred following the implementation of the BMP activities. When these data are combined with estimates of groundwater recharge rates at each of the field monitoring stations, an average reduction of 60% in road salt mass loading to the water table was observed between the initial study (2003) and the 2008 study. The data support the overall conclusion that significant reductions in road salt loads to the subsurface resulted from the implementation of the BMP strategies in 2003. The study shows that a considerably lower percentage of the total applied road salt mass is entering the subsurface under the new salt management practices as compared to historical practices. The trends observed in the groundwater Cl<sup>-</sup> data collected from the monitoring network correlates well with the observations made from a detailed assessment of chloride occurrence and distribution in the unsaturated zone. Accordingly, monitoring of changes in groundwater quality in shallow monitoring wells provide useful quantitative assessment of the performance of different BMPs in the urban environment.”

Thus, the Report summarizes:

"The data clearly support the overall observation that significant reductions in road salt loads to the subsurface were achieved through the implementation of the BMP strategies in 2003.

Compared to pre-BMP levels in 2001, the study found that BMPS implemented to reduce salt application resulted in a reduction of 45% in the average total mass of Cl<sup>-</sup> stored in soil. The data clearly support the overall observation that significant reductions in road salt loads to the subsurface were achieved through the implementation of the BMP strategies in 2003."

The second study quantified the chloride loading and distribution of snowfighting in a salt vulnerable area. The findings: "The data show that average chloride concentrations declined with distance from the road way. Variability in the data is related to several factors that influence both the redistribution of snow in urban environments and salt demand."

The third study measured and compared the chloride content of runoff from two parking lots treated with different deicers: road salt (sodium chloride) and a potassium chloride-based "commercially available alternative de-icing material Mountain Organic Natural Icemelter." As the Report says, "Parking lot runoff is a significant source of chloride to the environment." Over the winter 2008-2009, "(t)he data show that chloride losses from a parking lot treated with Mountain Organic Natural Icemelter were demonstrably higher than for a parking lot treated with road salt."

### **Documented proof: salt management works**

The Waterloo Report establishes two foundational principles: First, those charged with managing salt in an environmentally sound manner are taking their responsibilities seriously. And, second, the best practices they are using will make significant environmental improvements. Both are to be celebrated.

More must be done, however. With advances in technology to help us better manage road weather incidents and a growing public expectation that winter roads should be maintained consistently in safe operating condition, comes the challenge to bring along those snowfighters who haven't grasped the reality that their professionalism not only saves lives, but can save the environment as well. After all, even though 89% of the municipalities have salt management plans, 11% do not. And other areas of best practice are even less fully implemented.

What the Waterloo Report means is that snowfighting agencies have fresh ammunition in competing for scarce budget resources. With those resources, their snowfighting operations will improve the environment. We have solid evidence of return on this investment.

In particular, the Waterloo Report identifies a number of areas where lagging implementation of best practices can make a significant difference. These include:

- Adoption of salt management plans
- Implementation of quality operator training, including training of contract and seasonal workers. Certification of operators could be considered, the Report concludes
- Improved record-keeping to measure outputs, outcomes and continuous improvement
- Mapping of salt vulnerable areas so they can receive customized treatment
- Better design and good housekeeping practices at salt storage facilities
- Better design of parking lot and related stormwater runoff systems and more training for their private sector operators
- Replacement of non-Code snow disposal facilities with those designed to Code standards. While these are long-term investments, we should expect all new sites to meet Code standards and that agencies have a program to replace the others over a period of time
- And, of course, further research. The Waterloo Report suggests the need to develop a

reliable winter severity index, simpler tools to help identify salt vulnerable areas and better tools to educate the public about winter maintenance issues and benefits.

### **Sensible Salting: an evidence-based strategy for the future**

For decades we've taken great comfort in trying to do the best we can to unlock the benefits of road salt while minimizing any downside. Adoption of Sensible Salting practices was a key step forward in the 1960s. Its inherent wisdom has gained consensus stature in the following decades. But there was always that nagging doubt: what if using best practices in storing and applying road salt was, indeed, the best we could do, but not really good enough? What if some radically new paradigm is required to have sustainable winter roadway operations?



Consensus is not enough. We should demand evidence. The Salt Institute is proud of its commitment not only to Sensible Salting, but to an evidence-based public policy agenda. We've been proud to join with the Ontario Ministry of the Environment to take leadership in establishing an evidence-based path forward which has validated the best management practices approach. No longer will we need to fret that even our best efforts may be inadequate. This outcomes study validates our revered Sensible Salting strategy and reinforces the critical priority of salt users to use its precepts to discharge their environmental stewardships. The Waterloo Report is a beacon lighting the way forward for snowfighting professionals.

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