Deicing Program Research and Technologies

A - Developing a Sensible Salting Program

Morton Satin

Salt Institute, Alexandria, VA

Why Develop a Sensible Salting Program?

- <u>Mismanagement</u> of chloride salts poses a key problem
- Salt storage may be more important than application
- Impacts are local and reversible
- Proper management = acceptable impacts
- Minimizing environmental impacts a constant focus

Sensible Salting Program

- **Initiated by Salt Institute in 1972**
  - Use minimum salt to achieve service level
  - Excellence in Storage, 1988
- **APWA/CPWA, 1965**
- **TAC *Salt Management Guide*, 1999**
- **Salt Institute – Partner for training**
  - http://www.saltinstitute.org/snowfighting

Sensible Salting Program

A good Sensible Salting program includes:

- Personnel training
- Good equipment
- Calibration of spreaders
- Use of automatic controls
- Adequate, covered storage
- Proper maintenance around storage areas
- An awareness of safeguarding the environment by all who use salt

Winter Stakeholders' Challenge

- Consensus goal is minimum environmental impact consistent with need for safety and mobility
- Agree on priority <u>actions</u>
- Identify meaningful assessment tools to measure improvement

Top priority: training

- All operators and supervisors
- Often done today by provincial ministries and larger cities
- A particular challenge for smaller units of government, contractors
- Operators and supervisors can be trained <u>quickly</u>; no reason to delay

Second priority: salt storage

- Consensus on approach: keep precipitation off the salt; store salt on a pad
- Buildings make economic sense for customer-sized storage, but
- Buildings require significant investment; takes time to secure budget funding

What are there benefits to Sensible Salting?

Although there is an implicit understanding that sensible salting makes good sense in terms of providing adequate winter services and minimizing the impact on the environment, unless an assessment can be made to quantitatively determine the benefits of sensible salting we can never be sure of its advantages.

This was why we decided to financially support a comprehensive environmental monitoring program to assess the efficacy of current voluntary road salt management programs for reducing environmental chloride inputs from road salt practices.

Deicing Program Research and Technologies

B - Canadian Research

i) Assessment of Best Management Practices
ii) Novel Modeling of Stormwater Management

Assessment of Best Management Practices

Project Rationale and Context

In 1995, a comprehensive five-year scientific assessment of the environmental impacts of road salt was conducted under the Canadian Environmental Protection Act, 1999 (Environment Canada, 2001) - significant losses of chloride from road salt adversely impact.

- freshwater ecosystems
- terrestrial ecosystems (soil, vegetation & wildlife)
- drinking water supplies

Code of Practice for the Environmental Management of Road Salt, 2004 - help municipalities/authorities better manage salt use to reduce adverse environmental impacts of chloride while maintaining road safety.

Project Rationale and Context

Recommendations of the Code:

1) Develop salt management plans, based on a review of existing road maintenance operations, identification of means and goal setting to reduce the negative impacts of salt releases

2) Implementation of best management practices (BMPs) in the areas of salt application, salt storage and snow disposal as reported in the Transportation Association of Canada's (TAC) Syntheses of Best Management Practices.

Project Rationale and Context

TAC Syntheses of Best Practices for Road Salt Management

1. Salt Management Plans
2. Training
3. Road and Bridge Design
4. Drainage and Stormwater Management
5. Pavements and Salt Management
6. Vegetation Management
7. Design and Operation of Road Maintenance Yards
8. Snow Storage and Disposal
9. Winter Maintenance Equipment and Technologies

http://www.tac-atc.ca/English/informationservices/readingroom.cfm

Project Rationale and Context

Assumption:

Voluntary, state-of-the-art salt management practices when applied as per Code recommendations will benefit the environment and road authorities by:

- reducing chloride levels
- improving water & soil conditions
- increasing operational efficiency
- improving roadway safety
- providing cost savings

Knowledge Gaps

- No systematic quantification of the environmental benefits and cost savings of Code recommendations …particularly *in the two main areas where applied!*

- Pressure to regulate……..

- Rigorous data required for Environment Canada formal review of Code of Practice in 2010

Filling the Gaps

By conducting a comprehensive environmental monitoring program, the project we supported is designed to assess the efficacy of current voluntary road salt management programs for reducing environmental chloride inputs from road salt practices.

Specific Objectives

1. Review the status of Salt Management Plans within the Regional Municipality of Waterloo, ON. Report on aspects of salt management plans to include; salt management objectives, situational analyses, level of documentation, approaches to training, monitoring and management review.
2. Collect, analyze and report historical road salt application rates within the Regional Municipality of Waterloo and compare this information with data from other municipalities that have representatives on the Ontario Road Salt Management Group (ORSMG).

Specific Objectives

Training

3. Report on the current and proposed level of winter maintenance training for municipal and private operators.
4. Monitor chloride levels in runoff from two parking lots maintained by municipal (trained) and private (untrained) operators.

Specific Objectives

Drainage and Stormwater

5. Monitor chloride levels at the outflow and inflow of two stormwater ponds (conventional and enhanced) and two receiving streams in Waterloo.
6. Monitor chloride levels in shallow groundwater and soils in salt vulnerable areas within the Regional Municipality of Waterloo

Specific Objectives

Vegetation Management

7. Monitor chloride levels in surface and subsurface zones of a grassed swale located in Toronto (in cooperation with the Toronto Region Conservation Authority).
8. Evaluate chloride removal by selected plants in preparation for field trials in 2nd year.

Specific Objectives

Design of Road Maintenance Yards

9. Compare surface and subsurface chloride losses from “state of the art” and “conventional” road maintenance yards in Regional Municipality of Waterloo.

Milestones (Year 1)

Phase I – Coordination with RMOW's WMPPWG and Other Stakeholder/Collaborators (October, 2007)

Phase II – Preliminary (Pilot-Scale) Monitoring Program (November 2007 to May 2008)

1. Review published and gray literature since 2001 Environment Canada document
2. Analysis of salt release from storage facilities and road application in selected sewersheds
3. Analysis of salt release from snow disposal sites
4. Site-scale pavement studies
5. Road Salt Management Workshop (April 2008)
6. Initiation of chloride-volatilizing plant research

Milestones (Year 2)

Phase III – Full-Scale Monitoring Program (November 2008 to August 2009)

1) Analysis of salt release from storage facilities and road application in selected sewersheds
2) Treatment measures for winter maintenance sensitive areas
3) Analysis of salt release from snow disposal sites
4) Porous pavement studies
5) International Conference on Road Salt Management (University of Waterloo – May 2009)

Anticipated Project Outcomes

Provide a quantitatively rigorous assessment of current voluntary road salt management programs designed to reduce chloride inputs from winter road maintenance practices in the RMOW.

Workshop and International Conference: provide a forum for researchers and stakeholders to discuss the successes and challenges of winter road maintenance practices and to demonstrate the utility of recent innovations/practices to provide guidance to improve policy documents and practice.

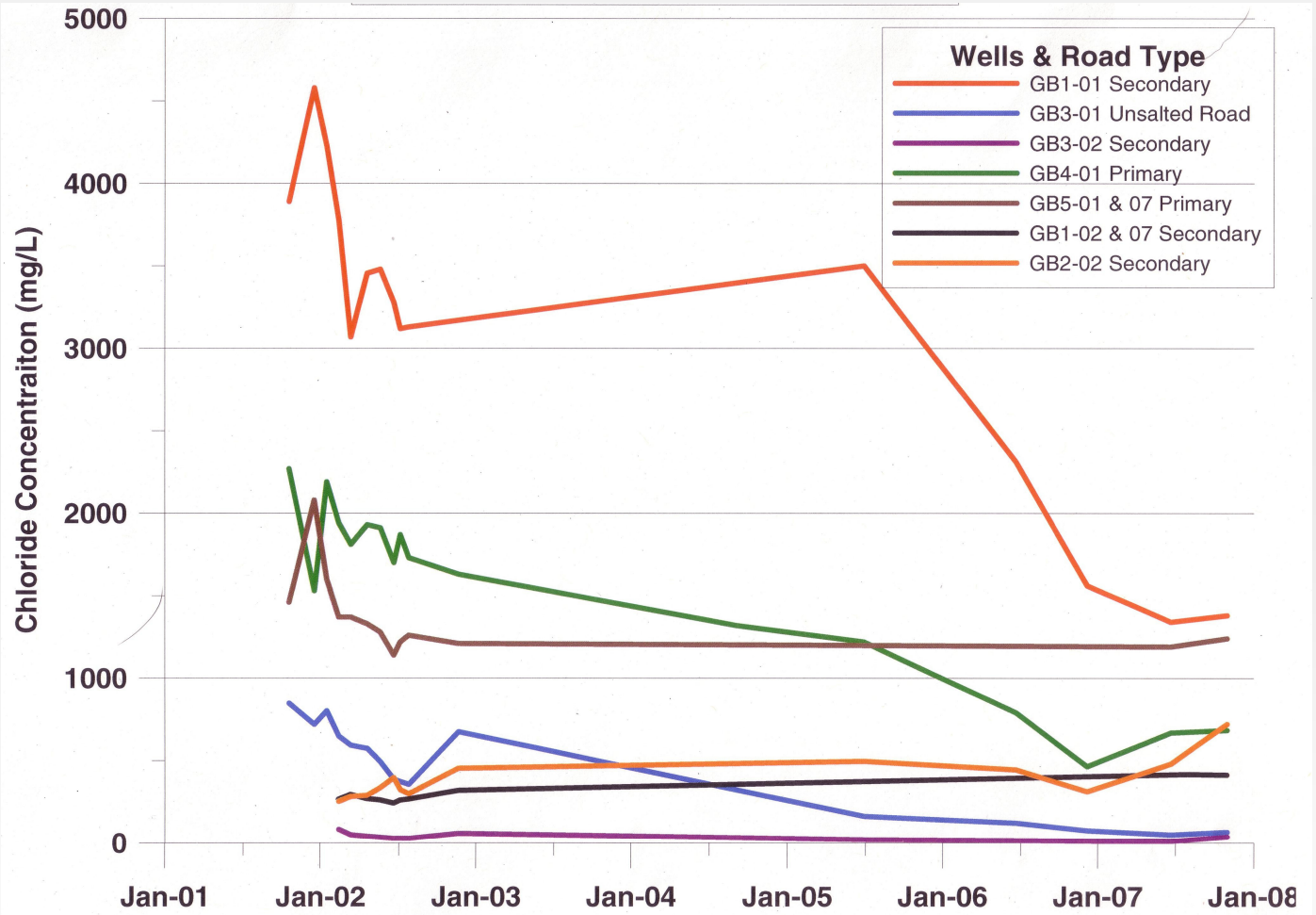
Anticipated Project Outcomes

Final report: make recommendations for improving both policy and practice as they relate to mitigating the adverse environmental impacts associated with winter road maintenance practices

Provide data for Environment Canada Code of Practice Review

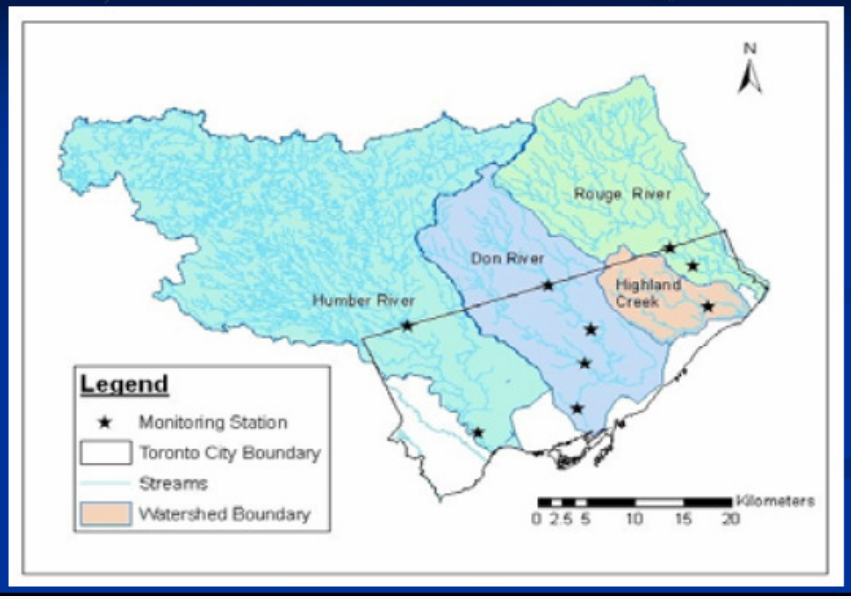
Initial Indications

Greenbrook Well Field Road Salt Monitoring



Novel Modeling of Stormwater Management

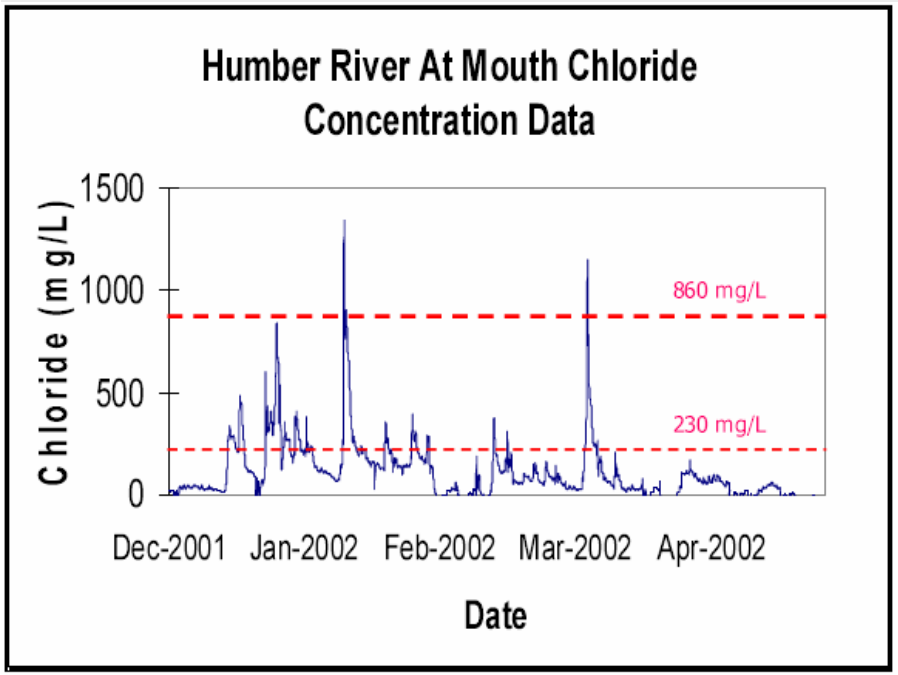
City of Toronto Chloride Monitoring Stations

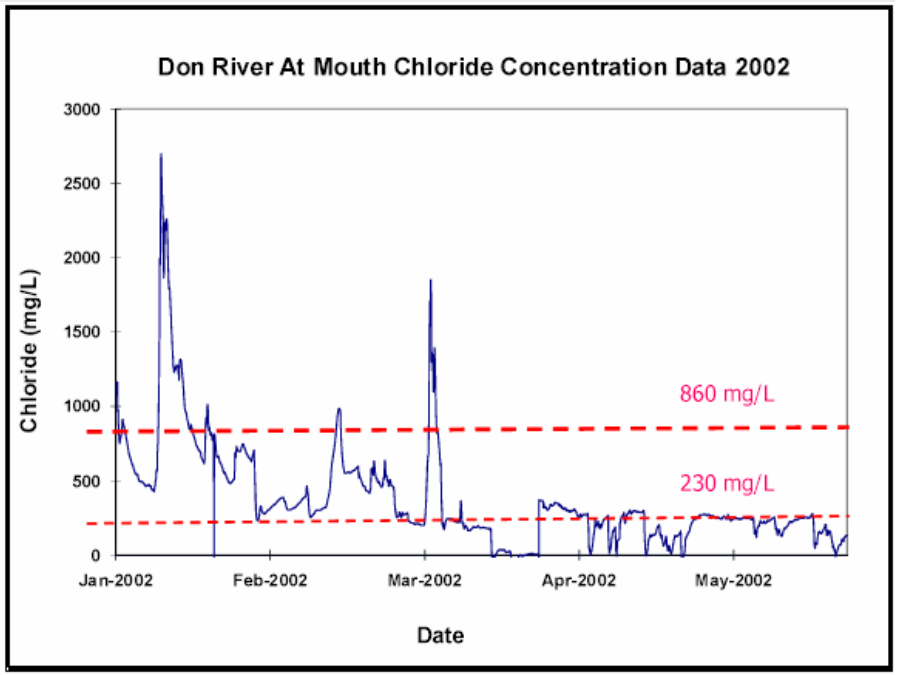


Chloride Guidelines: Drinking Water and Irrigation

- **Drinking Water**
  - Chloride: **250 mg/L** (aesthetic objective)
  - Sodium: **200 mg/L** (aesthetic objective) (medical officer to be notified when Na concentrations exceed 20 mg/L)
- **Irrigation Water**
  - Chloride: **100 to 700 mg/L**

Chloride peaks during winter maintenance



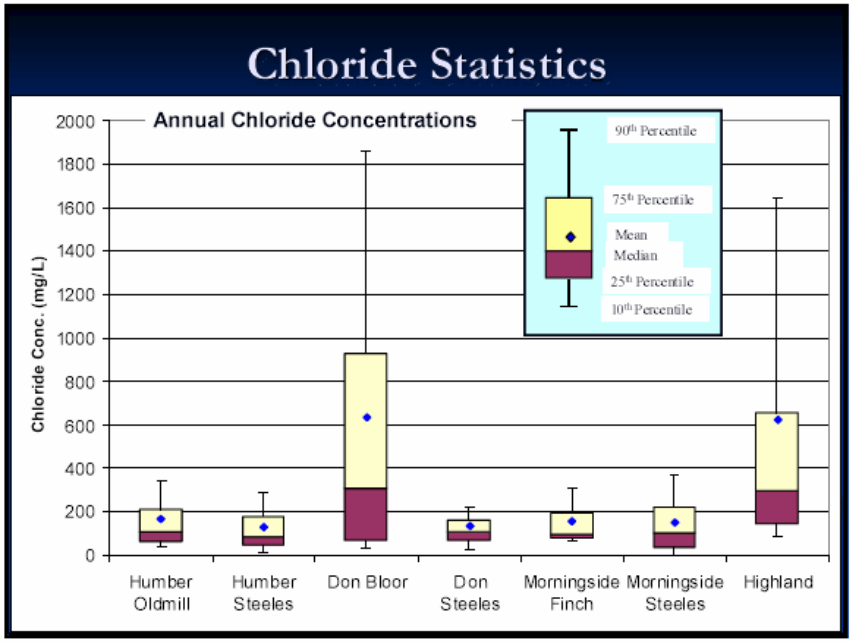


Goals of research program

Research Objectives

1. Advance scientific knowledge on urban stormwater runoff with focus on salt-induced snow melt ;
2. Evaluate the effectiveness of various salt management practices; and
3. Optimize salt management practices using advanced modeling tools and real-time weather forecast

Determination of Exceedance Events

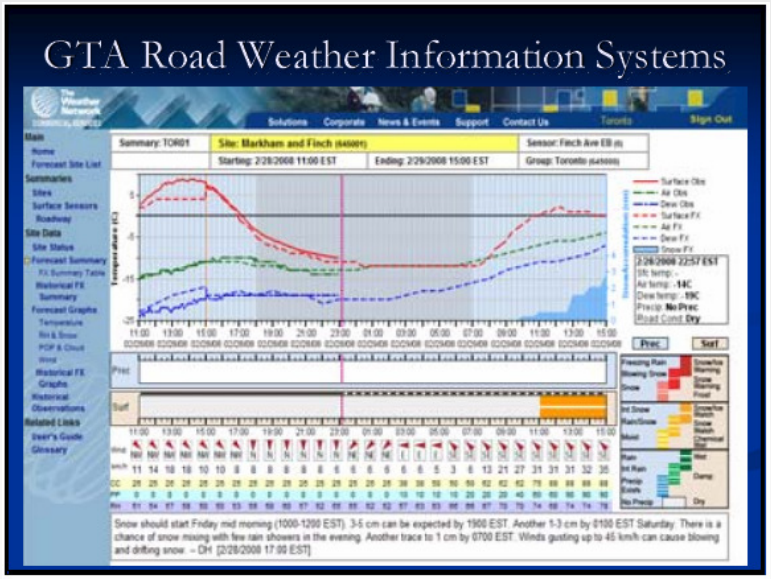


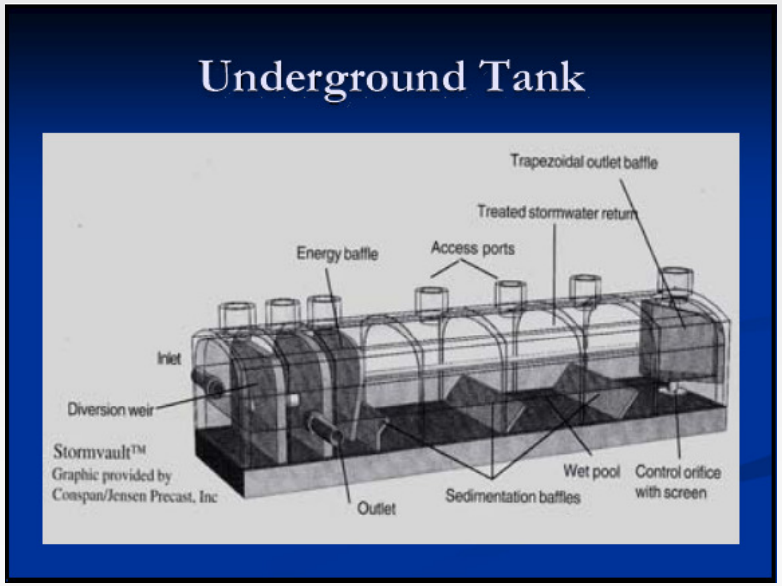
Chloride Event Statistics for Don River at Bloor Monitoring Station

Year	Chloride Threshold	No. of Events	Total Duration of Exceedance (hr)	Mean Event Duration (hr)	Standard Deviation (hr)	Mean Event Max. Conc. (mg/L)	Standard Deviation (mg/L)
2002	230 mg/L	12	2522	209	± 223	826	± 785
	860 mg/L	8	413	51	± 46	1460	± 558
	1,500 mg/L	3	81	27	± 26	1993	± 565
2003	230 mg/L	7	3080	454	± 902	809	± 1103
	860 mg/L	8	1611	201	± 229	1653	± 905
	1,500 mg/L	7	961	137	± 148	2301	± 746
2005	230 mg/L	12	1629	135	± 186	1711	± 1817
	860 mg/L	8	354	44	± 39	2488	± 1679
	1,500 mg/L	7	142	20	± 19	3020	± 1443

Note: Year 2004 was removed from the table because of limited data availability.

Using the latest in Weather Information Systems, application rate analysis, groundwater data modeling, and computer-controlled stormwater storage management, the goal is to level out and minimize chloride discharges and their impact on the environment





Thank You!

Morton Satin
Director, Technical and Regulatory Affairs
The Salt Institute
www.saltinstitute.org