Report of the Salt Use Subcommittee to the Commission on the Environment on Road Salt Use and Recommendations

City of Madison, Wisconsin

Salt Use Subcommittee to The Commission on the Environment
December 11, 2006

INTRODUCTION

The City of Madison is responsible for the safe winter maintenance of 750 street miles (or 1650 lane miles) of roads and highways. A major component of the City's winter road maintenance program is the use of road salt as a deicing agent since it has been proven an effective, economical, and readily available material. However, due to growing environmental concerns, the City Streets Division was directed by the Common Council to reduce the amount of road salt used for winter maintenance in the Lake Wingra watershed starting in the winter of 1972-1973. The remainder of the City followed in 1977-1978. In addition to public use of road salt, there are also concerns regarding the amount used by private businesses and residents, and how it impacts the environment. Rough estimates indicate that private/commercial use of salt may be equivalent to the amount used on Madison's public streets.

WHY REDUCE ROAD SALT USAGE

Road salt moves though a variety of pathways that can impact vegetation, soil, groundwater, and surface waters (Figure 1.) The salt applied to roads, sidewalks, and driveways is most often sodium chloride, NaCl. Excess salt on roads often dries to powder and is then transported by wind to other locations. In addition, salt dissolves as warmer weather melts the snow and ice and brings new precipitation in the form of rain. Water then carries the dissolved sodium (Na^+) and chloride (Cl^-) ions as it soaks into the soil and groundwater or flows downhill through the gutters and storm sewers into our lakes.

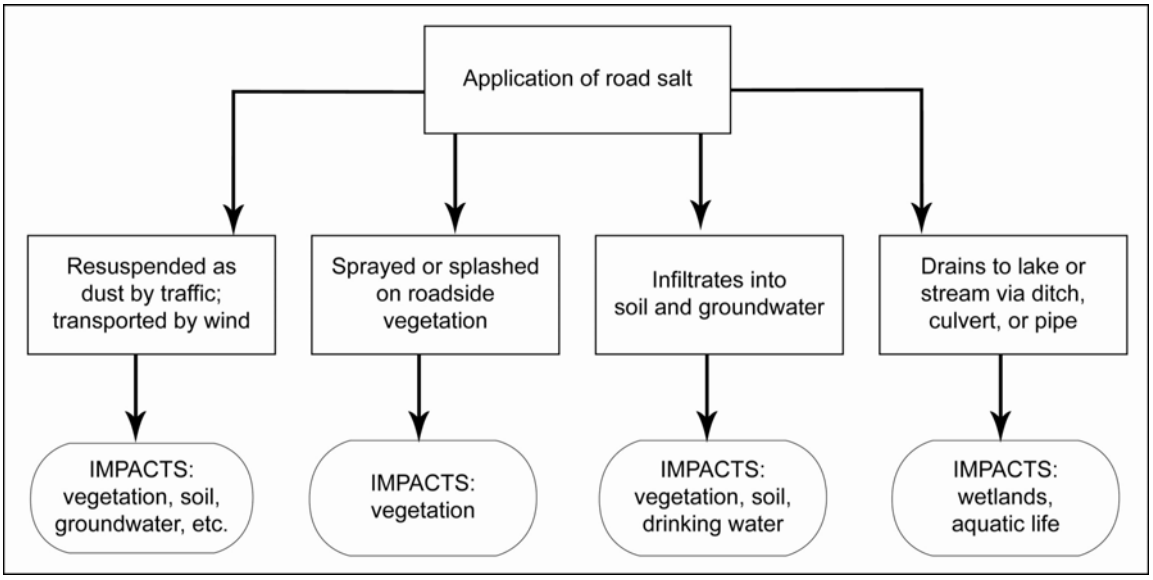

Figure 1: Fate of Road Salt in the Environment (Adapted from National Research Council 1991[1])

Regulatory standards and guidelines for sodium and chloride in surface water, groundwater, and drinking water have been established by the U.S. Environmental Protection Agency and the Wisconsin Department of Natural Resources. Samples from Madison waters sometimes exceed these (see Table 1 below). For example, the EPA recommends that sodium concentrations in drinking water not exceed 20 mg/L for higher-risk individuals on low-sodium diets. Currently, the EPA requires that all public water systems monitor sodium levels and report levels greater than 20 mg/L to local health authorities so that physicians treating people on sodium-restricted diets can advise patients accordingly. City drinking wells #14, #17, and #23 have sodium levels in excess of 20 mg/L. Well #4, abandoned in 1992, had sodium levels exceeding 45 mg/L, which is more than twice the recommended maximum.

Table 1: Regulatory Standards and Guidelines for Sodium and Chloride

Regulatory standards and guidelines for sodium and chloride ions in surface waters, groundwater, and drinking water; and maximum concentrations observed in different Madison locations. (All values expressed as milligrams per L.)

	Na	**Cl**
Regulatory standard/guideline (mg/L)		
WDNR NR 105 chronic toxicity for surface waters		395
WDNR NR 105 acute toxicity for surface waters		757
WDNR NR 140 groundwater preventative action limit		125
WDNR NR 140 groundwater enforcement standard		250
USEPA drinking water secondary maximum contaminant level		250
USEPA drinking water equivalency level guideline	20	
Maximum observed concentrations (mg/L)		
Lakes		
Lake Wingra monthly sample (April 1997)		118.5
Lake Wingra annual average (2005)	54.5	104.8
Lake Monona annual average (2005)	27.4	52.3
Lake Mendota annual average (2005)	18.7	37.5
Lake Mendota (near Spring Harbor stormsewer outfall, Feb 2003)		3300
Odana Hills Pond (Jan 2005)		520
Groundwater		
Shallow groundwater (Odana Hills MW-804B, May 2006)	87	140
Shallow groundwater (Arboretum Spring, 2002)		99
Deep groundwater (Madison City Well #14, 2003)	23	69
Storm water system		
Starkweather Creek (2004)		1500
Edgewood retention pond (Feb 2005)		4560
Storm water runoff (Spring Harbor, 2004)		36,000

Chloride levels are generally increasing in Madison's groundwater aquifers (Figure 2). Between 1975 and 2004, increases of 246%, 551%, and 282% have occurred in Madison Wells #6, #10, and #17, respectively. Well #14 has exceeded 60 mg/L chloride since

2002, and Well #23 exceeded 70 mg/L in 2004. The now-abandoned Well #4 had chloride levels greater than 100 mg/L, close to the WDNR groundwater preventative action limit (PAL) of 125 mg/L. Similarly high values are found in some area springs and shallow wells (Table 1).

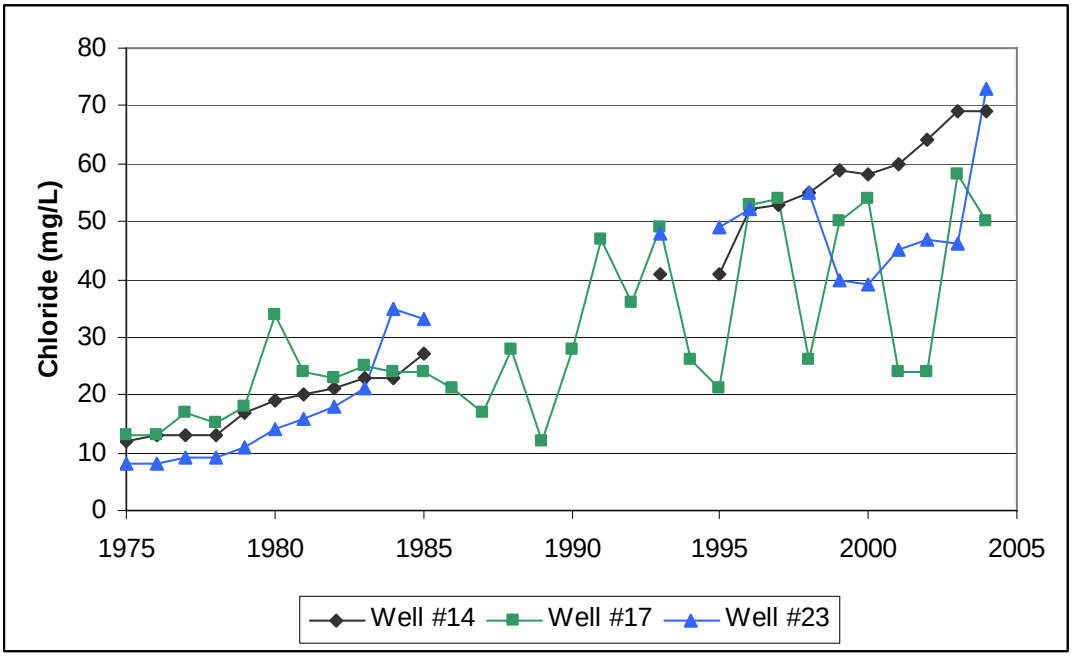

Figure 2: Chloride Levels in Three Madison Water Utility Drinking Wells

Chloride levels in three Madison Water Utility drinking water wells , 1975-2004. (Source: City of Madison 2004-2005 Road Salt Report, prepared by the Madison Public Health Department.)

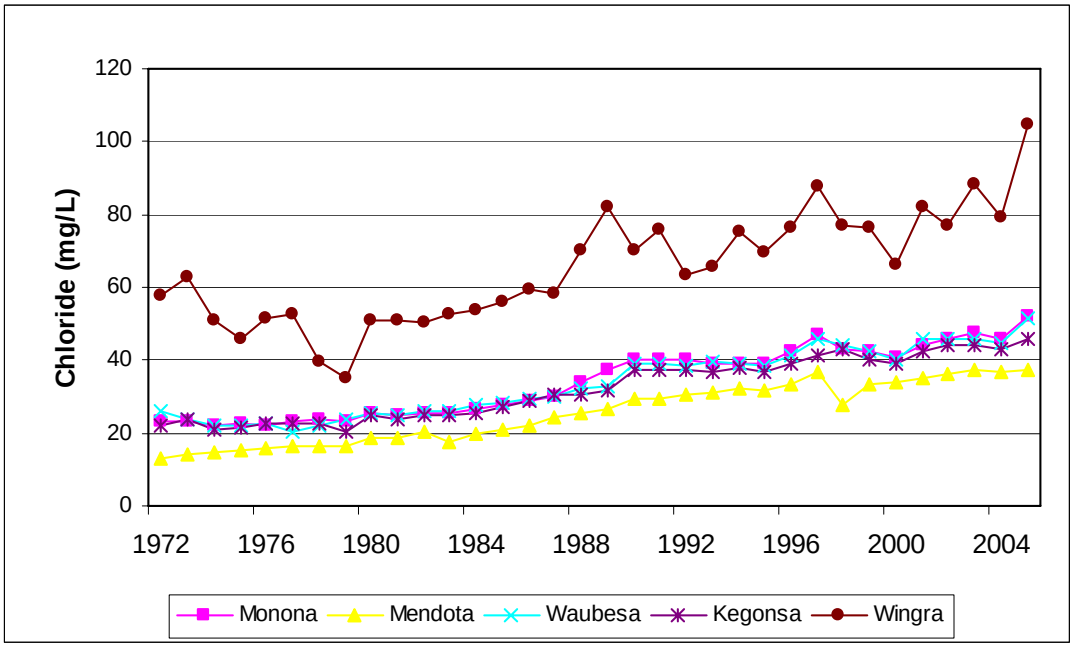

Figure 3: Chloride Levels in Madison Lakes

Chloride levels in Madison lakes, 1972-2005. (Source: City of Madison 2004-2005 Road Salt Report, prepared by the Madison Public Health Department.)

While chloride concentrations in Madison lakes are generally well below toxicity standards for surface waters, they have nearly doubled in recent decades (Figure 3); and levels that exceed WDNR toxicity standards for surface water have been observed in storm water runoff, ponds, creeks, and in Lake Mendota itself near the Spring Harbor stormsewer outfall (Table 1).

Table 2: Examples of Observed Impacts

Area of Impact	Examples of Impacts
Human health	• Hypertension from excess sodium in drinking water • Ferrocyanide, added to chloride salts to prevent clumping, can release 25% cyanide ions in presence of sunlight
Infrastructure	• Corrosion of concrete reinforcing rods in road, bridges, parking structures, etc. • Corrosion costs estimated at $3.5 to $7 billion per year in the U.S. • Corrosion protection practices increase the cost of auto manufacturing by nearly $4 billion/year • Corrosion protection costs estimated at $8.3 billion/year for highway bridges, and $109 billion for epoxy coating;
Vegetation	• Osmotic imbalance in plants, inhibiting water absorption and reducing root growth • Inhibition of seed germination and root growth for grasses and wildflowers (for NaCl as low as 100 ppm in soil) • Competition to native species from salt-tolerant invasive species
Soil	• Inhibition of soil bacteria (for NaCl concentrations as low as 90 ppm), compromising soil structure and increasing erosion • Accumulation of salt, particularly sodium, in soil over time, reduces soil fertility and affects soil chemistry
Groundwater	• Remediation of salt contamination in drinking water estimated at $10 million nationally
Wildlife	• Compromised health in birds ingesting salt at 266 mg/kg; median lethal dose in birds and mammals is 3,000 mg/kg
Aquatic life	• Decreased dissolved oxygen and increased nutrient loading, promoting eutrophication • Release of toxic metals from sediment into the water column • Reduction of number and diversity of macroinvertebrates • Critical tolerance values in 10% of aquatic species exceeded for prolonged exposure to chloride concentrations >220 mg/L • Median lethal dose (7 days exposure to salt) for 17 species of fish, amphibians, crustaceans ranges from 1,440 – 6,031 mg/L (mean value of 3,345 mg/L)

(Sources: Environment Canada. 2000. Priority Substances Assessment Report: Road Salts. www.ec.gc.ca/substances/ese/eng/psap/final/roadsalts.cfm National Research Council, Transportation Research Board. 1991. Highway Deicing: Comparing Salt and Calcium Magnesium Acetate. Special Report 235. www.nas.edu/trb/publications/sr235.html; Wegner, W. and M. Yaggi., 2001. Environmental Impacts of Road Salt and Alternatives in the New York City Watershed, Storm water: The Journal for Surface Water Quality Professionals http://www.forester.net/sw_0107_environmental.html; F.M. D'Itri. 1992. Chemical deicers and the environment. Lewis Publishing, Boca Raton, Florida)

While it is very difficult to assess all the consequences of road salt contamination, a wide variety of impacts resulting from the use of road salt have been documented (Table 2).

Environmental impacts, including acute and/or chronic toxicity to various aquatic organisms, have been shown to occur at levels below those sometimes observed in local surface waters. For example, chloride measured in February 2003, in Lake Mendota near the Spring Harbor stormsewer outfall exceeded the average 7-day lethal NaCl exposure for 17 species of fish, amphibians, and crustaceans[1].

Sodium and ferric ferrocyanides occur in road salt as anti-caking additives. Because ferric ferrocyanide has been shown to release free cyanide as a result of its breakdown when exposed to sunlight, in 2003 the U.S. Environmental Protection Agency added this compound to its list of "toxic pollutants" and "hazardous substances" under Section 307(a) of the Clean Water Act. There is a great deal of uncertainty as to the potential human health effects of ferrocyanides in road salt; however, the Canadian government has recommended that these additives be reduced because of the potential health effects.

CITY OF MADISON WINTER ROAD MAINTENANCE PROGRAM

The current City of Madison Winter Road Maintenance Program relies on plowing, the use of road salt as a de-icer, and sand as an abrasive. Approximately 710 of the 1,650 lane miles of streets are maintained by salting with the remainder being sanded at hills, intersections and curves. Based on experience, Streets Division staff utilizes a salt application rate of 150 lbs. per lane mile. Reviews are conducted annually of the salt routes, annexations, bus route changes, and public outcry in order to determine additions/deletions to the salt routes. Pertinent details of the Winter Road Maintenance Program are summarized below.

A. Policy Standards
    - Clear pavement on arterials and bus routes
    - Plowing of residential streets once 3-inches of snowfall has accumulated
    - Abrasives used on hills and curves for areas not salted
B. De-Icing Materials
    - Road Salt (150 pounds/lane mile)
    - Currently a Calcium Chloride solution is used as the pre-wetting agent
C. Abrasives:
    - Sand (80%) / Salt (20%) – mixed by end loader
D. Equipment
    - Salting units equipped with computerized and calibrated spreading equipment
    - 80% have pre-wetting equipment, 100% within 3 years is expected
    - GPS tracking systems are being installed during the 2006-2007 winter season with expected completion by January 1, 2007

[1] The observed concentration of chloride (3,300 mg/L) at this time and location is equivalent to 5,500 mg/L salt, assuming that all the chloride originally dissociated from NaCl. This exceeds the average 7-day LD50 of 3,345 mg/L salt for 17 species of aquatic organisms.

- Hand held pavement temperature sensors available, but not reliable due to calibration difficulties
- No vehicle mounted pavement temperature sensors are currently in use
- No stationary weather or pavement monitoring stations are in use or operated by the City of Madison

E. Weather Data
- Uses contracted weather services to forecast snow events.

WINTER MAINTENANCE EQUIPMENT AND TECHNOLOGY

Winter maintenance technology has evolved dramatically over the past 10-15 years. Improvements in weather monitoring and forecasting, more accurate salt application controllers, alternative materials, and methods of application have all assisted the snowplow operator in managing the amount of road salt applied during winter maintenance operations.

Roadway Weather Information System (RWIS)

Beginning in the mid-1980's, weather stations installed adjacent to highways and airport runways have assisted weather forecasters in monitoring current weather conditions and providing real time weather conditions to forecasters that can be input into weather forecast computer models to provide more accurate winter weather forecasts. Infrared pavement and air temperature sensors installed on maintenance vehicles provide real time temperatures and assist winter maintenance decision makers with deciding when to apply road salt and how much to apply.

Ground Speed Controlled Salt Application Controllers

First used in Wisconsin in the mid 1990's, ground speed controllers installed with road salt applicators tie the speed of the salt spinner or conveyor to the speed of the salting truck so that salt is applied at a consistent application rate, whatever the speed of the vehicle might be. The controller also automatically shuts off the salt applicator when the vehicle comes to a complete stop.

On-board Prewetting Units

Salt trucks can carry liquid "pre-wetting" agents, such as salt brine, or magnesium chloride, that are sprayed directly onto the road salt prior to it being applied to the pavement surface. The pre-wetting agent assists the bonding of the road salt to the pavement and provides moisture to begin the conversion of the solid road salt to brine, which melts snow or ice. The use of prewetted salt allows operators to lower salt application rates since there is less salt "bounce" off the pavement surface.

Salt Brine Production Systems

A solution of 23.3% salt brine can be produced by mixing road salt with water. Salt brine can then be used as a "pre-wetting" agent with road salt or for "anti-icing" applications made directly to the pavement.

Anti-Icing Technology

"Anti-icing" is a proactive approach to winter maintenance. Liquid snow melting agents are applied directly to the pavement surface prior to a frost, snow, or ice event to prevent the frost, snow or ice from bonding to the pavement. The pavement surface then stays wet but not slippery or icy. Snow can be easily plowed off a surface treated with an anti-icing agent. Salt brine, liquid magnesium chloride, and agricultural based products can be used as anti-icing agents. The use of the anti-icing technique can cut road salt use by 10-20%.

Use of Abrasives

Abrasives such as sand have been used on streets and highways for many years to provide temporary traction. Typically, road salt is mixed with sand in a 5% or 10% by volume blend to prevent the sand from freezing. However, studies have shown that this amount of road salt does not provide any amount of snow melting capacity. These studies indicate that mixing salt and sand is inefficient, and small amounts of salt should be mixed with sand only to prevent the sand from freezing in stockpiles or spreader trucks.

Salt Management And Awareness In Other Communities

The idea of Salt Management to lessen the environmental impacts of road salt is not only a local concern. Programs have been used or studied in areas with similar winter weather conditions to Madison and include anti-icing, salt management, salt use awareness and education. Appendix A provides a list of example programs already being used in other communities, with the Toronto case being of particular interest.

PRIVATE SALT USE IN MADISON

Winter road maintenance is not the only use of road salt in the City of Madison. Deicing salt is also applied to sidewalks, driveways, and parking lots on both commercial and residential private property. It is difficult to obtain information on the amount of deicing salt used on private property. The amount of salt applied to residential sidewalks and driveways is probably small compared to what is used for road maintenance. Local retailers are probably the best source of information on how much salt is sold to homeowners. Parking lots, however, might have as much salt applied to them as the public streets. There are thousands of acres of parking lots in Madison and many of the commercial property owners hire private contractors to apply salt whenever the weather

conditions threatens the safety of their customers. Private contractors will apply salt to the parking lots many times each winter.

A number of private contractors were requested to provide information on how much they apply to parking lots each winter. Specific questions were asked about application rates and frequency of application. The application rates ranged from about 0.14 to 0.30 tons/acre for each application. Ranges of 0.13 to 0.15 tons/acre were reported for the Minneapolis area by Tim Larson with the Minnesota Pollution Control Agency (MNPLC). The number of times the parking lots are salted each winter ranged from about 20 to 30 times. These numbers provide the basis for estimating the amount of salt applied to parking lots each winter.

To provide a conservative estimate of the amount of salt used on parking lots, the lowest application rate (0.14 tons/acre) and the lowest frequency (20 times) were used in the calculation. It was also assumed only 80 percent (3,200 acres) of the 4,000 acres of parking lot in Madison have salt applied each year. If these numbers are simply multiplied together, the result is about 9,000 tons of deicing salt applied to Madison parking lots each winter. Using the highest application rate (0.30 tons/acre) doubles the amount of salt used on parking lots.

It appears the private applicators apply a significant amount of the total salt used in Madison each year. The stated application rates are an important factor in the amount of salt used on the parking lots. Salt is applied to Madison roads at a rate of about 150 pounds for each lane mile. An acre of parking lot represents a little less than one lane mile. If the application rates provided by the private applicators are accurate, they are applying salt to the parking lots at a rate between 280 and 600 pounds for each lane mile. This is at least twice the rate that salt is applied to Madison's streets.

SUMMARY OF ALL SALT USE IN MADISON

The most recent Madison Road Salt Report (Hausbeck, 2005) summarizes 34 years of road salt use in Madison. In the last ten years (1995 to 2005) the amount of road salt used for winter road maintenance ranges from 6,400 to 12,500 tons, with an average of 8,800 tons each year (Table 3). Weather conditions play an obvious role in the variability observed in the amount of road salt used each year. Some of the increase in the total amount of road salt used is probably due to an increase in the miles of streets being maintained. These two variables do not explain however, the increase in the amount of salt applied for each mile of maintained street. The amount of road salt used each year normalized for the number of street miles maintained increased from about 6 tons/mile maintained to 14 tons/mile maintained (Figure 4). Our current measure to account for the number of streets maintained, street miles, might overestimate the application rate because it does not take into account the number of lanes each street represents.

Another factor increasing the frequency of salt application might be people's expectations for a higher quality driving experience under all types of winter weather conditions.

Of course, Madison is not the only community in our area applying road salt for winter road maintenance. Deicing activities that occur in the communities surrounding the City of Madison also impact our water resources. Only 30% of the of the land drained by the Yahara River north of Lake Waubesa lies within the City of Madison. In the past, efforts to quantify the amount of salt applied outside the City of Madison have been mostly unsuccessful. The Dane County Highway Department and county municipalities purchased 66,760 tons of road salt according to the state contract for the 2004-05 winter season (Table 4). If all of this salt were applied during the season, it would be approximately five times the amount applied by the City of Madison. However, there is no information on how much of this road salt was applied during the winter.

Other groups applying salt in the process of winter maintenance include businesses, private contractors, and residential property owners. Amounts of deicing salt applied to residential sidewalks and driveways would probably have to be obtained from retailers. As stated before, a conservative estimate of how much deicing salt is applied to parking lots in Madison each year is 9,000 tons. This is equal to the average amount of salt the City uses each year for winter road maintenance.

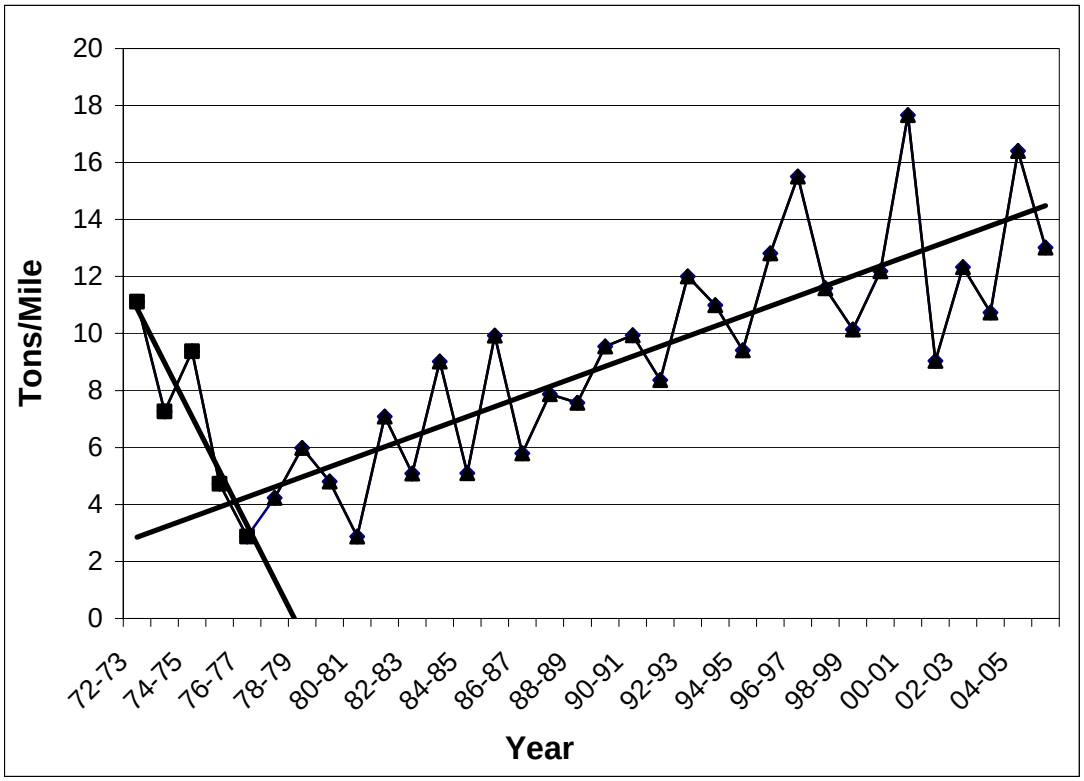

Figure 4: Salt Use Per Mile of Maintained Street (The scatter of the points above and below the line is, in large part, due to the variation in the "severity" of the winter weather from year to year. The "street miles" used are the total miles of streets maintained by the City of Madison and not the street miles that are actually salted each winter.)

Table 3: Madison Street Division Winter Road Maintenance Activities

Year	Material Applied				Streets Maintained (miles)	Salt Applied per Mile[2] (ton/mile)	Change from Winter 1972-73	
	# Salt Applications	Salt (tons)	Sand (tons)	Calcium Chloride[1] (gallons)			(tons/mile)	(%)
1972-73	21	5691.25	2991.85	--	511.91	11.12	--	--
1973-74	29	3755.20	5221.48	--	517.25	7.26	-3.86	0
1974-75	34	4853.80	4627.41	--	517.40	9.38	-1.74	-16%
1975-76	27	2486.18	5143.52	--	525.40	4.73	-6.39	-57%
1976-77	24	1519.96	5703.15	--	529.14	2.87	-8.25	-74%
1977-78	20	2275.74	8927.78	--	538.04	4.23	-6.89	-62%
1978-79	27	3282.40	8461.78	--	547.67	5.99	-5.12	-46%
1979-80	21	2679.78	4936.02	--	557.61	4.81	-6.31	-57%
1980-81	20	1617.76	5796.21	--	562.57	2.88	-8.24	-74%
1981-82	24	4010.05	7536.36	--	565.41	7.09	-4.03	-36%
1982-83	23	2890.53	3484.45	--	567.78	5.09	-6.03	-54%
1983-84	23	4980.10	6181.89	--	552.07	9.02	-2.10	-19%
1984-85	20	2896.65	4263.67	--	567.78	5.10	-6.02	-54%
1985-86	30	5574.10	8730.37	--	561.09	9.93	-1.18	-11%
1986-87	16	3274.20	3010.78	--	564.26	5.80	-5.32	-48%
1987-88	23	4491.30	5367.15	--	571.00	7.87	-3.25	-29%
1988-89	23	4393.28	7060.56	--	580.00	7.57	-3.54	-32%
1989-90	23	5604.95	5809.48	--	587.40	9.54	-1.58	-14%
1990-91	24	5836.00	5727.78	--	587.40	9.94	-1.18	-11%
1991-92	20	4950.28	3751.39	--	591.20	8.37	-2.74	-25%
1992-93	31	7146.88	4121.00	--	595.20	12.01	0.89	8%
1993-94	27	6825.06	3952.56	--	621.30	10.99	-0.13	-1%
1994-95	28	5909.64	4195.80	--	627.80	9.41	-1.70	-15%
1995-96	22	8093.81	7025.87	--	632.00	12.81	1.69	15%
1996-97	35	9862.15	6115.45	--	636.00	15.51	4.39	39%
1997-98	31	7451.00	4062.03	--	643.00	11.59	0.47	4%
1998-99	24	6644.03	6835.16	--	655.00	10.14	-0.97	-9%
1999-00	25	7977.86	4703.52	--	655.00	12.18	1.06	10%
2000-01	28	12485.03	7818.43	--	707.10	17.66	6.54	59%
2001-02	20	6423.02	2320.00	--	710.40	9.04	-2.08	-19%
2002-03	20	9010.33	3162.50	--	730.98	12.33	1.21	11%
2003-04	22	7852.65	4908.59	--	732.07	10.73	-0.39	-4%
2004-05	22	12037.06	3926.42	8066	733.5	16.41	5.29	48%
2005-06	24	9762.38	2928.56	2040	749.99	13.02	1.90	17%

[1] Road salt is wetted with a 32% Calcium chloride solution at a rate of 6 gallons per ton of road salt while spreading.

[2] Salt applied per mile is calculated by dividing the total amount of road salt applied by the miles of street maintained. This value does not account for the salt mixed with sand (20% salt) or the chloride added to the environment from calcium chloride.

Table 4: Salt Purchases on the State Contract in Dane County, 2005-06

Municipality	Tons Purchased	Municipality	Tons Purchased
Town of Albion	350	Village of Mt Horeb	1,000
Town of Cottage Grove	710	Village of Oregon	500
Town of Dunn	500	City of Fitchburg	1,500
Town of Oregon	680	City of Madison	12,400
Town of Sun Prairie	300	City of Middleton	1,500
Town of Verona	600	City of Sun Prairie	1,480
Town of Westport	300	City of Verona	600
Village of Cambridge	130	Dane County	44,200
Total road salt purchased on the State DOT contract in Dane County = 66,570			

SHORT TERM RECOMMENDATIONS & ESTIMATED COSTS

CITY OF MADISON STREETS DIVISION

The items listed below are recommendations that should provide useful tools or procedures to reduce the amount of salt being used to treat public streets in the City of Madison. Anticipated cost estimates are included as rough estimates; additional cost analysis should be performed by knowledgeable staff (both Streets and Accounting) prior to acting on most of these recommendations.

Provide weather/temperature monitoring station on southwest side

The initial cost of a weather monitoring station (RWIS) would be $30,000 to $50,000, depending upon the type of station (full weather station or pavement temperatures only) and access agreements to RWIS information. Yearly operating and maintenance costs for a station are $2,200 to $2,400. More detailed information can be obtained from the WisDOT RWIS program manager if this recommendation is pursued.

Demonstrate anti-icing technique with County equipment and salt brine

(For example: Odana Golf Course pond drainage area)
Estimated cost to the City of Madison for this demonstration is $5,000-$10,000 for a single "winter season". These costs would be impacted by the size and scope of the demonstration, any agreements made with the County and possibility the cost of the salt brine used in the demonstration.

Provide more City Employee snowplow driver training

Training to stress the importance of salt reduction while still maintaining necessary safe driving conditions. In-house training costs would include the employee's/supervisor's time involved plus minor expenses for training aides. Outside training through the UW-

Extension offices would involve the time of the employee(s), the cost of the trainer (approximately $500 per training session) plus minor expenses for handouts.

Reduce salt content of sand

Reduce salt content of sand from 20% to 10% or 5% or even lower (i.e. the lowest percentage that still provides for freeze protection). This can be done by using updated mixing equipment (possible rental units). Reducing salt content from 20% to 10% would reduce material costs by about $330 per 100 tons of sand. If reduced from 20% to 5% the material costs would be reduced approximately $500 per 100 tons of sand.

Lower average road salt use per lane mile

Lowering average road salt use to 100 lbs. per lane mile, provided traffic safety can be maintained, would need to be implemented as a pilot study to determine effectiveness and safety. By reducing the average road salt use per lane mile by 50 lbs. per lane mile, in conjunction with the pre-wetting of road salt and the use of the anti-icing techniques within the test area, a drop in salt usage of 25-30% is expected. In an average winter (9,000 tons of salt used citywide) this could amount to a citywide material cost savings of $75,000-$90,000

GPS AVL technology to track trucks and collect accurate material usage

The cost savings from this item stems from improved efficiency in truck and material usage. The City Streets Division has budgeted to start installing these tracking units in its trucks starting in the 2006 season.

Review accuracy of weather forecasting

Costs incurred by this item would be from staff time used to obtain and review data. Assistance from the WisDOT RWIS program manager may be possible. Until the scope of such a review is determined costs cannot be estimated.

Onboard infrared pavement/air temperature sensors on vehicles

Providing sensors on supervisor vehicles or snowplows would cost $400-$800 each, depending on the model selected. The City Radio Shop could install the units.

Convert “street miles” to “lane miles” in reports related to the use of road salt

This project would require staff time from both the Streets Division and the Engineering Mapping Section. No time or cost estimate was available at the time of this report.

Sampling program with conductance monitors

Provide monitoring program during critical runoff times to better define acute problem areas.

Discuss road salt use and impacts with regional groups

Work with other regional groups and government agencies such as the Dane County Lakes & Watershed Commission and the Madison Areas Municipal Storm Water Partnership to expand the awareness of salt use and its impacts.

PRIVATE OPERATORS AND PROPERTY OWNERS

The items listed below are recommendations that should provide useful tools or procedures to reduce the amount of salt being used to treat private streets, parking lots and sidewalks in the City of Madison.

Education

Provide educational material and training for private applicators
A salt reduction training program has already begun for private applicators in the Twin Cities. Development of the training program was paid for by the MNPLC. Response to the training has been very positive. We recommend the City of Madison sponsor training opportunities for private applicators. The training is available from Fortin Consulting, Inc. located at 215 Hamel Rd, Hamel, MN. Their contact information is connie@fortinconsulting.com or 763-478-3606. Expected consultant fees for this program are estimated at $3,000.

Calibration

Calibrate private operator equipment

Homeowners

Provide educational materials to homeowners

Reporting

Track salt use and promote voluntary reporting on an annual basis. Possible coordination through the Public Health Department for tracking and inclusion in their annual report.

LONG TERM RECOMMENDATIONS

The items listed below are recommendations that should provide useful tools or procedures to reduce the amount of salt being used in both the private and public sector. These recommendations involve greater planning, funding and/or public involvement than those listed in the short-term sections.

Ordinances

Develop ordinances for regulating both private and public salt use including training, certification and reporting requirements. Do additional demonstrations of alternatives to chloride-containing deicers and anti-icers (examples of non-chloride materials can be

found at http//www.anti-icers.com/non_chlorides and
http//:www.dot.state.co.us/Publications/ResearchReports.htm#deicers)

Modeling

Determine future levels of chlorides in Madison lakes and streams (estimate impact on environment) by computer modeling.

Driver Alert Program

Develop an advisory alert program for classifying winter weather and road conditions to be used to inform the public on expected driving conditions in the City of Madison.

Monitoring

Conduct extended monitoring of sodium and chloride levels in storm water runoff, lakes, and groundwater to provide sufficient data for expanded modeling program.

Reporting

Recommend the City of Madison report back to the COE on an annual basis regarding the implementation of salt reduction recommendations and programs.

CLOSING REMARKS

Winter road maintenance in Madison is critical and the application of road salt is an important tool in the maintenance process. However, the overuse of road salt can negatively impact the environment. For this reason, the Madison Common Council implemented a plan to reduce the use of road salt in the City of Madison to 50% of the amount used in the winter of 1972-73. After correcting for the number of street miles maintained, it was calculated that 48% more road salt was applied in the winter of 2004-05 compared to 1972-1973.

Monitoring of surface and groundwater continues to show increasing trends in chloride and sodium levels. Storm water monitoring during snowmelt has identified surges of high levels of chloride. These surges have the potential of harming aquatic life and/or causing species shifts, eliminating less tolerant species from our lakes and streams.

Additional efforts to reduce road salt applications are needed if Madison is going to achieve the goals set in the 1970's. These goals set by the City, although worthwhile, will still lead to increased environmental impacts. The road salt application policies will need to be continually reviewed and updated and the goal of reducing the use of road salt must be supplemented by a long-term goal of finding more environmentally safe alternatives to road salt.

APPENDIX A

SALT MANAGEMENT AND AWARENESS IN OTHER COMMUNITIES

ANTI-ICING PROGRAMS

- WisDOT supports an anti-icing program on the state highway system in 63 of the 72 Wisconsin counties.
- Dane County Highway Department performs anti-icing applications on all bridges and some "trouble spots" that it maintains on the state highway system.
- Iowa DOT performs anti-icing applications on the entire Interstate highway system in Iowa using salt brine as the anti-icing agent.
- West Des Moines, Iowa (population = 46,400) has an extensive anti-icing program on the entire arterial system in West Des Moines for both frost and snow events.
- Dubuque, Iowa (population = 58,000) performs anti-icing applications on primary streets, steep grades, and bridge decks in Dubuque.

SALT MANAGEMENT PROGRAMS

As part of the Canadian Environmental Protection Act of 1999, the Government of Canada established a Code of Practice for the Environmental Management of Road Salts that became effective in Spring, 2004 in order to reduce the harmful effects of road salt on the environment while keeping roads safe. The use of road salt was not banned by the Government of Canada but road salt is now used by all agencies in Canada based on a required salt management plan (Reference: http://www.ec.gc.ca/nopp/roadsalt.en/index.cfm).

A Synthesis of Best Practices for Road Salt Management was published in September, 2004 (Reference: http://www.tac-atc.ca/english/informationservices/readingroom.cfm). For example, the City of Toronto, Canada has an extensive salt management plan. Features of the plan include prewetting of road salt, anti-icing applications, improved training of equipment operators, decreasing salt application rates, proper equipment calibration, computerized salt spreader controllers, improved record keeping systems, installation of a RWIS system, and a citizens media relations campaign (Reference: http://www.city.toronto.on.ca/transportation/snow).

A summary of the Toronto salt management program was presented in an article in the April, 2005 edition of Better Roads magazine (Reference: http://www.betterroads.com/articles/apr05e.htm).

A summary of the Renfrew County, Ottawa, Canada salt management plan was presented in an article in the Winter 2006 edition of the Salt Institute's "Salt and Highway Deicing" newsletter (Reference: http://www.saltinstitute.org/21.html)

SALT USE AWARENESS PROGRAMS AND GROUPS

The Riverside Stewardship Alliance is a program developed to protect and restore urban watersheds. The alliance promotes the sensible use of salt by individuals on their private property. A program established for the City of Toronto, Canada includes a public information campaign (http://www.riverside.org)

The Freshwater Society of Minnesota is dedicated to promoting the protection and rational management of freshwater resources through publications, programs, and conferences (Reference: http://www.freshwater.org)

A winter maintenance of parking lots training program is currently being developed through a pollution prevention grant from the Minnesota Pollution Control Agency. The class and certification program is designed for private companies that perform parking lot winter maintenance. (Reference: http://www.fortinconsulting.com/winter_training.html)

The Salt Institute promotes the sensible use of road salt in many of its publications. (Reference: http://www.saltinstitute.org/4.html).

REFERENCES AND BIBLIOGRAPHY

In order to save paper the reference list for this report can be found on the Internet at following web address.

http://www.cityofmadison.com/engineering/stormwater/saltreportref.pdf