Road Salts and Water Quality

Water Quality Advisory Group

Montgomery County

(11/9/15)

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Why Road Salts are an issue

* Public safety: Roads salts are used to clean our roads from snow and ice in winter
* However, road salts pollute our streams:
  * Nearly 84% of the US streams measured in a recent study had increased chloride concentration
  * High concentration of chloride (above 230 mg/l) is unsafe for wildlife (salamanders grow slowly, newts are deformed when exposed to icing salts, song birds can die after consuming road salt, etc.) [Chloride runoff from highways has been measured over 25,000 mg/L]
* Public Health concerns
* High cost in damages for vehicles & infrastructure (bridges, parking, pavement, etc.), etc.

Road Salt Application - History & Cost

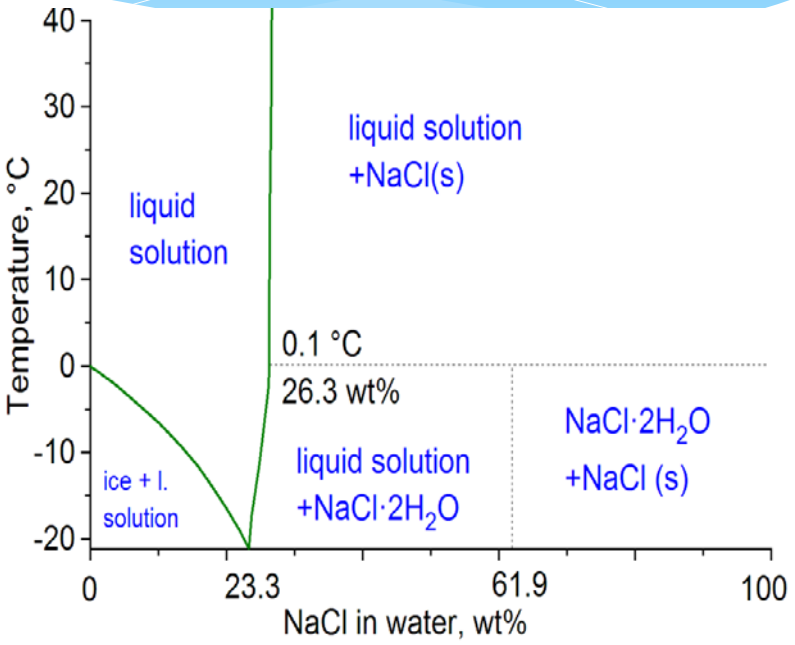
* After World War II, road salt use began to soar due to the expanding highway system
* Salt use grown from 1 million tons in 1955 to nearly 10 million tons before 1970
* Approximately the same level of road salt is used in the last 20 years
* Budget - For example, just in February 2014 (based on a newspaper article):
  * Maryland spent more than $70 million on salt
  * VDOT's Northern Virginia district spent $83 million on salt
* In addition, it was estimated that annual cost in damages for vehicles and infrastructure was approx. 1,000 to 2,000 $ millions 1991 (Transportation Research Board, 1991)

EPA WQ Criteria for Chloride

- **Chronic threshold of 230 mg/L** is defined as the four-day average concentration which should not occur more than once every three years on average
- **Acute threshold of 860 mg/L** is defined as the one-hour average concentration which should not occur more than once every three years on average

Snow Melting Capability of NaCl

- Minimum freezing point of a water-salt mixture is –21.12 °C (–6.02 °F) for 23.31 wt% of salt
- Freezing near this concentration is so slow that the freezing point of –22.4 °C (–8.3 °F) can be reached with about 25 wt% of salt



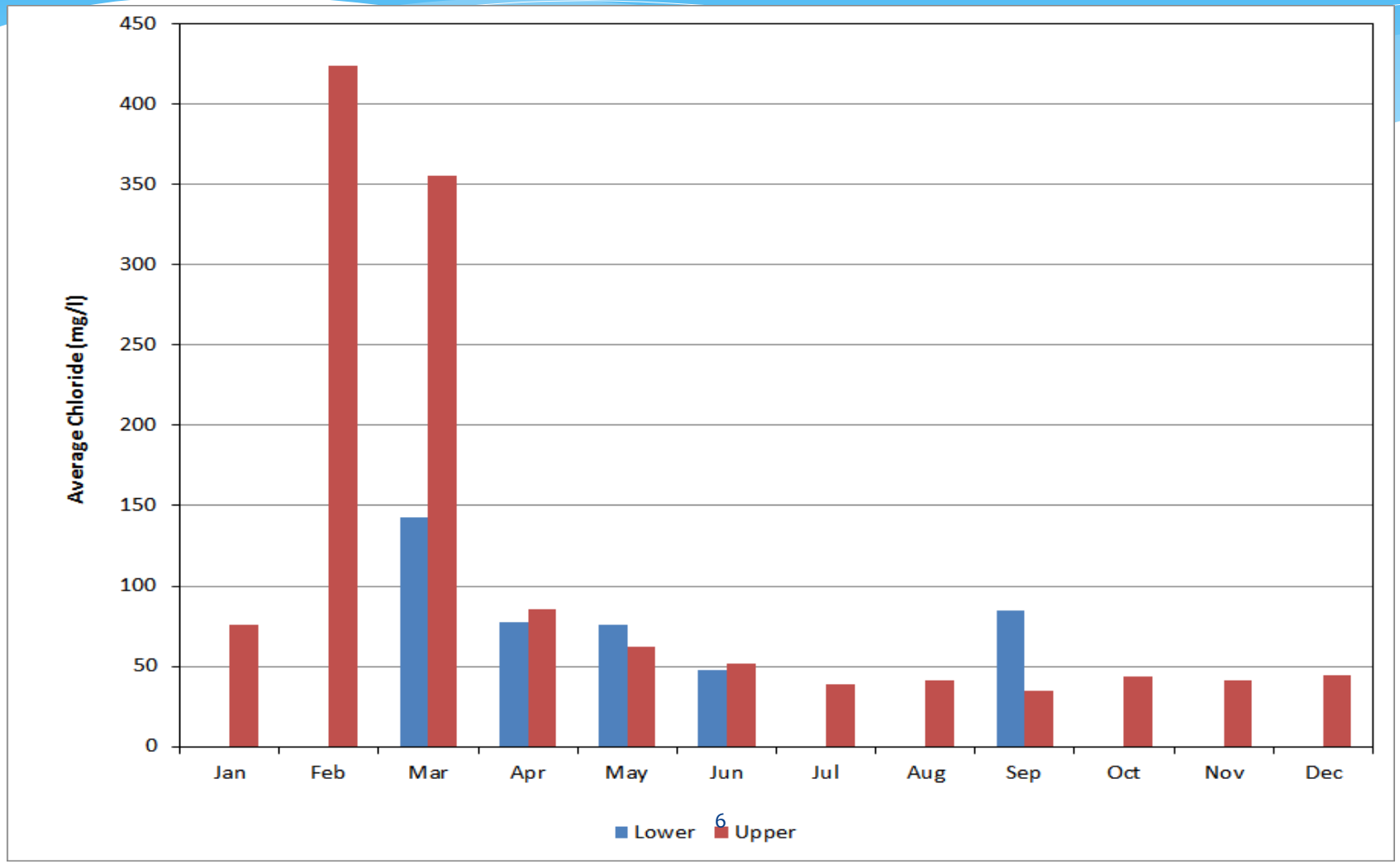
Chloride Studies
Accotink Creek (example)

The *Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed,* *Fairfax County, ICPRB, Sept. 29,2015*

* **Observed Chloride Concentrations Exceeding the Acute Chloride concentration**

Criterion Date	Chloride Concentration (mg/l)
02/02/2010	1320
02/19/2014	925
03/05/2014	1410
03/19/2014	977

Average Monthly Chloride Concentration in the Accotink Creek (from the Stressor Analysis Report)



Road Salt Alternatives

* Brine (mixtures of salt and water) is used for pretreatment & deicing, sometimes with additional agents such as calcium and magnesium chloride
* Regular salt loses its effectiveness on the highway when the surface temperature hits 20 degrees Fahrenheit
* Brine's freezing point is at approx. minus 6 degrees Fahrenheit
* Adding other chlorides (e.g. MgCl) lowers freezing point to minus 23 degrees Fahrenheit
* Adding beet brine to the salt seems makes it also effective in the lower temperatures
  * Also, a mixture of a byproduct from sugar beet processing and rock salt adhered to road surfaces about 40% better than loose rock salt alone. Because it stayed on the road longer, the treatment did not have to be repeated several times, saving time and money

COG "Green" Contract for Ice - melt

* This summer, COG awarded a Contract for the Environmentally and Pet-Friendly Ice – melt product to the Kissner Group (Canada based company, with a distribution center in Delaware) through COG's Cooperative Purchasing program
* This ice – melt product contains Calcium Magnesium Acetate (CMA) in addition to Magnesium Chloride and Potassium Chloride (all are 0.01 – 5%)
* Based on the Worchester Polytechnic Institute research, "Calcium magnesium acetate (CMA) … does not contaminate the environment. With few problems, CMA was chosen as the most promising, sustainable solution"

Potential BMPs & Alternatives (based on literature research)

* Reduce of road salt applied by using:
  * Salt brine (road pretreatment, etc.)
  * Best Management Practices & Training (staff & contractors)
  * Use of road salt alternatives/ additives (need for additional research of alternatives/their effectiveness)
* Potential for collecting snowmelt runoff from major stormwater outfalls (e.g. use of road salt recycling tanks, etc.)
  * Recycling will reduce chloride peaks in the streams without adversely affecting road safety

COG Water Program – Initial Plans

* Organize a workshop to discuss local water quality chloride trends, TMDL implications, & observed impact/benefits of using CMA – and any potential next steps
* Prepare a simple factsheet to summarize those findings/observations and potential next steps

Resources

* Spending on area road salt surpasses budgets, 2/7/14
* Highway Deicing. Comparing Salt and Magnesium Acetate, Transportation Research Board, Washington, DC 1991
* The Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed, Fairfax County, ICPRB, Sept. 29,2015
* Controlling High Chloride Salt Water Runoff, University of Guelph , Salt Institute, 2009
* Calcium Magnesium Acetate - A Greener Deicer, WPI
* Beet it, beet it, beet it, beet it: Then the snow will be defeated, Washington Post, October 31, 2015
* Controlling High Chloride Stormwater Runoff , Statewide Salt Management Plan, Maryland State Highway Administration, October 2015