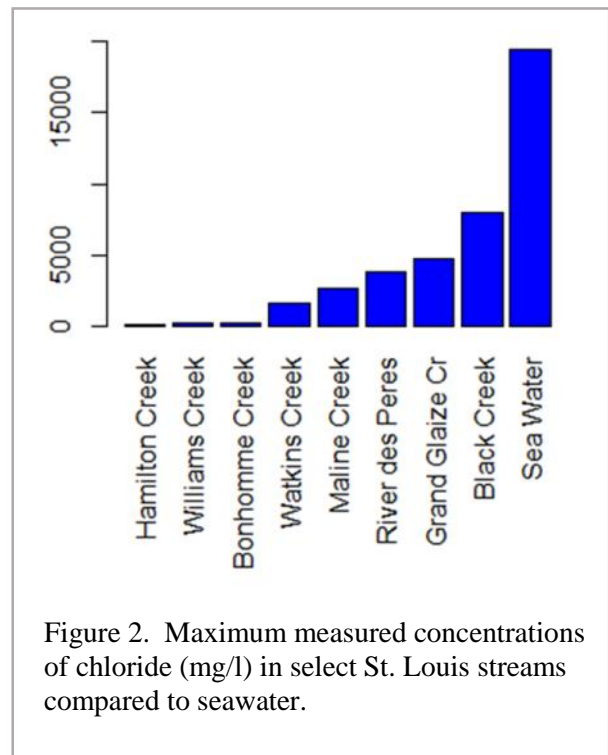
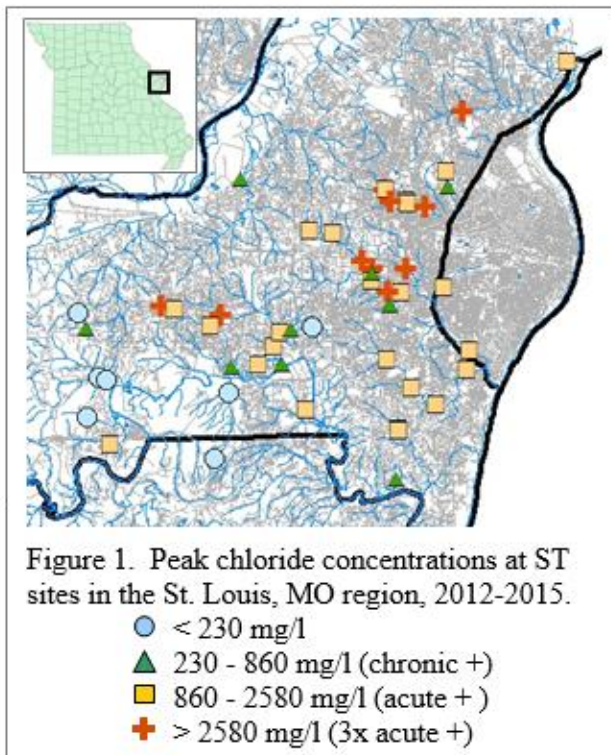


St. Louis Area Chloride Monitoring 2016-17

Introduction:

Chloride pollution from road salt is a common issue in urban communities in the snow belt. The application of road salt to melt snow and ice results in an increase of chloride concentrations in nearby streams and groundwater. This increase can far exceed toxicity limits for freshwater aquatic life in urban streams. Winter chloride concentrations in urban waterways often exceed US EPA recommended exposure criteria for protection of aquatic life: 230 mg/l chronic, 860 mg/l acute.

To document the scope and scale of the chloride reaching streams in urban and suburban areas of the St. Louis region, volunteers with the Missouri Stream Team (ST) program have monitored concentrations of chloride in their adopted waterways since 2012. In that time, 31 trained volunteers have collected over 1,500 in-stream chloride measurements at 52 sites throughout the St. Louis region (Figure 1). They have identified chloride concentrations above the chronic and acute toxicity thresholds at 43 and 34 of these sites, respectively. They have also found chloride concentrations that are over one third of the amount that is found in seawater (Figure 2).



Equipment:

Quantab Titrators for Chloride – Low range (30-600ppm)
High range (300-6000ppm)
Conductivity Meter – Low range (0-1990uS/cm)
High range (0-19.90mS/cm), if available
Conductivity Calibration Solution (1000uS/cm)
2 Thermometers (air, water)
Clean, dry sample bottle(s) (plastic or glass)
Data sheet(s) and writing implement

Methods:

Volunteers may wish to arrange a box of equipment for this chloride monitoring project that is easy to grab and go. Use either data sheets provided by the ST Program (required if you send your data sheets to the ST program) or the sheet provided with this document. Pre-label bottles for each site if tests will be run away from the stream. If your equipment is broken or your chemicals are expired, please place an order with the ST: streamteam@mdc.mo.gov.

Sampling frequency - Volunteers are asked to monitor their sites once per week if possible. If time and conditions permit, additional sampling immediately before and after snowfall or icy precipitation events is encouraged. Ideally, volunteers should collect at least one sample before the first snowfall of the season.

Calibration - Each day water will be sampled, volunteers should calibrate conductivity meters, making sure to record the expiration date of the sodium chloride standard and the date of calibration on the data sheet. Dispose of the standard solution after each use; be sure you keep a supply of this standard as you will probably use at least a couple of bottles. Follow the standard ST procedures for calibrating your meter.

Conductivity - Measure and record the conductivity. Many volunteers only have a low range conductivity meter. Anything greater than 1990 uS/cm will cause the meter to flash “OR”, which stands for out-of-range; “OR” readings are very likely after snowfalls or ice storms. If this occurs and you have a high range conductivity meter, measure the conductivity with the high range meter and record the value. If you do not have a high range meter, record “OR” on the data sheet as the conductivity reading. DNR will not accept values obtained through dilution.

Chloride - Over the course of the project, most volunteers will need both low range and high range chloride strips. The low range chloride strips should be adequate if conductivity is 1800uS/cm or less; high range chloride strips should be used if conductivity is above this level. To measure chloride, collect a sample of stream water in a sample bottle (the glass macroinvertebrate vials work well). The chloride strip may be inserted into the sample while still on site, or you may take the sample with you. Chloride tests should begin within 12 hours of collection if the sample is kept in a cooler or refrigerator. If not kept cool, please run the sample within 2 hours. If you sample multiple sites and run the samples away from the site, be sure to track which sample comes from each site.

Place a Quantab chloride strip into the sample bottle, making sure that the orange horizontal band at the top of the strip stays out of the water. When the orange horizontal band turns black, the strip is fully developed and you can read the value. Record the number at the top of the white peak, which indicates the chloride value in Quantab units. The side of the bottle of Quantab strips will have a chart for turning your units value into ppm of chloride. The chart is different on each bottle, so DO NOT mix strips from different bottles. Be sure to note if you are using high or low range strips.

Weather - While on-site, record the date and time of the sampling, as well as the weather conditions. Set thermometers in water and air in a shaded area. After your sampling is complete, record the inches of rainfall over the past 7 days. If you do not have access to a rain gage, one source for rainfall data is Weather.com [<http://www.weather.com>]. On the webpage, enter the zip code of your site, then click on the "Monthly" tab. Reported precipitation for the past seven days is recorded in the Almanac on the right hand side.

Flow - If your site is near a USGS stream gage, please include the gage number on your data sheet. Stream gage information may be found at: [<http://waterdata.usgs.gov/mo/nwis/rt>]. Upon returning from sampling, visit the USGS website to determine the flow (discharge) that was measured in your stream at the time when you sampled. Note that the website is updated approximately hourly and that you can download 5-minute data for several past months. If you are not near a stream gage, please record flow as "yes" or "no".

Photographs and Site Notes - If you have a digital camera available, please take photos of your site at least once. Also, each time you visit your site, please make note of signs of wildlife (living or dead) at your site in the notes section of the data sheet.

Salt Piles - If you see an uncovered salt pile (apartment/condo complexes, strip malls), please report it to the Department of Natural Resources St. Louis Regional Office at 314-416-2960 and to Roland Biehl of the Metropolitan St. Louis Sewer District (MSD) at 314-436-8715.

Data Submission:

All data must be submitted to the Missouri ST program, preferably via their on-line database [<http://mdc4.mdc.mo.gov/applications/StreamTeam/Default.aspx>]. Log in to your own account and enter the data according to the instructions. Please contact Brian Waldrop (brian.waldrop@mdc.mo.gov) or Karen Westin (karen.westin@dnr.mo.gov; 573-526-7838) if you need assistance setting up your account. If you opt to mail your data to the program, remember that they require that you submit on their data sheets.

Each volunteer is also asked to submit data and at least one site photo by e-mail to the project lead, Danelle Haake, at the end of April. The data may be submitted in one of several ways:

1. A Google Sheets link is provided to all volunteers by email. This link goes to an on-line file that includes datasheets and graphs for each site enrolled in the study. If you choose to enter your data in this file, please contact Danelle so that she may set the appropriate permissions for your datasheet(s).
2. If you are not interested in entering the data, you may scan and e-mail your data sheets.

Next Steps:

The data collected will be used in scientific studies by researchers at St. Louis University. This research is currently focused on assessing the impacts of the use of salt brine as an anti-icing best management practice. Additional research efforts are focused on the local impact of chloride on aquatic invertebrates, as well as the residence time and long-term impacts of chloride in groundwater.

If you have questions, comments, or suggestions about this program, please contact Danelle Haake: dboeckma@slu.edu.

St. Louis Chloride Project

Team Number _____ Trained Submitter _____ USGS Gage # _____

Stream _____ County _____ Site Number _____ Site Location _____

Date								
Time								
Weather								
Rainfall								
Flow								
Air Temp								
Water Temp								
Cl Exp Date								
Cl QU	high low	high low	high low	high low	high low	high low	high low	high low
Cl ppm								
Cond Exp Date								
Cond Cal Date								
Cond mS/cm								
Notes: (particularly note any wildlife, including invertebrates, fish, mammals, birds, or animal tracks)								