CHLORIDE IN THE SPRING CREEK WATERSHED

Water Resource Monitoring Project

For more information contact the Water Resources Coordinator at 814-237-0400 or visit us at www.springcreekmonitoring.org

Spring Creek Watershed Fact Sheet NO. 1

What is chloride??

Chloride is a naturally occurring element and commonly occurs as a part of salt compounds (think of table salt or the type you apply to melt ice on a sidewalk). Chloride can become a problem when concentrations increase to levels that are harmful to aquatic life and may adversely affect drinking water taste.

The diagram below shows how chloride concentrations increase across waterbodies on Earth. Arrows indicate increasing chloride concentration.

Freshwater
Ponds, lakes, rivers, streams
1-250 mg/L

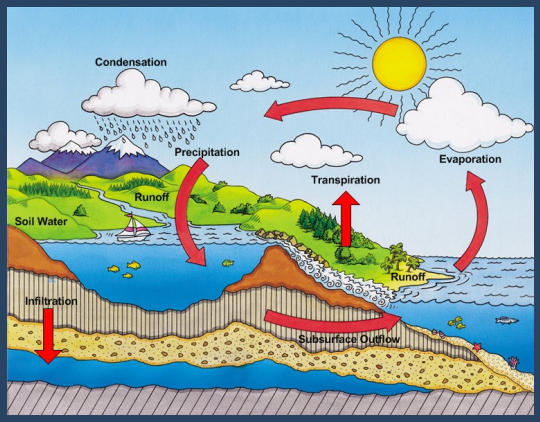
Brackish Water
Estuaries, mangrove swamps, brackish lakes
250-5,000 mg/L

Saline Water
Seawater, salt lakes
5,000-19,400 mg/L

Chloride in the environment:

When rain falls it dissolves salts and minerals near the Earth's surface, and transports them either directly into surface flow (streams or rivers) or move down through soil layers, later becoming groundwater.

Salt deposits occur where saline water such as seawater evaporates and leaves behind the dissolved salts and minerals.



As water flows in streams and rivers toward the ocean it will accumulate surface runoff from roadways that may contain contaminants. Chloride is a naturally occurring element but is also used by humans and may concentrate in the environment, especially from road salt. Ocean water is salty because of the accumulation of dissolved sodium chloride that is left behind as water evaporates.

Problems arise when water bodies that naturally contain low concentrations (such as streams in the Spring Creek Watershed) are overloaded from human usage of chloride containing products.

What are sources of chloride?

Water Softeners

Fertilizers

Chloride-based Road Deicers

Most of the contamination locally is coming from ROAD SALT

An average of 19.5 million tons of road salt were applied annually in the U.S. between 2008-2011. (Kelly and Matos 2013, USGS Historical Data).

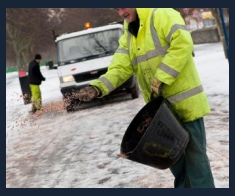
What is the problem with chloride based deicers?

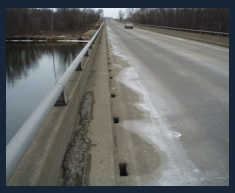
Salt is easily washed from roadways during rain events or snow melt. It directly enters surface waters or percolates to groundwater.

Chloride is not naturally broken down, taken up, or removed from the environment.

Contaminated freshwater results in:

Respiration issues in aquatic organisms.
Increased availability of heavy metals that could poison fish and plant species.





EPA GUIDELINES

Surface Water Maximum Contamination Levels:

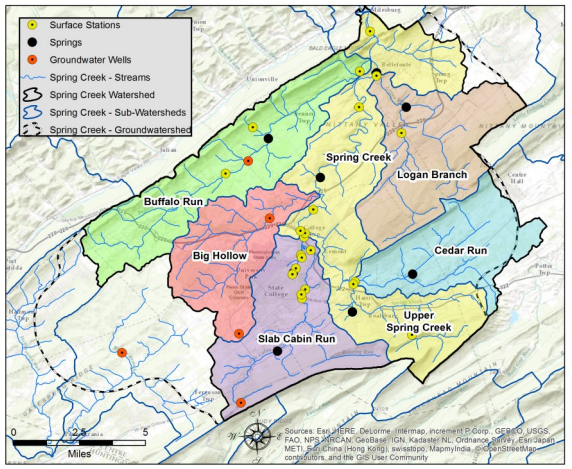
1 hour (acute) average: 860 mg/L
4-day (chronic) average: 230 mg/L
Invertebrates first affected >1,000 mg/L

Drinking Water Secondary Maximum Contamination Level:

250 mg/L
Point when water tastes salty

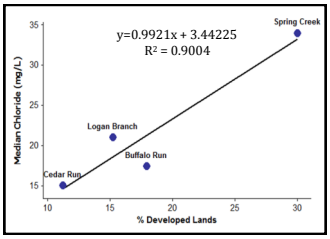
The Water Resource Monitoring Project

- **Since 1997 has measured quality and quantity of surface and groundwater in the Spring Creek Watershed. Currently our monitoring includes:**
  - **15 surface water stations measuring water quality, quantity, or both (yellow dots).**
  - **8 springs measuring water quality (black dots).**
  - **5 groundwater wells measuring water level (orange dots).**
- **Data collected quarterly allows us to track trends in water quality parameters (such as chloride) and water quantity over time in both surface and groundwater.**



Chloride Trends

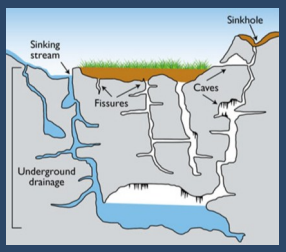
- Of the three most common land uses in our watershed, development showed the best correlation to chloride concentration (vs. forests and agricultural land).



- No significant difference existed between groundwater and surface water concentrations.
- Chloride has significantly increased at 9 of our 12 monitoring sites from 1999-2014 but no concentrations approached the lowest surface water quality standard of 230 mg/L.
- The average rate of increase in surface water in the past 15 years has been 0.88 mg/L/year across all sites.

The Spring Creek Watershed

Our watershed is mostly underlain by limestone and dolomite geology, collectively known as carbonate formations. Soils act as a natural filter, removing many contaminants as water passes through them. Sinkholes form where slightly acidic rainwater slowly dissolves the carbonate bedrock, which is also known as karst geology. Sinkholes facilitate fast movement of pollutants like chloride into groundwater by bypassing soil's filter. In our watershed, groundwater contamination leads to surface pollution because over 80% of surface waters are fed by groundwater.



Many stormwater outfalls carrying road salt drain into karst features, creating a direct link to our groundwater resources.

Summary

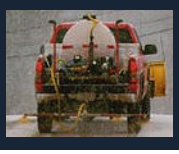
- Chloride is accumulating in groundwater and subsequently flowing through surface waters.
- All sites in our watershed are still below the chloride maximum contamination levels for aquatic organisms (230 mg/l) and for human consumption (250 mg/l).
- Compared to similar urbanized areas, our values are still low.
- Over time we have seen chloride concentrations increase. If this trend continues at the same rate, some locations will exceed minimum contamination levels in ~50 years.

How can we reduce chlorides?

Use mechanical snow removal as early as possible. Apply the minimum amount of salt to deice surfaces.

Mix water with salt to make a brine so the salt will stick better to pavement.

Technology in salt trucks enables usage of most effective chloride deicer and regulates how much is applied.



June 2016