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FERC
Docket Number: CP13-83
Arlington Storage Co, LLC proposed request to expand gas storage near Watkins Glen

I would like to take this opportunity to comment on two facets of Arlington Storage Co.’s expansion of their storage of gas in abandoned salt caverns just north of Watkins Glen, NY. I have some professional expertise to comment on the issues raised below, as they all can impact water quality in Seneca Lake, a body of water that I have been monitoring for nearly two decades. These issues revolve around a very real possibility that the storage of gas will release more salt brine from the Salina Formation to Seneca Lake. Let me explain.

The Fate of a Brine Spill into Seneca Lake:

A brine spill of a brine many-times saltier than seawater, will not mix with Seneca Lake, many-times less salty than seawater. The dense brine will flow down to the deepest point in the lake as a density current. It will not stay in the epilimnion (surface water) nor mix with the entire lake. This brine pool will define a chemocline between its upper boundary and the remaining lake, and a mixolimnion (thermally mixed layer) above and monimolimnion (stagnant layer) below the chemocline. The monimolimnion, by definition, will not mix with the rest of the lake, and instead will become stagnant and anoxic over time. The extent of lake-floor coverage by the brine and the thickness of the brine unit above the lake floor depend on the volume of the spill and the exact bathymetric details of the lake floor.

Interestingly, a saline layer was already detected along the deepest portion of Seneca Lake. CTD profiles are available by request. Each profile depicts water salinity vs. water depth in the lake, and the more saline water was observed within 20 meters of the lake floor. All of the CTD profiles shown here were collected on the same day, July 14, 2011, along a north to south, mid-lake transect this past summer. Different cruises during the summer observed a similar saline pool at the deepest portion of the lake. It is unclear if fall or spring thermal overturn is strong enough to mix the observed saline water along the lake floor.

This density-current process has good and bad points. On the positive side, the brine will have less time to impact municipal drinking water supplies, as most supply lines draw from the epilimnion or metalimnion, and the brine should quickly descend to the lake floor. On the negative side, the stagnant and anoxic brine pool will negatively influence benthic communities and alter redox chemistries in the deepest portions of the lake.

Salt Seepage into Seneca Lake:

Salt (sodium and chloride ions) concentrations in Seneca are 4 to 5 times larger than the other Finger Lakes. Cayuga Lake is saltier as well. Mass balance hydrogeochemical arguments made by Wing et al. (1995) and substantiated by Halfman et al. (2006) indicate that Seneca gains salt (major ions) from surface runoff, mine wastes, and groundwater sources, and looses salt to flow out the outlet, calcium and carbonate ions precipitate as calcium carbonate in the lake, and burial in the sediments. The contribution of sodium and chloride from groundwater sources is significant, approximately 40,000 to 45,000 metric tons per year for sodium and 60,000 to 70,000 metrics tons per year for chloride. Seneca and Cayuga are believed the only lakes to be influenced by this groundwater source because these are the only basins deep enough to intersect into the salt bearing Salina Formation, and have active mining operations within the lake basin.

Jolly, USGS, Reston, presented historical chloride data spanning the past century for both lakes. He compiled chloride concentration data buried in reports from municipal drinking water suppliers, as they are regulated to test for chloride in their supply water. His plot for Seneca Lake is reproduced below along with some other data (mostly my unpublished data). It shows that the chloride concentrations were not constant over time but instead rose from “typical” Finger Lake concentrations in the 1900s to larger concentrations in the 1970s, only to decrease slowly since the 1970s to today. The decrease over the past few decades is due to the dilution of the epilimnion by rain water and surface runoff each summer, i.e., stratified season. The slightly more dilute epilimnion then mixes with the slightly more saline hypolimnion during fall overturn, and results in a slightly less saline lake every year. Recent modeling efforts indicated that the input of salt must have exceeded 10 times the natural input by streams in a multi-step process to create the observed chloride concentrations (Halfman, 2013).

The shape of the chloride concentration curve mimics the rise and subsequent decline in salt production at the mines at the southern end of Cayuga and Seneca Lakes. The inferred parallel nature of the two trends however, strongly suggests a cause and effect relationship. It suggests that pressure applied to the salt formations from the dissolution of the salt, forces seepage of brine water into the lake, where the salt beds intersect the bedrock floor of the lake or through known fractures in the overlying bedrock from the storage facilities. This relationship is unusual because the salt caverns are significantly below the bedrock floor of the lake at Watkins Glen providing a potential sense of security. I am worried that the expanded storage of pressurized gas will also induce seepage of brine into Seneca Lake. Will the brine pool increase in size from those observed in 2011? It would be problematic if salt concentrations rose to levels above sodium MCLs because Seneca Lake is a source of Class AA drinking water for nearby communities.

Halfman, J.D., C.M. Caiazza*, R.J. Stewart*, S.M. Opalka*, and C.K. Morgan*. 2006., Major ion hydrogeochemical budgets and elevated chloride concentrations in Seneca Lake, New York. NE Geology and Env Sci. 28:324-333

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