

## **Identifying Sources of Perchlorate in Ground Water, Suffolk County, NY – Project Plans and Some Preliminary Research**

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Perchlorate ( $\text{ClO}_4^-$ ) in ground water, an increasing health concern, has been detected in historically and currently farmed regions of Suffolk County, Long Island, New York. The U.S. Geological Survey (USGS) currently is investigating chlorine and oxygen isotopes of  $\text{ClO}_4^-$  to discern whether the perchlorate is derived from agricultural sources (fertilizers) or non-agricultural sources (such as explosives, fireworks, and rocket propellant). Two known agricultural sources of  $\text{ClO}_4^-$  are Chilean nitrate fertilizer that is mined from the Atacama Desert, and marine kelp. Chilean nitrate fertilizer has been used extensively in farming nationwide since the early 1900s, but its use has subsided since the 1930s. There is evidence of continued use of Chilean nitrate fertilizer through the present; however, the extent of this fertilizer's application in Suffolk County is unknown. Marine kelp currently is used by some vineyards and organic farmers but the seasonal application rates and lengths of use are also unknown.

The USGS, in cooperation with the Suffolk County Water Authority, plans to sample ground water from two regions of Suffolk County that historically have been farmed extensively since the 1900s and whose ground water contains detectable concentrations of  $\text{ClO}_4^-$ . The two areas are on the North Fork and near Huntington. The objective is to use compound-specific isotopic analyses to analyze ground water  $\text{ClO}_4^-$  concentrations  $>2$  ppb to discern whether the  $\text{ClO}_4^-$  is derived from fertilizer or other sources. Chlorine and oxygen isotope analysis will be performed on  $\text{ClO}_4^-$  collected from ground water to identify the source as either agriculturally or non-agriculturally derived. The  $\delta^{37}\text{Cl}$  values of Chilean perchlorate range from  $-14.5$  to  $-9.2$  ‰, and those for non-agricultural perchlorate (such as explosives) range from  $-3.1$  and  $+1.6$  ‰. The  $\delta^{18}\text{O}$  values for Chilean perchlorate range from  $-9.3$  to  $-2.2$  ‰ and those for non-agricultural range from  $-24.8$  to  $-12.5$  ‰. Isotope ranges of other perchlorate sources, such as marine kelp, are still being investigated. Samples will be collected along a transect in the farming area of Cutchogue on the North Fork. Ground-water flow and traveltime models will be used to evaluate the patterns and rates of  $\text{ClO}_4^-$  movement through the system and ground-water age will be measured through tritium analyses to indicate whether  $\text{ClO}_4^-$  within the flow system could be derived from Chilean nitrate fertilizer. Elevated  $\text{ClO}_4^-$  concentrations ( $> 9$  ppb) present in rural Huntington ground water may also be attributed to fertilizer application. Prior to the 1950s, Huntington was a large farming region and some small vegetable and sod farms still exist in the area but the majority of the land is now residential. Perchlorate present in ground water in Huntington will also use the compound-specific isotope analysis to identify the source as either agriculturally or non-agriculturally derived. Several fertilizer samples, including kelp mixtures, have been collected from four farms in both areas for  $\text{ClO}_4^-$ . If they are found to contain  $\text{ClO}_4^-$ , isotope analyses may be used to distinguish the  $\text{ClO}_4^-$  in these fertilizers from that in other  $\text{ClO}_4^-$  sources that could have contaminated ground water in the two areas.