Seattle Public Utilities

Memorandum

December 9, 2010

To: **Peter Hahn, Director, SDOT**

Steve Pratt, Operations Director, SDOT

From: **Bruce Bachen, Drainage and Wastewater Quality Director, SPU**

Re: **MgCl2 Brine and the Aquatic Environment**

Seattle Public Utilities (SPU) received a request from the Seattle Department of Transportation (SDOT) to evaluate the environmental impacts of the use of magnesium chloride ($MgCl_2$) brine as an anti-icing treatment for roadways during severe winter weather. To evaluate potential impacts, SPU staff reviewed information on $MgCl_2$ brine provided by SDOT, conducted a brief web literature search regarding potential environmental impacts of $MgCl_2$ brine, and used the chloride model developed for SPU's 2009 *Snow & Ice Control and the Aquatic Environment Report* to estimate how $MgCl_2$ brine would compare to the conservatively modeled chloride levels in selected Seattle streams.

Literature

Colorado Department of Transportation (CDOT, 1999) released a report by Professor William Lewis that summarized studies of the environmental effects of the use $MgCl_2$as a deicer. The abstract of this report is quoted below:

The overall conclusion of the study is that application of magnesium chloride deicer having a chemical composition and application rate similar to those of 1997-98 is highly unlikely to cause or contribute to environmental damage at distances greater than 20 yards from the roadway. Even very close to the roadway, the potential of magnesium chloride deicer to cause environmental damage is probably much smaller than that of other factors related to road use and maintenance, including pollution of highway surfaces by vehicles and use of salt and sand mixtures to promote traction in winter. Magnesium chloride deicer may offer net environmental benefits if its use leads to a reduction in the quantity of salt and sand applied to roadways. The environmental safety of magnesium chloride deicer depends, however, on low concentrations of contaminants and avoidance of rust inhibitors containing phosphorus. Appropriate specifications for vendors and routine testing can insure the continued environmental acceptability of magnesium chloride deicers.

The annual application rate cited in the Colorado report was 12,000 L (approximately 3000 gallons)/lane mile per year. Given the differences in climate, annual application rates would be anticipated to be much lower for Seattle, perhaps 10% or less of the Colorado application rate. Given the results of this study and further accounting for this difference in regional climate would suggest very low risk of environmental impacts. The study does point to the importance of

maintaining standards to avoid undesirable contamination and this is consistent with one of the recommendations of our 2009 report.

Model results

One difference between the use of $MgCl_2$ compared to NaCl deicer is the number of chloride ions per molecule. This difference, along with differences in application rates, raised questions about the resulting chloride levels that could be expected in streams adjacent to treated roadways. SPU identified Thornton Creek as the most sensitive stream of those analyzed in the 2009 report. Therefore we examined potential chloride levels in Thornton Creek, using a 30% $MgCl_2$ brine and an application rate of 25 gallons per mile (provided by SDOT) using the chloride model developed for the 2009 analysis of sodium chloride treatments.

Under typical flow conditions and expected application scenarios for $MgCl_2$ treatment, Thornton Creek chloride levels would be expected to remain under Ecology's water quality standards for chloride. The chloride levels contributed by a single $MgCl_2$ brine application would be higher than a NaCl brine application (approximately double) and equivalent to the amount that would result from a light rock salt treatment of 75 lbs/mile.

Summary

Under expected conditions and application scenarios, the environmental risk of the use of magnesium chloride brine is expected to be relatively low. Much of the discussion of risks and mitigating factors in SPU's 2009 report applies to $MgCl_2$ as well as NaCl and the executive summary of the report provides additional information.

References

CDOT, 1999. *Studies of Environmental Effects of Magnesium Chloride Deicer in Colorado*. Final Report. Report No. CDOT-DTD-R-99-10. Colorado Department of Transportation Research Branch. November 1999. pp.133. (http://cospl.coalliance.org/fez/eserv/co:5091/tra2109910internet.pdf)