SETAC North America 31st Annual Meeting

Abstract Title: Effects of nanosilver on *Daphnia magna* and *Pimephales promelas*

Authors: Sarah Hoheisel, Amanda Brennan, Steve Diamond, and David Mount

The increasing use of nanosilver in consumer products warrants investigation into its toxicity to aquatic organisms. A series of studies were conducted comparing the potency of nanosilver to ionic silver (Ag^+) at acute and sublethal levels and to evaluate the likelihood that the source of nanosilver toxicity is the presence of Ag^+ rather than a separate mechanism related to the unique properties of silver at the nano-scale. 48-h LC_{50}s were obtained for *D. magna* juveniles exposed to four sizes of nanosilver (10, 20, 30 and 50 nm) and Ag^+. Based on bulk concentrations, all nanosilver sizes were less acutely toxic than Ag^+, and a trend of increasing toxicity with decreasing average diameter of nanosilver was observed. This trend appeared to be dependant on particle surface area and number of surface atoms, however it is unclear whether these metrics are descriptive of surface activity or variable release of silver ions. Ion resin exchange was used to remove Ag+ from nanosilver suspensions (confirmed by the complete removal of silver from AgNO3 solutions) to determine the importance of Ag+ to observed toxicity. The acute toxicity of nanosilver suspensions to *D. magna* after ion exchange was shown to be similar to that of untreated nanosilver suspensions, suggesting that Ag+ did not contribute significantly to the toxicity of the suspensions, or that ion release occured rapidly after ion exchange. 96-h LC_{50}s and 7-day EC_{20}s were also obtained for *P. promelas* exposed to nanosilver and Ag^+. A comparison of the acute-to-sublethal ratios of these materials shows litle difference between nanosilver and Ag^+. A difference in these ratios would be suggest differences in toxic mechanisms bewteen particles and

ionic silver. These results indicate that nano silver particles are much less toxic, on a bulk basis, than Ag+. However, it remains unclear whether particles, per se, are toxic, or if observed responses are dependant on release of Ag+ to media or directly to biological targets. It remains difficult, as well, to estimate the Ag^{+} exposure that will result from a given release of nanosilver into natural waters. Further research is required to understand the relationship of nanosilver to its delivery of Ag^{+} in environmentally relevant matrixes.