Department of Physics
MCMICKEN COLLEGE OF ARTS AND SCIENCES

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APLICATION DEADLINE: March 1, 2006

The Department of Physics is pleased to offer the following research project for the summer of 2006. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and if possible, develop a timetable for the twelve-week research period.

Pb RELEASE FROM HOUSEHOLD PLUMBING IN WASHINGTON DC AND IN CINCINNATI

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Dissolving Pb from lead service lines and Pb-containing brasses and solders has become a major health issue for many water distribution systems, especially Washington DC. Using a variety of spectroscopic techniques, we will compare pipe samples from two utilities: Washington DC and Cincinnati OH. Both use surface water as the main source and both have a number of lead service lines running from the water mains to customer's houses. They both have issues with the creation of toxic disinfection by-products through the reaction of naturally occurring organic matter in the surface water with the disinfectant. They differ in that DC uses chloramine disinfection to reduce byproduct formation, whereas Cincinnati has elected to use granular activated carbon (GAC) to remove organic matter from the source water before disinfection. They can then use chlorine disinfection with minimal byproduct formation.

The switch by DC to chloramines was associated with large releases of Pb. We found that both utilities have a variety of Pb minerals present in their pipes, but that the surface layers for Cincinnati are dominated by the PbO_2 mineral plattnerite, which is extremely insoluble, whereas the DC surface layers have appreciable litharge (PbO), which is much more soluble. Plattnerite formation is favored by highly-oxidizing water, which chlorine provides but chloramine does not. The use of GAC treatment by the Greater Cincinnati Water Works has permitted the effective use of chlorine disinfection and also led to a more stable and less soluble set of Pb minerals lining the pipe surfaces.

For both utilities, we found that by far the most severe corrosion and scale buildup occurs at the junctions between brass and lead pipes. We attribute this to a galvanic corrosion of the brass by the adjacent lead sections. A consequence is that much of the lead detected at customer's taps is coming not from the lead service branches but from accelerated corrosion of Pb-containing brasses. Further reductions in Pb levels will require that releases from brass also be addressed.