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IN SITU MERCURY STABILIZATION

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BNL Royalty Project Internal Status Report

September 2004

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DISCLAIMER

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Mark Fuhrmann, Jay Adams, and Paul Kalb

The funds from the allotment of royalty income were used to experimentally explore feasibility of related, potential new techniques based on the Environmental Sciences Department successful technology licensed for the *ex situ* treatment of mercury. Specifically, this work is exploring the concept of using Sulfur Polymer Cement (SPC) in an *in situ* application to stabilize and/or remove mercury (Hg) from surficial soil. Patent disclosure forms have been filed for this process.

Soil was artificially spiked with 500 ppm Hg and a series of experiments were set up in which SPC rods were placed in the center of a mass of this soil (see photograph in Figure 1). Some experiments were conducted at 20° C and others at 50°C. After times ranging from 11 to 24 days, these experiments were opened, photographed and the soil was sampled from discrete locations in the containers. The soil and SPC samples were analyzed for Fe and Hg by x-ray fluorescence. The Hg profile in the soil was significantly altered, with concentrations along the outer edge of the soil reduced by as much as 80% from the starting concentration. Conversely, closer to the treatment rod containing SPC, concentrations of Hg were significantly increased over the original concentration. Preliminary results for elevated temperature sample are shown graphically in Figure 2. Apparently the Hg had migrated toward the SPC and reacted with sulfur to form Hg S. This appears to be a reaction between gaseous phases of both S and Hg, with Hg having a greater vapor pressure. The concentration of low solubility HgS (i.e., low leaching properties) developed within 11 days at 50° C and 21 days at 20°C, confirming the potential of this concept.

Additional studies are needed to:

- define the temperature dependency more precisely
- better understand reaction kinetics
- characterize the reaction products by standard laboratory and synchrotron-based techniques
- define capacity of treatment rods before saturation is achieved
- examine the optimal size and density of treatment rods for effective removal of contaminants
- evaluate the required scale for cost-effective and timely treatment
- begin scale-up and engineering feasibility
- investigate long-term behavior of treated rods if left *in situ*
- evaluate feasibility and technologies for removal and treatment of rods if this is required for regulatory compliance or long-term risk aversion

Once some of the above information is obtained, a clearer picture of technology viability can be drawn. At that point, commercial partners and/or licensees can be sought.

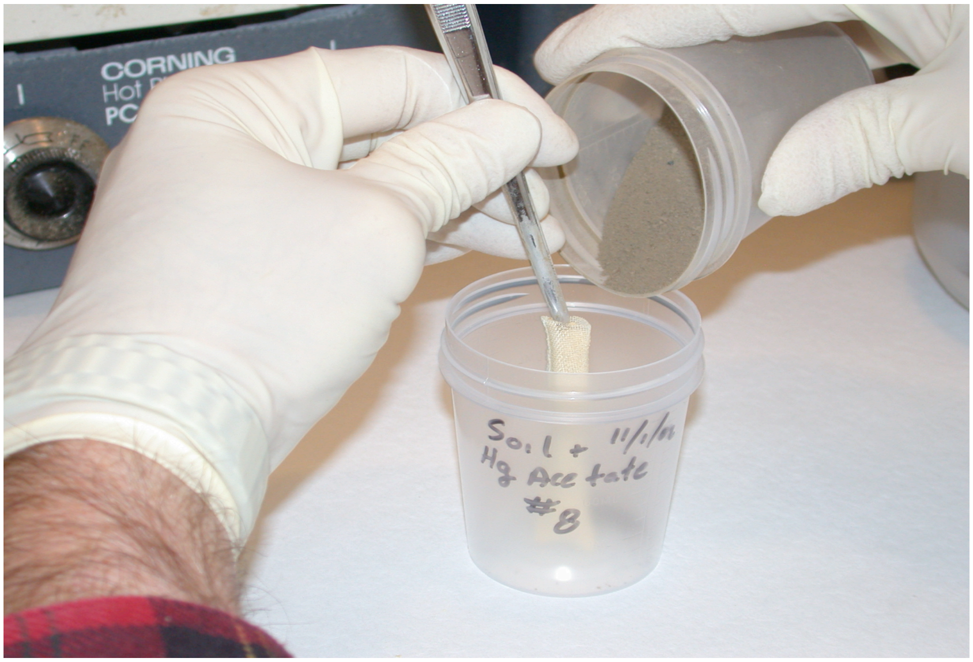

Figure 1. Preparing In Situ Treatment Experiment

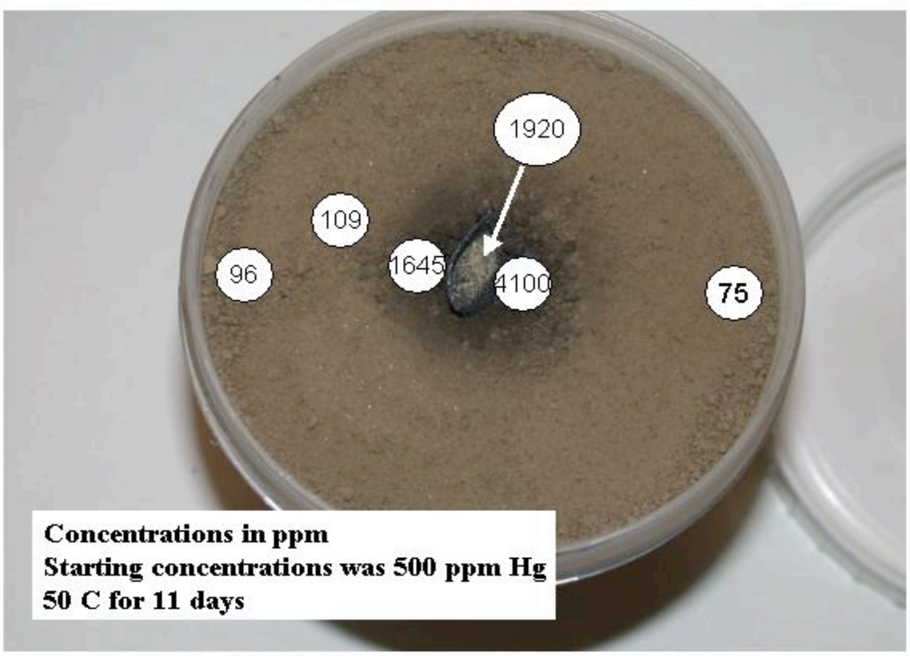

Figure 2. Distribution of Hg in spiked soil showing effect of treatment rod