SENSORS COUPLED WITH RISK AND DECISION MODELS FOR COMMUNITY WATER MANAGEMENT

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Mercury is a dangerous neurotoxin that can cause a plethora of health effects at very low levels (as low as 6 ppb in drinking water). These effects are often heightened in rural and disadvantaged populations where they have less control over environmental and occupational exposure and the resources to monitor mercury pollution. Although necessary for validation, standard laboratory techniques to test water (e.g., atomic adsorption spectroscopy) are accurate but are excessively expensive and impractical due to the advanced instrumentation, complex training, and the analysis time. Here, we demonstrate the development of low-cost, facile, and rapid electrochemical nanosensors for mercury determination coupled with a risk and decision support model on a mobile device to equip the communities with field measurements. Electrodes were fabricated by laser scribing polyimide and decorated with nanocuprous oxide, recovered from recycled material, by anchoring copper nanoparticles using a novel magneto-hydrodynamic deposition process for creating carbon-metal nanohybrid structures. The electrochemical behavior and sensor performance were analyzed via voltammetry on a portable potentiostat. Mercury sensors were linear from 0 - 1000 ppb, response time of less than 3 min, and a relatively high sensitivity. The sensors were paired with a hazard quotient assessment on smart phone technology to create a participatory monitoring effort in the region and map out areas of higher and lower risk. This information is being used to create a Multi-Criteria Decision Analysis with the communities in order to implement a mitigation plan. The methods for developing the carbon nanosensors and decision support tools do not require specialty equipment, are facile, economic, and quick, which makes this method practical for development in rural areas. Sensors, risk models, and decision support present a new paradigm in participatory monitoring for vulnerable rural communities in Cauca, Colombia.

PRESENTER BIO: Victoria Morgan is a PhD candidate in Agricultural and Biological Engineering. She is co-advised by Dr. McLamore and Dr. Kiker in a project that combines low-cost nanotech with risk and decision models. The goal is to determine the best outcome by assessing economic, health, cultural/social, and ecological costs.