PROGRESS AND PLANS OF NATIONAL NANOTECHNOLOGY INITIATIVE (NNI) AGENCIES

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Department of the Interior (DOI)

U.S. Geological Survey (USGS)

Summary

Current analytical methods generally provide contaminant concentrations at a single point in time and space. Improved methods for obtaining real-time information on the presence of chemical contaminants in the field is a badly needed tool for disaster responders, resource managers, and researchers evaluating chemical contaminants (including nanomaterials) in natural systems. There are several fundamental challenges that must be overcome to implement these technologies in complex environmental samples, including cross-reactivity, false negatives and positives, fouling, and limited sensitivity. Innovations in sampler methods and sensing technologies can be leveraged to decrease the uncertainty associated with exposure metrics used for characterizing exposure and biological effects, particularly over time and space. Future methods for sensing contaminants associated with disaster may also include adapting alternative animal bioassays (cell, invertebrate) to rapidly assess contaminants in field-collected samples. Ultimately these functional sensors can provide information regarding unknown contaminant stressors, mixtures, and site-specific data.

Plans and Priorities by Program Component Area (PCA)

PCA 5. Environment, Health, and Safety

USGS plans include the following:

- Partner with Army Research Office to conduct an investigative research workshop focusing on the challenges in sensing environmental contaminants (including nanomaterials) in water. This would focus on the state of science for aquatic sensors and challenges that might include fouling, limits in sensitivity, cross-reactivity and lack of specificity, and recovery after detection.
- Complete study on the use of nanosilica particle-based thin films for sampling hydrophobic organic contaminants. Adapt existing passive sampler technology to develop a simple fluorescence-based cellphone adaptor to detect oil in water and sediment. This is based on the extraction of oil using solid phase extraction or solvents to isolate oil followed by ultraviolet excitation (380 nm) and detection using the cellphone camera. A USGS phone app and three-dimensional printed platform would be used for field deployment.
- Future sensor development using materials science and biological approaches would be considered pending support for research in this area.