Knowing It's Safe

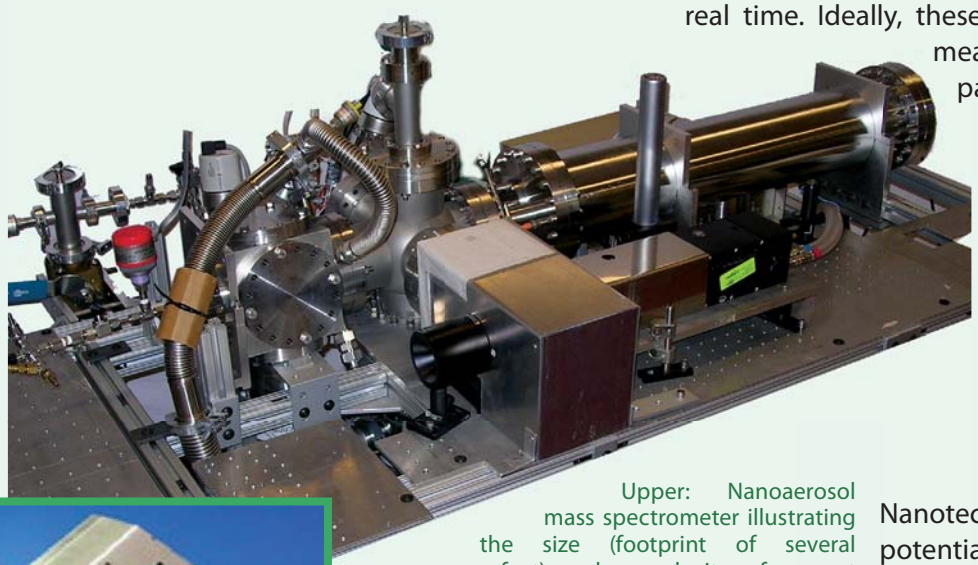
Exposure Measurements for Engineered Nanoscale Materials

Interested Agencies: CPSC, DOD, DOE, DOL, DOT, EPA, FDA, NIH, NIOSH, NIST, NSF, USGS

Knowing the concentration and types of engineered nanoscale materials in the air, in water, and on surfaces is essential to evaluating the potential impacts on workers, consumers, the public, and the environment.

Definitive methods for identifying engineered nanoscale materials in the environment are neither well developed nor readily available. Presently, estimating exposure to and concentrations of nanomaterials is possible only for a limited number of material types. The results of these measurements are often inaccurate, and the process is cumbersome and typically involves collecting samples in the field for subsequent analysis in the lab. The instruments used in these analyses incorporate sophisticated technologies and methods, such as electron energy-loss spectrometry, that require expert operators to collect the data and interpret the results. Moreover, a single instrument may cost hundreds of thousands of dollars and be capable of measuring only one or two of the many parameters of interest, for example average size or elemental composition. Even these limited measurements can take hours, if not days, to complete.

For exposure and concentration measurements of engineered nanoscale materials to become feasible, existing methods for measuring the relevant parameters must be simplified and refined and new approaches must be developed. For these measurements to become practical, the instruments will need to be affordable, portable, and work in the field, and provide exposure and concentration information in real time. Ideally, these instruments would also measure several relevant parameters, such as size distribution, shape, charge state, and chemical composition. Such instrumentation would greatly facilitate risk assessment analyses and would facilitate the development of appropriate exposure mitigation programs.



Upper: Nanoaerosol mass spectrometer illustrating the size (footprint of several square feet) and complexity of current instrumentation for measuring nanoparticles in the atmosphere (courtesy of M. V. Johnston, University of Delaware). Lower left: Concept of a future-generation instrument (courtesy of Sandia National Laboratory).

Nanotechnology itself could potentially provide platforms for a next generation of analytical instruments, perhaps through the development of high-density, multianalyte sensor arrays.