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Measurement and Monitoring Technologies for the 21st Century

$21M^2$

Through the Measurement and Monitoring Technologies for the 21st Century ($21M^2$) initiative, EPA's Office of Solid Waste and Emergency Response (OSWER) is encouraging the deployment of promising measurement and monitoring technologies. The initiative identifies technology needs, sponsors research and demonstration of new technologies, and maintains a searchable, regularly updated database of citations and abstracts relevant to recent work in the identified needs areas.

NEEDS AREAS/FIELD PROJECTS.
Each year the $21M^2$ project solicits suggestions from regional and headquarters waste programs for new technologies or test methods that they would like to develop or deploy. The submitted suggestions have identified "needs areas" for characterization or monitoring problems that lack a satisfactory technical solution. Eighteen topics in 10 needs areas (see chart on page 2) have been recognized that reflect evolving requirements across all waste programs. To date, $21M^2$ has sponsored 19 projects. Completed project results are described in the following reports, available at http://www.clu-in.org/programs/21m2/projects/

* Field Test of an Ultraviolet Differential Optical Absorption Spectrometer for Remote Air Toxics Sensing
* Perchlorate Screening Study: Low Concentration Method for the Determination of Perchlorate in Aqueous Samples Using Ion Selective Electrodes
* Measurement of Fugitive Emissions at a Region I Landfill
* Guidance on the Use of Passive-Vapor-Diffusion Samplers to Detect Volatile Organic Compounds in Ground-Water-Discharge Areas, and Example Applications in New England

In addition to hosting information on sponsored projects and the status of technology demonstrations and methods development, the website also contains other useful tools:

Literature Citation Database. The $21M^2$ project gathers intelligence on a quarterly basis from commercially published material and the gray literature to identify new information relevant to the needs areas. Citations and abstracts found in these quarterly updates are maintained in a searchable database. Over 3,000 references are available, including 199 articles about techniques for locating or monitoring light or dense NAPLs and 859 articles on sensors.

Specialized Literature Searches. Literature searches are conducted periodically on topics of particular interest, such as nanosensors. The collected citations and abstracts are posted on the website in a PDF file and also are merged into the main citation database. Special searches have been performed on a variety of topics:

* Nanotubes, Nanopores, Nanoclusters and Other Foundations for Nanosensors,
* Geophysical Methods for Locating and/or Monitoring DNAPLs,
* Open-Path Monitoring Techniques,
* Landfill and Containment Leak Detection in the Vadose Zone,
* Perchlorate Analysis

Characterization and Monitoring Technology Focus Areas. This section highlights detailed background information on selected technologies that can be used for monitoring and measurement efforts in the needs areas. These background papers contain a description of how a technology works, what it has been and can be used for, and an extensive bibliography. The technology descriptions also list brief case studies to demonstrate both proven and emerging uses. Technology descriptions have been developed for **sampling equipment for obtaining sediment and pore water samples**, and for **open path monitoring systems** that use UV-DOAS, OP-FTIR, LIDAR, Raman spectroscopy, and tunable diode lasers.

The table below identifies the needs areas and specific topics of interest within them that fall within the focus of the 21M^2 Initiative.

Needs Areas	Specific Topics
Air Emissions Monitoring	• Continuous emissions monitors for thermal hazardous waste treatment systems • Remote sensing for fence-line monitoring for fugitive emissions
Mining Sites Characterizing and Monitoring	Monitoring technologies for mine waste sites
Contaminated Sediment Characterization	Sampling and analytical technologies for potentially contaminated sediment
Field Screening and/or Analytical Methods	• Dioxin • MTBE in soil and groundwater • Perchlorate, particularly in water samples • Pesticides and their degradation products
Indoor Air Quality	Monitoring vapor intrusion into buildings
In Situ Monitoring Systems	• Sensor technologies for long-term groundwater monitoring • In situ sensors for monitoring groundwater contamination and/or treatment system performance • Leak detection technologies for small municipal landfills
Laboratory Analytical Methods	New methods for determining total cyanides and cyanide speciation
In Situ Remedies Performance Evaluation	In situ remediation systems and natural attenuation monitoring
Non-Invasive Subsurface Chemical Detection	• Technologies for locating and monitoring DNAPL contamination • Non-invasive monitoring technologies for mercury and heavy metals in soils
Underground Storage Tanks	• Internal inspection methods for internally lined underground storage tanks (USTs) • Leak detection methods for USTs and pipes

Additional Information

More information on the 21M^2 program is available from several sources:

- 21M^2 Program. *http://cluin.org/programs/21m2/* or
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