

# Adaptive Sampling and Analysis Puts Site Characterization on the Fast Track

## Challenge

Traditional methods for characterizing sites contaminated by hazardous waste have relied on preplanned sampling programs and off-site analysis to determine the extent and level of hazardous waste contamination. High cost, the need to over-sample to ensure complete and accurate results, and long lead times are some of the more serious drawbacks to these approaches.

## Argonne's Answer

Researchers at Argonne National Laboratory developed innovative Adaptive Sampling and Analysis Programs (ASAPs) incorporating rapid, on-site sample analysis and real-time, adaptive decision support (Figures 1 and 2). Designed for use in the field, Argonne's ASAPs can integrate quantitative sampling data and adapt their decision-making support accordingly. ASAPs using Argonne's approach have been conducted at a variety of sites, with substantial benefits, as shown in the table.

Site Location	Benefits Provided by Argonne's ASAP Approach
Sandia National Laboratories Albuquerque, NM	<ul style="list-style-type: none"> <li>• 60% suggested savings compared to traditional techniques</li> <li>• Reduction in number of soil borings, samples collected, and overall analytical costs</li> </ul>
Kirkland Air Force Base Albuquerque, NM	<ul style="list-style-type: none"> <li>• 22% reduction in cost for soil borings</li> <li>• Significant reduction in per-sample analytical cost</li> <li>• 50% reduction in number of samples collected</li> </ul>
Argonne National Laboratory Argonne, IL	<ul style="list-style-type: none"> <li>• 60% reduction in number of soil borings</li> <li>• 66% reduction in number of samples</li> </ul>
Joliet Army Ammunition Plant Joliet, IL	<ul style="list-style-type: none"> <li>• 75% reduction in analytical costs</li> <li>• More accurate volume estimate for contaminated soils compared to gridded approach proposed by contractor</li> </ul>
Brookhaven National Laboratory Upton, NY	<ul style="list-style-type: none"> <li>• More exact enumeration and delineation of pits</li> <li>• Millions of dollars estimated savings in projected cost of pit excavation</li> </ul>
FUSRAP Site 1 Painesville, OH	<ul style="list-style-type: none"> <li>• \$10 million dollar estimated overall project cost savings</li> <li>• Work received a DOE Pollution Prevention Award</li> </ul>
FUSRAP Site 2 Luckey, OH	<ul style="list-style-type: none"> <li>• Reduced per-sample characterization costs</li> <li>• ASAP approach resulted in a much more detailed delineation of surficial beryllium and radionuclide contamination</li> </ul>
Private Site Mt. Pleasant, MI	<ul style="list-style-type: none"> <li>• Greatly reduced per-sample analytical costs</li> <li>• Reduced reliance on soil sampling and <i>ex-situ</i> gamma spectroscopy analyses</li> <li>• Allowed combination of characterization and remediation activities into one field work cycle</li> <li>• Enabled a more effective remediation with a more precise excavation footprint</li> </ul>

## How ASAPs Work

ASAPs incorporate a variety of software tools that can run on standard laptop and desktop computers, including:

- Geographical Information Systems (GIS) — commercial software used to support ASAP-based characterization programs by providing rapid data visualization and integration capabilities.
- Argonne's Plume™ software — provides quantitative support for adaptive sampling and analysis.
- Java™-based maps and data browser — makes dynamic maps and data tables available through standard web browsers.



*Figure 1. A walkover survey using the Global Positioning System is performed to define the excavation area.*



*Figure 2. The ASAP approach typically reduces the number of soil samples that must be collected.*

Argonne's approach is vastly superior to sending samples off to a lab, waiting for results, and (if necessary) returning to the site to obtain additional samples. ASAPs can be used for characterization work during a remedial investigation or to support contaminated soil excavation work. In the latter case, the use of ASAP methods during the excavation process facilitates the implementation of precision excavation techniques, which can dramatically reduce overall remediation costs.

An additional benefit of Argonne's efforts to develop ASAPs has been the opportunity to establish strong working relationships with private-sector organizations and the attendant potential for spin-off R&D activities that can further leverage the DOE's investment.

### Collaborator

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