An Integrated Chemical, Biological, Radiological Agent Monitoring Solution

J. Herbert Dempsey, Ram Hashmonay (ARCADIS G&M, Inc.)
Robert Ronan (Rupprecht & Patashnick Co., Inc.)
James Miller, Peter Law (Severn Trent Laboratories, Inc.)

29\textsuperscript{th} Environmental and Energy Symposium & Exhibition
Richmond, Virginia

April 09, 2003
Outline

- Previous support
- The team
- Biological agent monitoring
- Biological agent analysis
- Radiological agent monitoring
- Chemical agent monitoring
- Summary and Questions
Previous Support

- Los Alamos National Laboratory
- U. S. Environmental Protection Agency
- DoD Environmental Security Technology Certification Program (ESTCP)
- U. S. Air Force Research Laboratory
The Team

- ARCADIS
- R&P
- STL
- UNISEARCH
- ManTech
Biological Agent Monitoring

- R&P Instrumentation - Basis for Salt Lake City Winter Olympics Bio-aerosol Monitoring System
- Proven Existing Environmental Monitoring Technology Transferred to Meet New Requirement
Bioaerosol Sampler Development

■ Apply Lessons Learned
  – Indoor/Outdoor Applications
  – Small Size (Foot Cubed) – Low Noise
  – High Collection Efficiency/Flow Rate
  – Concentrated Sample – Inert Collection Substrate
  – Traceability
  – Flexible Communication
  – Simple Operation – Tamper Resistant
  – Flexible Power Sources
  – Real-time Radiological/Particulate Monitor
Concept to Hardware
Bioaerosol Sampler Features

- Patented Airborne Sample Analysis Platform ASAP™ System
- Computerized Date-Time-Loc Stamp
- Low Noise/High Flow Rate (200 l/min)
- Remote Communications
- Operating Data and Sensor Data Automatically Recorded to One-Time Write Only Electronic Chip
Bioaerosol Sampler (concluded)

- **iBASS (Integrated Bio Aerosol Smart Sample)**
  - Polyurethane foam (PUF) collection media
  - Memory button (over-write protected)
  - Approximately 95% collection efficiency for particles between 1 and 10 microns

- **Integrated Radiological Monitor**

- **Particle concentration sensor for aerosols more than 1 micron diameter**
Bioaerosol Analysis

- PCR Using Idaho Technologies R.A.P.I.D. Analyzer
- Anthrax Genetic Material Successfully Retrieved and Detected from PUF Collection Substrate
- No False Positives
- Anthrax, Tularemia, Plague and Brucellosis Mixture Successfully Retrieved, Separated and Detected from PUF Substrate
Laboratory Analysis

- SOPs for Analytical, Reporting and Sample Handling are Completed
- Analysis Time 1 – 2 Hours On-Site (24 to 48 Hours at Off-Site Lab)
Optical Remote Sensing (ORS) for Chemical Releases

- Spectroscopic Methods
  - Open Path Fourier Transform Infrared (OP-FTIR)
  - Differential Optical Absorption Spectroscopy (DOAS)

- Laser Based Techniques
  - Tunable Diode Laser Absorption Spectroscopy (TDLAS)
  - Differential Absorption Lidar (DIAL)
Chemical Monitoring

- Automatic, Real-Time
- Indoor/Outdoor Optical Remote Sensing (ORS) to 1 km Path Length
- Open Air and Emergency Response
- Broad Range of Chemicals
- Compact/Versatile Instrument Design
- On-Site or Remote Data Processing
ORS Plume Imaging

- Near Real-Time Spatial Resolution
- Multiple Beams to Determine Vertical and Horizontal Gradients
- Optimization Algorithms to Reconstruct the Mass Equivalent Plume
- No Need for Tracer Release or Inverse Dispersion Modeling
- Plane-integrated Concentration $\times$ Wind Speed = Emission Flux
Landfill Methane Emissions
Demonstrated/Accepted Environmental Monitoring Techniques Adapted for Homeland Security Applications

New Generation of Instrumentation Enhanced with Flexible Communication/Data Management Options

Search for Real-Time Biological Sensor Continues

Alternative FTIR Interferometers Being Evaluated

Uniquely Experienced Team of Collaborators
Questions?

Contacts:

Herb Dempsey – hdempsey@arcadis-us.com – (919) 544-4535
Ram Hashmonay – rhashmonay@arcadis-us.com – (919) 544-4535
Bob Ronan – bronan@rpco2.com – (518) 452-0065
Peter Law – plaw@stl-inc.com – (413) 572-4000
Jim Miller – jmiller@stl-inc.com – (716) 691-2600