Summary of Leak Detection Group Discussion

(EPA ORS Workshop, 30 July 2002)

Participants: Bill Vaughan (Remote Sensing Air, Inc. & A&WMA), Dave Payton (ERG), Carrie Middleton (EPA NEIC), Don Stedman (University of Denver), Robert Kagann

Problem areas: The following areas were identified where ORS/optical techniques could be used to define leaks:

Refineries and Chemical facilities – air toxics, hydrocarbons, ozone precursors
Landfills – methane, air toxics (e.g. vinyl chloride), ozone precursors, confirm cap integrity
Urban areas – methane, solvents from drug labs

Current State of the Art:

INDUSTRIAL PLANTS/REFINERIES -

Hand-held Photoionization detectors (PIDs) at individual valves, fittings, gaskets, etc.
Fenceline ORS to detect trends (using pollutant roses to pinpoint process area) and trigger closer investigation.
Shoulder mounted laser-scanning systems (GasVue) to image leak clouds on a view of the piping based on backscatter of IR beams from hard targets.
[Passive IR images of leaks in a field of view described in first ORS Workshop (July 2001) by Pacific Advanced Technology.]
Linkage of fixed ORS beam data with meteorological record to back calculate source regions, used by (Shell UK since mid 1990s).

LANDFILLS -

Walk site in a grid pattern to collect grab samples for GC/MS lab analysis – California Calderon method – but misses some fissures/breaks in landfill cap.
Flux chambers placed over small areas and collect isolated releases for lab analysis – samples are spot-specific and miss most fissures/breaks in the landfill cap.
Tracer (N_20) injection into landfills and use of ORS beams down wind to quantify emission rates. (Developed and used in Europe.)
Dual beam with dual tracer releases at the surface to calculate surface emission flux between two beams – proposed not tried, requires relatively flat terrain.
Use of vertically scanned ORS beams and meteorology to determine upwind flux from tomography, possible to use on slopes and somewhat uneven terrain.
Horizontal scanning of relatively flat terrain using tomography to look for hot spots/leaks in landfill cap.

URBAN AREAS -

Driving extractive or short open path instruments on city streets to detect absorbing clouds. (Optical techniques so sensitive that many leaks are found and instrument de-tuning or leak prioritization required to make it practical in light of regulatory requirements on utilities.)

Importance (if measurements lead to timely corrective action/repair) -

Reduce total VOC emissions and ozone precursors
Reduce greenhouse gases (methane much stronger IR absorber than CO2)
Reduce air toxic emissions

Action items (to increase acceptance/use of ORS techniques for various applications):

INDUSTRIAL PLANTS/REFINERIES –

Have EPA/API indicate that imaging techniques are acceptable and encourage application through incentives of some kind.
Address the conflict between regulations that require costly estimation of the leak rate reduction from a repair along with the repair rather than going ahead and repairing the leak to achieve the desired goal of fewer fugitive emissions.

LANDFILLS –

Develop general ORS procedure(**s**) that encourage either complex (tomography) or simpler (tracers and beams) methods depending on budget and data objectives for a given problem/application.
Communicate to the solid waste landfill community that ORS methods are available and applicable under various scenarios **and** are acceptable to EPA if above guidance is followed.
Develop industry incentives for the use of ORS in flux determinations.

URBAN AREAS -

Remove the regulatory/economic barrier to practical repair of detected methane leaks using very sensitive optical techniques, where existing requirements based on insensitive techniques require that "any leak detected must be repaired immediately." Move toward prioritizing repair based on size of leak.
Develop acceptance that de-tuned optical sensors are useful in prioritizing/finding high leakers that require appropriate attention.

[Submitted by group facilitator, Bill Vaughan, 4 August 2002.]

Applications of Optical Remote Sensing (ORS) Methods to Homeland Security
Panel Summary—Joe Wander, Air Force Research Laboratory

The Homeland Security [HS]/Homeland Defense "programs are poorly defined and hastily organized, but they control a huge amount of money. Of specific concern are its requirements, which are neither clearly stated nor coordinated among the various agencies involved, and which preclude the conception of responsive development efforts. A number of relevant precedents have been investigated by DoD, of which potential proposers should make themselves aware.

There are windows of opportunity, but ORS is not *The* Universal tool for HS—

- ORS is completely inapplicable to nuclear and radiological devices and events
- Most chemical and biological (CB) weapons are delivered as aerosols
- It is impossible to constantly monitor the entire country with ORS evices
- Certainty of identification by ORS is less than 100%
  - But false screening positives can be canceled by specific confirmations
- Detection of a CB event does not protect the population from attack
  - But it guides response, evacuation, casualty management

Acknowledging the realities of cost limitation, some possible roles include

- Perimeter and local-area monitoring of targets of particular vulnerability or value
  - *E.g.*, a chemical plant, national symbol, or command-and-control center
- Hand-held, go/no go decision tool for first responders arriving at event site
  - Rugged, less than $500/copy, SIMPLE to operate and maintain
- Assessment of damage, residual risk, and progress of recovery efforts
- Approach decision tool for responding assets (*e.g.*, fire truck)
- Standoff sensor for weapons in cargo, illegal immigrants offshore/at open border
  - This contributes to protecting the population from attack

The final form of most devices incorporating ORS will have to be presented as integrated systems, and the first devices into the field will likely be imperfect and improve with succeeding generations. Dual-use–dual-function systems will be the economic survivors because CB attacks are ultralow-probability events that do not warrant suites of dedicated detectors. The ideal ORS [or other] device will be a simple, rugged, compact, self-powered system that perform one or more routine, necessary function[s] common to both civilian and military environments, and that responds uniquely and linearly when it encounters trace amounts of a specific CB agent[s] or class[es] of agent.

Current OPM Experience

1. **Overwhelming Consensus on**:

   a. Need for general "Outreach" on the part of the ORS community to provide information to state and local agencies on the current capabilities of ORS systems, demonstrated applications of these systems, and potential applications of the systems.

   b. Critical need for "referenceable" EPA document (NIST) outlining ORS technologies and their "recognized" applications. This is to serve as a guide for agencies in selecting an appropriate ORS approach for specific testing requirements.

   c. Need for EPA Guidance Document for siting of ORS systems to assure "representitive" data similar to the documents which exists for criteria pollutant instrumentation.

How to accomplish these things

Outreach:

- Success stories made available to states and local agencies (Web)
- EPA Documents (as above) accessible on EPA Web site
- ETV program for demonstrated performance of specific instruments
- Workshops (STAPA/ALAPCO) to provide education of state and local agencies/organizations (perception is that these technologies are too complex and too costly to use routinely)

Documentation:

- Press for rapid document generation under the Homeland Security umbrella
- Work with other organizations (e.g. ASTM) if immediate funding is not available

2. Possible Improvements Needed:

a. Simplify operation, esp. analytical methods development
b. Make software "smarter" to handle changes in the measurement matrix
c. Find ways to get more funding to state agencies so they can upgrade their systems rather than "keeping old systems running just one more year"

Fugitive Emissions-Particulate Matter Working Group

Key Problems

Regional haze
Emission Trading
Title V Permitting-Air Toxics (HAPs)
Stakeholder Concerns
Homeland Security

By better characterizing the emissions being emitted by industry (used in the generic) allows industry more capability of obtaining and remaining in compliance with regulatory and permit requirements. Also better understanding the types of emissions being produced from "daily activities from industry" assist in addressing the concerns of the local stakeholder. There is a need for remote sensing capabilities for on going efforts for Homeland Security.

Present State of Technology

Network of high volume samples

Time Average Sampling
Gross characterization
Speciation

Drawbacks

Time
Not fully characterizing the emissions
No real time data

Improvements

The present "tool box" needs to be improved by adding remote sensing capabilities to better characterize emissions from industries and potentially assisting with homeland security. This requires the regulator and industry to work closely together in developing and approving methodologies that can be implemented cost effectively thru communities and industries. This will enhance further technical research in remote sensing technologies making the equipment faster, better, smaller and driving the cost down to a reasonable value for industry to implement the "entire tool box".

Potential Applicability

Regulatory Enforcement
Industry
The First Responder requires a simple "red/green light" tool to allow them to make quick field decisions concerning the immediate emergency. As we start to put our arms around the needs of "Homeland Security" there will be high demand for standoff remote sensing capabilities that could be networked nation wide to establish some type of continuous monitoring capabilities serving as early warning system. This type of system will also serve as continuous training program for technicians to assure that their techniques remain sharp and responsive to any type of chemical or biological warfare.

Recommendations

Partnering by the regulatory and industries to develop acceptable methodologies and tools that will increase the capability of the "tool box" to better characterize emissions. By accomplishing this first recommendation this will eventually drive the cost of the remote sensors down because the demand will increase. Industry should also work to refine and simplify some of the tools allowing the First Responder to have quick screening tool to assist in dealing with the emergency at hand. Homeland Security should network with federal, state and local agencies to utilize existing infrastructure allowing funds to be used more efficiently and economically to increase the "tool box" and technology.