

ITRC PROJECT PROPOSAL: Tech-Reg Guidance for ORS-Based Air Screening to Facilitate Health-Based, Mitigative Decision-Making During Waste Site Cleanups

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Problem Statement

There are many thousands of waste sites in the US awaiting cleanup, a significant portion of which are located in urban or residential areas. Although most of these sites are not classified as “hazardous,” exposure to potentially harmful airborne contaminants released during their cleanup is often a concern to local communities. To address this concern, a total of four to eight real-time air monitoring stations are typically positioned along the site perimeter, and one or more compound groups (e.g., TVOC, BTEX) are monitored. Speciation is required whenever “trigger” levels established for these compound groups are exceeded. However, compound speciation capabilities can be limited, and results are often not available in a timely manner. More importantly, narrow contaminant plumes will pass undetected between monitoring stations some or most of the time. For these reasons, such programs are generally of limited use in guiding the moment-to-moment decisions needed to control air emissions during cleanup activities.

Despite these drawbacks, “traditional” perimeter air monitoring programs provide value added, depending on their design and proper implementation. For example, they can document the air quality at the time of sample collection and provide an accurate assessment of offsite exposure upon project completion. However, traditional programs are expensive to implement, they are not necessarily able to detect all contaminants of concern (e.g., naphthalene), and site coverage depends on the number and placement of monitoring stations (a preferred station location may be compromised by site security considerations or by bordering barriers such as waterways). The cost of traditional programs increases with the number of stations needed to adequately cover a site.

Virtually all of the shortcomings of traditional air monitoring are eliminated by the proper application of optical remote sensing (ORS) (see Solution / Impact). ORS can be used to provide conclusive evidence of real-time, community protection during each step of a site cleanup, at a lower cost. More than two dozen speciated compounds can be monitored simultaneously. Although ORS enjoys a recognized legal status (USEPA Compendium Method TO-16), it has not gained the widespread acceptance envisioned by its proponents over the past decade or more.

There are a variety of reasons for this lack of acceptance. One is a general misunderstanding about the “path-integrated” concentration; many believe that the data are somehow of inferior quality compared to point data when, in fact, quite the opposite is true. Not only are the precision and accuracy of the ORS data far better, generation of a path-integrated concentration solves the serious spatial data-representativeness issue mentioned above.

Other reasons stem from regulatory inconsistency about its use. Many states have had in place, for a decade or more, perimeter air monitoring guidance designed around point monitoring to measure compound groups during site cleanups. While this monitoring approach was, at the time, state-of-the-art, some consultants take the position today that the ORS approach is not specifically addressed in the guidance and should, therefore, not be considered; they even go so far as to say that ORS does not meet the state requirements because it provides information on individual compounds, and not compound groups. Further, site owners with projects on the “fast track,” are not interested in spending time working with regulators to gain approval for a new air monitoring method.

Another reason ironically involves the superior quality of the data. Some site owners, while convinced of the utility of the technology, refuse to consider its use because it is “too good.” For example, the potential exists for a regulator or community group, partway through a site cleanup, to demand the inclusion of additional monitored compounds not specified in the original list of target contaminants, yet detected in the absorbance spectra through routine QC checks by a trained spectroscopist.

Creation of this Tech-Reg guidance is needed to remove these and other barriers to the widespread acceptance of the ORS technology during site cleanups.

Solution / Impact

The recent maturation of ORS as a class of air measurement technologies has led to the creation of many new environmental applications. Technologies of interest here are open-path, Fourier-transform infrared (FTIR), ultraviolet (UV), and tunable diode laser (TDL) spectroscopy. Each is able to generate a highly accurate, real-time depiction of individual (speciated) gaseous compounds along an entire measurement path, i.e., a path-integrated concentration. When used in combination with onsite meteorological data, these measurement technologies are able to provide accurate estimates of emission rates and offsite air impacts (or inhalation exposure) from complex area sources, such as landfills and waste sites – objectives not possible to achieve with traditional, fixed-station point monitoring. The most widely used ORS technology is open-path FTIR spectroscopy, owing to its ability to measure more than two dozen target compounds simultaneously.

The Gas Technology Institute (GTI) recently completed a 2½-year applied R&D project (GTI project) in which the modified cross-sector-averaging (MCSA) technique, an ORS screening method, was successfully tested during the cleanup of two former manufactured gas plant (MGP) sites. Based on the cross-sector-averaging technique developed by USEPA Region 7 to assess downwind, real-time air quality impacts from large industrial facilities, the MCSA technique is a true screening tool. It allows a fundamental “yes/no” decision to be made based on continual assessment (every 10 minutes) of the maximum downwind concentration through employment of a series of simplified, yet conservative, assumptions. This decision is tied to the question which is continually asked: “*Can it be demonstrated that the maximum possible community exposure is insignificant?*” If the answer is yes, the site cleanup proceeds normally. If the answer is no, some form of mitigative measure is implemented (e.g., slow down the cleanup, apply foam) until there is compliance with a pre-determined, 10-minute “action level” established to coincide with the 10-minute monitoring period. The 10-minute action levels act as conservative proxies for longer-averaged, health-based concentrations of concern (typically 24 hours). By acting on data collected and averaged over consecutive 10-minute periods, ample time is afforded for field personnel to apply mitigative controls as needed to ensure that the longer-term, health-based thresholds are not even approached.

The GTI project included a detailed cost comparison between the MCSA technique and the most commonly employed traditional approach. Besides its technical advantages, the MCSA technique was shown to be less expensive to implement. The cost for a typical six-month monitoring program employing a network of six, fixed-station point monitors, including confirmatory sampling, was estimated between \$453,000 and \$713,000, depending on the particular assumptions employed; the cost to implement the MCSA technique ranged from \$241,000 to \$353,000. On average, for a six-month program, the MCSA technique was shown to be about 30 percent less expensive than a four-station network, 50 percent less than a six-station network, and 60 percent less than an eight-station network.

At USEPA’s invitation, GTI presented results of its project at the Second International Workshop on Optical Remote Sensing (proceedings at <http://www.epa.gov/ttn/chief/efpac/workshops/remotesens08.html>), April 2008, Research Triangle Park, North Carolina. USEPA continued its support of the GTI project by offering to facilitate Internet training on their CLU-IN website and providing a preliminary note to the methods guidance created by GTI for MGP site application.

The MCSA technique is tried and proven. It can be employed with any ORS-based spectroscopic technology which generates a path-integrated concentration (FTIR, UV, or TDL). It has been successfully employed by Atmos Energy Corporation during the cleanup of an MGP site in Bristol, Tennessee. Although ORS acceptance is, in general, increasing (it is being actively promoted by USEPA, amongst others), there remains resistance by some to this and similar air measurement techniques. In addition to the barriers mentioned in the Problem Statement, some consultants, who derive substantial rental revenues from large inventories of traditional air monitoring equipment, resist based purely on financial considerations. There is often resistance to change, in general, by *all* involved: site owners, air consultants, engineers, and, unfortunately, regulators.

Creation of the Tech-Reg guidance will help break down these barriers. Building upon the methods guidance created during the GTI project, the Tech-Reg guidance will facilitate the uniform, consistent application of the MCSA technique. Impacts to the environmental marketplace will be:

- Continual, conclusive demonstration of insignificant community exposure during waste site cleanups

- Overwhelming community support by virtue of improved decision-making during site cleanups (please see **Atmos Energy News Release**, www.msi-air.net/ato062905.pdf, which speaks to the point that cleanup decisions at their Bristol site were made every 10 minutes, rather than “after the fact” as with traditional air monitoring)
- Elimination of the need for post-cleanup reporting
- Real-time reporting of more than two dozen speciated gaseous compounds (including naphthalene, an important compound found at many fossil-fuel refining sites; e.g., MGP, coal-coking, waste-oil)
- An infinite “sample holding time,” as all data are collected and stored electronically
- Elimination of all errors associated with sample collection and handling (there is no sample, *per se*)
- A significant cost savings compared to traditional, fixed-station point monitoring

Success Measures

The following success measures will determine project effectiveness:

- Concurrence with this Tech-Reg guidance by all 50 states and USEPA, thereby breaking down the barriers to regulatory acceptance of the technique
- ITRC solicitation of a follow-on project to: (a) provide Internet or classroom training; and (b) establish a network of knowledgeable state agency personnel to facilitate effective and consistent method implementation
- Significant investment (and return) by open-path FTIR, UV, and TDL manufacturers in response to this new market
- Emergence of a body of environmental consultants and other providers capable of implementing this technique

Summary of Deliverables

The sole project deliverable will be the Tech-Reg guidance document, “ORS-Based Air Screening to Facilitate Health-Based Mitigative Decision-Making During Waste Site Cleanups.”

Besides providing detailed guidance on implementation of the MCSA technique, the document will describe successful case studies and provide discussion on barriers which, up until now, have inhibited acceptance of ORS, in general, for environmental application. Also, specifications will be provided for software required to control the storage, retrieval, analysis, and reporting of all data to support end-user decision-making, and to evidence the technical defensibility and legal admissibility of each monitoring event.

Project Schedule

Based on a start date on or about January 1, 2009, the anticipated date for completion of the Tech-Reg guidance document is December 1, 2009. One Team meeting will take place in February, and teleconferences will occur on a bi-monthly basis.

Target Audience

The primary audience consists of all entities involved in the cleanup of those waste sites which have the potential to cause harmful air exposure to the local community from the cleanup itself. Included might be MGP sites, Brownfield sites, and any other sites which are located in or near urban or residential settings. Specifically, the primary audience includes: cleanup contractors; air monitoring consultants; responsible and responding parties and companies (e.g., utility companies, DOD, DOE); and federal, state, and local regulatory agencies.

The secondary audience includes local health departments, community groups, and community relations personnel for affected companies and facilities.

Related Work

There is potential linkage to three ITRC teams: the Sampling, Characterization, and Monitoring Team (the MCSA technique is fully consistent with the USEPA's TRIAD approach), the Brownfields Team, and the Risk Assessment Resources Team.