

Environmental and Sustainable Technology Evaluations (ESTE): Verification of Portable Optical and Thermal Imaging Devices for Leak Detection at Petroleum Refineries and Chemical Plants

Impact Statement

Industrial facilities, such as chemical plants and petroleum refineries, emit compounds that are listed as toxic or hazardous air pollutants (HAPs). HAPs are of concern to environmental decision-makers because exposure to these classes of compounds has been linked to cancer and other serious health effects. These compounds react in the atmosphere to form ozone which also has adverse health effects to exposed populations, such as facility workers and people living in neighboring communities. Undiscovered gas leaks, known as fugitive emissions, in chemical plants and refinery operations can impact regional air quality with the resultant loss of the product for the industry.

Federal and state monitoring programs have been developed to reduce fugitive emissions. These programs are currently based on EPA Method 21, which relies on the manual collection of emissions measurements using an organic vapor analyzer at each potential leak site, such as a valve or flange. Since the actual number of components to be tested in a refinery or chemical plant can be quite large, the application of Method 21 monitoring can be both time intensive and expensive. Opportunities for detecting leaks are also limited by the frequency in which components are tested.

Remote sensing systems offer an operator the ability to monitor components from a distance and identify, in some cases instantaneously, leaking components within the line of sight of the optical or thermal imager. A number of environmental variables can affect the performance of an optical or thermal imaging system used for fugitive leak detection, including the type of compound that is leaking, its concentration and leak flow rate, ambient temperatures, and gas temperatures. Additional information is needed on the ability of the technologies to provide accurate and reliable fugitive emission monitoring data for industrial leak detection and repair (LDAR) programs.

ETV ESTE Portable Optical and Thermal Imaging Devices Project

In 2006, EPA's ETV Program started an ESTE project to verify the performance of portable optical and thermal imaging devices for leak detection at petroleum refineries and chemical plants. EPA needs information on their performance to support proposed Alternative Work Practice To Detect Leaks From Equipment outlined in the Federal Register, April 6, 2006, 40 CFR Part 60, (EPA-HQ-OAR-2003-0199; FRL-8055-2). This project was managed by EPA Office of Research and Development, National Exposure Research Laboratory, with input from EPA Office of Air and Radiation, EPA Region 6, and EPA Office of Air Quality Planning and Standards (OAQPS). A draft protocol was developed for testing the performance of optical and thermal imaging devices based on input from EPA, stakeholders, and vendors. The draft protocol was completed in November 2007.

ETV Program

The [ETV Program](#) operates as a public-private partnership mainly through cooperative agreements between EPA and private nonprofit testing and evaluation organizations. These ETV verification organizations work with technology experts to create efficient and quality-assured testing procedures that verify the performance of innovative technologies. ETV operates six centers which cover a broad range of environmental technology categories. Vendors and others in the private sector, as well as federal, state and local government agencies, cost-share with EPA to complete priority ETV protocols and verifications. In 2005, a new element of ETV was initiated, Environmental and Sustainable Technology Evaluations (ESTE), in which the most important technology categories for meeting EPA needs are verified through contracts with verification organizations. ETV developed the draft protocol for verifying portable optical and thermal imaging devices for leak detection at petroleum refineries and chemical plants under an ESTE project. See <http://www.epa.gov/etv/este.html> for more information on the ESTE project.

ETV Advanced Monitoring Systems Center Portable Optical and Thermal Imaging Device Activities

ETV's Advanced Monitoring Systems Center (AMS) verifies the performance of technologies that monitor air, water, and soil. In 2005, AMS prioritized remote optical and thermal imaging devices for verification. AMS decided to use the draft protocol developed under the ETV ESTE project as a basis for verifying the performance of these technologies for fugitive emission monitoring in industrial applications.

Three vendors have signed verification agreements with AMS: FLIR, Pacific Advanced Technologies, and Electrophysics. The devices will be laboratory tested at a British Petroleum facility in October 2008 and field tested at two industrial facilities in Texas (planned for December 2008 and April 2009). Several aspects of leak detection performance will be examined, including: gas compound detection under a variety of environmental conditions; determination of detection limits, measurement accuracy and repeatability; and the portability and ease-of-use of these devices. A prioritized suite of vapors (12-14 compounds) will be analyzed. The Texas Chemical Council and American Chemistry Council are providing co-funding for the performance verification testing.

Results will be published in verification reports and statements, which will be made publicly available on the ETV Web Site along with the approved test/quality assurance plans and stakeholder meeting minutes.

References

EPA, 2007. *EPA's Environmental Technology Verification Program*. EPA/600/F-07/005. May.

Battelle, 2008. *U.S. EPA Environmental Technology Verification Program, Advanced Monitoring Systems (AMS) Center, Air Stakeholder Committee Teleconference, May 8, 2008*. May.

Battelle, 2008. *U.S. EPA's Environmental Technology Verification Program Advanced Monitoring Systems Center*. August.

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ETV Advanced Monitoring Systems Center

ETV [Advanced Monitoring Systems Center \(AMS\)](#) verifies the performance of technologies that detect contaminants and natural species in air, water, and soil. AMS is operated by Battelle, a non-profit technology research and development organization, under a cooperative agreement with EPA.

AMS develops test plans, conducts independent tests of technologies, and prepares verification reports and statements for the technologies tested. Vendors of these technologies can use the verification reports and statements for marketing purposes. Regulators, permittees, and users of the verified technologies can refer to the verification reports and statements to help make permitting and purchasing decisions.

To date, AMS has completed verification tests of over 125 technologies, including continuous emission monitors for mercury, dioxin, and ammonia; ambient monitors for fine particulate, ammonia, hydrogen sulfide and ozone; test kits for arsenic, cyanide, atrazine, and other water contaminants; and multi-parameter water probes. Nearly 20 additional technologies are currently in the verification testing process.

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ETV AMS Center

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