

EXECUTIVE SUMMARY

In August and September 2000, an intensive field study, called the Texas Air Quality Study (TexAQS), was conducted in the Houston-Galveston area (HGA) to study ozone and other air pollution issues in that region. As part of TexAQS, aerial surveys of chemical species in the atmosphere above the HGA showed higher ozone and ozone-precursor concentrations than would be expected from the emission inventory of volatile organic compounds (VOCs). The findings resulting from the TexAQS study prompted the evaluation of a number of novel approaches to identifying and controlling sources of air pollution.

One such approach is the use of optical gas-imaging devices to identify emissions resulting from leaks in refinery and chemical plant process equipment, which have historically represented a large percentage of the volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from these facilities. Two studies recently conducted in Texas successfully demonstrated that gas-imaging devices offer an operator the ability to monitor process equipment from a distance and identify – in some cases instantaneously – leaking components (of a sufficient mass) within the line of sight of the optical imager. The remote sensing and instantaneous detection capabilities of optical gas-imaging technologies allow an operator to scan areas containing tens to hundreds of potential leaks, thus eliminating the need to visit and manually measure all potential leak sites.

As a follow-up to the above referenced studies demonstrating the effectiveness of gas-imaging devices for identifying equipment leaks, ENVIRON International Corporation was retained in October 2004 by the Houston Advanced Research Center (HARC) to manage a project entitled “Survey and Demonstration of Monitoring Technology for Houston Industrial Emissions (Project H31.2004). The primary objective of this project was to identify, assess, and demonstrate cost-effective monitoring systems and technology to measure integrated (as opposed to process-specific) emissions profiles.

In preparation for TexAQS II, a number of workgroups have been developed to assist in defining study objectives. One such workgroup is focusing on remote sensing. Thus, this report provides comparative information that can be used by the Remote Sensing Workgroup to meet its objective. To that end, several areas where remote sensing technology might be used to support TexAQS II are discussed in the report, including:

- Continuous Emissions Monitoring
- Accidental Release
- Emissions Inventories

Additionally, the report discusses the considerations for the development of a testing protocol for the recommended candidate remote sensing methods.

To successfully meet the objectives of the project, the study team evaluated a range of remote sensing and air sampling gas detection technologies suitable for identifying and monitoring hydrocarbon leak plumes from petroleum refineries and petrochemical plants as would be found along the Houston Ship Channel. The first step in the project was to determine the different

technologies and companies capable of remotely detecting VOC emissions from a large industrial area.

From this initial analysis, 29 companies were identified as potentially having remote-sensing technologies suitable for this project review. Upon further review, 21 of the 29 companies were found to have instruments that met the project qualifications. The following is a summary of these 21 companies:

- Four of the companies are based overseas in Sweden and Russia, two are located in Canada, and the remaining 15 are either US-based or have offices in the United States.
- 16 of the companies have technologies that are commercially available.
- Eight companies have technologies (instruments) capable of being operated from an aerial platform.
- Nine companies provided information on an instrument that can transmit a signal to a remote monitoring station.
- 16 companies have instruments with real time measurement capability.
- Six companies have instruments that are fixed-beam (i.e. “fence-line”) monitoring technologies.

The identified technologies were evaluated through the use of a number of criteria including effectiveness, sampling and post-processing time, accuracy, range, safety and utilization, annualized cost and commercial readiness. An evaluation matrix was prepared with multiple sub-criteria in order to compare the different technologies and instruments.

Of the twenty one remote sensing and air sampling gas detection technologies selected for evaluation, only seventeen devices were ultimately scored based on the availability of a complete set of evaluation data. While the information contained in this report offers a general review of the capabilities of these various technologies and provides a means for assessing the suitability of these technologies for a range of applications, of particular interest in this study are those technologies that can measure VOCs in conditions typically encountered at a refinery or chemical plant, or across the entire ship channel. To do that, the selected technology must demonstrate a broad range of capabilities including portability and the ability to view a range of hydrocarbon emissions.

Based on the identified criteria, the passive gas plume-imaging camera from Leak Surveys, Inc. and the FTIR system from IMACC represent the technologies best suited for further evaluation at this time. While the Ophir system ranked highest among the optical remote sensing technologies, its ability to only see methane and ethane at this time limits its broader application.