THE USE OF A GAS-IMAGING DEVICE FOR DETECTING FUGITIVE EMISSIONS

NARSTO Emission Inventory Workshop
October 2003

ENVIRON

REGULATORY CONTROL OF FUGITIVE EMISSIONS

- Since the early 1980's, the U.S. EPA has supported the development and eventually required the implementation of leak detection and repair programs (LDAR) for control of fugitive emissions from piping components including valves, connectors, pumps, compressors, pressure relief devices.

- Additional state initiatives and the adoption by the EPA of the Hazardous Organic NESHAP (HON) and the Refinery MACT (maximum achievable control technology) require nearly every U.S. refinery and chemical plant to implement a LDAR program.

METHOD 21 CAN BE COSTLY AND INEFFICIENT

- Method 21 requirement to monitor every component individually is very labor intensive
- In a typical large U.S. refinery, the number of fugitive emission components can be over 200,000 with annual LDAR operating costs exceeding $1,000,000
- Analyses by the American Petroleum Institute have shown that over 83% of controllable fugitive emissions come from only about 0.24% of the piping components.

REMOTE SENSING

- Because of concerns about the cost and effectiveness of Method 21, efforts are underway in both public and private sectors to develop new methods for detecting fugitive emissions
- Remote sensing (by way of optical gas imaging devices) offers an operator the ability to monitor components from a distance and identify - in some cases instantaneously - leaking components (of a sufficient mass) within the line of sight of the optical imager

FIELD STUDIES

- To evaluate the capabilities of optical gas imaging devices, several published field studies have been conducted:
  - 1999 refinery test conducted in Deer Park, TX
  - 2002 study at two ethylene facilities in the Houston-Galveston TX area
  - 2003 refinery test conducted in Beaumont, TX
- Additional field and laboratory tests are underway to evaluate active laser and passive infrared systems

2002 ETHYLENE FACILITY STUDY

Study objectives…

- Evaluate the capability of a gas-imaging device to detect fugitive emissions under normal plant operating conditions
- Gather data to establish the mass emission detection capability of the gas-imaging device.
- Gather data to establish the sensitivity of the gas-imaging device to various factors that might be encountered during routine use at a chemical plant.

VISUAL VERSUS INFRARED IMAGE

Visual image of open-ended drain

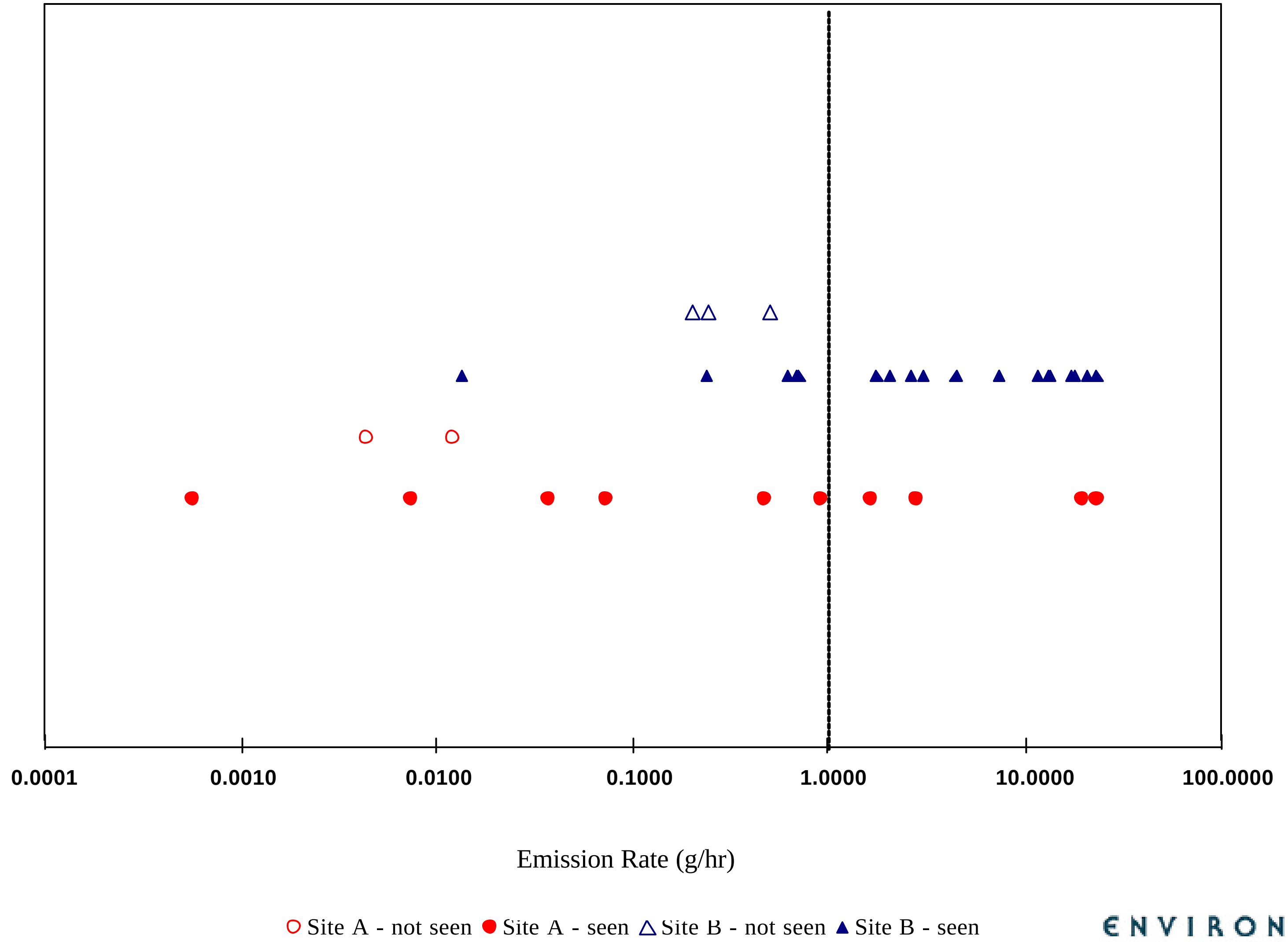
Infrared image from gas imaging device of open-end drain

FIELD STUDY FINDINGS

- At Site A:
  - 7,187 components were monitored in four days
  - 95 leaking components were found (70 traditional and 25 nontraditional)

- At Site B:
  - 1,178 components were monitored in four days
  - 52 leaking components were found (49 traditional and 3 nontraditional)

EMISSION RATE OF BAGGED COMPONENTS



ENVIRON

ON-GOING STUDY OBJECTIVES

- Further evaluation of gas-imaging devices to determine the detection sensitivity to a broader range of chemicals
  - long-range Backscatter Absorption Gas Imaging (BAGI) active laser camera
  - mid-range BAGI active laser camera
  - image multi-spectral sensing (IMSS) passive infrared camera
- Chemicals evaluated:
  - propylene
  - formaldehyde
  - acetaldehyde
  - isoprene
  - all butenes (butylenes)
  - 1,3, butadiene
  - toluene
  - all pentenes
  - all trimethylbenzenes
  - all xylenes
  - all ethyltoluenes
  - all hexenes
  - all butanes
  - all pentanes

ENVIRON