

The value of leak detection needs to be compared with the chances of a significant accident, a worker-safety/exposure law suit, and even the scrutiny of regulator or community activists

Weighing the risks against the rewards

Preventing volatile organic compound (VOC) fugitive emission leaks from equipment and piping has been a hot enforcement topic for the Environmental Protection Agency (EPA) for over a decade.

Fugitive emissions historically accounted for over half of VOC emissions reported by petroleum refineries, and those emissions may have been under-reported.¹

But through leak detection and repair (LDAR) best-practice settlement agreements reached with most major refiners in the US, the EPA has reduced toxic fugitive emissions from the petroleum sector by 44% since 2000.

The cost of leak detection

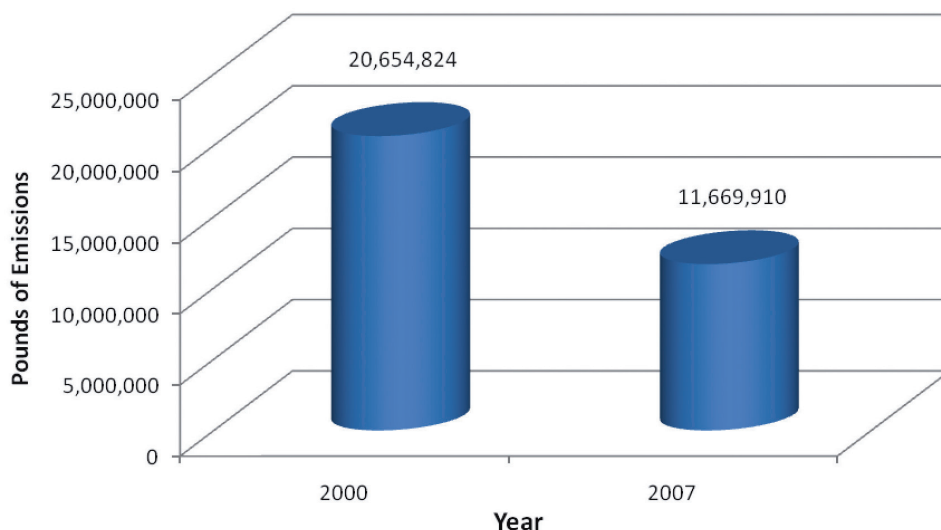
While VOCs have obvious monetary value, the value of a site LDAR programme must be weighed against the equipment monitoring and repair costs, process/worker safety, and the risks of any potential negative publicity should the facility be subject to any enforcement action.

As storage-space leasing companies, terminals usually bear no financial cost for product lost to air emissions during the period of storage, as long as loss rates remain below 3-4%.

Most terminals are considered minor sources (emitting less than 100 tonnes a year combined pollutants), so operating permit fees are lower as well.

Fees for greenhouse gas (GHG) emissions in the US have not yet been established. Until recently, LDAR monitoring of potential leak interfaces

Toxic fugitive emissions from US petroleum sector



Source: EPA TRI (Toxic release inventory) Explorer, July 2009

using a total hydrocarbon analyser cost as little as \$0.35 (€0.25) per component (valve, pump, flange, etc.). But enforcement by US regulatory agencies has resulted in most monitoring service contracts in the large manufacturing industries being transformed from a 'per component' basis to a 'time for monitoring' basis to remove the incentive to monitor overly quickly.

Repair costs vary by component type, condition, configuration, location, metallurgy and facility location, so are difficult to judge. But in parts of the US with stringent repair thresholds and deadlines (and severe VOC non-attainment rules) such as the Los Angeles basin, companies have become good at making the right kind of repairs at the right time, greatly reducing the number of more invasive (such as packing drill-and-tap) and costly repairs (such as equipment

enclosures) to stop leaks.

The true cost of LDAR is a question of risk and probability – depending on the chances of a significant accident, a worker-safety/exposure law suit, or the increased scrutiny of regulator or community activists.

The probability of a major accident from equipment leaks in the terminal industries seems fairly low: process conditions are generally less severe (near ambient), so there is less driving potential for the kind of big leak which could pose a real threat.

However, as the 2005 explosion at the BP refinery in Texas City, Texas, showed, not only leaks in high pressure lines cause problems: there, vapours displaced from overfilling a process vessel were ignited by a vehicle nearby, killing 15 people and causing widespread damage to the plant.

Worker exposure risk from fugitive emissions may also be greater in comparison to

other kinds of risks in the plant because most equipment is generally located at ground level for operator accessibility. Leaks from that equipment will likely occur in the worker breathing zone and can significantly impact worker health, depending on the materials being managed.

Enforcing the regulations

In the US, terminal industries are generally subject to less stringent LDAR regulations than their manufacturing counterparts. At many terminal facilities, most of the equipment is subject only to audio, visual and olfactory inspection rather than instrument inspection, and does have to be listed individually on diagrams or in equipment inventory listings.

Record-keeping requirements are much reduced, and reporting requirements are minimal if any.

With these considerations



FLIR GasFindIR 320 hydrocarbon imaging camera

alone regulatory compliance may not appear as a significant concern. However new technology considerations are changing the risk and probability of LDAR scrutiny for the VOC storage and terminal industries.

Leak detection technology

Two relatively new emission detection technologies have the potential to radically change both enforcement scrutiny and public image for the terminal industry.

The first is optical leak imaging. Infrared (IR) cameras which are tuned to wavelengths in which energy is absorbed by hydrocarbons can be used to quickly scan larger areas and optically confirm the presence and source of large leaks.

The cameras can be fitted with longer lenses to easily spot large leaks from the facility perimeter.

Emissions from storage tanks can be especially easy to spot through pressure/vacuum vents, rim vents, and even from external floating roof tanks as the breeze occasionally whips up accumulated hydrocarbons on the tank roof and carries them over the side.

In the US, numerous EPA, state, and local regulatory agency offices own or have access to these cameras. Because much of the facility is frequently viewable from the fence line in the terminal industry, regulators may no longer need to perform in-depth, onsite inspections to get a rough feel for facility compliance with air regulations.

Even when the emissions may be permitted, as is the case with diurnal tank or seal gap emissions, a now-

visible hydrocarbon plume from a facility may invite increased scrutiny and targeted inspections of general facility operations, which may then uncover otherwise unidentified noncompliance. For example, optical imaging may be used to call a facility's storage tank roof landing and degassing practices into question, both current hot enforcement topics.

From enforcement actions come potentially hefty fines and unwanted attention in the media. But almost more costly are community activists which now have access to the same optical imaging technology.

These concerned citizens live in the communities where terminal industries operate, and have a much greater, personal interest in the impacts of facilities than regulatory agencies do.

Their attention can translate into unrelenting scrutiny, and use of the media to elevate

their concerns when the agencies cannot or are not unwilling to respond. Numerous instances have already occurred where IR camera footage from facility equipment leaks or storage tank emissions has been aired on local TV stations. The black clouds of smoke in these grayscale videos make for a compelling case that the facility is being mis-managed, or at least that there is real environmental harm and health impacts to the community, when this may not be the case.

The second technology is called Differential Absorption Light Detection and Ranging (DIAL) for short.

DIAL is a fence-line monitoring technology capable of measuring near-real-time mass emission rates of various pollutants that has been used in Europe for the past 15 years.

A calibrated laser beam is pulsed to different locations in a two-dimensional array at the facility boundary to create a concentration profile.² Wind speed information is then combined with the concentration data to determine the flux of pollutants crossing the boundary. Emission estimates are reportedly accurate to within +/-12%.

Based on a 2006 study performed at a Canadian refinery, traditional emissions estimation methods used in Canada and the US underestimated storage tank emissions by roughly 33 times, and equipment leak (fugitive) emissions by 12 times.

The relative importance of this technology to terminal industries should be clear. Should EPA revise its emission estimation methods to more closely match empirically-determined rates (currently under review), most minor source terminals would then become major sources, which are subject to more stringent emission standards, permitting fees and requirements, and self-auditing/reporting standards. EPA has already mandated use of the DIAL technology in civil settlements with US refiners where emission estimates are in question.

Hydrocarbon leaks from terminal industries represent a true liability to operations. Leaks translate into increased business risk and costs, whether from process/employee safety, permit fees, lost product costs, agency enforcement, or local public scrutiny.

Although the local inspector may not yet be knocking, advances in emissions detection technologies increase the public's ability to monitor operations. A well-defined hydrocarbon monitoring and repair programme is essential to help manage that liability. ●

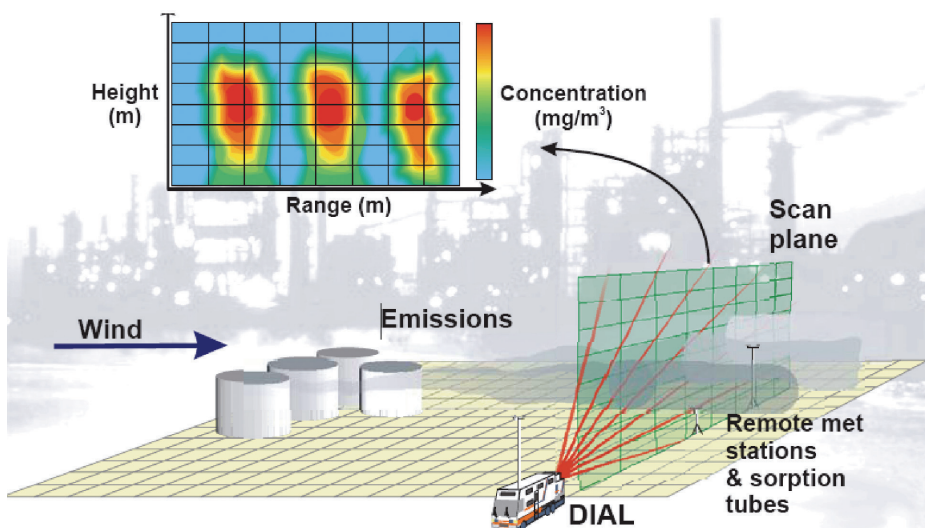
For more information:

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1 Enforcement Alert, United States Environmental Protection Agency, Office of Enforcement and Compliance Assurance, Document Number EPA 300-N-99-014, 1999

2 Refinery Demonstration of Optical Technologies for Measurement of Fugitive Emissions and for Leak Detection, Alberta Research Council, 2006

DIAL configuration



Spectrasyne: demonstration of optical technologies for measurement of fugitive emissions and for leak detection, Alberta Research Council, 2006