

Optical Flame Detection for Tank Farms



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Fires pose a significant risk to tank farms and the Large Atmospheric Storage Tanks (LASTs) that they house.

While linear heat detection systems traditionally were the industry standard for LAST fire safety, recent incidents have demonstrated that a better solution is needed.

Optical Flame Detectors can quickly identify small fires from longer distances, while Intelligent Video Fire Detectors (IVFDs) with 3D hazard mapping for optimal placement offer even better protection.

In what follows, we explore these innovative approaches to fire safety and demonstrate that common barriers to their adoption are now far less prohibitive.

Fires in Large Atmospheric Storage Tanks (LASTs)

The sheer size of LASTs — often more than 60m in diameter — makes extinguishing and controlling a fire in the event of an outbreak extremely challenging.

When grouped together, there is an even greater risk of a large fire spreading between LASTs.

This can have catastrophic consequences, both in terms of safety and commercial impact. Blast waves, damage to neighboring communities and costly product damage are all plausible results.

LAST Fire Incidents

The industry has been alerted to the severity of fire risks, due largely to some notable tank field disasters which have occurred over the past two decades.

These include the 2005 Buncefield Explosion (UK), the 2009 Caribbean Petroleum Tank Terminal Explosion (Puerto Rico), and the 2019 Intercontinental Terminals Company in Deer Park, Texas.

LAST Farms Pose Significant Challenges for Fire Protection

The Necessity for Change

Although industry-wide changes to fire safety measures were introduced following the incidents of 2005 and 2009, recent events, like the 2019 ITC fire, demonstrate the need for better protection.

Traditionally, the industry relies largely on the use of linear heat detection systems, which monitor LASTs' rim seals and the top of tanks. These are prone to damage, false alarms, and ultimately failure.

Common Causes of LAST Fires

Research has shown that LAST fires are most commonly caused by lightning strikes, which account for roughly 50% of all tank field fires. Secondary causes include static electricity, leaks and live ruptures.

While some in the industry claim that fires of this nature can be avoided with improved design, construction, and health & safety protocols, the fact remains that accidents and mistakes will continue to happen.

We can never pre-empt human error or equipment failure, which is why it's important to be able to promptly identify a fire as soon as it has ignited.

Effective Alternatives to Linear Heat Detection

It's evident that better methods of LAST fire monitoring, rapid detection and mitigation are needed.

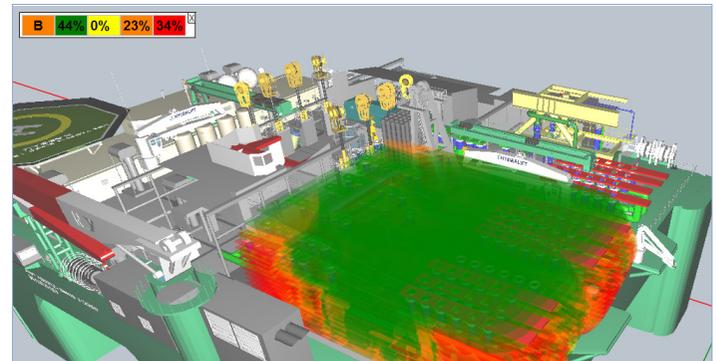
While linear heat detection is the most common approach to fire safety in LASTs, advanced fire detection methods represent an enhanced safety approach.

The use of optical flame detectors placed within tank farms and at the rim of LAST seals — coupled with 3D mapping software to achieve optimal coverage — is an effective alternative to traditional approaches.

Optical Flame Detection and Mapping Tools

Industry-standard multi-spectrum infrared (IR3) optical flame detectors can identify small fires at distances of over 30m, and large fires at significantly greater distances. For smaller fires, detection distances and timescales compare favorably to those of linear heat detectors.

When coupled with modern mapping software like HazMap3D, the advantages of modern fire detection systems, in comparison to linear heat detection methods, are clear to see.



Combining optical detectors with 3D mapping software helps LAST operators to:

- Verify adequate coverage
- Identify coverage gaps and perform iterative detector layout adjustments to resolve them

Intelligent Video Flame Detectors (IVFDs)

The benefits of optical flame detectors plus 3D mapping software can be further improved with the use of IVFDs. This system uses pixel analysis algorithms to identify fires based on radiation intensity, flicker frequency, and radiation source shape.

IVFDs are not easily deceived by water, rain, fog, snow or dirty optics. Where desired, a live feed can be viewed directly by operators. This feature is ideal for tank farm facilities without automated fire suppression systems in place, due to the high

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cost of false alarms. Instead, operators can visually verify a fire within seconds of viewing a live feed displaying the issue identified by the detector, and manually trigger a safety response.

Using IVFDs and 3D mapping can achieve superior fire detection rates and response times to traditional optical flame detectors and linear heat detectors.

Removing Barriers to Adoption

Despite their benefits, certain factors associated with optical flame detection systems for LASTs are viewed as barriers to their adoption. While valid, these potential barriers are now less significant than some might realize.

Faster Detection Times

To combat the problem of false alarm expenses, some tank farms delay or even remove their automated fire suppression systems. However, an immediate response is necessary to tackle a fire. With delay comes a higher risk of disaster.

Optical flame detection systems are able to detect a fire faster and earlier than linear heat detectors: within approximately 10 seconds of a very small fire developing. Smaller fires might not trigger heat detection alarms, but it is in these early stages of a fire that the problem can be best resolved.

Lower Maintenance Costs

While optical flame detectors may cost more than linear heat detectors, they are cheaper to operate and maintain.

With optical flame detectors, there is a lower risk of damage, as they can identify flames from a safe distance. Some are also designed to survive direct flame impingement, especially important when used at the top of LASTs near their seals.

Linear heat detectors must be replaced when safety responses are triggered. Given the fact that false alarms are common with heat detectors, equipment replacement and associated labor costs can be very expensive.

Efficacy of Optical Detectors

Previously, there were some concerns within the industry about the possibility of false alarm triggers and the inadequate coverage of very large tanks when using optical flame detectors.

Advances in detection systems and 3D mapping tools now allow detector coverage to be assessed carefully and objectively, meaning coverage should no longer be a significant concern.

Optical Flame Detection is the Right Choice for LAST Fire Protection

Optical flame detection solutions have been successfully deployed at facilities across the globe to protect LASTs of up to 100m in diameter. For reference, most LASTs have a diameter of between 76–91m). The linear heat detection method isn't working — optical flame detection is the right solution.

Combining optical flame detectors and 3D mapping software is a more efficient approach to LAST fire protection than linear heat detection. Intelligent video flame detectors plus 3D mapping offers even greater reliability.

Viking Intelligent Optical Flame Detection Portfolio



Viking VSF301

The Viking VSF301 is an explosion-proof video flame detector. It processes live video images to detect the characteristic properties of flames visually, by means of its FM- and SIL 2-certified flame detection algorithms and onboard digital signal processing (DSP). The detector provides live video images for situational awareness and has a Micro-SD memory card slot to record images for forensic analysis.

Viking VSF300

The Viking VSF300 is an explosion-proof intelligent video flame detector (iVFD) capable of detecting an n-heptane (gasoline) fire at 200 feet and JP4 (kerosene-gasoline blend jet fuel) at 300 feet. The detector processes live video images to detect the characteristic properties of flames using onboard digital signal processing (DSP) and advanced software algorithms.

Viking VSF303

The Viking VSF303 is an explosion-proof multi-spectrum infrared (IR3) flame detector. The device delivers superior performance, responding to hydrocarbon liquid fuel and gas fires at long distances. The VSF303 has been tested by Factory Mutual (FM) to detect a hydrocarbon fuel pan fire at 60 m (~ 200 feet) within 5 seconds.

Design Services & Support Information

Global Engineering Support Services Center (GESSC)

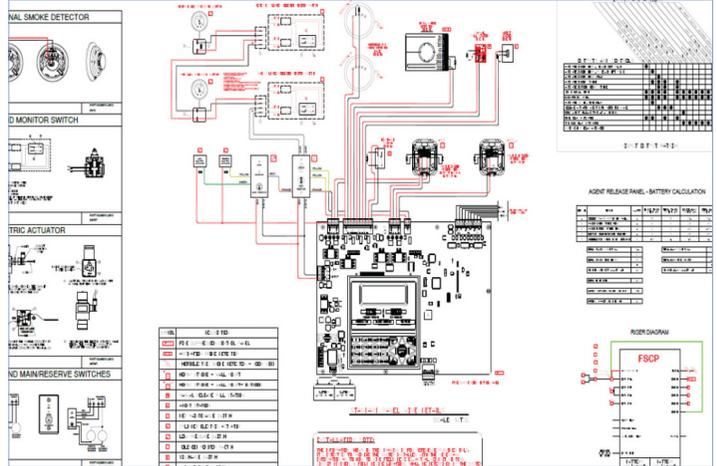
The GESSC provides support and resources to help with the design, installation, and maintenance of fire protection systems from start to finish. We work with various engineering design tools including CAD, 3D modeling software, and our own calculation software to create design packages that meet code-compliance, budget, application, and bandwidth requirements. Our team provides timely, accurate, and complete solutions for your project needs.

GESSC assists consultants, architects, engineers, contractors, and building owners with system design. Working with our local partners, we provide training processes, and support installation, commission, service, and maintenance operations. With GESSC, you're sure to find that pre-planning and good design achieve successful and efficient project delivery.

We offer extensive, hands-on experience with a focus on life cycle optimization, simplified facility operation, maintenance, and efficiency. Our focus on multi-trade coordination, improved accuracy, clear documentation, reduced waste, and early decision-making sets our services apart. Additionally, we are able to support projects in multiple languages and regions. Choose from supported product lines or custom-order desired products to fit your needs.

Buying VIS Solutions

All VIS solutions are sold through Viking SupplyNet. Established in 1988, Viking SupplyNet distributes the largest selection of integrated detection, alarm, and suppression systems to customers in over 70 countries. Viking SupplyNet's state-of-the-art inventory system links all locations worldwide to ensure that every solution is available for timely delivery – to any job site, anywhere in the world.



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