

# LNG Plant Fire Saf



The historical safety record for the LNG industry is strong. Engineering, installation and lifetime use takes into account the well-known hazards of such an installation. Different levels of protection ensure that potential hazards are discovered and eliminated before they become a major risk to the installation premises and the people working there.

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**W**hile LNG in its original form is a liquid, it will quickly turn into a vaporized gas upon entering into the atmosphere. Potential ignition sources may create a dangerous situation quickly, and thus the goal is to discover any atmospheric presence of gas as early as possible. This is why the detection system becomes an early as well as important barrier to protect an LNG plant. Detecting potential risks and taking necessary precautions to eliminate or prevent them from worsening is the main objective of the safety system. Several factors need to be examined in order to make sure that we have a trustworthy system.

#### **Typical Detection Solution**

There are two key factors when considering a fire and gas detection system: availability and reliability. The first is rather self-explanatory – it is important that the detection system (and its functions) is available when needed. The latter is no less important – that we can rely on the system to perform when needed. The first step to ensure we can trust our system is to look at the chain of devices necessary to detect and take appropriate action.

Every scenario – the beginning of a fire or a gas leak – can be reported by a detector. The detector is the system's initiating device, and its performance is crucial to ensure early and reliable detection. We want to detect the incident as early as possible, and at the same time avoid detection and reporting of unwanted or nuisance alarms. Different detectors have different properties, particularly when it comes to performance. Comparing

datasheets may cause detectors, which perform very differently, to look almost the same. When consulting manufacturers and suppliers of fire and gas equipment, a good rule of thumb is to always ask for what testing has been done according to performance standards, for example FM3260 for flame detection. This will point out the differences when it comes to the performance of a specific device. It is of course important that the equipment has the right ingress protection and can withstand necessary environmental conditions, but after all, it is the performance of the device that determines whether or not it will properly detect an incident.

The detector will report a detected incident to the detection system, so it is important to avoid loss or delay in the communication channel. A factor in achieving this is to try to utilise a loop, or another form of redundancy, for the communication between the detector and the system. In a loop, short-circuit isolators will ensure that any detector or cable faults will keep all other devices properly communicating with the system.

The purpose of the detection system itself is also to ensure that any appropriate actions are taken. In an integrated fire and gas detection system actions are taken by activating outputs to different devices, for example, activating beacons or sounders and closing ventilation devices or dampers. In such cases, the detection system passes the alarm on to a Distributed Control System (DCS) that will take care of the required actions. However, it is important to highlight the need for a secure communication channel

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between the two systems. Very often the project will also require redundancy mentioned earlier for this type of communication.

## Safety and IEC 61508

So how do we consider a communication channel or a detection loop to be safe or not? In installations like an LNG plant, a hazard and operability study (HAZOP) is normally done to identify and evaluate potential problems that may be a risk to people or equipment. This will help us determine what kind of equipment is required to protect the installation. However fire and gas equipment have different safety ratings that need to be examined.

Reliability is important for the entire system and not just single components. A good standard for consideration of system availability and reliability is IEC 61508 (Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems). This standard defines what is called "Safety Integrity Level" (SIL), an assessment of reliability, failure to safety (how safe the system is) and management and lifecycle considerations. The SIL tells us something about the probability of a failure on demand; that is, how likely is it that the system functions as intended on the day we actually need it. It can work ten out of ten times when tested, but that does not matter if it fails the next time it is supposed to detect a real hazard.

It is important that the entire system is evaluated according to this standard, and not just single components. The entire system, from detection by one of the initiating devices to action by one of the outputs, should achieve the requested level of safety (normally SIL2 is required for a fire and gas detection system). Combining single components does not necessarily give us the same rating (even if they are rated SIL2 individually). To make sure, we maintain all aspects of IEC 61508, a Safety Analysis Report (SAR) is often done during the project. In order to simplify this and ensure you will maintain the required safety level, you should ask the suppliers to prove compliance of the entire system according to IEC61508. This will ease the projecting of a safety system.

In most cases, an LNG plant is a wide installation with long distances between areas and structures. The installation consists of buildings, process areas, pipelines and other premises to be protected. By choosing a system that can integrate all types of detection as well as extinguishing devices, it will provide a significant reduction in the installation cost. For example, the AutoSafe fire and gas detection system is being applied worldwide in one of the most critical industries, Petrochemical Oil and Gas. Part of the reason for this is that the system maintains a third-party verification and certification according to IEC 61508. The system has just been introduced in Australia, and is about to be installed on the Queensland Curtis LNG project (QC LNG). The QC project involves a 540 kilometre pipeline linking the gas fields to Gladstone, and the construction of a LNG plant on Curtis Island for conversion of the gas to LNG for export. The first stage of the project will include two LNG trains (processing units) with a design lifetime of



more than 20 years. The production capacity should be more than 8.5 million tonnes of LNG per year, increasing up to 12 million tonnes).

The QC LNG project will have one AutoSafe detection panel in each building and, due to the long distances between the buildings, all panels are interfaced via a redundant fibre-optic network.

A similar system is also installed at the Ras Laffan refinery in Qatar. The Ras Laffan Port is a combination of several self-contained buildings and modules, and all detection and extinguishing equipment is integrated into one detection panel. This includes everything from traditional heat and smoke detection, manual call points, and flame and gas detection, to individual release of separate extinguishing zones inside each building. Early warning aspiration systems (HSSD) are also integrated into the same. By combining all the panels into a single plant-wide network, it is possible to monitor the entire plant from one or several locations.

The detection panels interface all types of detectors and take appropriate actions. Communication to a plant-wide DCS is normally done via Modbus or by direct interpretation of the fire and gas systems' communication protocol. In addition, local workstations are located in centralised control rooms and the local fire station. The entire system will fulfil a requirement for a SIL2 rating.

By using loops for all the field devices, we ensure that any break or short-circuit in the wiring will not influence the performance of the system. Even the flame and gas detectors can be protected from such faults by having them localised on a loop. In the solution above, the same two-wire loop also provides power to the detectors, which can translate to major savings when it comes to installation costs.

Fire and gas detection systems for LNG plants can be achieved in different ways; most importantly, we need to consider the safety aspect of the solution. In order to properly accomplish this, we should examine the entire system with all intended functions. Only by doing this, can we say how safe the system is, and if we are able to maintain the required safety rating for the system. After all, the system needs to be 100 percent efficient, 100 percent of the time. **IFF**

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