



# RESTORING FIRE DETECTION CONFIDENCE

*The use of visual flame detection equipment can provide operators with a proven and comprehensive early warning system*



**H**aving confidence in a safety system to mitigate fire hazards as well as increasing safety is a vital part of tank storage operations.

Micropack were contracted by a major oil company to perform a flame detection mapping review on a number of floating roof crude oil storage tanks on one of their refineries in the UK.

The company reviewed the arrangement of proposed visual flame detectors located around the rim seal of each of the eight storage tanks.

## HAZARD

As has been documented in many journals and papers, the rim seal around the entire circumference of the floating roof tank presents a major fire hazard.

Micropack reviewed the flammable properties of the stored inventory (crude oil) and determined that flammable vapours were likely to be present around the rim seals, at vents and within the tanks. To minimise the potential for ignition, fully bonded equipment helped to reduce the risk and attention was paid to earthing bonds between the wall of the tank and the roof via a shunt array. Lightning protection systems are also typically used to prevent ignition as detailed in NFPA 780.

The common form of fire detection used around the rim seal of floating roof tanks is linear heat detection. At this refinery (as with countless others), the operator deemed it inadequate due to spurious alarms and challenges with maintenance.

In this application, the need for fire detection is due to two critical situations: crude tank fires where the oil boils over, due to the presence of water and fires around the seal of the rim. It has been documented previously that a safer approach would be to let fires in storage tanks burn, but not when the two aforementioned situations arise.

The most common type of fire in storage



**Micropack FDS301 visual flame detector**

tanks are rim seal fires and the rate at which they can spread along the foam dam is rapid.

Fixed foam rim seal pourers located at the top of the shell wall are the most common way of fighting a rim seal fire. This approach was used at this site.

## EXISTING SYSTEM

The existing linear heat detection system had been installed for many years and had suffered mechanical damage over this time. The company in question had reported numerous spurious alarms due to the umbilical power cord and shorting due to poor/damaged electrical connections in the system. These spurious alarms resulted in unwanted shutdowns, lost time through personnel visiting site and ultimately a loss in confidence in the primary form of fire detection.

## PROPOSAL

The client wished to resolve the false alarm issues by utilising visual flame detection as a primary means of detecting fires at the rim seals. Visual flame detectors were proposed to be mounted in fixed locations at the top rim of each tank to view the circumference of the floating roofs without the need to run an umbilical to the roof itself. This resulted in no moving power connections required to accommodate the mobility of the floating roofs.

The visual flame detector also includes a live video feed of the detectors field of view, which means that the area can be monitored

Facility: Refinery UK	Area: Crude Storage Tanks
<b>Technical Requirements</b> These performance targets were assigned with reference to the Operators own Fire and Gas design standard where possible and in the event of the lack of quantified performance criteria in that document, current industry standards typically applied in the UK /North Sea region were utilised.	
<b>Emergency Response</b> The main objective of the fire detection system was to provide early and reliable detection of fire events if they occur. Also, it is expected to alert personnel and initiate protective actions automatically or manually upon activation. A mobile firefighting unit would also be dispatched for the purpose of initiating foaming fire suppression at the storage tanks.	

**Table 1 - performance targets**

## FIRE RISK CATEGORY

Grade Time	Target Fire Size for Alarm (RHO - Radiant Heat Output)	Target Fire Size for Executive Action (RHO - Radiant Heat for alarm (s))	Response Output)
Moderate Risk	~100kW	~500kW	< 10
Low Risk	~640kW	~640kW	< 10
Specialised	Specific to each hazard	Specific to each hazard	< 10

Table 2: fire detection (hydrocarbon processing areas)

from the control room and in the event of a fire, personnel do not have to venture into a potentially dangerous situation. Following an alarm or incident, recorded video footage from before, during and after the alarm signal is generated which can be reviewed to gather information on the event retrospectively. This information is invaluable to the incident investigation team to ensure lessons are learned from any fire.

Two varying flame detector arrangements were assessed using Micropack’s fire and gas mapping software HazMap3D and proposed to the client.

**Option 1** Two visual flame detectors positioned on each tank, pointing towards to the centre, at opposing sides.

**Option 2** Three visual flame detectors positioned on each tank pointing inwards, located 120° to each other.

When mapping the roof of the tank, the hazardous area was defined as the circumference of the tank, at least 1m width either side of the rim seal. The flame detection performance targets used were based upon typical industry standards used by other operators and guidance from the Health and Safety Executive on flame detection performance, in the UK.

### FLAME DETECTION COVERAGE RESULTS

**Option 1** Having two visual flame detectors positioned at opposing sides of the 100m tanks, provided a percentage coverage of

approximately 60%, which as can be seen in Table 1, is below the 70% target.

**Option 2** Having three visual flame detectors positioned at 120° to each other provided superior coverage, approximately 85%. This option was proposed to the client as the appropriate option as it met the performance target and provided acceptable video coverage of the tank rim seal.

### CONCLUSION

From the two proposed solutions, the client chose to install three visual flame detectors per tank, which ensured maximum coverage for small burning fires around the rim seal of the tank. The operator was also able to reduce maintenance costs, increase safety (using the live colour CCTV output), and most critically restore their confidence in the safety system, while demonstrating a suitable management of risk to the Health and Safety Executive.

### FOR MORE INFORMATION

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