Offshore Petroleum Regulator for Environment & Decommissioning

Contaminated lagging and self-heating

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Introduction

This information sheet provides guidance for duty holders on oxidative self-heating (OSH) hazards associated with fibrous lagging contaminated with some organic fluids, in particular triethylene glycol (TEG). OSH is a low temperature oxidative reaction that is known to be a common cause of fires where some organic fluids are stored or transferred at elevated temperatures. Fluid leaking into the lagging is warmed by the vessel or pipework which starts the reaction. The production of heat warms the contaminated lagging, and this increases the rate of oxidation leading to further warming and so on. Eventually the lagging starts to smoulder and may transition into a flaming fire which can spread to other materials.

Background

The risk of OSH is highest in materials that can self-heat from relatively low starting temperatures. The commonest examples are unsaturated fats such as cooking oils. Leakage of these materials into the lagging of extract systems serving fryers has caused numerous disastrous fires. Triethylene glycol (TEG), which is commonly used as a gas dehydrating agent offshore, is also susceptible to self-heating from relatively low temperatures.

Risk tends to be highest for higher molecular weight materials. For example, the low molecular weight glycols used as antifreezes (eg monoethylene glycol) evaporate before the onset of self-heating (Britton 1991[1]).

Most types of fibrous glass or mineral wool insulation can be involved in OSH. There is typically no reaction between the contaminant (which burns) and the insulation which serves simply as an inert, air-permeable matrix. All that is required is that the insulation fibres

- have a large surface area
- allow the movement of air and do not melt before the onset of OSH

Closed cell foams are a low risk from OSH as they are less easily contaminated and do not allow the passage of air.

1. Britton, L. G (1991) *Spontaneous fires in insulation* Process Safety Progress Volume 10 Issue 1

Advice on the prevention of OSH in contaminated lagging and removal, safe storage, and transport to disposal

The accepted method of preventing OSH if lagging is suspected of being contaminated is to saturate material with water within a bag, and store in steel drums prior to disposal. It has been noted that OSH will still occur if insufficient water is added to the lagging when it is bagged. Good practice is seen as storing and transporting the lagging in steel drums. Filling the storage drum with water not only eliminates oxygen it also acts as a large heat sink.

Include OSH as a hazardous occurrence to the platforms fire hazard analysis. Toolbox talks prior to intrusive activities on the subject will focus attention on the fire potential.

Thermal insulation lagging tends to hide defects, cracks, splits, and small holes that may allow fluid leaks into the inside of the lagging adjacent to the hot surface of the vessel/pipework. Periodic removal is usually part of a planned maintenance regime for inspection purposes. Fully developed thermal runaway reaction to ignition will only occur if there is an adequate supply of fresh air. Removal of the lagging allows the organic fluid to contact air and OSH starts. Hence lagging removal should be planned, and the actual process carried out as quickly as is reasonably practicable, followed by rapid water saturation of the material. Given the high risk of OSH, good practice would include specific inspection and test procedures to identify locations with potential for organic fluids and lagging to co-exist. Areas such as gas turbines, glycol re-generation units, bellows, pipework flanges and vessel intrusion points etc are likely candidates.

All organic fluids present on a platform that are likely to come into contact with lagging should be subject to a test to determine the temperature at which spontaneous self-heating will occur. UN TEST N.4 has been used by HSE to determine such temperatures.

It would be beneficial for hazard management if the steel surface temperatures of the lagged vessel or pipework were measured and recorded in relevant planned maintenance (PM) routines. Steelwork surface temperatures in excess of the auto ignition temperature of the fluid in question are then readily available to evaluate the risks from fires in local risk assessments etc.

Relevant legal requirements

- Health and Safety at Work etc Act 1974 (HSWA), Sections 2 and 3
- Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015, Regulation 24
- Offshore Installation (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER), Regulations 5, 9, 12 and 13
- Offshore Installations and Wells (Design and Construction etc) Regulations 1996, Regulations 5

This guidance is issued by the Offshore Major Accident Regulator (OMAR). Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.