HSE Information Sheet

The risks posed by exposure to inerting gases in the open air

Offshore Information Sheet 4/2008

Contents

Introduction

In 2001 there was a serious accident offshore in which employees were overcome by inerting gases while working in the open air. The accident occurred during maintenance work on an inert gas piping system and could potentially have resulted in one or more fatalities, similar incidents have occurred elsewhere. This Information Sheet, which replaces Safety Notice 3/2002, provides guidance on the risks associated with inerting gas, even in open and apparently well ventilated spaces.

Background

The term ‘inerting gas’ usually refers to a gaseous mixture containing little or no oxygen and mainly consisting of non-reactive gases or gases having a high threshold before they react. Nitrogen, argon and carbon dioxide are common examples.

The escape of inerting gas can pose a serious risk even in the open air, particularly if employees are working close to open pipework or manholes and the system has not been adequately depressurised; or where there is a spillage of cryogenic liquid. If the area is partly enclosed or there is minimal air movement, this will put workers at even greater risk. Rapid unconsciousness will also pose a risk of injury from falling, possibly from height.

Inerting gas is used for a number of applications offshore eg;

- to control the concentration of oxygen in containers or tanks storing flammable gas or vapour;
- transfer of flammable liquids under pressure;
- drilling and well operations activities;
- pipe freezing; and
- pipe purging.

Inerting gases can be supplied as a compressed gas or cryogenic liquid. Alternatively, they can be produced by several methods including;

- the uptake from a ship’s main or auxiliary boiler;
- burning fuel in an independent combustion; or
- producing nitrogen from air by absorption and diffusion techniques.

Gases generated from combustion processes will contain mainly nitrogen, carbon dioxide, water vapour, argon and some carbon monoxide. While carbon monoxide is not an inerting gas, the potential for its presence needs to be considered because of its toxicity.

Inert gas is normally undetectable without the use of specialist monitoring equipment. Asphyxiants can also collect in pits, confined spaces and other low lying areas where ventilation is poor, creating an additional hazard.

Inerting gases can be split into two broad categories;

- those having an asphyxiant effect, eg nitrogen; and
- those having a toxicological effect, eg carbon dioxide.

Asphyxiant gases such as nitrogen will displace the oxygen in the air. If the oxygen content is reduced by only a few percent from normal (21%) there can be a substantial risk to life. Even reduced levels of oxygen, which are not immediately life threatening, can affect behaviour and judgement thereby inhibiting decision making.

Where the inerting gas is a mixture having asphyxiant and/or toxicological properties the relative concentration of each constituent will ultimately determine the pattern of adverse health effects resulting from exposure. Constituents may behave independently of each other, or could act in an additive or synergistic manner.

Liquified gases such as nitrogen present additional hazards as they are extremely cold and contact with exposed skin can result in ‘cold burns’.

Liquified gases can present a risk not only in use, but also during transport and storage. Where bulk containers of liquified gas are handled by crane or fork-lift truck, there is a potential for the container to be punctured and the liquid released.

Spillages of liquified gases will rapidly vapourise. Duty holders must ensure that emergency procedures are appropriate and do not increase the risk eg;

- water sprays, if aimed directly at the liquefied gas, may deflect it to other areas;
- contact between liquified gas and water may result in a rapid phase transfer which can be violent and present a risk to people nearby;
- water sprays may increase the rate of evaporisation thereby increasing the size of the gas cloud and hence the risk of asphyxiation; and
- water may freeze, producing a slippery surface and impeding escape.

Action required

Duty holders should identify where they use inerting gases and for what purpose.

The hazard and risks of transport, storage and use of inerting gases, including the risk in open spaces, should be adequately assessed and the appropriate controls put in place.

Duty holders should develop emergency response procedures to deal with releases of both cryogenic liquids and inerting gases. Duty holders should work with suppliers and contractors to ensure that the procedures effectively deal with the risk and do not further exacerbate it.

Relevant legal requirements

Management of Health and Safety at Work Regulations 1999 (SI 1999/3242), Regulations 3, 4 and 7

Control of Substances Hazardous to Health Regulations 2002 (SI 2002/2677), Regulations 6, 7 and 13

Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (SI 1995/743), Regulation 8

The Confined Spaces Regulations 1997 (SI 1997/1713) **do not** apply offshore but they, along with the associated ACOP and guidance[1], provide valuable advice where confined spaces present an additional risk.

References

1 Safe work in confined spaces Confined Spaces Regulations 1997 Approved Code of Practice, Regulations and guidance L101 HSE Books 1997 ISBN 0 7176 1405 0

Further information

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This information sheet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do