

HSE information sheet

Offshore Information Sheet No. 1/2009

Explosion hazards due to spray releases

Contents

[Introduction](#)

[Background](#)

[Action required](#)

[Standards and guidance](#)

[Best practice approach](#)

[Relevant legal requirements](#)

[References](#)

[Further information](#)

Introduction

This information sheet brings attention to the explosion hazard of spray releases caused by:

- Atomisation on release of fluids under pressure:
- Impingement of released fluids on nearby equipment:
- Recondensation after the release of flashing liquids.

Incidents at Flixborough (see ref 1) and, in particular, Buncefield (see ref 2) have been linked to such releases.

Detailed guidance from explosion mechanisms at Buncefield will take time to emerge and this note therefore advocates that safety cases address risk reduction measures to minimise this hazard.

Background

Flammable sprays, mists and aerosols ie clouds of small particles of fluids which only boil above ambient temperature, or have high flash points, can be produced at modest pressures. A release of these have the potential to form highly explosive clouds. For example in FPSO pump rooms, wellbays and 'degassed' liquid compression trains, irrespective of any contribution from 'light' fractions or dissolved gases.

Action required

HSE expects that, where spray releases are possible, duty holders should provide a review of this hazard in all future safety cases and thorough review summaries. This should include:

- a) Consideration of risk reduction measures, for example improved layout, blast protection, mist detection, spray guards, removal of obstructions, increased ventilation etc. It is expected that these measures should be implemented unless clear justification for their absence is available for inspection.
- b) A discussion of the uncertainties in the processes of atomisation, breakup by impingement on nearby equipment, evaporation, and condensation.
- c) The above analysis should include ranking of risks due to explosions so that the effectiveness of remedial measures can be maximised.
- d) Simple models, such as referred to in CRR 403 (see ref 3), section 8, page 54, should be considered and a determination made of whether the release is in the aerosol producing regime.

Standards and Guidance

UKOOA, Fire and Explosion Guidance. Part 1 Avoidance and mitigation of explosions Issue 1 October 2003, Pages 219-220

UKOOA, Ignition Probability review and Model Development
AEAT/NOIL/27780001/001R Issue 1 - A report produced for UKOOA, Sections 2.2.5.
Mist generation and rainout is discussed at page 82 in section 6.4.7

IP15, Annex A and P.T. 2002, Roberts 'Calculations in support of IP15' Section 2

IEC 60079-10 Annex D. Section 4

NORSOK Z013 Risk and Emergency preparedness Rev2, 2001-09-01
Annex G (G.2.1.6)

Best practice approach

In determining the risks, and hence potential remedial measures from spray releases, the following factors should be taken into account:

- the wider flammability range of mists,
- possible higher overpressures from smaller cloud sizes,
- some droplet clouds are as easily ignited as their gas equivalent,
- the lower auto ignition temperatures of higher hydrocarbons,
- the shattering of larger droplets by the shock wave,
- radiative absorption of a droplet cloud, ahead of the flame front, once a deflagration commences and possible transition to detonation.

Relevant legal requirements

Health and Safety at Work etc Act 1974 (HSWA), Sections 2 & 3
Offshore Installations (Safety Case) Regulations 2005 (SCR05), Regulations 13 & 14
Offshore Installations (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
(DCR) Regulation 5

References

- 1 Flixborough April 2007 UCL, reviewed in Safety and Loss Prevention Subject Group News Letter issue 35 August 2007 by the IChem E.
- 2 [Explosion Mechanism Advisory Group Report](#) Buncefield Major Incident Investigation Board August 2007
- 3 [Contract Research report 403/2002](#) Flashing Liquid jets and two-phase dispersion, a review HSE Books 2002 ISBN 0 7176 2250 9.

Further information

Any queries relating to this sheet should be addressed to:

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<p>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</p>
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