Dangerous Substances & Explosive Atmospheres

Eric Bertram
DSEAR covers workplaces where there are dangerous substances present that can potentially create an explosive atmosphere during normal operations or as an abnormal occurrence.
Categories of Explosive Atmospheres

DSEAR covers two categories of explosive atmospheres:

1. Explosive atmospheres that involve gases, vapours or mists
2. Explosive atmospheres that involves a dust or dusts
Zones 0, 1 & 2 for gases, mists and vapours

Zones 20, 21 & 22 for dusts

Zones 0 & 20 are the highest risk atmospheres and require the greatest control
DSEAR Experience

Combustion processes:

• Steam Boilers
• Combined Heat & Power (CHP)
• Turbines
Case Study

• HSE visited a customer’s site
• Recycling waste paper
• There was an issue with the accumulation of combustible dusts
• While on site the inspector took the opportunity to visit the boilerhouse where we were responsible for the operation of the site’s steam boilers and requested the DSEAR risk assessment
• No DSEAR risk assessment
• Fire risk assessment – stated there was a negligible, if any, risk of explosion and no further action was required
• Not accepted by the inspector – found to be in breach of regulation 5 of DSEAR – failure to carry out a DSEAR risk assessment
Case Study

- Operated energy plant on more than 400 sites
- Inspector chose to take this issue up with the operator not the owner
- 1 month to put a plan together and 6 months for completion

The inspector’s interpretation of DSEAR was:

‘If a building has a gas line with a joint on it there is a potential for a gas leak and therefore a risk of explosion and requires compliance with DSEAR.’
Case Study

This interpretation is not quite correct

Steam

Hot Water
Less than $105^0C$
Assessment Process

Vz  = 0.1 m³

NE  = Negligible Extent

i.e. Zone 0 NE, Zone 1 NE & Zone 2 NE
## Risk Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Source of Ignition</th>
<th>Flammability</th>
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</thead>
<tbody>
<tr>
<td><strong>Gases, Vapours, Mists</strong></td>
<td>Electricity</td>
<td>Extremely Flammable</td>
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<tr>
<td>Present or frequently present during normal operations</td>
<td>Y Tools</td>
<td></td>
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<tr>
<td>Present occasionally during normal operations</td>
<td>Hot Works</td>
<td>Y Sparks</td>
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<tr>
<td>Not normally present during normal operation but if it does occur will only persist for a short period</td>
<td>Y Naked Flame</td>
<td>Y Clothing</td>
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<tr>
<td>Not normally present during normal operation but if it does occur will only persist for a short period</td>
<td>Y Hot Surface</td>
<td>Y Static</td>
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</table>

**Risk Evaluation** – based on numerical values 1 to 5 on likelihood & severity, where 1 is low and 5 high, 1/6 low – 8/15 medium – 16/25 high

<table>
<thead>
<tr>
<th>Description of Hazard</th>
<th>Persons at Risk</th>
<th>Existing Control Measures</th>
<th>L</th>
<th>S</th>
<th>R</th>
<th>Additional Control Measures</th>
<th>L</th>
<th>S</th>
<th>R</th>
<th>Action by</th>
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<tbody>
<tr>
<td>• Prevent</td>
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<td>• Control</td>
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<td>• Mitigate</td>
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</table>

Add an Introduction, Scope and Conclusion
Assessment

- Building Volume
- Equipment Volume
- Free Volume
- Surface Area of Ventilation ($m^2$)
- Gas Pressure
- Ambient Temperature
- Location of Ventilation

Wind Direction and Average Wind Speed
Calculation

There are a number of ways to calculate Vz

BS EN 60079-10-1:2009

HSL – Quadvent Software (Accurate up to 10 bar gas pressure)

A Vz of 0.1m³ or less does not necessarily mean there is no risk of explosion. There can be areas within the plantroom that has a gas line with a flange or other type of joint which may not have suitable ventilation.
Plantroom Schematic

Volume of Plantroom = 1090 m³
Volume of Equipment = 200 m³
Free Volume = 1890 m³
Gas Pressure = 250 mbar

Ventilation Louvre free volume 50% of ventilation area
LV - 16/2 = 8 m² (0 m from floor)
HL – 16/2 = 8 m² (4.5 m from floor)
No fly mesh fitted
Vz calculated using HSL Quadvent
Vz calculated to be 0.00m³
Plantroom designated to be Zone 2NE

SW prominent wind direction at an average wind speed of 5 m/s

Mains Gas

Not to Scale

22/12/2015
Signage
Equipment

Ex

CE
Institution of Gas Engineers & Managers (IGEM)

IGEM/UP/2 (Edition 3) – Installation of Pipework on Industrial and Commercial Premises
IGEM/SR/25 (Edition 2) – Hazardous Area Classification of Natural Gas Installations
IGEM/SR/23 – Venting of Natural Gas
British Standards

BS EN 60079-10-1: 2009 – Explosive Atmospheres
BS EN 1775: 2007 – Gas Supply – Gas Pipework for Buildings – Maximum Operating Pressure less than or equal to 5 bar
BS EN 1127-1: 2011 – Explosive Atmospheres – Explosion Prevention & Protection
BS EN 15001-1: 2009 – Gas Infrastructure Gas Installation Pipework with a Gas operating Pressure of Greater than 0.5 bar for Industrial Installations and Greater than 5 bar for Industrial and Non Industrial Installations
Thank You