

# Ammonia Refrigeration Safety

## - Whose job is it anyway?

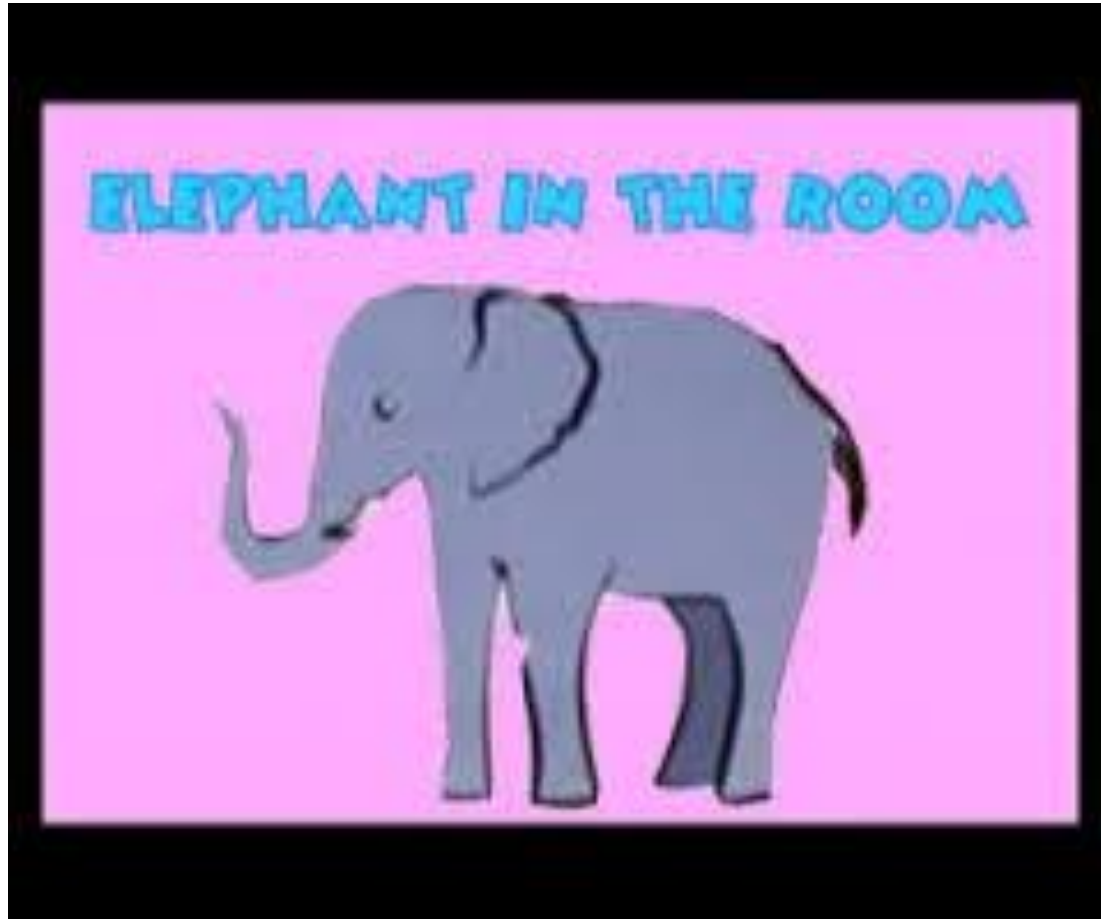
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(Process Safety)

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# The Elephant in the Room....



# The Properties of Ammonia

- Colourless gas at room temperature
- Lighter than air
- Has a strong characteristic smell (detectable by smell as low as 5ppm)
- Is easily liquefied
- Toxic-WEL 25ppm (8 hr TWA) & 35ppm (15 min STE)
- Flammable — Concentrations 16 – 25% by volume

So keep it contained within the system !

# How are we going to do that?

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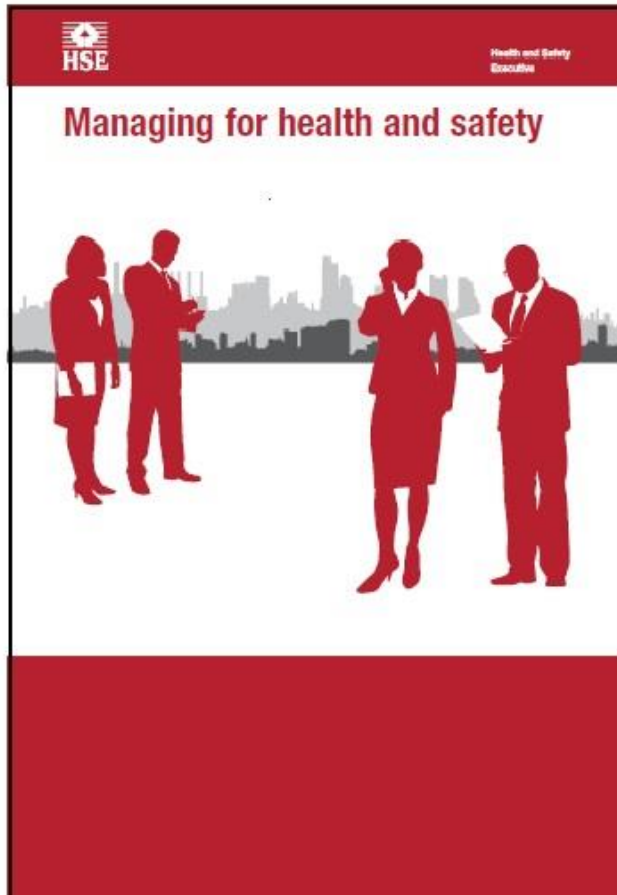
- Design it right!
  - Install it right!
  - Operate it right!
  - Maintain it right!
- ...and plan for if something goes wrong.

# Relevant Regulations

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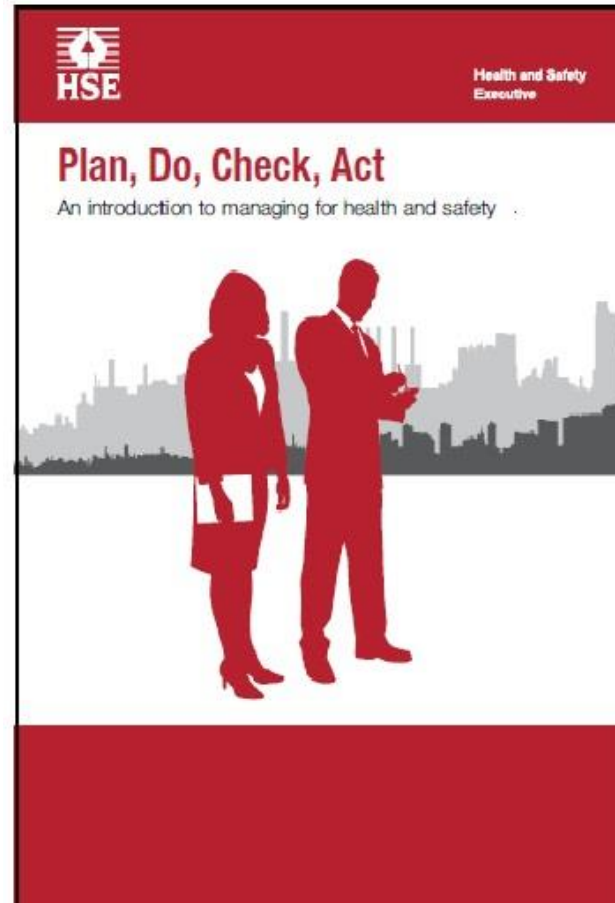
- Management of Health and Safety at Work Regulations 1999
- Provision and Use of Work Equipment Regulations 1998
- Pressure Systems Safety Regulations 2000
- Dangerous Substances and Explosive Atmospheres Regulations 2002

# Management of Health and Safety at Work Regulations 1999 (HSG65)

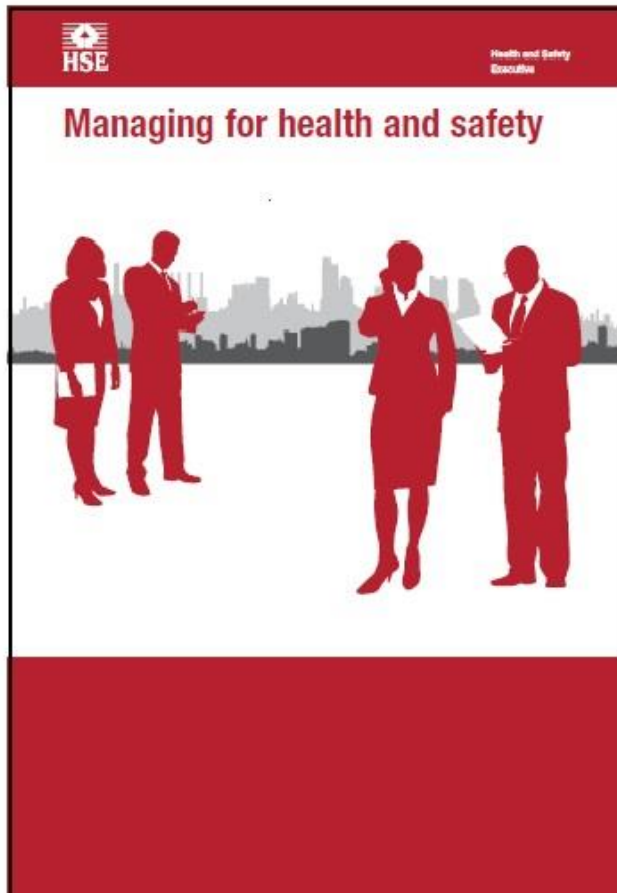


- Reg 3: Risk Assessment
- Reg 4: Principles of Prevention to be applied.
- Reg 5: Health & Safety Arrangements – Planning, Organisation, Control, Monitor Review
- Reg 7: Health and Safety Assistance

# Plan, Do, Check, Act (INDG275)



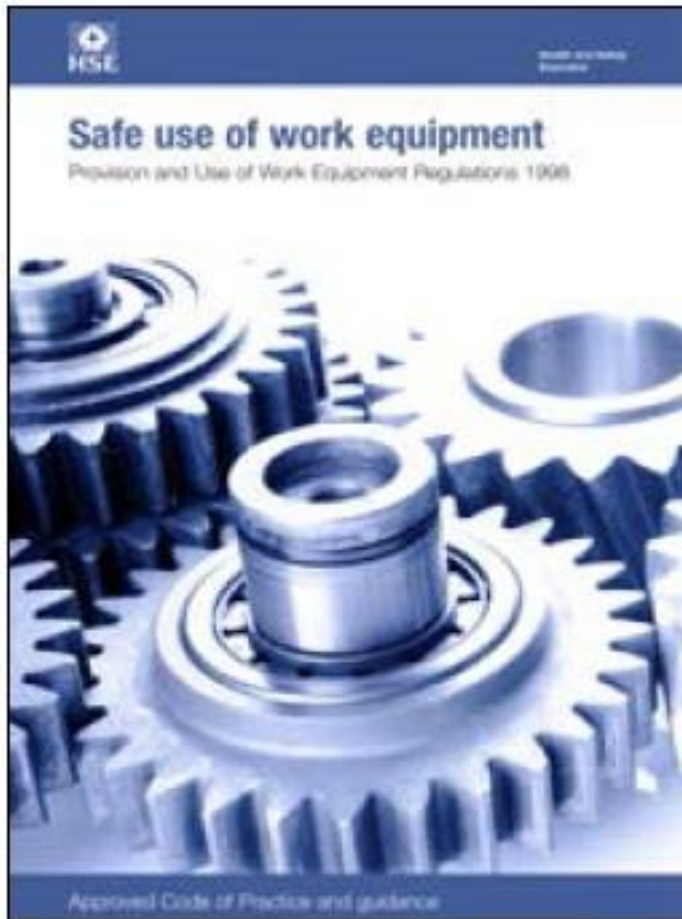
# Management of Health and Safety at Work Regulations 1999 (HSG65)



- Reg 8: Procedures for Serious and Imminent Danger
- Reg 12: Persons working in host employers' or self-employed persons' undertakings
- Reg 14: Employees' Duties

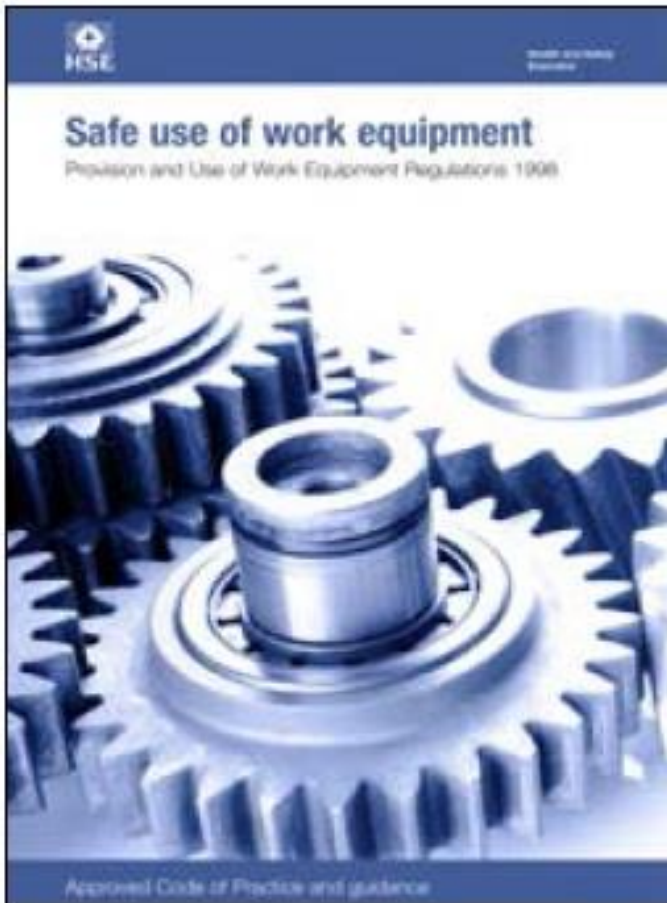


# Provision and Use of Work Equipment Regulations 1998 (L22)



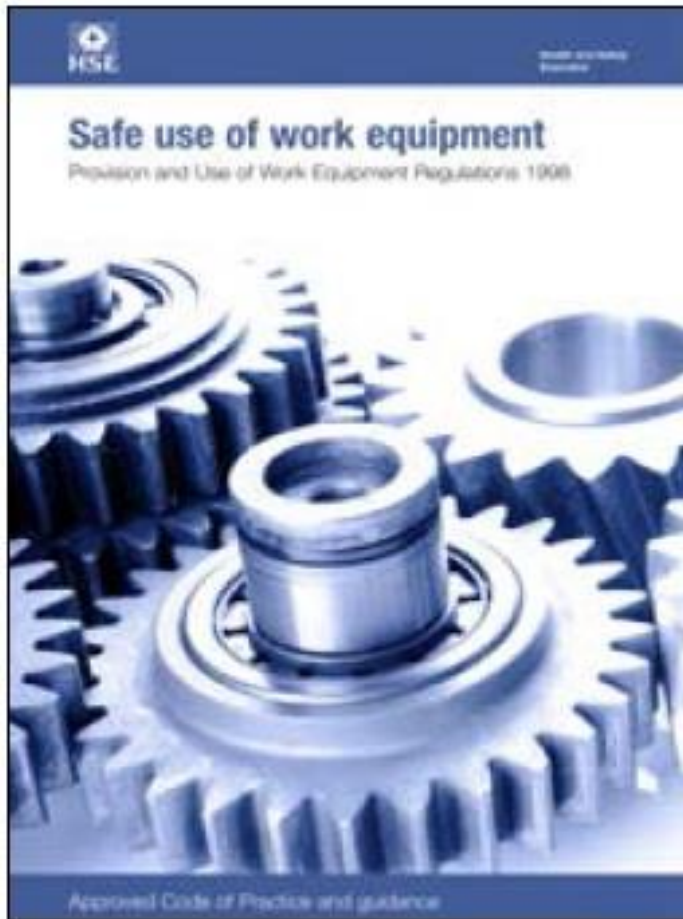
- Sets out duties of anyone who provides work equipment
- Definition of work equipment is very wide
  - Tools – hammers, spanners
  - Lifting Equipment
  - Ladders, pressure washers
  - Installations – series of machines (compressors, evaporative condensers etc..)

# Provision and Use of Work Equipment Regulations 1998 (L22)



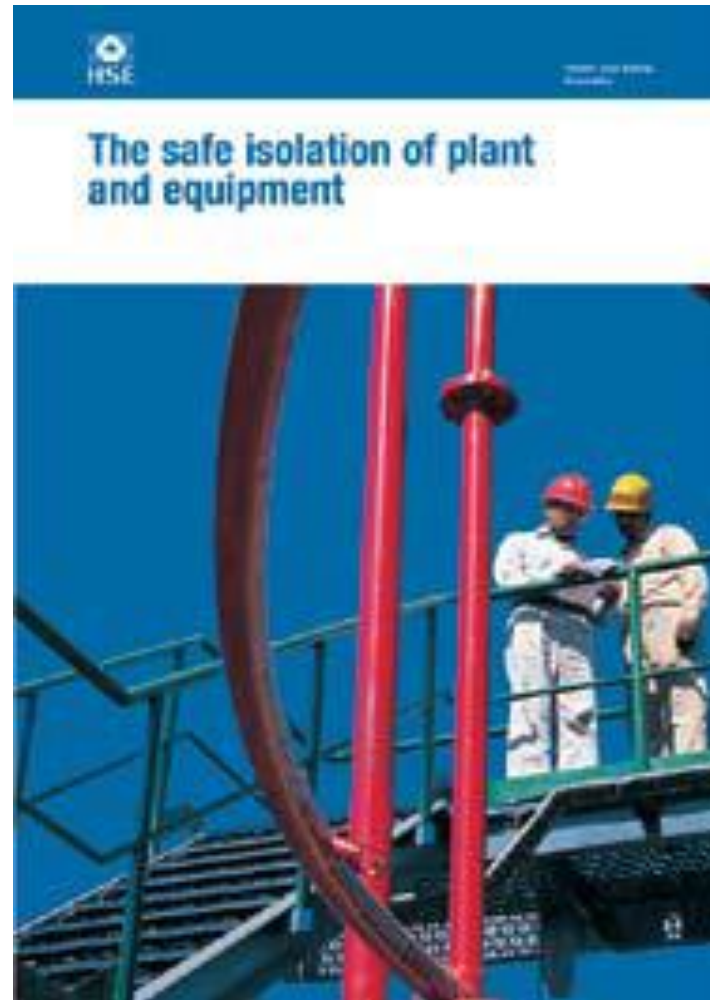
- Reg 3: Application –applies to;
  - Employers
  - Self-employed
  - Someone in control of work equipment
- Reg 4: Suitability of work equipment
- Reg 5: Maintenance
- Reg 6 Inspection

# Provision and Use of Work Equipment Regulations 1998 (L22)



- Reg 8: Information & Instruction
- Reg 9: Training
- Reg 13: High or Very Low Temperatures
- Reg 22: Maintenance Operations

# The Safe Isolation of Plant and Equipment – HSG253



# The Safe Isolation of Plant and Equipment – HSG253



## Appendix 6: Example of a selection tool to establish the 'baseline standard' for a final isolation

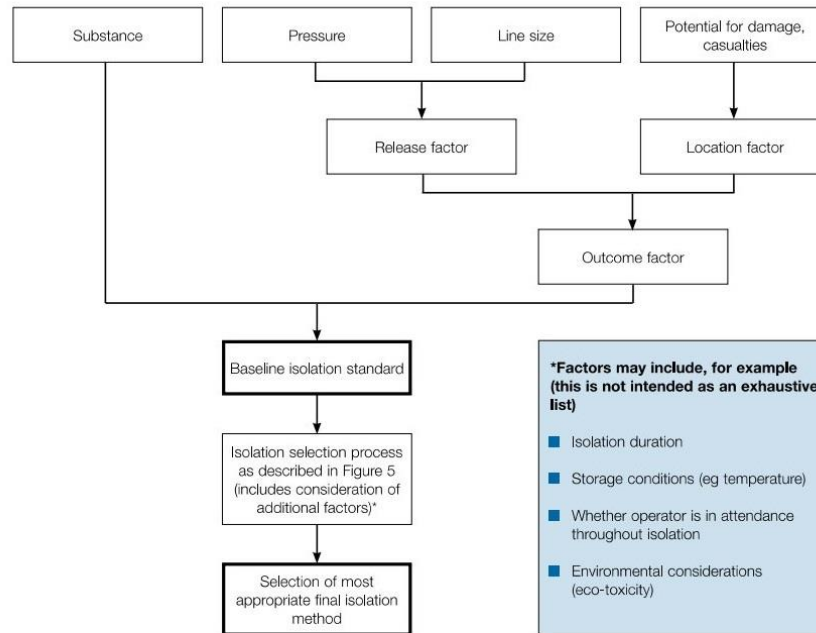


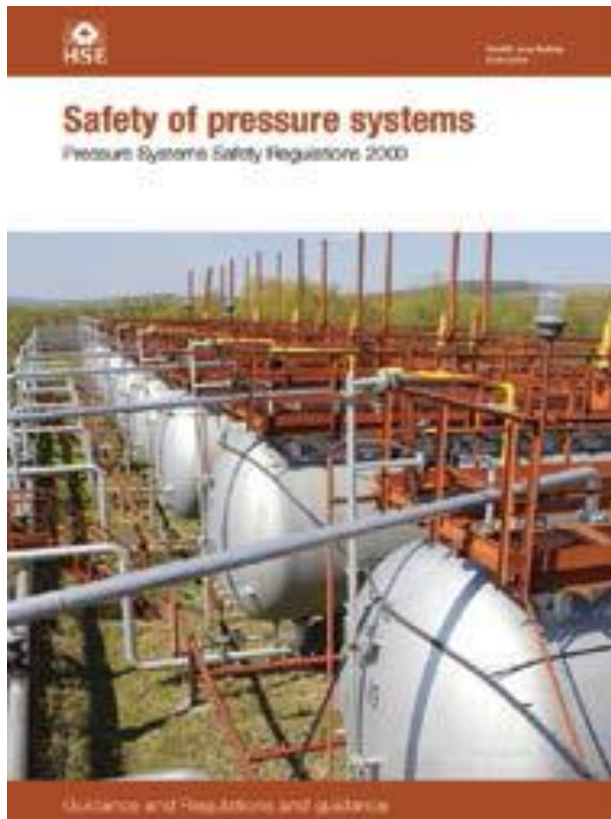
Figure 11 Overview of use of the selection tool to select a final isolation method

# The Safe Isolation of Plant and Equipment – HSG253



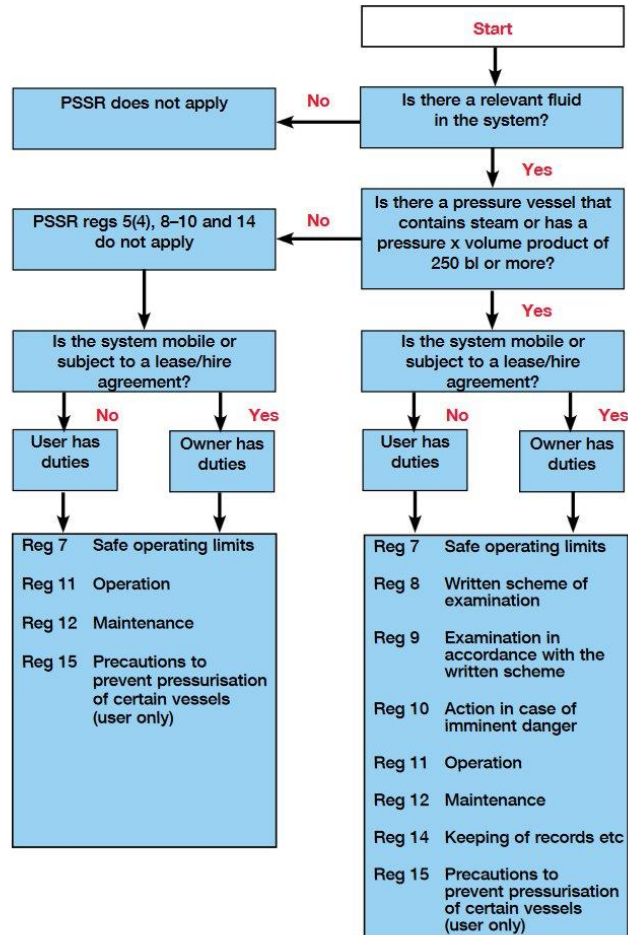
| Category                        | Features  | Method  | Illustrative example |
|---------------------------------|---|---|----------------------|
| <b>I Positive isolation</b>     | Complete separation of the plant/equipment to be worked on from other parts of the system.                                  | Physical disconnection (eg spool removal)   |                      |
|                                 | Valved isolation of an appropriate standard is required during the installation of positive isolation.                      | Double block, bleed and spade   |                      |
|                                 |   | Single block and bleed and spade  |                      |
| <b>II Proved isolation</b>      | Valved isolation. Effectiveness of valve closure(s) can be confirmed via vent/bleed points before intrusive work commences. | Double block and bleed (DBB)  |                      |
|                                 | Within this isolation category the level of mechanical security is greatest for DBB and lowest for SBB.                     | Double seals in a single valve body with a bleed in between   |                      |
|                                 | As a general rule, SBB should not be used with hazardous substances (see paragraph 120).                                    | Single block and bleed (SBB)  |                      |
| <b>III Non-proved isolation</b> | Valved isolation. No provision to confirm effectiveness of valve closure prior to breaking into system.                     | Double valve  |                      |
|                                 | Where possible, double valve isolation should be used rather than single valve.   | Single valve  |                      |
| <b>Key:</b>                     |   |   |                      |
|                                 |   | Live system   |                      |
|                                 |   | Equipment/process system to be isolated   |                      |
|                                 |   | Block valve (closed)  |                      |
|                                 |   | Vent or bleed (valve position should be determined by risk assessment – see discussion of bleed valves in paragraphs 178-179) |                      |
|                                 |   | Blank flange or spectacle plate   |                      |
|                                 |   | Pressure monitoring facility  |                      |

# Pressure Systems Safety Regulations 2000 - L122



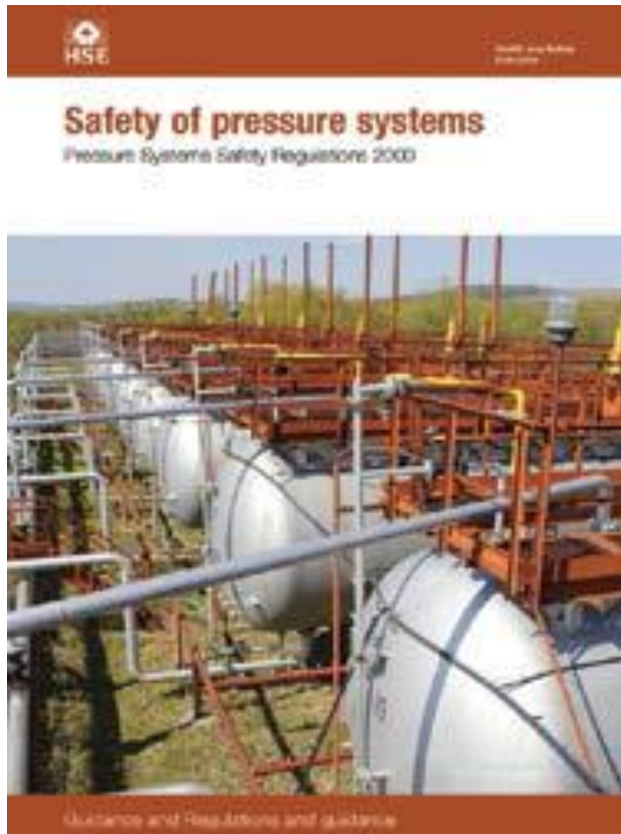
- To prevent serious injury from the hazards of stored energy
- Apply to steam at any pressure and gases/fluids above 0.5 bar
- Some duties only apply if the product of the system pressure (in bar) and volume (in litres) exceeds 250 bar.litres
- Small refrigeration system of 25kw or below are exempt from these regulations.

# Pressure Systems Safety Regulations 2000



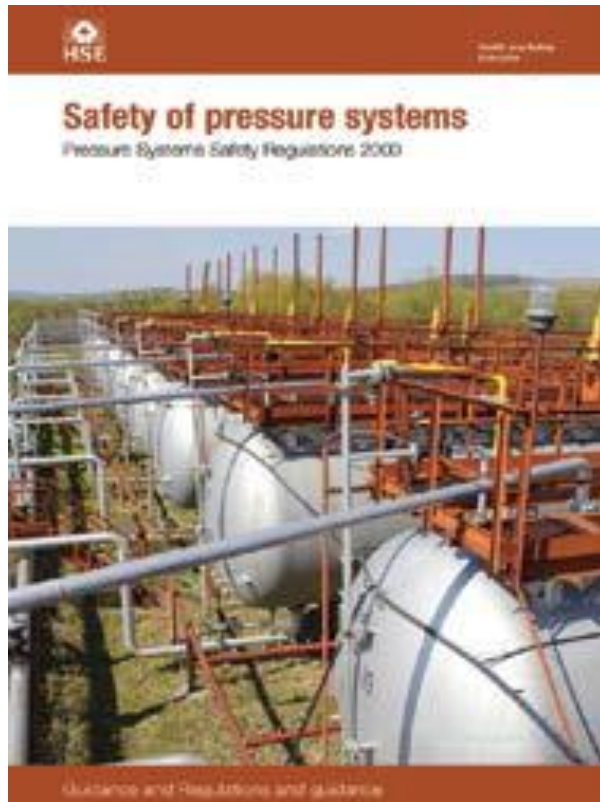


# Pressure Systems Safety Regulations 2000 - L122



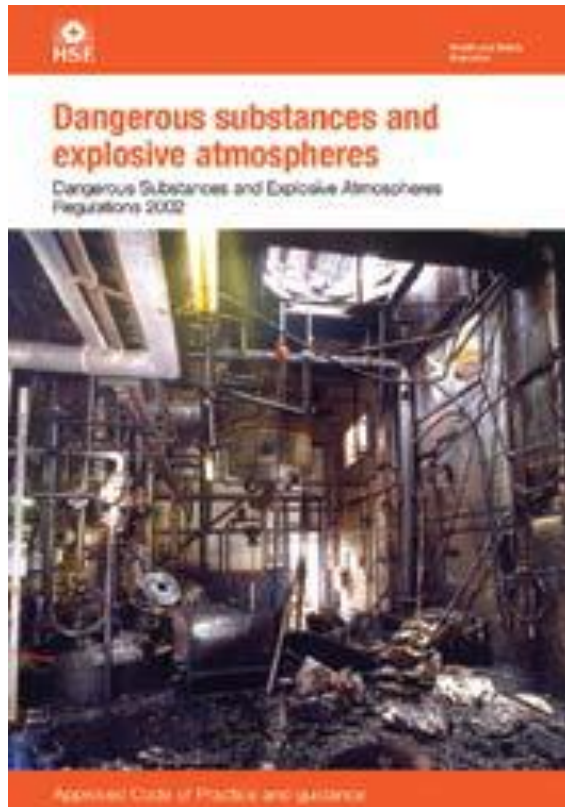
- Reg 7: Safe operating limits
- Reg 8: Written scheme of examination (250bl +)
- Reg 9: Examination in accordance with the written scheme (250bl +)
- Reg 10: Action in case of imminent danger (250bl +)

# Pressure Systems Safety Regulations 2000 - L122



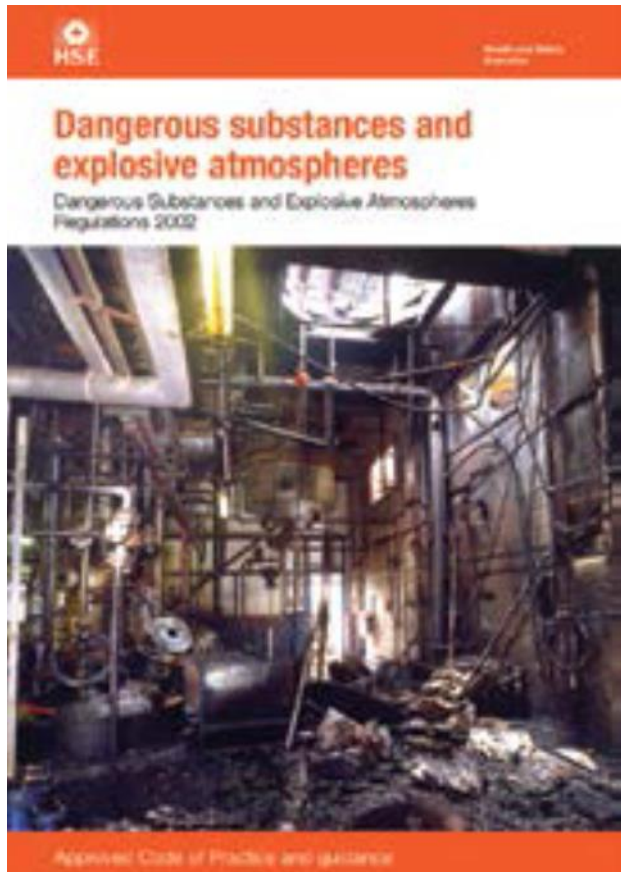
- Reg 11: Operation
- Reg 12: Maintenance
- Reg 14: Keeping of records etc.. (250bl +)

# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



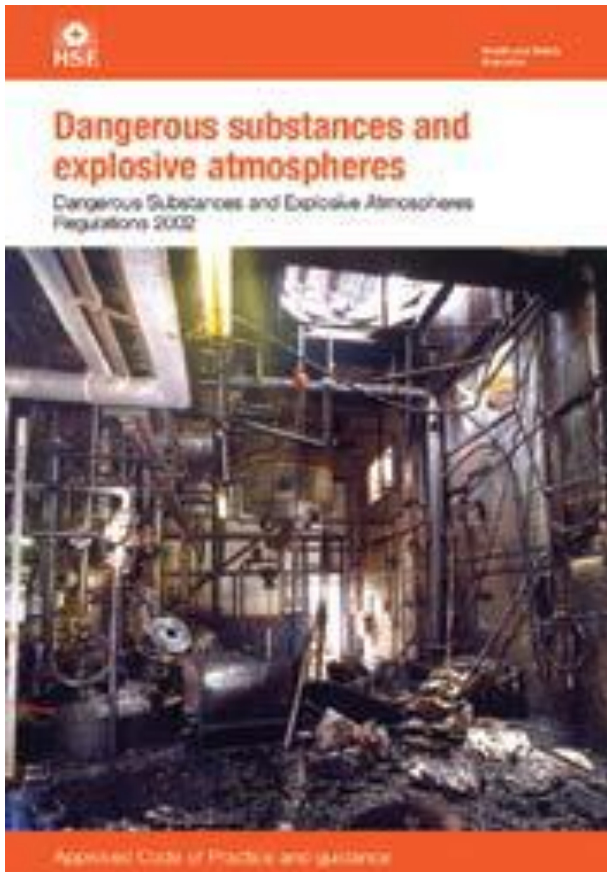
- Dangerous substances;
  - Explosive, Oxidising, Extremely flammable, Highly flammable, flammable
  - Substances creating a risk due to their physio-chemical properties.
  - Dusts capable of forming an explosive mixture with air.
- In general deals with risks from fires & explosions

# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



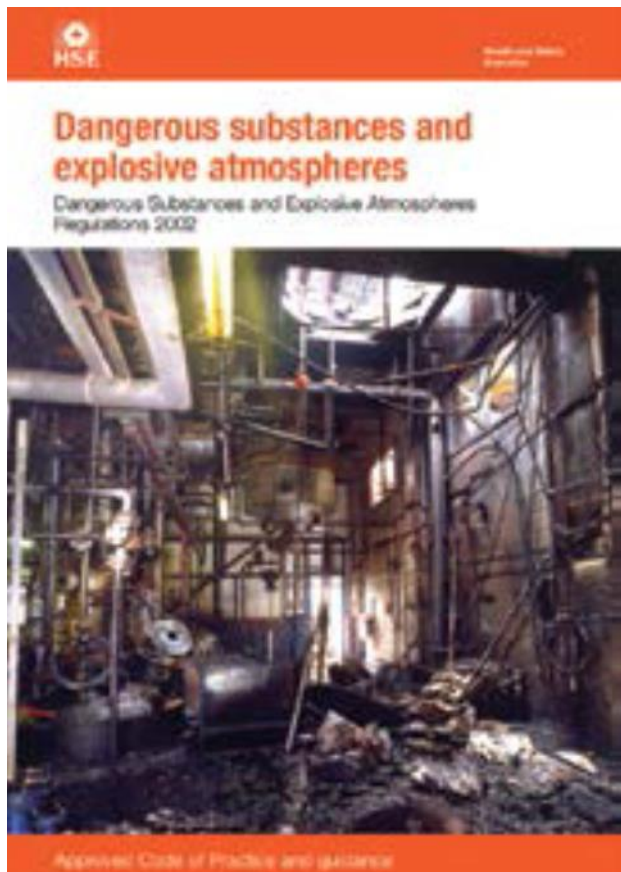
- Places duties on employers which include the self-employed
  - to their employees
- AND
- to others who maybe effected whether at work or not.

# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



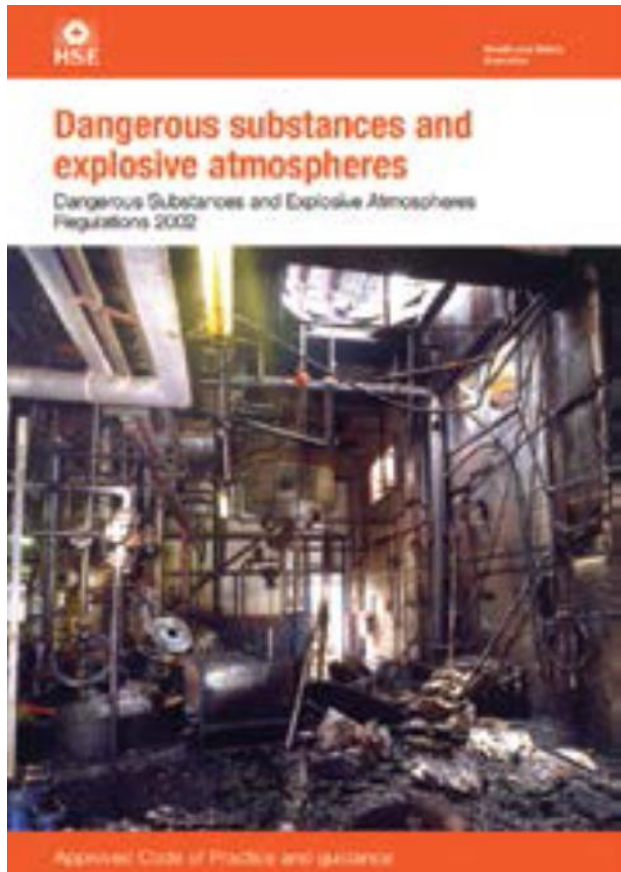
- Reg 5: Risk Assessment – Duty on employers to undertake an assessment of the risks from dangerous substances
- Contains a list of considerations;
  - Hazardous properties
  - Information from supplier (safety data sheets)
  - Circumstances of work (eg. amount, safe handling & storage)

# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



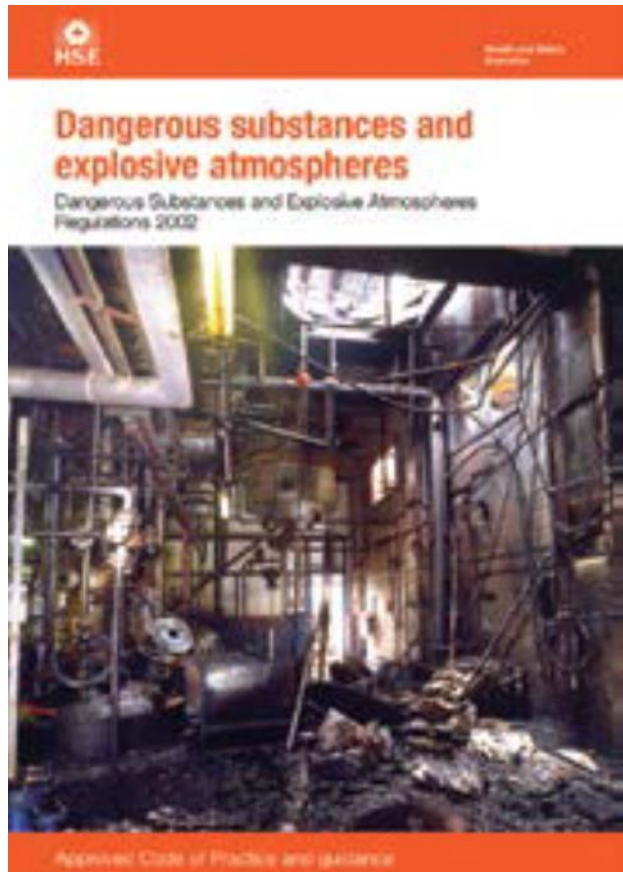
- Activities like maintenance (higher risk)
- The likelihood that an explosive atmosphere will occur and its persistence (HAC).
- The likelihood that ignition sources, including electrostatic discharges will be present.

# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



- Scale of anticipated fire/ explosion.
- Any additional safety information
- Duty to review risk assessment
- Duty to record significant findings if employer has 5 or more employees

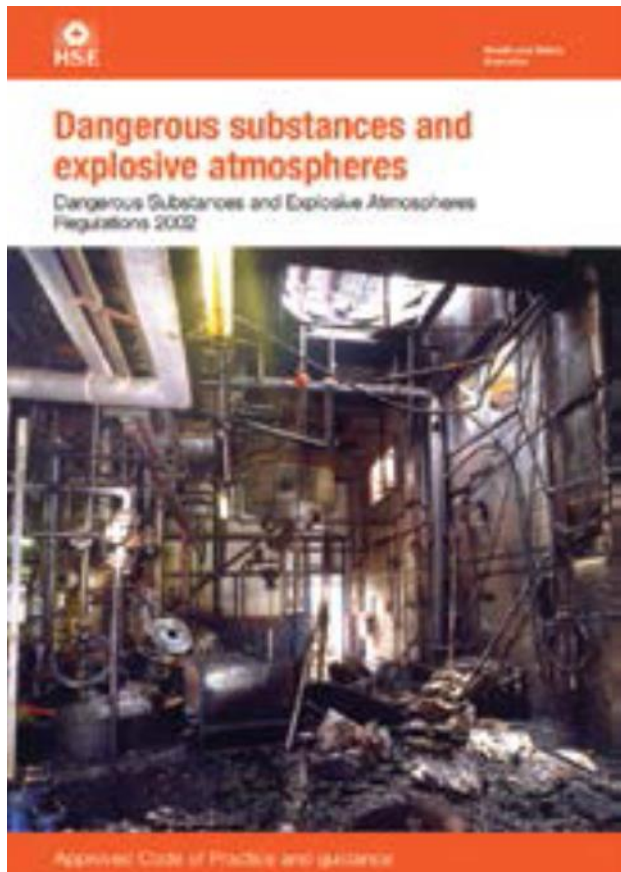
# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



- Reg 6: Elimination or reduction of risk from dangerous substances
  - Elimination in preference to reduction
  - Where elimination not possible, control the risks and mitigate the consequences
  - Hierarchy of control & mitigation measures

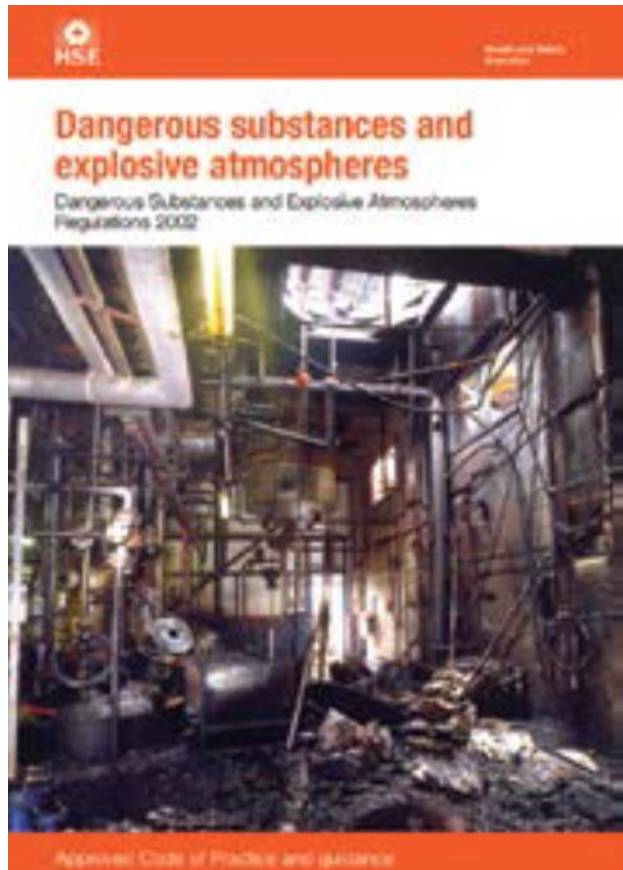


# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)



- Reg 7: Places where explosive atmospheres may occur
  - Classify places into hazardous and non-hazardous
  - Further classify hazardous places into zones (0,1,2)
  - Ensure equipment in zoned areas is suitable for that zone
  - Hazardous areas to be marked at entrance

# Dangerous Substances & Explosive Atmospheres Regulations 2002 (L138)

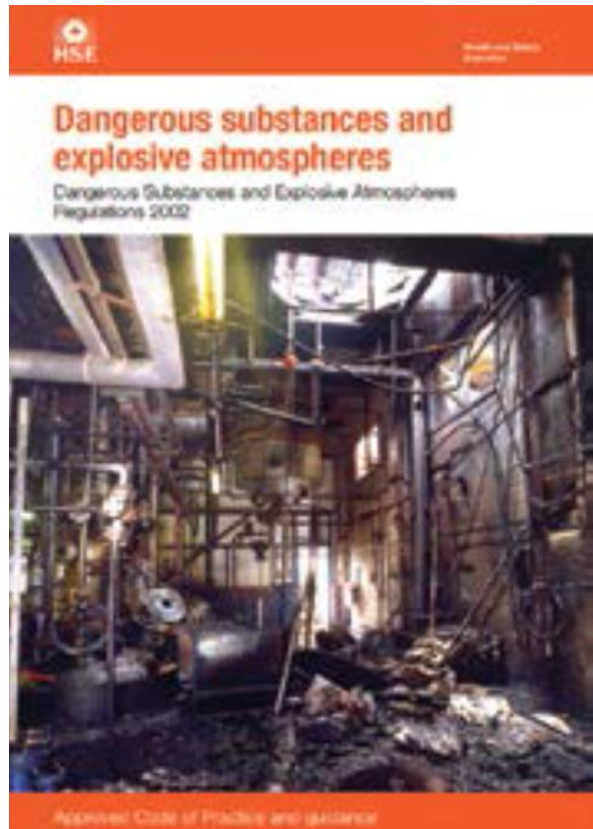


- Reg 8: Arrangements to deal with accidents, incidents and emergencies.
- Reg 9: Information, instruction and training

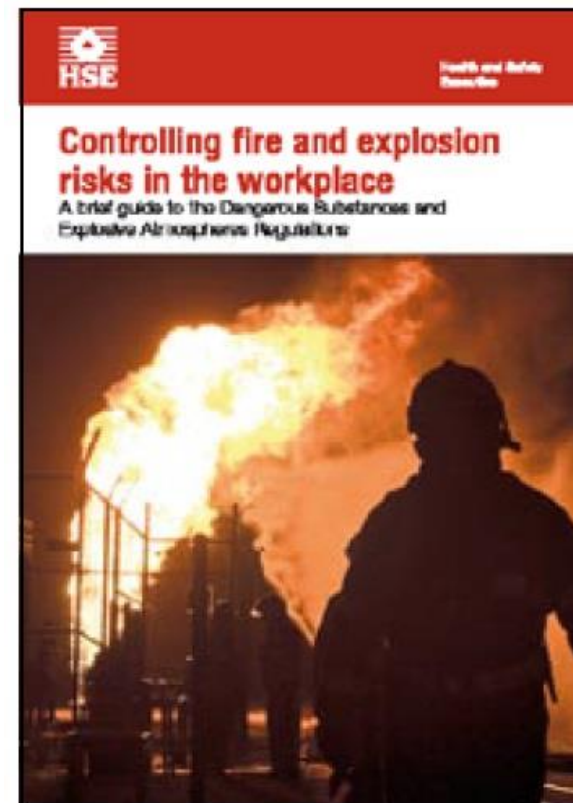
# Dangerous Substances & Explosive Atmospheres Regulations 2002



## L138 – Detail



## INDG370 - Overview



# **HSE INSPECTIONS**