

# **Safe management of ammonia refrigeration systems**

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Safe Management of Ammonia Refrigeration Systems – May 2017 in Grantham

# Original objectives of PM81...

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- Prompted by concerns that the likely increase in the use of ammonia following the phase-out of Chlorofluorocarbons (CFCs) could lead to an increase in incidents of ammonia escape **unless the underlying management of ammonia systems was improved.**
- To highlight the **need to undertake a risk assessment** to identify those components and tasks crucial to safety and how they can be controlled where ammonia is used.
- Detail the **tighter management control** needed over ammonia systems.
- To **highlight the most significant health and safety requirements of current standards** (BS4434 & IoR code) and to make them more accessible to users.



# HSE identified concerns in 2014...

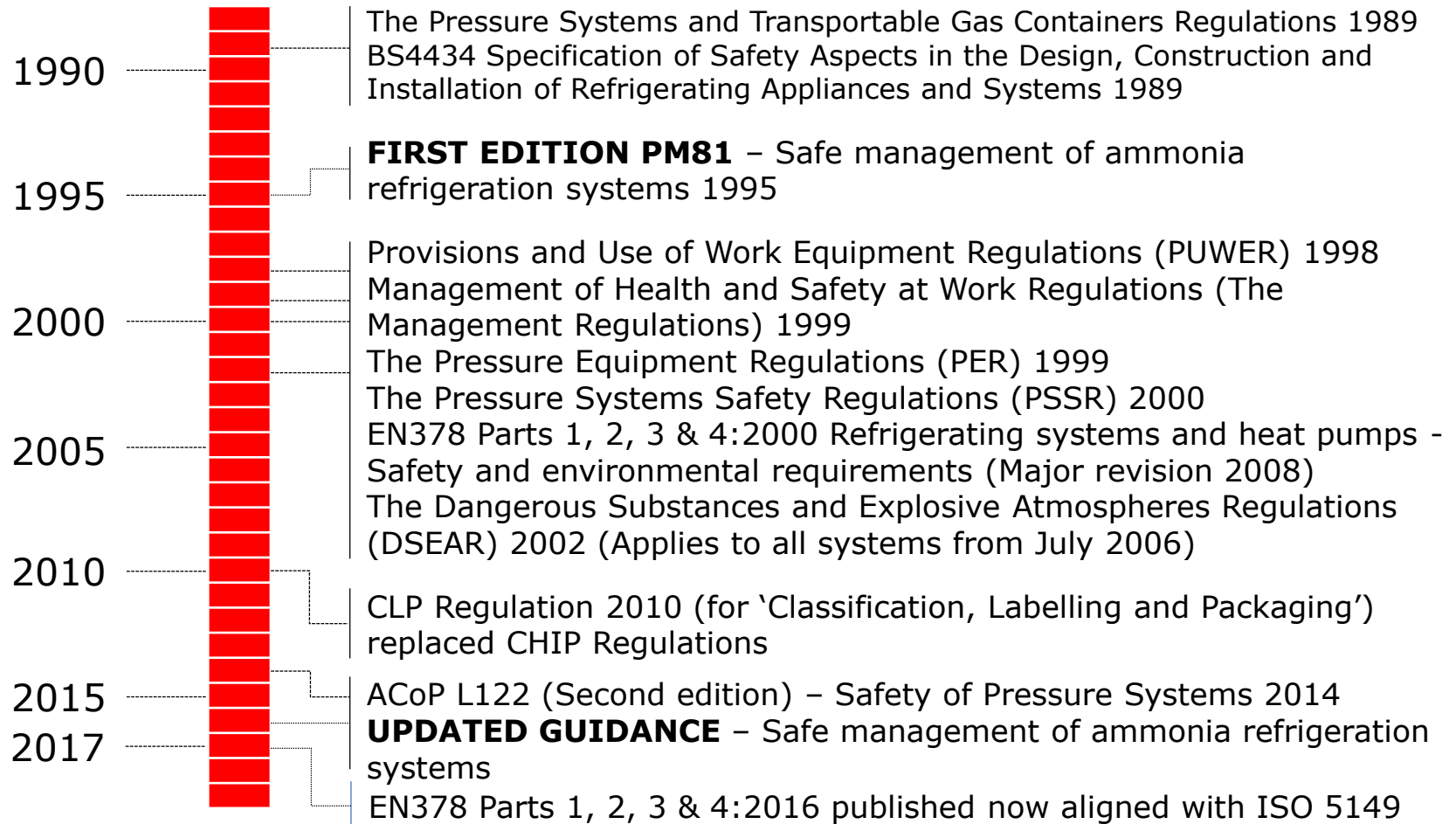
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The HSE has **identified common failures** in the understanding of ammonia refrigeration technology in some designers, installers, contractors and site staff. These include;

- A **lack of understanding of the science of ammonia refrigeration** and the implications for design and modification.
- Failure(s) to **select, install, maintain, check and use systems correctly**;
- Failure(s) to **identify through assessment** the likely sources of gas escape so that appropriate plant modifications may be made or appropriate plant checks instituted to detect likely sources of leakage at an early enough stage;
- Failure(s) to **prepare and rehearse emergency procedures** to limit the effect of leakage if one occurs; and
- Failure(s) to **train personnel**.



# So what has changed since PM81 was first published...?



# Main Regulations regarding ammonia refrigeration systems...

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- The Management of Health and Safety at Work Regulations 1999.
- Provisions and Use of Work Equipment Regulations (PUWER) 1998.
- Pressure Equipment Regulations 1999.
- Pressure System Safety Regulations (PSSR) 2000.
- Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002.
- Sarah Schumacher's earlier presentation dealt with Employers obligations under these Regulations.
- The guidance **Safe management of ammonia refrigeration systems** and this presentation is intended to explain what this means in practice.



# The Management of Health and Safety at Work Regulations 1999...

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Places a duty on employers to **assess and manage risks to their employees and others arising from work activities;**

- Implement the health and safety measures identified as necessary by the **risk assessment;**
- Appoint **competent people** to help them implement the necessary **controls and procedures;**
- Set up **emergency procedures;**
- Provide clear information and **training to employees;**
- Work together with other employers sharing the same workplace.



# Provisions and Use of Work Equipment Regulations (PUWER) 1998...

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- Suitable for the intended use.
- Safe for use, **maintained** in a safe condition and **inspected** to ensure it is correctly installed and does not subsequently deteriorate.
- Used only by people who have **received adequate information, instruction and training.**
- Accompanied by suitable health and safety measures, such as **protective devices and controls.** These will normally include emergency stop devices, adequate means of isolation from sources of energy, clearly visible markings and warning devices.

# Pressure Equipment Regulations 1999...

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- The Regulations cover the placing on the European Market or putting into service of pressure equipment and assemblies with a maximum allowable pressure greater than  $\geq 0.5$  bar.
- Pressure equipment means vessels, piping, safety accessories and pressure accessories.
- Assemblies means several pieces of pressure equipment assembled to form an integrated, functional whole such as a refrigeration system.
- PER does not apply to pressure equipment and assemblies placed on the market before 29 November 1999:
  - ❑ However, there is a need for a '**global conformity assessment**' when a pressure system undergoes major replacements or modifications.





# Pressure System Safety Regulations (PSSR) 2000...

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- Provide safe and suitable equipment by using the appropriate design, construction and installation standards and/or codes of practice for example EN378.
- Requires **operators to know the operating conditions and provide operating instructions** for the control of the whole system including emergencies.
- Fit **suitable protective devices** and ensure they function properly.
- **Carry out suitable maintenance** taking into account the use of system and it's age.
- Make provision for **appropriate training**.
- Appoint a '**competent person**' to prepare **Written Scheme of Examination (WSE)**
- Have the equipment **regularly examined**.



# Maintenance of the system...

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- Covered fully in PSSR Regulation 12. The type and frequency of maintenance for the system should be assessed and a suitable maintenance programme planned.
- A suitable maintenance programme should take account of:
  - ❑ the age of the system;
  - ❑ the operating/process conditions;
  - ❑ the working environment;
  - ❑ the manufacturer's/supplier's instructions;
  - ❑ any previous maintenance history;
  - ❑ reports of examinations carried out under the written scheme of examination by the competent person;
  - ❑ the results of other relevant inspections (for maintenance or operational purposes); and
  - ❑ repairs or modifications to the system; and
  - ❑ the risks to health and safety from failure or deterioration.

# Written Scheme of Examination...

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- For PSSR qualifying systems, the plant must not be operated unless the user has a WSE for its periodic examination, written by a **competent person** covering:
  - ❑ All protective devices, for example high pressure cut-outs, pressure relief valves and bursting discs;
  - ❑ Every pressure vessel and heat exchanger; and
  - ❑ All parts of the pipework in which a defect may give rise to danger.
- The main requirements of a WSE are set out Regulations 8 & 9 of PSSR 2000.
- The **person responsible for operating the system** should be able to demonstrate that it is working within its safe limits.

# Role of the Competent Person...

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- It is the **responsibility of the user/owner to appoint a competent person** capable of carrying out the duties in a proper manner with sufficient expertise in the particular type of system.
- The attributes and role of competent persons and their required competences are explained in paragraphs 97-99 of the ACoP L122 – Safety of Pressure Systems.
- The competent person must:
  - ❑ Prepare the WSE before the system is first taken into operation;
  - ❑ Carry out inspections in accordance with the requirements of the WSE, modify the WSE (if required following inspection) and issue a report certifying the condition of the plant;
  - ❑ Review and modify the WSE before any modifications are carried out to the system and before it is taken back into operation.

# Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002...

Workplace	Date when DSEAR/ATEX requirements must be met
<p>Workplace in use <b>before July 2003</b> (Equipment already in use before July 2003 can continue to be used indefinitely provided a risk assessment shows it is safe to do so).</p>	<p>Workplace must meet requirements <b>by July 2006</b>.</p> <p><i>Today all ammonia refrigeration systems within the UK are required to comply with DSEAR.</i></p>
<p>Workplace in use before July 2003 but modified before July 2006.</p>	<p>Workplace must meet requirements from the time the modification takes place.</p>
<p>Workplace comes into use for the first time <b>after June 2003</b>.</p>	<p>Workplace must meet requirements <b>from the time it comes into use</b>.</p>

# What are the major differences between PM81 and SMARS...

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- Updates and clarifies the requirements of current legislation that is applicable to the design, installation, operation and maintenance of ammonia refrigeration systems.
- Details any duties of Employers when complying with current legislation.
- Clarifies the need for Employers to assess and manage risks to their employees and others arising from work activities.
- Identifies the appropriate safety measures that are required.
- Explains the role and duties of the 'competent person' as required by PSSR 2000.
- Highlights the need to train and educate staff so they can carry out their duties correctly.
- Clarifies the need for ammonia refrigeration systems to be maintained so they are safe to operate.
- Clarifies the term 'User' as defined in PSSR 2000.



# What can we learn from past incidents involving ammonia...

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- Experience of past incidents involving ammonia refrigeration systems has shown that the overall arrangements to manage such systems must be improved.
- Further, it has been concluded that training is the common factor to improving the safety record for ammonia refrigeration:
  - ❑ Training system specifiers to ensure they are competent and fully appreciate the risk consequences of their decisions.
  - ❑ Training designers to understand how to eliminate or minimise risks is perhaps the most potent improvement that can be made.
  - ❑ Training operators and maintenance technicians to avoid errors that could cause them serious injury or in the worst cases cost them their life.
- Statistically:
  - ❑ Older plants are more likely to suffer catastrophic failure.
  - ❑ Poorly operated and or maintained systems are also more vulnerable.

# The future...

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- Senior Members of John Pride's team at HSE have recently reviewed SMARS:
  - ❑ HSE Publications Governance Group have supported his proposal that HSE endorse SMARS 2016 and the DSEAR Ammonia Guidance document (currently being finalised).
  - ❑ Sufficient new guidance has been published to warrant a second edition. For example EN 378:2016 etc...
- Both documents provide a sensible and proportionate approach to managing health and safety
- Anyone who has registered and received a copy of SMARS 2016 will automatically receive a copy of the new Second edition in the second half of 2017.

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**THANK YOU FOR YOUR ATTENTION**

**ANY QUESTIONS...?**

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