

Safe management of ammonia refrigeration systems

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Safe Management of Ammonia Refrigeration Systems – May 2017 in Grantham

Original objectives of PM81...

- 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.

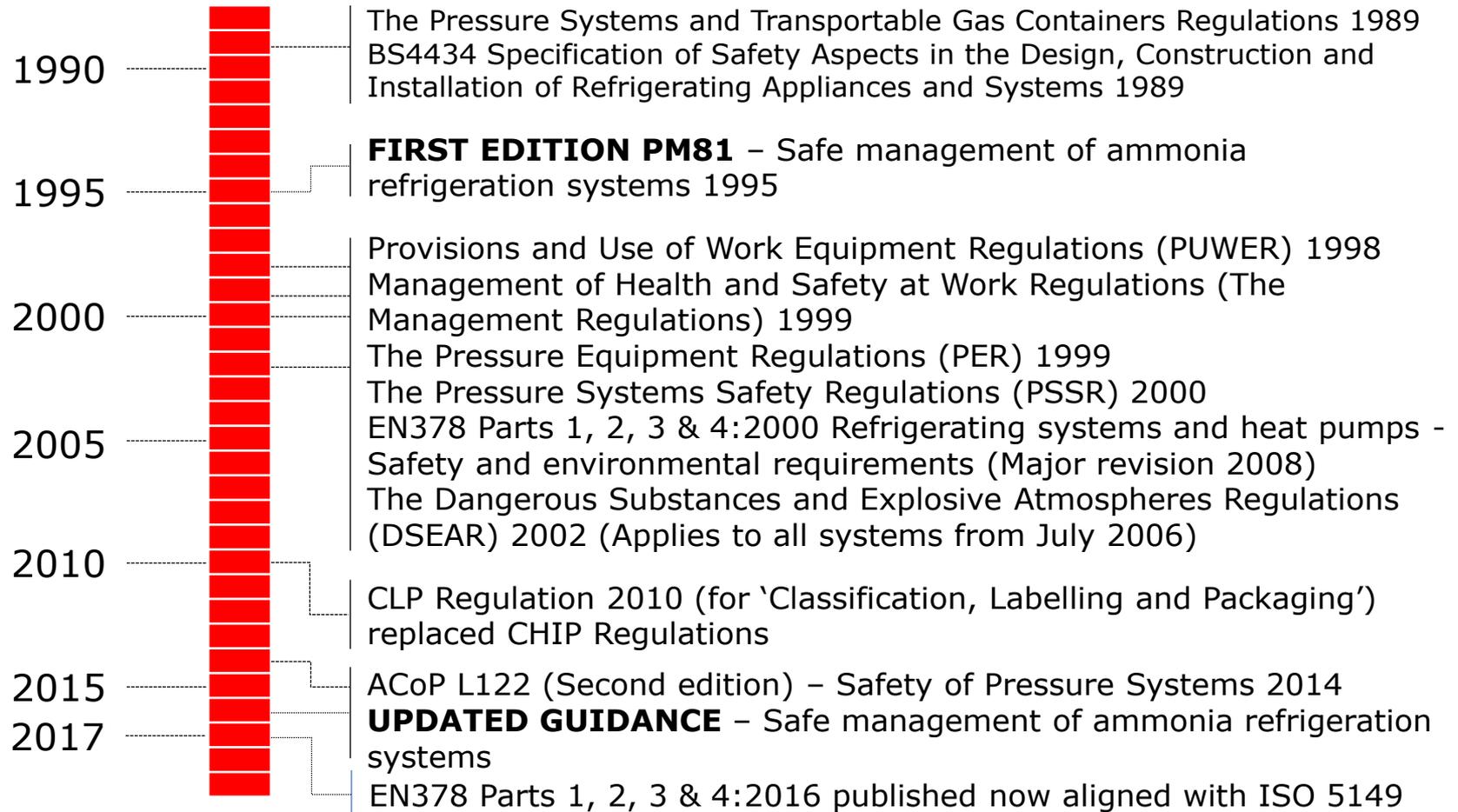
HSE identified concerns in 2014...

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...

- 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...

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...

- 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...

- 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 ≥ 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...

- 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...

- 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...

- 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...

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



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

- 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...

- 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...

- 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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