Safe handling of Ammonia as Refrigerant, Part 2

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Safety Ammonia 2

Aim:
Improve safety through knowledge and competence

Target Group:
1. Refrigeration Engineers and Operators
2. Fire Department and Ambulance Personnel
WHO IS CREATING RISKS?

Risk = Probability x Consequence
### Risk evaluation

<table>
<thead>
<tr>
<th>NEAR-MISS</th>
<th>CATASTROPHE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interrupted course of event</td>
<td>• Immediate resources restricted to confer stop</td>
</tr>
<tr>
<td>• No personal injury</td>
<td>• Limited in time</td>
</tr>
<tr>
<td>• Slight material damage</td>
<td>• Ends when we can think constructive</td>
</tr>
<tr>
<td>• May be corrected with own resources</td>
<td>• Looked upon differently from involved persons or spectators both physically and psychologically</td>
</tr>
<tr>
<td>• Within company budget</td>
<td></td>
</tr>
</tbody>
</table>
RISK EVALUATION

PRESSURE VESSEL FAILURES:
Obey codes based on experience,
failure-very unlikely

©
### Emission

#### Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Chlorine</th>
<th>Sulphur Dioxide</th>
<th>Ammonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density for vapour in air</td>
<td>2.5</td>
<td>2.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Latent heat at atmosph. pressure kJ/kg</td>
<td>283.0</td>
<td>402.0</td>
<td>1370.0</td>
</tr>
</tbody>
</table>

#### Table 2.

<table>
<thead>
<tr>
<th></th>
<th>Boiling Point °C</th>
<th>Evaporated mass kg/m² and min during minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minutes</td>
<td>0-2</td>
</tr>
<tr>
<td>R12</td>
<td>-29.6</td>
<td>4.80</td>
</tr>
<tr>
<td>Propane</td>
<td>-42.0</td>
<td>1.10</td>
</tr>
<tr>
<td>NH₃</td>
<td>-33.4</td>
<td>0.23</td>
</tr>
</tbody>
</table>
How large is the ammonia leak

If in doubt- SOUND THE ALARM!
AMMONIA LEAKAGE IN ENGINE ROOM

- Close doors!
- Use equipment and plant emergency stop buttons!
- Start emergency ventilation!
- Inform your Management!
- Make your colleagues leave the localities!
Meet fire engines at gatehouse!

Show the way to the place of the accident!
WHAT DO YOU DO WHILST WAITING FOR THE FIRE BRIGADE?
IN CASE OF A LARGE AMMONIA RELEASE
ALWAYS INFORM LOCAL MANAGEMENT

The LOCAL MANAGEMENT will inform Regional Management or Head Office.

REGIONAL MANAGEMENT/HEAD OFFICE will take care of relations to media: newspapers, radio and TV.
AMMONIA RELEASE TO THE LOCAL ENVIRONMENT
Emission

- Operative mistake
- Packing/Gasket
- Bad Weld
- Corrosion
- Outside physical damage
- Process fault
- Combinations and vibrations
CHECK VALVES, SOLENOID VALVES AND THERMOSTAT POCKETS

It is better to ask one question too many!
Internal/External Valve Stations
Flammability of Ammonia
EXPLOSIVE MIXTURE =
15 - 28 percent by volume of ammonia in air

The risk is found in confined rooms like engine rooms, process rooms, storage rooms!
Comparison of different flammable concentrations in air

- R 32
- R 143a
- R 152a
- R 170 (Ethane)
- R 290 (Propane)
- R 600a (Isobutane)
- R 717 (Ammonia)
- R 1270 (Propene)
- Acetylene
- Petrol
- Ethanol
- Methane
- Acetone

Vol% in air
<table>
<thead>
<tr>
<th>lower toxicity</th>
<th>higher toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>higher flammability</strong></td>
<td><strong>A3</strong></td>
</tr>
<tr>
<td>LFL ≤ 0.10 kg/m³ or heat of combustion ≥ 19000 kJ/kg</td>
<td></td>
</tr>
<tr>
<td><strong>lower flammability</strong></td>
<td><strong>A2</strong></td>
</tr>
<tr>
<td>LFL &gt; 0.10 kg/m³ and heat of combustion &lt; 19000 kJ/kg</td>
<td></td>
</tr>
<tr>
<td><strong>no flame propagation</strong></td>
<td><strong>A1</strong></td>
</tr>
<tr>
<td>no LFL based on modified ASTM, E681-85 test</td>
<td></td>
</tr>
<tr>
<td>no identified toxicity at concentrations ≤ 400 ppm</td>
<td></td>
</tr>
<tr>
<td>evidence of toxicity below 400 ppm (based on data for TLV-TWA or consistent indices)</td>
<td></td>
</tr>
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</table>
And you must never ever forget full face mask and gloves!
J WORKED FOR 30 YEARS AND I HAD ONLY ONE ACCIDENT.