

# from experience

## Ammonia Machinery Room Safety Controls

Industrial ammonia machinery room safety controls are a key element in keeping personnel and property safe from harm. These protection systems safeguard against four major threat categories: fire/explosion caused by a combination of a spark and a high concentration of ammonia (NH<sub>3</sub>) in the room, personnel exposure to NH<sub>3</sub> caused by a leak, a piping system overpressure, and liquid carryover from a vessel to compressors. Each of these safety concerns has its respective safety system for prevention.

- The first two safety concerns, an ammonia fire/explosion and personnel exposure, are protected by using properly specified ammonia sensor instrumentation. To mitigate personnel exposure, a low-level sensor, typically 0-300 parts per million (ppm), is used. These sensors initiate emergency exhaust and ventilation systems to bring in fresh air in the event ammonia is detected at as little as 25 ppm ammonia. Alarm notification is sent to machinery room personnel so immediate protective action can be taken. Higher-level sensors are used to detect a major leak and shut down machinery room equipment (including ammonia compressors, pumps, and automated valves) if levels reach a maximum of 40,000 ppm (25% of the Lower Explosion Limit or LEL). Sensors are strategically located in areas where ammonia is likely to concentrate and must be tested per the manufacturer's recommendation.
- The third safety concern, a piping system overpressure, is prevented by an Emergency Pressure Control System (EPCS) which allows the over pressure zone to vent to a lower pressure zone. The idea is that the pressure is relieved before a safety valve is lifted off its seat, thus preventing NH<sub>3</sub> from being released to the atmosphere.
- Since compressors are designed to compress gas, not liquid, the carryover of liquid from ammonia vessels to ammonia compressors would cause significant damage to the compressors. To prevent this, high liquid level instruments are installed on the vessels to interlock the compressors off when a high level is detected, protecting the compressor from damage.

### Five Fast Facts About Ammonia

- Ammonia has a strong odor detection threshold of as little as 5 ppm. Levels higher make it nearly impossible for someone to stay in the room, making it self-protective.
- 300 ppm is an Immediately Dangerous to Life and Health (IDLH) air concentration if exposure lasts longer than 30 minutes (established by OSHA).
- 160,000 ppm is the Lower Explosive Limit (LEL).
- 250,000 ppm is the Upper Explosive Limit (UEL).
- Ammonia levels between the LEL and UEL fall within the flammable zone! This is the concentration that would support an explosion/fire.

In addition to each of these protections discussed above, an emergency stop function is also located outside of each machinery room door allowing manual intervention by personnel.

It is important to know that each one of these safety systems is the last line of defense in a multi-layered ammonia control system. Since these safety systems are rarely utilized, testing their functionality on a routine basis is an important aspect of the process safety management program. Having properly installed and tested safety controls within a **properly designed Machinery Room** will go a long way in maintaining worker and building safety.

### experience in brief

For more information on safety controls in ammonia machinery rooms, see these two important regulations:

- ANSI/IIAR-2 Equipment, Design & Installation of Closed-Circuit Ammonia Mechanical Refrigerating Systems.
- International Mechanical Code (IMC).

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Industrial Refrigeration Consortium (IRC)  
Madison, Wisconsin  
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