

SAFETY ALERT

AMMONIA REFRIGERATION / CHILLING PLANTS

Cold Storage Units & Chemical / Pharmaceutical Factories

Safety Alert No. 10/2026 June 2026

1. BACKGROUND & APPLICABILITY

Ammonia (NH₃) is extensively used as a refrigerant in industrial chilling plants for cold storage facilities, food-processing units, chemical factories, and pharmaceutical plants. Ammonia is classified as a Toxic, Flammable gas (IDLH: 300 ppm; PEL: 25 ppm TWA, 35ppm STEL) and its use falls within the purview of the Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and the Occupational Safety, Health and Working Conditions (OSHWC) Code, 2020.

This Safety Alert has been issued following inspections and incident reports from ammonia refrigeration plants revealing recurring deficiencies in equipment maintenance, leak management, emergency preparedness, and statutory compliance. All occupiers/managers of factories operating ammonia chilling systems are required to review, implement, and record the action points in this alert.

2. PROPERTIES OF AMMONIA — WHY IT IS DANGEROUS

Property	Value / Significance
Molecular formula	NH ₃ — colourless gas with pungent odour
Odour threshold	1–5 ppm (good warning property at low concentrations)
PEL	25 ppm — 8-hour time-weighted average, 34ppm Short Term Exposure Limit
IDLH	300 ppm — Immediately Dangerous to Life and Health
Flammable range (LEL–UEL)	15%–28% vol. in air — fire/explosion risk at high concentration
Liquid ammonia hazard	Cryogenic burns, rapid vaporisation to toxic cloud on release
MSIHC Schedule 1 threshold	50 MT (Major Accident Hazard site above this quantity)

3. ROOT CAUSES OF AMMONIA INCIDENTS

- Corrosion and fatigue failure of pipelines, flanges, and valves due to absence of a preventive maintenance programme
- Leaking or failed mechanical seals on compressors and pumps
- Improper or missing pressure-relief valve (PRV) testing leading to uncontrolled venting
- Absence of continuous ammonia gas detection systems in compressor rooms and cold stores
- Workers entering compressor/engine rooms without personal protective equipment (PPE)
- Inadequate emergency preparedness — no written emergency response plan (ERP), untested evacuation drills

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- Storage of ammonia cylinders and bulk tanks in inadequately ventilated areas
- Absence of trained, certified refrigeration plant operators during shift operations
- Failure to maintain plant logbooks and inspection records as required under the Factories Act

4. REFERENCE INCIDENTS — LESSONS LEARNED

The following types of incidents have been reported in the sector. Occupiers must treat each as a learning case for their own facility:

- Compressor room ammonia leak due to failed shaft seal — workers hospitalised with respiratory injuries; root cause: deferred seal replacement
- Catastrophic pipe joint failure in a cold store — ammonia toxic cloud led to evacuation of adjacent residential area; root cause: corrosion not detected in annual inspection
- PRV activation releasing ammonia directly into occupied area — no diffusion/absorption system installed
- Worker overcome ammonia vapour in compressor room — absence of fixed gas detector and alarm; victim found unconscious
- Cylinder valve failure during filling — no remote shut-off valve; manual isolation delayed release

5. COMPLIANCE REQUIREMENTS

The following requirements are MANDATORY

5A. PLANT INTEGRITY & MAINTENANCE

- Implement a written Preventive Maintenance Programme (PMP) for all pressure vessels, compressors, pipelines, fittings, and heat exchangers — with quarterly inspection records
- All pressure vessels shall hold valid certificates as applicable
- Pressure Relief Valves (PRVs) to be tested annually and after any relief event; test certificates to be maintained on-site
- Pipeline integrity testing (pressure test / leak test) at intervals not exceeding 3 years using soap solution or electronic detector — documented
- Oil separator, receiver, and condenser inspections to be logged in plant logbook
- Compressor oil levels, temperatures, and discharge pressures to be recorded every shift

5B. LEAK DETECTION & MONITORING

- Install fixed, continuous ammonia gas detection sensors (electrochemical / catalytic) in:
 - Compressor / machine room
 - Cold storage chambers (entry vestibule)
 - Control room area
 - Condenser / cooling tower area (outdoor)
- Ammonia leakage Detectors with audible and visual alarms visible from outside the room shall be provided
- Portable multi-gas detectors (including NH₃) to be held at site for confined space entry and maintenance work

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- Gas detection system to be calibrated every 6 months; calibration records to be maintained
- Water curtain shall be provided around ammonia receivers to prevent escape of leaking ammonia

5C. PROCESS SAFETY CONTROLS

- Install high-pressure cut-out (HPCO) and low-pressure cut-out (LPCO) on each compressor — regularly tested and set to manufacturer specifications
- Liquid level controls on receivers and vessels must be functional; high-level alarms to be tested monthly
- PRV discharge to be piped to a water absorption / scrubber tank — not released directly to atmosphere or occupied areas
- Emergency shut-off valves (manual or remotely operated) to be provided at strategic points including main liquid receivers and suction headers
- Plant to be equipped with an automatic system to isolate the refrigerant charge in the event of a fire (automatic emergency shut-off)
- All ammonia refrigerant piping to be colour-coded with flow direction arrows and hazard labels

5D. PERSONAL PROTECTIVE EQUIPMENT (PPE)

- The following PPE to be maintained at the plant site and inspected every 6 months:
 - Self-Contained Breathing Apparatus (SCBA) — minimum 2 sets with spare cylinders
 - Full-face ammonia respirator (cartridge type, for escape only, not entry into IDLH atmosphere)
 - Chemical-resistant gloves (neoprene or butyl rubber, long-cuff)
 - Chemical-resistant apron / full-body splash suit
 - Face shield (polycarbonate, chemical splash rated)
 - Safety boots (chemical resistant)
- PPE to be stored in a readily accessible, clearly marked cabinet outside the compressor room
- Workers must be trained in correct donning and doffing of SCBA before any entry into ammonia areas

5E. EMERGENCY RESPONSE PREPAREDNESS

- A written On-Site Emergency Plan (OSEP) is mandatory for all MAH sites under MSIHC Rule 13; for smaller sites, a written Emergency Response Procedure (ERP) is required under OSHWC Code
- ERP must include: leak response procedure, evacuation route maps, assembly point locations, emergency contact list
- Mock drills to be conducted at least once in a quarter — both announced and unannounced; drill records with observations and corrective actions to be maintained
- A dedicated eyewash station and safety shower (tepid water) to be installed outside the compressor room and at the ammonia charging/filling area
- Emergency decontamination procedure for ammonia splash / inhalation victims to be displayed in the first-aid room
- Co-ordinate OSEP with local Fire Brigade and nearest hospital — MOU or confirmation letter to be maintained

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5F. COMPETENCY

- All workers in the refrigeration area to receive induction training on ammonia hazards, PPE use, and emergency procedures — records to be maintained
- Contractors and casual workers engaged for maintenance must receive site-specific safety induction before commencing work
- Permit to Work (PTW) system to be implemented for all high-risk maintenance tasks — hot work, confined space entry, breaking of refrigerant pipelines

6. SELF-INSPECTION CHECKLIST FOR OCCUPIERS FOR GUIDANCE

Occupiers must conduct and record a self-inspection using the following checklist at intervals not exceeding 3 months.

S.No.	Inspection Item	Compliant (Y/N)	Remarks
1	Valid pressure vessel for all vessels displayed on-site		
2	PRV tested within last 12 months — test certificate available		
3	Fixed NH ₃ gas detectors installed, calibrated, and alarm set		
4	SCBA sets (minimum 2) maintained with valid cylinder charge		
5	Compressor HPCO / LPCO tested this quarter		
6	PRV discharge piped to scrubber / absorption tank — not to open atmosphere		
7	Emergency shut-off valves (SOVs) operational and accessible		
8	Eyewash station and safety shower operational with clean supply		
9	Qualified and experienced operator present during all operational shifts		
10	Permit to Work (PTW) system in place for maintenance tasks		
11	Emergency Response Plan / OSEP document available and updated		
12	Mock drill conducted in last 6 months — records maintained		
13	Ammonia piping colour-coded with flow arrows		
15	Workers trained on ammonia hazards and emergency procedures — records maintained		

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7. FIRST AID FOR AMMONIA EXPOSURE

Exposure Type	Immediate Action
Inhalation	Remove victim to fresh air immediately. Do NOT enter contaminated area without SCBA. If breathing is difficult, give oxygen. Seek medical attention. DO NOT give mouth-to-mouth — risk of secondary exposure.
Skin contact	Remove contaminated clothing. Flush affected area with copious water for at least 20 minutes. Cover with sterile dressing. Transport to hospital.
Eye contact	Flush eyes immediately with large amounts of water for 15–20 minutes. Remove contact lenses if worn. Do not rub eyes. Transport to ophthalmologist immediately.
Ingestion (rare)	Do NOT induce vomiting. Rinse mouth with water. Give water or milk (250 ml) if conscious. Transport to hospital immediately.

Issued in the interest of Industrial Safety and Prevention of Accidents. The above advisory is to create awareness on safety systems. This will not absolve the responsibility of managements to comply with statutory norms under relevant statutory provisions-

Issued by Director of Factories, Government of Telangana