Anhydrous Ammonia

- Highly efficient refrigerant, but with some dangerous properties
  - Toxic
  - Highly corrosive
  - Flammable at certain concentrations in air
- Deemed an extremely hazardous substance by Congress
- Anhydrous ammonia releases at facilities have resulted in **property damage, injuries, hospitalizations, and several deaths.**

Source: Len Wallace, US EPA
CAMEO Chemicals: Regulatory Page for Ammonia

Regulatory Information

What is this information?

EPA Consolidated List of Lists

<table>
<thead>
<tr>
<th>Regulatory Name</th>
<th>CAS Number/313 Category Code</th>
<th>EPCRA 302 EHS TPQ</th>
<th>EPCRA 304 EHS RQ</th>
<th>CERCLA RQ</th>
<th>EPCRA 313 TRI</th>
<th>RCRA Code</th>
<th>CAA 112 (r) RMP TQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>7664-41-7</td>
<td>500 pounds</td>
<td>100 pounds</td>
<td>100 pounds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia (anhydrous)</td>
<td>7664-41-7</td>
<td>500 pounds</td>
<td>100 pounds</td>
<td>100 pounds</td>
<td>X</td>
<td>10000 pounds</td>
<td></td>
</tr>
<tr>
<td>Ammonia (conc 20% or greater)</td>
<td>7664-41-7</td>
<td>500 pounds</td>
<td>100 pounds</td>
<td>100 pounds</td>
<td>X</td>
<td>20000 pounds</td>
<td></td>
</tr>
<tr>
<td>Ammonia (includes anhydrous ammonia and aqueous ammonia from water dissociable ammonium salts and other sources; 10 percent of total aqueous ammonia is reportable under this listing)</td>
<td>7664-41-7</td>
<td>see ammonium hydroxide</td>
<td>313</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“X” indicates that this is a second name for an EPCRA section 313 chemical already included on this consolidated list. May also indicate that the same chemical with the same CAS number appears on another list with a different chemical name.

(EPA List of Lists, 2015)

DHS Chemical Facility Anti-Terrorism Standards (CFATS)

<table>
<thead>
<tr>
<th>Chemical of Interest</th>
<th>CAS Number</th>
<th>Min Conc</th>
<th>STQ</th>
<th>Security Issue</th>
<th>Min Conc</th>
<th>STQ</th>
<th>Security Issue</th>
<th>Min Conc</th>
<th>STQ</th>
<th>Security Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia (anhydrous)</td>
<td>7664-41-7</td>
<td>1.00 %</td>
<td>10000 pounds</td>
<td>toxic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia (conc. 20% or greater)</td>
<td>7664-41-7</td>
<td>20.00 %</td>
<td>20000 pounds</td>
<td>toxic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(DHS, 2007)

OSHA Process Safety Management (PSM) Standard List

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>Threshold Quantity (TQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia solutions (&gt;44% ammonia by weight)</td>
<td>7664-41-7</td>
<td>15000 pounds</td>
</tr>
<tr>
<td>Ammonia, Anhydrous</td>
<td>7664-41-7</td>
<td>10000 pounds</td>
</tr>
</tbody>
</table>

(OSHA, 2011)

https://cameochemicals.noaa.gov/
Common Compliance Issues
Common Issues

- Identifying Hazards
- Operating Activities
- Maintenance/Mechanical Integrity
- Emergency Actions
- Consider Risks from Climate Change
Safety deficiencies or releases resulting from

- Failure to identify hazards in design or operation of system
- Failure to complete a process hazard analysis (PHA)

<table>
<thead>
<tr>
<th>What if</th>
<th>Hazard</th>
<th>Consequences</th>
<th>Safeguards</th>
<th>Recommendations</th>
<th>Target and Actual dates for completion</th>
<th>Completed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain valve open/leaking on lowest vessel</td>
<td>Potential release of ammonia from leak point</td>
<td>Significant volume of ammonia release into engine room</td>
<td>Log vessel operating parameters every 4 hours. Ammonia alarm starts ventilation on.</td>
<td>Ensure operator monthly checks that caps and plugs are placed on system and protected from damage</td>
<td>First check on July 15, 2015</td>
<td>John Smith</td>
</tr>
<tr>
<td>Manual valve closed in pump discharge line</td>
<td>Potential for high pump discharge pressures</td>
<td>Over pressurize system, which could lead to ammonia release in engine room</td>
<td>Pressure regulator (linked back to ultra-low vessel) is in pump discharge line. Logs of pressure every 4 hours.</td>
<td>Consider providing a PRV on the discharge line of pumps</td>
<td>September 23, 2015</td>
<td>Jane Doe</td>
</tr>
<tr>
<td>Pump stops (due to mechanical failure or low level switch)</td>
<td>Loss of ammonia flow to evaporators</td>
<td>No safety or environmental consequences (operative issue).</td>
<td>Preventative maintenance program and operator attention during ammonia system operations</td>
<td>No recommendations</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Source: US EPA Region 7
Have Information Available About the System to Identify Hazards

• Block flow/process flow diagram
• SDS sheet
• Equipment list with design info. such as max. design pressure and capacity
• Desired operating ranges
• Ventilation system capacity
• Industry standards

Source: US EPA Region 7
Prevent Release from Operating Activities

• Facility should have written operating procedures, emergency procedures and maintenance procedures.

• Inadequate secondary containment for chemicals to contain spills or leaks.

Source: Len Wallace, US EPA
Maintenance/Mechanical Integrity

- Storage of flammable chemicals in buildings that are not structurally appropriate for such chemicals or that are not equipped with proper fire protection.

- Failure to periodically inspect tank systems and ensure their integrity.

Source: Len Wallace, US EPA
Corrosion
Unstable
Unstable
Inadequate aisle space, hindering access by facility staff or emergency responders in the event of an accidental release.

Source: Len Wallace, US EPA
Inadequate aisle space, hindering access by facility staff or emergency responders in the event of an accidental release.
Emergency Actions

- Emergency plan(s) located so responders can find and use.

- Up-to-date EPCRA Tier II reports submitted to
  - Fire department
  - Local Emergency Planning Committees (LEPCs) and Tribal Emergency Planning Committees (TEPCs)
  - State Emergency Response Commission (SERCs) and Tribal Emergency Response Commissions (TERCs)

Common Issue: Failure to submit a Tier II form, Safety Data Sheet (SDS), or TRI Form R, in violation of EPCRA

Source: Len Wallace, US EPA
Lack of attention to solutions or mixtures leads to incorrect calculation of threshold quantities for reporting.
Emergency Eye Wash Shower Station

Source: Len Wallace, US EPA
Presence of Combustible Materials and Electrical Hazards in Machinery Rooms

Source: Len Wallace, US EPA
Storage of incompatible chemicals in close proximity to each other, creating a risk of fire, explosion, or release of toxic gases and fumes.
Regulations and Enforcement
Some of the key laws and regulations:

• Clean Air Act Section 112(r), 42 U.S.C. § 7412(r)
  • General Duty Clause, 42 U.S.C. § 7412(r)(1)
  • Risk Management Program, 40 C.F.R. Part 68

• The Emergency Planning and Community Right-to-Know Act (EPCRA)

• OSHA: Process Safety Management Program (PSM), 29 CFR § 1910.119

• Department of Homeland Security: Chemical Facility Anti-Terrorism Standards (CFATS), 6 CFR Part 27

• Maritime Transportation Security Act (MTSA), 33 CFR Subchapter H Part 105

• State fire, building, and mechanical codes
Background on CAA Section 112(r)

Clean Air Act § 112(r)

- General Duty Clause (GDC)
- Risk Management Plan (RMP)
Clean Air Act 112(r) requires facilities that manage extremely hazardous substances to:

1. “Identify hazards which may result from such releases using appropriate hazard assessment techniques”
2. Design and maintain safe facility to prevent releases
3. Minimize consequences of accidental releases which do occur

EPA's General Duty Clause website
https://www.epa.gov/rmp/general-duty-clause-under-clean-air-act-section-112r1
Occupational Safety and Health Administration (OSHA)

OSHA Process Safety Management for Storage Facilities:
https://www.osha.gov/Publications/OSHA3909.pdf

OSHA Hazard Communication:
https://www.osha.gov/hazcom

OSHA Chemical Hazards and Toxic Substances:
https://www.osha.gov/chemical

PSM/RMP Requirements & Threshold Quantities for Each Standard:
https://www.osha.gov/chemical-executive-order/psmterminology
Risk Management Plan (RMP)

General Risk Management Program Guidance:  
https://www.epa.gov/rmp/guidance-facilities-riskmanagement-programs-rmp#general


Chemical Warehouse Risk Management Guidance:  
https://www.epa.gov/rmp/guidance-facilities-riskmanagement-programs-rmp#warehouses

Chemical Distributors Risk Management Guidance:  
https://www.epa.gov/rmp/guidance-facilities-riskmanagement-programs-rmp#distributors

Determining Offsite Consequences of Releases website:  
https://www.epa.gov/rmp/rmp-guidance-offsiteconsequence-analysis
Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency’s (CISA) Office of Chemical Security

CISA Chemical Facility Anti-Terrorism Standards Fact sheet: https://www.cisa.gov/publication/cfats-fact-sheet

Website: https://www.cisa.gov/cfats
Common Citations at Chemical Warehouses and Distribution Facilities

Len Wallace, US EPA Region 1 Inspector
• Failure to account for the chemicals in all containers (including aerosol cans, cylinders, storage tanks, etc.) that could be affected by the same emergency event, such as a fire.

• Failure to file and implement an RMP, often because insufficient inventory facility management systems failed to flag that chemical inventories had exceeded regulatory thresholds.

• Failure to include the entire weight of a flammable mixture with a National Fire Protection Association (NFPA) flammability rating of 4 in threshold calculations, not just the amounts of Risk Management Program listed chemicals.
Common Issues

• Failure to sufficiently coordinate with local emergency responders; local fire departments had safety concerns about some facilities.

• Failure to complete a CISA CFATS Top-Screen, as well as not utilizing predictive filing to determine all reportable chemicals of interest.
Emergency Planning and Community Right to Know Act: Tier II Reporting

• File Tier II Report
  Note: state and local governments may impose lower thresholds
• Tier II Required annually by March 1st for the previous calendar year
  Note: if you bring an Extremely Hazardous Substance (EHS) to facility over threshold for the first time, you will need to report within a shorter timeframe

Tier2 Submit™ software: https://www.epa.gov/epcra/tier2-submit-software

State Tier 2 reporting requirements and procedures:
https://www.epa.gov/epcra/state-tier-ii-reporting-requirements-and-procedures
EPCRA Resources

Tier2 Submit 2021 Software:

State Tier 2 reporting procedures and requirements:

EPCRA Quick Reference Fact Sheet, Fall 2020

Guide to EPCRA, Fall 2020
New England EPCRA Webinars and Videos

• EPCRA Tier2 Submit Software Demonstration for Massachusetts and Connecticut Facilities, February 8, 2022 10:30am-12pm ET

• EPCRA Tier2 Submit Software Demonstration for Maine and Rhode Island Facilities, February 10, 2022 10:30am-12pm ET

• EPCRA Tier2 Submit Software Demonstration for Vermont and New Hampshire Facilities, February 15, 2022 1:30-3pm ET

Four recorded videos from EPA New England below provide detailed information about these requirements for covered facilities.

https://www.epa.gov/epcra/emergency-planning-and-community-right-know-act-epcra-workshops-new-england
Enforcement

- Serious deficiencies found on several Region 1 inspections
- Need a way to improve safety
- Owners are likely to improve the safety of their facilities once they recognize the hazards at their facility

SAFETY ADVISORY
Risks of Improper Storage of Hazardous Chemicals at Chemical Warehouses and Chemical Distribution Facilities

Some chemical warehouse and distribution facilities may be failing to properly manage hazardous chemicals as required by Section 112(r) of the Clean Air Act and the Emergency Planning and Community Right to Know Act (EPCRA) Sections 302, 304, 311, 312 and 313, enforced by the U.S. Environmental Protection Agency (EPA); the Process Safety Management (PSM) standard at 29 CFR § 1910.119, enforced by the Occupational Safety and Health Administration (OSHA); and the Chemical Facility Anti-Terrorism Standards (CFATS) regulation at 6 CFR § 27, and the Maritime Transportation Security Act regulation at 33 CFR §105, enforced by the Cybersecurity and Infrastructure Security Agency (CISA) and United States Coast Guard (USCG) respectively. This advisory informs the industry that companies must ensure that their chemicals are managed safely, secure, and in compliance with EPA, OSHA, CISA and USCG programs to help prevent chemical accidents and security incidents.

Contact Us with any Further Questions

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