Chapter Five

U.S. Regulatory Requirements

Introduction

The manufacture, storage, use and transportation of anhydrous ammonia is subject to several federal, state and local laws, regulations and ordinances. The discussion of every law, regulation and ordinance is beyond the scope of this chapter. Rather, this chapter provides a summary of three categories of federal laws and regulations governing activities involving anhydrous ammonia:

1. Occupational Safety Requirements — These laws impose obligations on employers to ensure the health and safety of employees in the work place. The Occupational Safety and Health Administration (OSHA), within the U.S. Department of Labor, administers most work place requirements. Individual states have the option to administer, enforce, and consult with employers on workplace safety regulations. Those states electing to use this option are called “State Plan States.” Currently, there are 25 States and territories with their own OSHA-approved occupational safety and health plans developed to a comparable standard with final Federal rules. In some cases, state versions of codes and standards have requirements that extend beyond the federal versions.¹

2. Environmental Requirements — These laws impose restrictions on activities that have the potential to impact the public surrounding boundaries of a plant as well as polluting the environment. The U.S. Environmental Protection Agency (EPA) administers most environmental requirements.

3. Transportation Requirements — These laws impose restrictions on the manner in which hazardous materials may be transported within the United States. The U.S. Department of Transportation (DOT) administers most transportation requirements.

There are several caveats to the description of these requirements, as noted below. First, the agencies which administer these laws frequently issue new regulations or modify existing regulations. This chapter does not reflect the changes in the law that occur after publication, thus, the information contained in this document is accurate at the time of publication. Second, the laws and regulations described in this chapter cover literally thousands of pages of the U.S. Code, the Code of Federal Regulations, and the Federal Register, which is the published compilation of all U.S. Government agency published regulations. This chapter summarizes these laws and regulations as they relate to anhydrous ammonia. To gain a complete understanding of a particular requirement, readers are advised to review the statutory language, the regulations and, in some cases, the Federal Register notice promulgating the regulations. Third, and most important, this chapter does not describe any state or local requirements. Readers are advised to review state and local requirements before undertaking any action involving anhydrous ammonia.

¹An example is the Cal-OSHA version of the Process Safety Management program (Title 8 §5189) has requirements that go beyond the federal version of this standard (29 CFR 1910.119).
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Occupational Safety Requirements

Occupational Safety Requirements

The Occupational Safety and Health Act of 1970 is the federal law which requires employers to protect the health and safety of employees in the work place. As noted above, OSHA has been delegated the authority and duty to promulgate standards addressing workplace hazards, including those posed by chemicals such as ammonia.

The following is a brief summary of the OSHA regulations that have special application to workers that can, potentially, be exposed to ammonia.

Storage and Handling of Anhydrous Ammonia (29 CFR 1910.111)

OSHA has promulgated a regulation which establishes standards for the storage and handling of anhydrous ammonia. These requirements are found in 29 C.F.R. § 1910.111 and are analogous to the standards articulated by the American National Standards Institute and Compressed Gas Association in their publication K61.1, American National Standard Safety Requirements for the Storage and Handling of Anhydrous Ammonia. The OSHA regulation, 1910.111, applies to the design, construction, location, installation and operation of anhydrous ammonia systems, including refrigerated ammonia storage systems. This OSHA regulation distinguishes “refrigerated ammonia storage systems” (tanks where ammonia is stored under refrigeration), which are subject to the standard, from ammonia refrigeration systems, which are not covered by the standard. In this regard, the OSHA regulation (1910.111) expressly states that the standard does not apply to “refrigeration plants when ammonia is used solely as a refrigerant.”

The regulations specify, among other things: marking requirements for non-refrigerated and refrigerated containers, storage locations for ammonia containers, specifications for container appurtenances, specifications for piping, tubing, hoses and fittings, specifications for safety relief valves, ammonia system charging protocols and filling densities, and product transfer procedures.

Process Safety Management Regulations

On February 24, 1992, OSHA promulgated the Process Safety Management (PSM) standard, which is designed to protect employees from the risks associated with the accidental release of highly hazardous chemicals. 57 Fed. Reg. 6403. The PSM regulation applies to facilities that have a “process” which involves a highly hazardous chemical at or above the threshold specified in 29 C.F.R. §1910.119, Appendix A, or that have a process which involves a flammable liquid or gas on-site at one location in quantities of 10,000 pounds or more, with certain exceptions. Because the PSM regulations are tied to the quantity of a highly hazardous chemical present in a process, facilities are only required to aggregate the quantity of a highly hazardous chemical present in a single process, instead of facility-wide, to determine whether the facility is subject to the PSM standard. OSHA defines a “process” as:

Any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such chemicals, or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process.

29 C.F.R. § 1910.111(a)(1)(ii)(b)
29 C.F.R. § 1910.119(b). The PSM regulation does not apply to: (1) retail facilities, (2) oil or gas well drilling or service operations, or (3) normally unoccupied remote facilities. 29 C.F.R. § 1910.119(a)(2).

Anhydrous ammonia is a highly hazardous chemical included on the Appendix A list because of its relatively high toxicity and high volatility. **The threshold quantity for anhydrous ammonia in the OSHA PSM regulations is 10,000 pounds. Thus, any facility which handles 10,000 pounds or more of ammonia within a single process, including an ammonia refrigeration system, has to comply with the PSM requirements.**

The major objective of the PSM regulations is to prevent catastrophic release and/or accidents involving highly hazardous chemicals. To meet this objective, the PSM regulations establish a series of programs and procedures to manage the risks inherent in handling these highly hazardous chemicals. Facilities that are required to comply with PSM must:

• Involve their employees in the initial development and on-going maintenance of the PSM program
• Maintain appropriate documentation for the process
• Establish programs to identify, analyze and assess the hazards associated with the process
• Develop written operating, maintenance, and safe work practice procedures for all operations involving the process
• Provide and document adequate training for all employees, including contractor employees, who operate or maintain the process
• Develop a written program to evaluate and manage contractors involved with the covered process
• Conduct pre-start-up safety reviews of systems and plants to insure their design and construction are consistent with process specifications
• Develop and implement programs to insure the on-going mechanical integrity of process equipment
• Implement safe work practices such as hot-work, lockout/tagout, confined-space entry and line opening
• Manage changes to systems to insure all aspects of the program are current and accurate
• Investigate all incidents which resulted in, or could reasonably have resulted in, a catastrophic release
• Have an emergency action plan or an emergency response plan describing specific activities during releases of hazardous chemicals
• Have provisions for regular audits to ensure that the PSM regulations are being followed, and
• Employers also have the option to utilize a provision of the standard aimed to protect trade secrets.

The following sections summarize each of these 14 PSM Elements.
Facilities subject to the PSM requirements must maintain documentation that accurately and completely describes the process. 29 C.F.R. § 1910.119(d). To this end, the facility should assemble the following information concerning the chemical:

- Toxicity information
- Permissible exposure limits
- Physical data
- Reactivity data
- Corrosivity data
- Thermal and chemical stability data, and
- Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.


In addition, the facility should assemble the following information concerning the process that utilizes the chemical:

- Piping and instrumentation diagrams (P&IDs)
- Block flow diagrams or simplified process flow diagrams (PFDs)
- Equipment lists and specifications
- Inventory and operating limitations
- Relief system design and design basis
- Ventilation system design, and


Facilities subject to PSM requirements must conduct a “hazard analysis” on covered processes. 29 C.F.R. § 1910.119(e). The objective of the hazard analysis is to identify hazards and/or operability problems which could result in an accident causing injuries, equipment damage or environmental damage through the unplanned and uncontrolled release of highly hazardous chemicals. The information obtained during the hazard analysis should be used to develop recommendations for design or operational changes to reduce risk at the facility. The hazard analysis must be repeated whenever a change is made to a covered process or prior to 60 months since the previous hazard analysis. 29 C.F.R. § 1910.119(e)(6).

A variety of hazard analysis techniques are available and are considered acceptable by OSHA. The hazard analysis techniques typically used for ammonia refrigeration facilities are the “What-if” method, the Checklist method, and the What-if/Checklist method. These techniques are described fully in the IIAR Guide to the Implementation of Process Safety Management (PSM) for Ammonia Refrigeration Facilities.

Facilities subject to PSM requirements must develop written operation and maintenance procedures that detail the procedures used to operate, maintain, and inspect each covered process. 29 C.F.R. § 1910.119(f). These procedures should cover all phases of operation at the facility, including start-up and shutdown, and should be readily accessible to employees. The need for safe work practices (i.e., lockout/tagout, confined space entry, opening process equipment or piping, hot work permits, and control over the entrance into the facility) should be included. The written operation and maintenance procedures should be reviewed on a periodic basis so they can be updated to reflect changes to the equipment or to the operating conditions.
Operator Training

The primary objective of the operator training program is to provide high-level, uniform training for personnel who operate and maintain processes which contain or use highly hazardous chemicals (such as ammonia). 29 C.F.R. § 1910.119(g) and (j). The program should include initial training on the overall safety practices and procedures at the facility, and classroom and on-the-job training specific to the process. In addition, training should include maintenance to ensure the ongoing integrity of the process equipment. The specific procedures used to qualify engineers and the qualifications for those conducting the training should be specified in the training program. Once qualified, engineers should receive periodic refresher training — at least once every three years. All training sessions should be documented. 29 C.F.R. § 1910.119(g)(2).

Contractor Training

The PSM regulations also specify requirements applicable to contractors. When selecting a contractor, the employer must “obtain and evaluate information regarding the contract employer’s safety performance and programs.” 29 C.F.R. § 1910.119(h)(2).

Work by outside contractors on covered processes should be performed in accordance with the accepted safety practices and procedures at the facility. 29 C.F.R. § 1910.119(h)(2). Facilities must ensure that contractors have received training in these practices and procedures. Also, employers must evaluate the contractor’s safety training program for his employees.

Mechanical Integrity

For certain designated types of process equipment, the PSM regulations require:

1. documented written procedures to ensure the ongoing integrity of the equipment;
2. employee training in the maintenance of the equipment;
3. documented periodic equipment testing; and

The following types of process equipment are subject to these four requirements:

- Pressure vessels and storage tanks
- Piping systems (including piping components such as valves)
- Relief and vent systems and devices
- Emergency shutdown systems
- Controls (including monitoring devices and sensors, doors, or interlocks), and
- Pumps.

Incident Investigations

Facilities subject to PSM requirements must have written procedures for investigating and documenting incidents involving a highly hazardous chemical, especially those which result in, or could reasonably have resulted in, a catastrophic release. 29 C.F.R. § 1910.119(m). The primary objectives of the incident investigations are to systematically examine the facts and circumstances surrounding the incident, determine the basic causes, and develop a corrective action plan to prevent the reoccurrence of the same or similar incidents. Investigations should be conducted in a timely fashion, typically within 24 to 48 hours of the incident, and the incident investigation team should consist of at least one person knowledgeable in the particular process(es). At the conclusion of the investigation, an incident report should be prepared and circulated to all members of the investigation team before it is formally issued to ensure that the team agrees with its conclusions. Facilities should also develop a formal system to ensure that all recommendations resulting from incident investigations are implemented. The facility must retain the incident report in its records for five years. 29 C.F.R. § 1910.119(m)(7).
Emergency Response Procedures

Under the PSM regulations, subject facilities must have an emergency action plan describing the procedures to follow during emergency events, including ammonia releases. 29 C.F.R. § 1910.119(n). The requirements for the emergency action plan must be written if there are more than ten employees. The emergency action plan should include an evacuation plan, an emergency notification plan, response procedures, and a training program.3

Audit Programs

Facilities subject to PSM requirements must conduct periodic audits (at least once every three years) to assess compliance with all aspects of the PSM program. 29 C.F.R. § 1910.119(o). The findings of the audit should be summarized in a report, and there should be a follow-up system designed to ensure that the audit recommendations are implemented. A facility must maintain copies of the two most recent audit reports in facility files. 29 C.F.R. § 1910.119(o)(5).

Hazardous Waste Operations and Emergency Response

On March 6, 1989, OSHA promulgated the HAZWOPER rule. 54 Fed. Reg. 9317. HAZWOPER requires employers to develop and implement procedures to protect the health and safety of employees involved in certain hazardous waste cleanup operations or emergency response operations for releases of hazardous substances listed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Ammonia is a CERCLA hazardous substance; thus, IIAR members must conform to the HAZWOPER requirements when responding to ammonia releases.

Under HAZWOPER, employers that expect their employees to respond offensively to mitigate releases of ammonia/Appendix A covered substances must assure that employees responding to releases of CERCLA hazardous substances comply with 29 C.F.R. § 1910.120(q). In this regard, employers must:

• Develop a written emergency response plan
• Develop communication procedures for emergency response situations
• Provide training in response to emergencies involving hazardous substances, and
• Conduct medical surveillance of employees who are part of an organized and designated hazardous materials (HAZMAT) team.

Each of these requirements are briefly discussed below.5

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3 Facilities that respond directly to a release may also be required to develop an emergency response plan pursuant to the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard. The components of the emergency response plan are described in the next section of this chapter.

4 Specifically: (1) government-ordered clean-up operations involving hazardous substances at uncontrolled hazardous waste sites, (2) corrective actions involving clean-up operations at sites covered by RCRA, (3) voluntary clean-up operations at sites covered by RCRA, or (4) operations involving hazardous wastes that are conducted at treatment, storage, and disposal facilities.

5 The HAZWOPER requirements for responding to an ammonia release have been summarized by Industrial Consultants in their Ammonia Readiness Lecture Manual (1989), excerpts of which are set forth herein.
Emergency Response Plan

Prior to commencing any emergency response operations, employers subject to section 1910.120(q) must develop and implement an Emergency Response Plan (ERP). 29 C.F.R. § 1910.120(q)(1). This plan must be in writing and available for inspection and copying by employees, their representatives and OSHA personnel. (The ERP is far more detailed than the “Emergency Response Procedures,” which facilities must develop under the PSM requirements, described above.)

At a minimum, the ERP must address the following:

• Pre-emergency planning and coordination with outside parties
• Personnel roles, lines of authority, training, and communications
• Emergency recognition and prevention
• Safe distances and places of refuge
• Site security and control
• Evacuation routes and procedures
• Decontamination procedures
• Emergency medical treatment and first aid procedures
• Emergency alerting and response procedures
• Mechanisms for the critique of response and follow up activities, and
• Proper personal protective clothing and emergency equipment.

29 C.F.R. § 1910.120(q)(2).

Employers who would evacuate employees from the workplace when an emergency occurs and do not permit any employees to assist in handling the emergency are exempt from preparing an ERP (if they provide an emergency action plan in accordance with 29 C.F.R. § 1910.38).

Communication Procedures for Emergency Response

The employer must also establish procedures for communication among and between emergency response personnel. All emergency responders and their communications must be coordinated through a senior emergency response official in charge of a site-specific Incident Command System (ICS). 29 C.F.R. § 1910.120(q)(3). The senior emergency response official responsible for responding to the emergency is designated as the Incident Commander (IC).

When responding to an emergency, the IC initially must: (1) identify the hazardous substances or conditions present, (2) determine the types of controls to implement, (3) evaluate the maximum exposure limits, and (4) develop and implement the hazardous substance handling procedures to be employed. Based on the IC’s findings, the IC will implement appropriate emergency operations utilizing trained personnel, and assure that the personal protective equipment (PPE) worn is appropriate for the hazard to be encountered.

Training Requirements

Employees who work with and are trained in the hazards of specific hazardous substances and who will provide technical advice or assistance during a hazardous substance release must receive annual training or demonstrate annual competency in their area of specialization. 29 C.F.R. § 1910.120(q). Training must be based on the duties and functions to be performed by each responder of the emergency response team. 29 C.F.R. § 1910.120(q)(6). The skill and knowledge levels required for all new responders (i.e., those hired after the effective date of the standard) must be conveyed to them through training before they are permitted to take part in actual emergency operations.
Employees expected to participate in emergency response operations or plans shall be given training in accordance with the requirements of the following five training levels:

- First Responder — Awareness Level
- First Responder — Operations Level
- Hazardous Materials Technician
- Hazardous Materials Specialist
- Incident Commander

Following is a summary of the training requirements for each level.

**First Responder — Awareness Level**

These are employees who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. 29 C.F.R. § 1910.120(q)(6)(i). These individuals are not expected to take any further action in responding to the emergency.

An employee assigned to the First Responder — Awareness Level must receive training and demonstrate competency in the following areas:

- Understanding what hazardous substances are, and the risk associated with them in an incident
- Understanding the potential outcomes associated with an emergency created when hazardous substances are present
- Recognizing the presence of hazardous substances, if possible
- Understanding their role in emergency response, and
- Recognizing the need for additional resources and making appropriate notifications, as necessary.

29 C.F.R. § 1910.120(q)(6)(i).

**First Responder — Operations Level**

These are individuals that respond to releases or potential releases of hazardous substances as part of the initial response for the purpose of protecting nearby persons, property, or the environment from the effects of the release. 29 C.F.R. § 1910.120(q)(6)(ii). They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures.

First Responders at this level must receive at least eight hours of training or have sufficient experience to objectively demonstrate competency in the following areas (in addition to those listed above for the Awareness Level):

- Understanding basic hazard and risk assessment techniques
- Selecting and using proper Personal Protective Equipment (PPE)
- Understanding basic hazardous materials terms
- Performing basic control, containment and/or confinement operations within the capabilities of the resources and PPE available
- Understanding how to implement basic decontamination procedures, and
- Understanding the relevant standard operating procedures and termination procedures.

29 C.F.R. § 1910.120(q)(6)(ii).

The employer must certify and document the first responders’ competency in the above mentioned areas.
**Hazardous Materials Technician**

These individuals respond to releases or potential releases for the purpose of stopping the release. 29 C.F.R. § 1910.120(q)(6)(iii). They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

Hazardous Materials Technicians must have competency in the previously mentioned areas for first responders and, in addition, receive 24 hours of training in the following areas:

- Implementing the employer’s emergency response plan
- Understanding the classification, identification and verification of known and unknown materials by using field survey instruments and equipment
- Functioning within an assigned role in the ICS
- Selecting and using proper specialized chemical PPE
- Understanding hazard and risk assessment techniques
- Performing advanced control, containment, and/or confinement operations within the capabilities of the resources and PPE available
- Understanding and implementing decontamination procedures
- Understanding termination procedures, and
- Understanding basic chemical and toxicological terminology and behavior.

29 C.F.R. § 1910.120(q)(6)(iii)

The employer must certify and document the employee’s competency with the above mentioned training requirements.

**Hazardous Materials Specialist**

These individuals respond with, and provide support to Hazardous Materials Technicians. 29 C.F.R. § 1910.120(q)(6)(iv). The duties of a Hazardous Materials Specialist are similar to those of the Hazardous Materials Technician, but require more knowledge regarding the various substances that they may be called upon to contain and manage. The Hazardous Materials Specialist may also act as the site liaison with federal, state, local and other government authorities with respect to site activities.

Hazardous Materials Specialists must receive at least 24 hours of training equal to the technician level and, in addition, have competency in the following areas:

- Implementing the local emergency response plan
- Understanding the classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment
- Understanding the state emergency response plan
- Selecting and using proper specialized chemical PPE provided to the hazardous materials specialist
- Understanding in-depth hazard and risk techniques
- Performing specialized control, containment, and/or confinement operations within the capabilities of the resources and PPE available
- Determining and implementing decontamination procedures
- Developing a site safety and control plan, and
- Understanding chemical, radiological and toxicological terminology and behavior.

29 C.F.R. § 1910.120(q)(6)(iv)

The employer must certify and document the employee’s understanding of the above mentioned requirements.
Incident Commander

As previously mentioned, the IC is the senior emergency responder official responsible for responding to the emergency. An IC must receive training at least equal to that of the first responder — awareness level. If the IC will perform functions beyond this level, then the IC must receive at least 24 hours of training equal to the first responder operations level and, in addition, have competency in the following activities:

- Implementing the employer’s incident command plan
- Implementing the employer’s ERP
- Knowing and understanding the hazards and risks associated with employees working in chemical protective clothing
- Implementing the local emergency response plan
- Familiarity with the state emergency response plan and the Federal Regional Response Team, and
- Understanding the importance of decontamination procedures.

29 C.F.R. § 1910.120(q)(6)(v)

The employer must certify and document the employee’s competency with the above mentioned training requirements.

Refresher Training

Those employees trained in the above-mentioned activities must receive annual refresher training of sufficient content and duration to maintain their competencies, or must demonstrate competency in those areas at least annually. 29 C.F.R. § 1910.120(q)(8).

A statement of competency must be prepared and maintained at the facility.

Medical Surveillance

Members of the Response Team and Hazardous Materials Specialists must receive a baseline physical examination and be provided with medical surveillance on a routine basis.

Confined Space Regulation

The confined space regulation requires employers to implement practices and procedures to protect employees from hazards associated with entry into confined spaces. A “confined space” is defined as a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work
2. Has a limited or restricted means of entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry), and
3. Is not designed for continuous employee occupancy.

29 C.F.R. § 1910.146(b)

Employers which have confined spaces in the work place must determine if any of the confined spaces are “permit required confined spaces.” 29 C.F.R. § 1910.146(c). A permit required confined space (PRCS) is a confined space having one or more of the following characteristics:

1. contains or has a potential to contain a hazardous atmosphere
2. contains a material that has the potential for engulfing an entrant
3. has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section, or
4. contains any other recognized serious safety or health hazard.

29 C.F.R. § 1910.146(b)

If the work place contains a PRCS, the following requirements apply:
Inform Exposed Employees

The employer must inform employees of the existence and location of the PRCS. Signs containing the words “DANGER — PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER” or other “equally effective means” may be used. 29 C.F.R. § 1910.146(c).

For a No-Entry PRCS

The employer must determine whether or not employees will be required to enter the confined space. If there is no requirement for entry by employees into the PRCS, the employer must: (1) implement measures to prevent employees from entering the space, (2) comply with the portion of the standard dealing with evaluation and posting of the location as a PRCS, and (3) reevaluate any non-permit required confined spaces, if there is any change in the use of the location. 29 C.F.R. § 910.146(c)(3).

If the PRCS Is Entered

If the employer concludes that employees will enter the PRCS, then the employer must develop a written PRCS program. 29 C.F.R. § 1910.146(c)(4). This program must describe the actions taken to control access to, and protect employees from, PRCS hazards.

For a “Hazardous Atmosphere” PRCS

If the employer can demonstrate that the only hazard posed by the PRCS is an actual or potentially hazardous atmosphere, then the employer need not prepare a PRCS program. 29 C.F.R. § 1910.146(c)(5)(i). In such a circumstance, the employer must demonstrate that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry and have monitoring and inspection data to support this decision. Id.

For entries into an actual or potentially hazardous atmosphere, any conditions that make it unsafe to remove an entrance cover to the PRCS must be eliminated before the cover is removed. 29 C.F.R. § 1910.146(c)(5)(ii). Further, once the entrance cover is removed, the opening must be guarded by a railing or other barrier. Before an employee may enter the PRCS, the internal atmosphere must be tested with a calibrated direct reading instrument to determine oxygen content, flammable gases and vapors and potentially toxic air contaminants.

There must not be a hazardous atmosphere within the PRCS whenever any employee enters or is in the PRCS. 29 C.F.R. § 1910.146(c)(5)(ii)(E). Continuous forced air ventilation must be used and the atmosphere must be periodically tested. 29 C.F.R. § 1910.146(c)(5)(ii)(F). If a hazardous atmosphere is detected during entry, employees are required to leave the PRCS immediately and the PRCS must be evaluated to determine how the hazardous atmosphere developed and what measures must be taken to protect the employees from the hazardous atmosphere. 29 C.F.R. § 1910.146(c)(5)(ii)(G). The employer is also required to verify that the PRCS is safe for entry, and that required pre-entry measures have been taken, through a written certification that contains the date, location of the space and the signature of the person providing the classification. Id.

It is important to remember that if a PRCS poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the PRCS may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated. OSHA, however, has stated that control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazard.
Training

Employers must provide training to each employee required to enter the PRCS before the employee has his first assigned duties, before there is a change in assigned duties and whenever there is a change in PRCS operations that present a new hazard. 29 C.F.R. § 1910.146(g)(2). In addition, there is a requirement that training be given whenever an employer has reason to believe that there are deviations from the PRCS entry procedures, where applicable by the standard or when there are inadequacies in the employee’s knowledge or use of the procedures. Id. The training must establish employee proficiency in the duties required by the PRCS standard and also introduce new or revised procedures as necessary for complete compliance. 29 C.F.R. § 1910.146(g)(3).

Certification

Employers must certify that employees have received the required training. 29 C.F.R. § 1910.146(g)(4). The certification itself must contain each employee’s name, the signatures or the initials of the trainers and the dates the training was given. Id. This certification must be made available for inspection by employees and their authorized representatives.

Rescue Requirements

Employees that may be called upon to conduct a rescue in a PRCS must: (1) be trained to use PPE and the appropriate rescue equipment; (2) be trained on their role in the rescue operation; (3) participate in annual simulated permit confined space rescues; and (4) be trained in basic first-aid and cardiopulmonary resuscitation (CPR). 29 C.F.R. § 1910.146(k)(1). Further, at least one member of the rescue team must hold current certification in first aid and CPR. For rescues by non-employees, the employer must: (1) inform the rescue service of the hazards that they may confront, and (2) provide the rescue service with access to all permit spaces from which a rescue may be required for planning purposes. 29 C.F.R. § 1910.146(k)(2).

OSHA has published a flowchart for the permit required confined space requirements, which is shown in Figure 5-1.
FIGURE 5-1 Permit-Required Confined Space Decision Flow Chart

Does the workplace contain PRCS as defined by § 1910.146(b)?

YES

Inform employees as required by § 1910.146(c)(2).

NO

Will permit space be entered?

YES

Prevent employee entry as required by § 1910.146(c)(3). Do task from outside of space.

NO

Task will be done by contractor’s employees. Inform contractor as required by § 1910.146(c)(8)(i), (ii) and (iii). Contractor obtains information required by § 1910.146(c)(9)(i), (ii) and (iii) from host.

YES

Both contractors and host employees will enter the space.

NO

Coordinate entry operations as required by § 1910.146(c)(8)(iv) and (d)(11). Prevent unauthorized entry.

YES

Prevent unauthorized entry.

NO

STOP

STOP

Does space have known or potential hazards?

YES

Can the hazards be eliminated?

NO

Can the space be maintained in a condition safe to enter by continuous force air ventilation only?

NO

Prepare for entry via permit procedures.

YES

Verify acceptable entry conditions (Test results recorded, space isolated if needed, rescuers/means to summon available, entrants properly equipped, etc.)

NO

Emergency exists (prohibited condition). Entrants evacuated, entry is aborted. (Call rescuers if needed.) Permit is void. Reevaluate program to correct/prevent prohibited condition. Occurrence of emergency (usually) is proof of deficient program. No re-entry until program (and permit) is amended. (May require new program.)

YES

PERMIT ISSUED BY AUTHORIZING SIGNATURE. ACCEPTABLE ENTRY CONDITIONS MAINTAINED THROUGHOUT ENTRY.

NO

Entry tasks completed. Permit returned and canceled.

Audit permit program and permit based on evaluation of entry by entrants, attendants, testers and preparers, etc.

STOP

STOP

NO

Permit not valid until conditions meet permit applications.

STOP

Space may be entered under § 1910.146(c)(5).

YES

Employer may choose to reclassify space to non-permit required confined space using § 1910.146(c)(7).

YES

Space may be entered under § 1910.146(c)(5).

NO

Coordinate entry operations as required by § 1910.146(c)(8)(iv) and (d)(11). Prevent unauthorized entry.

YES

Prevent unauthorized entry.

NO

STOP

STOP

NO

Not a PRCS. 1910.146 does not apply. Consult other OSHA standards.

STOP

STOP

YES

Can the space be maintained in a condition safe to enter by continuous force air ventilation only?

NO

Prepare for entry via permit procedures.

YES

Verify acceptable entry conditions (Test results recorded, space isolated if needed, rescuers/means to summon available, entrants properly equipped, etc.)

NO

Emergency exists (prohibited condition). Entrants evacuated, entry is aborted. (Call rescuers if needed.) Permit is void. Reevaluate program to correct/prevent prohibited condition. Occurrence of emergency (usually) is proof of deficient program. No re-entry until program (and permit) is amended. (May require new program.)

CONTINUE

Space may have to be evacuated and re-evaluated if hazards arise during entry.
Hazard Communication Standard

The OSHA Hazard Communication Standard (29 C.F.R. § 1910.1200) requires employers to inform their employees about the hazards associated with “hazardous chemicals” that they might encounter in the conduct of their job. A “hazardous chemical” is defined as “any chemical which is a physical hazard or a health hazard.” 29 C.F.R. § 1910.1200(c). A “physical hazard” is defined as “a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.” Id. A “health hazard” is defined as “a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees.” Id. Ammonia is a hazardous chemical because it poses a “health hazard.”

Employers must inform employees of the hazard posed by hazardous chemicals through container labeling and material safety data sheets (MSDSs). In addition, employers must establish a hazard communication program, pursuant to which employees receive training concerning the labels and MSDSs for hazardous chemicals. Information needed for the ammonia MSDS is provided in Chapter 4 — Ammonia Safety Data.

Lockout/Tagout Requirements

On September 1, 1989, OSHA promulgated its “lockout/tagout” standard. 54 Fed. Reg. 36,687 (codified at 29 C.F.R. § 1910.147). The standard requires employers to establish procedures to safeguard employees from the unexpected startup of machinery or equipment or release of hazardous energy while they are performing servicing or maintenance. The mechanisms identified in the standard to protect employees from these hazards are the so-called “lockout” and “tagout.” A lockout refers to the placement of a device, such as a lock on a circuit breaker, that prevents the transmission of energy to a piece of equipment that is being serviced. A “tagout” refers to the placement of a prominent warning, such as a tag on a circuit breaker, to inform employees that a piece of equipment is being serviced and that the equipment cannot be operated until the tagout device is removed.

The lockout/tagout standard identifies the practices and procedures necessary to shut down and lockout or tagout machines and equipment. In addition, the standard requires employers to: (1) develop written energy control procedures, which specify the lockout/tagout devices utilized in the work place, (2) train employees in their role in the lockout/tagout program, and (3) perform periodic inspections to maintain or enhance the energy control procedures. Each of these requirements are discussed below.

Energy Control Procedures

The employer must develop and implement written energy control procedures to control potentially hazardous energy whenever employees perform activities covered by the standard. 29 C.F.R. § 1910.147(c)(4). The written procedures must explain how to control hazardous energy during servicing or maintenance activities. If this information is the same for various machines or equipment or if other means of logical grouping exists, then a single energy control procedure may be sufficient. If there are other conditions — such as multiple energy sources, different connecting means, or a particular sequence that must be followed to shut down the machine or equipment — then the employer must develop separate energy control procedures.
The energy control procedure must outline the scope, purpose, authorization, rules, and techniques that will be used to control hazardous energy sources as well as the means that will be used to enforce compliance. At a minimum, it must include the following elements:

- A statement on how the procedure will be used
- The procedural steps needed to shut down, isolate, block, and secure machines or equipment
- The steps designating the safe placement, removal, and transfer of the lockout/tagout and who has the responsibility for them, and
- The specific requirements for testing machines or equipment to determine and verify the effectiveness of locks, tags, and other energy control measures.

29 C.F.R. § 1910.147(c)(4).

In addition, before lockout or tagout devices are removed and energy is restored to the machines or equipment, certain steps must be taken to reenergize equipment after servicing is completed, including: (1) ensuring that machines or equipment components are operationally intact, (2) ensuring that all employees are safely positioned or removed from equipment, and (3) ensuring that lockout or tagout devices are removed from each energy-isolating device by the employee who applied the device.

**Employee Training**

The employer must provide training and retraining as necessary and must certify that such training has been given to all employees covered by the lockout/tagout standard. 29 C.F.R. § 1910.147(c)(7). The certification must contain each employee’s name and date of training.

The amount and kind of training that each employee receives is based upon the relationship of that employee’s job to the machine or equipment being locked or tagged out, and the degree of knowledge relevant to hazardous energy that he or she must possess. In this regard, “authorized employees” (those who are charged with the responsibility for implementing the energy control procedures and performing the servicing or maintenance) must receive training that covers, at a minimum, the following areas:

- recognition of applicable hazardous energy sources
- details about the type and magnitude of hazardous energy sources present in the workplace, and
- the methods and means necessary to isolate and control those energy sources (i.e., the elements of the energy control procedures).

29 C.F.R. § 1910.147(c)(7)(A)

By contrast, “affected employees” (usually the machine operators or users) and all other employees need only receive training to be able to: (1) recognize when the control procedure is being implemented, and (2) understand the purpose of the procedure and the importance of not attempting to start up or use the equipment that has been locked or tagged out. 29 C.F.R. § 1910.147(c)(7)(B), (C).

Retraining must be provided whenever there is a change in job assignments, a change in machines, equipment or processes that present a new hazard, or a change in energy control procedures. 29 C.F.R. § 1910.147(c)(7)(iii)(A). Additional retraining must be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe, that there are deviations from, or inadequacies in, the employee’s knowledge or use of the energy control procedure. 29 C.F.R. § 1910.147(c)(7)(iii)(B).
Periodic Inspections

An inspection of each energy control procedure must be performed at least annually to assure that such procedures continue to be implemented properly and that the employees are familiar with their responsibilities under those procedures. 29 C.F.R. § 1910.147(c)(6). The inspection must be performed by an authorized employee other than the one(s) using the energy control procedure. The employer must certify that the inspection has been performed and correct any deviations or inadequacies observed during the inspection. The certification must identify the machine or equipment on which the energy control procedure was used, the date of the inspection, the employees included in the inspection, and the name of the person performing the inspection. 29 C.F.R. § 1910.147(c)(6)(i)(D).

For a lockout procedure, the inspection must include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected. 29 C.F.R. § 1910.147(c)(6)(i)(C). When a tagout procedure is inspected, a review on the limitation of tags, in addition to the above requirements, must also be included with each affected and authorized employee. 29 C.F.R. § 1910.147(c)(b)(i)(D).

Permissible Exposure Limit for Ammonia

In 1971, OSHA promulgated permissible exposure limits (PELs) for 425 air contaminants, including ammonia. PELs reflect the maximum amount of contaminants in air to which workers may be exposed over a given time period. The PEL for ammonia is 50 ppm. 29 C.F.R. § 1910.1000, Table Z-1.

To achieve compliance with a PEL, an employer must identify and implement administrative or engineering controls where feasible. If such controls are not feasible, employers may use personal protective equipment (PPE), such as respirators. Although OSHA had at one time attempted to revise these PELs, legal challenges derailed OSHA's action. Thus, the PEL for ammonia remains 50 ppm.\(^6\)

Apart from OSHA, NIOSH has established recommended exposure limits (REL) for anhydrous ammonia. The recommended exposure limit for ammonia on an eight hour time-weighted average (TWA) is 25 ppm and the short-term exposure limit (STEL) is 35 ppm (NIOSH Pocket Guide to Chemical Hazards, September 2005). See Chapter 4 of this Data Book for more information on human exposure to ammonia.

Immediately Dangerous to Life and Health (IDLH) Concentration

NIOSH defines the concentration that is immediately dangerous to life and health as: the “conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health (NIOSH Respirator Selection Logic, September 2004).” The IDLH concentration for ammonia is 300 ppm. See Chapter 4 of this Data Book for more information on human exposure to ammonia.

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\(^6\) See *AFL-CIO v. OSHA*, 965 F.2d 962 (11th Cir. 1992), in which the court found that OSHA had not "sufficiently explained or supported" the basis for modifying the PELs and, therefore, vacated and remanded the rule.
Environmental Requirements

The handling of ammonia is subject to a number of federal environmental laws and regulations, most of which are administered by EPA. Following is a brief summary of these environmental laws and regulations.

Emergency Release Reporting Requirements

Spills or “releases” of ammonia into the environment are potentially subject to a number of different emergency notification requirements. To determine whether a particular reporting requirement applies to a release, one must usually consider three factors: (1) the type of material released, (2) the amount of material released, and (3) the nature and extent of the release. Each of the various laws imposing a reporting obligation set different criteria under the three factors. Additionally, the agency to which the report must be made and the form of notice vary from law to law. Anhydrous ammonia appears on several of the lists of chemicals subject to release reporting under various federal laws.

Section 103(a) of CERCLA

Under § 103(a) of CERCLA, a release from a facility of a hazardous substance in a reportable quantity (RQ) must be reported immediately to the National Response Center (NRC) by the person in charge of the facility.7 The list of hazardous substances subject to CERCLA reporting, as well as the RQ for each listed hazardous substance, is set forth in the table at 40 C.F.R. § 302.4. Ammonia is included on this list with an RQ of 100 pounds.8

There are many complexities in determining whether a release is reportable, but the aspect of the CERCLA reporting requirement most relevant to ammonia end-users relates to unplanned releases of ammonia. A release of a hazardous substance is considered “reportable” only if it exceeds the RQ during a rolling 24-hour period. To illustrate the point, a slow leak that released four pounds of ammonia per hour would not be reportable under CERCLA because only 96 pounds would be released in a 24-hour period. By contrast, a leak of five pounds of ammonia per hour would be subject to the CERCLA reporting requirement because 120 lbs. would be released within a 24-hour period, which exceeds the 100 lb RQ.

Section 304(a) of EPCRA

The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) establishes a series of reporting requirements designated to inform the public about the nature of chemicals used by industries and the amount of such chemicals released into the environment. One of the EPCRA reporting requirements, § 304(a), is an emergency release notification provision, which is similar in many respects to CERCLA 103(a).9

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7 The telephone number for the NRC is (800) 424-8802.
8 The Clean Water Act imposes a similar reporting requirement. Under § 315(b)(5) of the Clean Water Act, a release of an RQ of a hazardous substance into waters of the United States must be reported immediately to the National Response Center. Compliance with the notification requirements under CERCLA § 103(a) would discharge any reporting obligation under the § 311(b) (5) of the Clean Water Act.
9 The other EPCRA reporting requirements do not concern emergency incident notification. These “routine” EPCRA reporting requirements are discussed later in this section of the chapter.
EPCRA § 304 applies to releases of both CERCLA hazardous substances and “extremely hazardous substances” (listed in 40 C.F.R. § 355, App. A). A release of either type of substance in excess of the RQ for such substances must be reported immediately by the owner or operator of the facility to the State Emergency Response Commission (SERC), the Local Emergency Planning Committee (LEPC) with jurisdiction over the facility, and the local fire department. As soon as practicable after such oral notification, the owner or operator of the facility must follow up with a written report to the SERC, LEPC and local fire department which describes the actions taken to respond to the release, any known or anticipated acute or chronic health risks associated with the release and, when appropriate, medical advice on treating individuals exposed to the substance.

One of the principal distinctions between CERCLA § 103(a) and EPCRA § 304(a) is that there is an exemption under EPCRA § 304(a) for a release which “results in exposure to persons solely within the boundaries of the facility.” 40 C.F.R. § 355.40(a)(2)(i). However, given the volatility of ammonia, this exemption would rarely apply to ammonia releases.

As previously mentioned, ammonia is a CERCLA hazardous substance with an RQ of 100 pounds, and is also an extremely hazardous substance with an RQ of 100 pounds. Thus, releases of 100 pounds or more of ammonia must be immediately reported: (1) to the NRC, pursuant to CERCLA § 103(a), and (2) to the SERC, LEPC and the local fire department, pursuant to EPCRA § 304(a).

**Emergency Incident Reporting Under HMTA**

Certain transportation-related releases of ammonia are subject to reporting requirements under the Hazardous Materials Transportation Act (HMTA). Specifically, a release of ammonia during transportation must be reported to the Research and Special Programs Administration (RSPA) if the release causes: (1) death; (2) injuries requiring hospitalization; (3) estimated carrier or property damage exceeding $50,000; (4) an evacuation of the general public lasting at least one hour; (5) one or more transportation arteries to shut down for at least one hour; or (6) the alteration of an aircraft’s operational flight pattern or routine. 49 C.F.R. § 171.15(a). Notice must be provided to RSPA at the earliest “practicable” moment at (800)424-8802 and the notice must include the following information: (1) name of the reporter, (2) name and address of the carrier, (3) telephone number of the reporter, (4) date, time and location of the incident, (5) the extent of injuries, if any, (6) classification, name and quantity of hazardous materials involved, if any, and (7) type of incident and nature of hazardous material involvement and whether a continuing danger to life exists at the scene. 49 C.F.R. § 171.15(b).

Within 30 days of the date of discovery, RSPA requires written notification of a release meeting any of the above mentioned criteria or when there has been any unintentional release of hazardous materials from a package. 49aC.F.R. § 171.16(a). The notification should be described on DOT Form F 5800.1. Id.

**EPCRA Routine Reporting Program**

There are a number of routine reporting requirements under EPCRA, which are intended to provide federal, state and local response agencies with the information necessary to respond to chemical incidents. Also, this information provides the public with information about the quantities of materials being stored, used and released at neighboring facilities.
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EPCRA §§ 302 and 303 — Emergency Planning

The EPCRA emergency planning provisions (EPCRA §§302 and 303) require facilities that handle specified quantities of listed “extremely hazardous substances” to undertake a variety of emergency planning activities in conjunction with other industrial facilities and the fire department in their community. EPA has promulgated a list of extremely hazardous substances and a threshold planning quantity (TPQ) for each listed substance (40 C.F.R. Part 355, App. A). Ammonia is an extremely hazardous substance with a TPQ of 500 pounds.

By May 17, 1987, facilities that exceeded, or equaled, the TPQ of an extremely hazardous substance at any time during the prior year were required to notify the SERC of that fact and participate in community emergency planning. 40 C.F.R. § 355.30(b). Any facility that qualifies after this date (i.e., handles an extremely hazardous substance in an amount greater than, or equal to, the applicable TPQ) must notify the SERC and LEPC within 60 days of exceeding the threshold. Id. In addition, facilities have a continuing obligation to notify the LEPC of any changes occurring at the facility which may be relevant to emergency planning. 40 C.F.R. § 355.40(d).

EPCRA § 311 — MSDS Reporting

Under EPCRA § 311, any facility required to prepare or have available a MSDS for a “hazardous chemical,” pursuant to the OSHA Hazard Communication standard, must submit a copy of the MSDSs for such chemicals to state and local authorities where certain minimum quantities of such chemicals are handled. Specifically, if 10,000 pounds or greater of any OSHA hazardous chemical is present at the facility at any one time, an MSDS for that hazardous chemical, or a list of such chemicals, must be submitted to the SERC, LEPC, and local fire department. 40 C.F.R. § 370.20(b)(1).

If the chemical is an “extremely hazardous substance,” the reporting threshold drops to 500 pounds. 40 C.F.R. § 370.20(b)(1). As previously mentioned, ammonia is an extremely hazardous substance and, thus, facilities handling in excess of 500 pounds are subject to EPCRA § 311. Affected facilities were required to comply with these requirements by October 17, 1987; a facility that exceeds a reporting threshold after this date must submit the MSDS within three months of exceeding the threshold. 40 C.F.R. § 370.21(c)(2).

EPCRA § 312 — Inventory Reporting

Under EPCRA § 312, facilities that are required to submit a MSDS for hazardous chemicals under EPCRA § 311 must also submit an annual inventory report for each such chemical to the SERC, LEPC, and local fire department by March 1 of the following year. 40 C.F.R. § 370.20(b)(2). Generally, facilities can comply with this requirement by completing a “Tier I” report which provides information regarding the maximum and average daily amount, and location, of hazardous chemicals by “hazard categories.” 40 C.F.R. § 370.25(a). Also, the SERC, LEPC, or local fire department may request the more detailed chemical-specific “Tier II” report, in which case a facility must comply with the request within 30 days. 40 C.F.R. § 370.25(c).
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EPCRA § 313 — Toxic Chemical Release Reporting

EPCRA § 313 is an annual reporting requirement that applies to facilities that: (1) have ten or more full-time employees; (2) fall within standard industrial classification (SIC) codes 20 through 39; and (3) “manufacture,” “process” or “otherwise use” a “toxic chemical” in excess of specified thresholds. See 40 C.F.R. Part 372. The list of “toxic chemicals” is found at 40 C.F.R. 372.65 and includes ammonia. Facilities that meet these three criteria in a calendar year must submit a Section 313 report (“Form R”) for each toxic chemical exceeding a threshold by July 1 in the following year to EPA and the SERC. 40 C.F.R. § 372.30. The reporting threshold is triggered if the facility “manufactures” or “processes” 25,000 pounds of the toxic chemical, or if the facility “otherwise uses” 10,000 pounds of the listed chemical during that calendar year. 40 C.F.R. § 372.25. The Form R requires the facility to provide estimates of releases of each toxic chemical to air, water, and land.

Form R reporting forms and related guidance documents may be obtained from:
Emergency Planning and Community Right-to-Know Document Distribution Center
Attn: NSCEP
P.O. Box 42419
Cincinnati, OH 45242-2419
www.epa.gov/tri

For additional information, contact EPA for a free copy of their latest edition of the Toxic Chemical Release Inventory Reporting Package.

Clean Air Act

The Clean Air Act of 1970 (CAA) is the federal law through which EPA protects air quality. Conceptually, the manner in which EPA protects air quality has not changed since 1970. EPA establishes national ambient air quality standards for “criteria pollutants” and then delegates to states the authority to achieve these standards within state borders pursuant to EPA-approved State Implementation Plans. Under these plans, states control the quantity of criteria pollutants that each industrial emitter may release through air permits. A separate Clean Air Act program applies to emissions of “hazardous air pollutants,” which similarly may be delegated to states for implementation. Ammonia is neither a “criteria pollutant” nor a “hazardous air pollutant” and, therefore, ammonia emissions are not subject to Clean Air Act permit controls.

In 1990, Congress enacted extensive amendments to the Clean Air Act. Several of these amendments affect emissions of ammonia, specifically: (1) Section 112(r), which requires EPA to promulgate regulations relating to chemical accident prevention; and (2) Section 612, which requires EPA to establish a program for the control and phase-out of substances harmful to the stratospheric ozone layer. Each of these programs is described below.

Chemical Accident Prevention

The goal of § 112(r) is to prevent accidental releases of regulated substances and other extremely hazardous substances to the air and to minimize the consequences of releases by focusing on preventive measures of those chemicals that pose the greatest risk. Section 112(r) requires EPA to establish a chemical accident prevention program. In this regard, EPA must promulgate a list of at least 100 substances known to cause, or reasonably anticipated to cause, death, injury, or serious adverse effects to human health or the environment when released to the air. For each listed substance, EPA must establish the threshold quantity that would trigger obligations under § 112(r). In addition, § 112(r) requires EPA to develop and implement a Risk Management Program (RMP) to provide for the prevention and detection of accidental releases of regulated substances under CAA § 112(r) and for response to such releases.
On January 31, 1994, EPA promulgated its list of regulated substances and thresholds. 59 Fed. Reg. 4478 (codified at 40 C.F.R. 68.130, Table 1). There are three categories on EPA's list: (1) a list of 77 toxic substances, (2) a list of 63 flammable substances, and (3) a list of explosive substances with a mass explosion hazard, as listed by DOT. Anhydrous ammonia is one of the 77 listed toxic substances, and has a threshold quantity of 10,000 pounds.

On June 20, 1996 EPA promulgated regulations implementing CAA § 112(r)'s RMP requirements. 61 Fed. Reg. 31,668. In response to concerns relating to Homeland Security, the EPA published revised requirements in March 2004 relating to RMP. The revised rule removes the requirement for facilities to describe their offsite consequence analysis (OCA) in the executive summary of RMPs, adds several new data elements to RMPs, and requires more timely reporting of significant accidents and changes in emergency contact information.

EPA's RMP is applicable to the owner or operator of any “stationary source” that has more than a threshold quantity of a regulated substance in a process. A “stationary source” is defined as: any buildings, structures, equipment, installations, or substance emitting stationary activities which belong to the same industrial group, which are located on one or more contiguous properties, which are under the control of the same person, and from which an accidental release may occur. 40 C.F.R. § 68.3. Under this broad definition, virtually all facilities, including ammonia refrigeration facilities, are stationary sources.

As previously mentioned, the RMP requirements are only applicable to a stationary source that has more than a threshold quantity of a regulated substance in a process (i.e., a “covered process”). Thus, to assess the applicability of the RMP to a particular facility, the facility must determine whether a “regulated substance” is present at the facility in a “process” in excess of the applicable threshold. The list of regulated substances, and corresponding thresholds, is contained in 40 C.F.R. § 68.130. For purposes of the RMP, a “process” is broadly defined as “any activity involving a regulated substance including any use, storage, manufacturing, handling, or on-site movement of such substances, or combination of these activities.” 40 C.F.R. § 68.3. Under this definition, ammonia refrigeration facilities with more than 10,000 pounds of ammonia in the process will be subject to the RMP.

Facilities with a covered process must be in compliance with the RMP requirements no later than the latest of the following dates: (1) June 21, 1999; (2) the date on which a regulated substance is first present above the threshold quantity in a process; or (3) three years after the date on which a new regulated substance is first listed under 40 C.F.R. § 68.130. See 40 C.F.R. § 68.10(a).
RMP Tiers

The RMP includes five basic components: (1) hazard assessment, (2) emergency response program, (3) management program, (4) prevention program, and (5) risk management plan. Three different “tiers” of requirements have been established for each of the five components: in ascending order of complexity, these tiers are referred to as Program 1 (P1), Program 2 (P2) and Program 3 (P3).

To be eligible for P1 (the minimal RMP requirements), a covered process must satisfy the following requirements:

1. documentation of no accidental release of a regulated substance from the process causing death, injury, response or restoration activities for exposure to an environmental receptor, for five years prior to the submission of the risk management plan, and
2. demonstration of no potential for off-site impact from a conservative worst-case release (i.e., no human receptors are located within the specified toxic or flammable endpoint for the regulated substance). 40 C.F.R. § 68.10(b).

A covered process that meets the P3 criteria is subject to the full gamut of EPA’s RMP. A covered process is subject to P3 requirements if:

1. the process is in one of nine specified standard industrial classification (SIC) codes, or
2. the process is subject to OSHA’s PSM standard (29 C.F.R. § 1910.119).

Covered processes not satisfying the P1 or P3 criteria are subject to the P2 requirements. The P2 requirements include all of the requirements for P3, with the exception of some reduced requirements for the prevention program component.

RMP Requirements Applicable to P3 Covered Processes

Most ammonia refrigeration facilities are subject to OSHA’s PSM standard. Accordingly, these facilities will likely be subject to EPA’s P3 criteria. Thus, this discussion will be limited to the RMP requirements applicable to P3 processes. Figure 5-2 identifies the RMP requirements applicable to each of the three tiers. Under P3, a covered process is subject to all five RMP components, namely, (1) hazard assessment, (2) emergency response program, (3) management program, (4) prevention program, and (5) risk management plan. 40 C.F.R. § 68.12(d).

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10 The applicable SIC codes are: 2611 (pulp mills), 2812 (chlor-alkali), 2819 (industrial organics), 2821 (plastics and resins), 2865 (cyclic crude), 2869 (industrial organics), 2873 (nitrogen fertilizers), 2879 (agricultural chemicals), and 2911 (petroleum refineries).

11 Some of ammonia refrigeration facilities, otherwise subject to P3, may be able to qualify for P1 status if the facility can satisfy the P1 criteria, i.e., (1) no accidental release of ammonia causing death, injury, response or restoration activities for exposure to an environmental receptor, for five years prior to the submission of the risk management plan, and (2) no off-site impact from a worst-case release of ammonia.
To satisfy the hazard assessment component, the facility must conduct a worst-case release scenario for the covered process and document the public and environmental receptors that are located within a circle circumscribed by the distance to the applicable endpoint for the regulated substance.\textsuperscript{12} 40 C.F.R. § 68.12(d)(2). Further, the facility must complete a 5-year accident history for the covered process. \textit{Id.} For purposes of the 5-year accident history, the facility must consider all accidental releases from the covered process that resulted in: (1) deaths, injuries, or significant property damage on-site; or (2) known off-site deaths, injuries, evacuations, sheltering in place, property damage, or environmental damage. \textit{Id.} § 68.42(a) The 2004 revisions to RMP require that information related to reportable releases be incorporated into the plant’s 5-year accident history within six months of the accident’s occurrence along with a re-submission of the RMP to the EPA. Finally, the facility must complete an alternative release scenario. \textit{Id.} § 68.28(d)(2). The alternative release scenario is a scenario that is more likely to occur than the worst-case release scenario. \textit{Id.} § 68.28(b).

To satisfy the emergency response component, the facility must develop and implement an emergency response program, which consists of: (1) an emergency response plan, (2) procedures for the use, inspection, testing and maintenance of emergency response equipment, (3) training for employees in the response procedures, and (4) procedures to review and update the emergency response plan, as necessary. \textit{Id.} § 68.95.

To satisfy the management program component, the facility must: (1) develop a management system to oversee the implementation of the RMP; and (2) designate a “qualified person” to oversee the development, implementation and integration of the RMP components. See 40 C.F.R. § 68.15(a) and (b).

The prevention program component applicable to a P3 process is basically identical to OSHA’s PSM standard with minor wording changes to address the statutory differences between the two programs (e.g., references to a “highly hazardous chemical” in OSHA’s PSM standard are changed to a “regulated substance” in EPA’s RMP). See 40 C.F.R. Part 68, Subpart D. Thus, facilities with covered processes subject to P3 will, likely, satisfy the prevention program component simply by satisfying OSHA’s PSM requirements.

To satisfy the “risk management plan” component, a facility must prepare and submit to EPA a risk management plan, which consists of: (1) an executive summary, which, among other things, identifies the regulated substance handled and briefly describes the facility’s accidental release prevention and emergency response policies, (2) a registration form, (3) worst-case release data from the hazard assessment, (4) 5-year accident history information from the hazard assessment, (5) alternative release data from the hazard assessment, (6) prevention program information, and (7) emergency response information. The risk management plan must be revised, updated and resubmitted at least every five years (or more frequently if reportable releases occur within the 5-year period) to a central source to be designated by EPA. 40 C.F.R. § 68.190(b)(1).

The 2004 revision to RMP eliminated the need to include a description of the off-site consequence analyses (OCA) in the executive summary of the publicly available RMP. EPA now expects that facilities will not include any information relating to OCA in their executive summaries.

\textsuperscript{12} For ammonia, the endpoint is 200 ppm.
### FIGURE 5-2 CAA § 112(r) Risk Management Program Requirements

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*This table outlines the requirements for CAA § 112(r) Risk Management Programs, detailing the components and activities necessary for compliance.*
Protection of Stratospheric Ozone

Section 612 of the Clean Air Act requires EPA to establish a program — identified as the Significant New Alternatives Policy (SNAP) program — to identify alternatives to Class I and Class II ozone-depleting substances and to publish lists of “acceptable” and “unacceptable” substitutes. Upon promulgation of the SNAP program, it is unlawful to replace a Class I or Class II substance with any substitute which EPA determines may present adverse effects to human health or the environment, where other substitutes have been identified that reduce overall risk and that are currently or potentially available.

On March 18, 1994, EPA published a final rule in the Federal Register which described the process for administering the SNAP program and listed acceptable substitutes in the major industrial use sectors. These sectors include refrigeration and air conditioning, solvents, foam blowing, fire suppression and explosion protection, sterilants, aerosols, adhesives, coatings and inks, and tobacco expansion. Ammonia is listed as an acceptable substitute for several refrigeration applications. For example, ammonia vapor compression is listed as an acceptable substitute for: (1) CFC-11, CFC-12, CFC-113, CFC-114 and R-500 in centrifugal chillers; (2) CFC-11, CFC-12 and R-502 in industrial process refrigeration; (3) CFC-12 and R-502 in ice skating rinks; (4) CFC-12 and R-502 in cold storage warehouses; (5) CFC-12 and R-502 in retail food refrigeration; and (6) CFC-12 and R-502 in commercial ice machines.

Clean Water Act

The federal framework for regulating the discharge of pollutants into waters of the United States is set forth in the Federal Water Pollution Control Act of 1972, also known as the Clean Water Act (CWA). 33 U.S.C. §§ 1251-1387. The Clean Water Act was substantially amended in 1977, 1982 and 1987, but the basic framework remains unchanged. At the core of the Clean Water Act is a prohibition on the discharge of any pollutant into waters of the United States without a permit. CWA § 301(a). Different permit programs apply to different types of discharges.

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13 Class I and Class II substances are listed in Appendix A and Appendix B, respectively, to 40 C.F.R. Part 82.

14 Any person may petition EPA to add a substitute to either of the lists. Such petitions will be granted or denied within 90 days of receipt of a complete petition. In addition, any person who produces a substitute for a Class I substance must notify EPA at least 90 days before new or existing alternatives are introduced into interstate commerce for significant new use as substitutes for a Class I substance.

15 Additional information on this rule is available through EPA's Stratospheric protection hot line: (800) 296-1996.
NPDES Permit Program

A “direct discharger,” i.e., a party that discharges pollutants through a “point source” directly to “waters of the United States,” is subject to the National Pollutant Discharge Elimination System (NPDES) permit program. 40 C.F.R. § 122.1(b). EPA defines a “point source” as “any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate, collection system vessel or other floating craft from which pollutants are or may be discharged.” 40 C.F.R. § 122.2. EPA defines “waters of the United States” broadly to include: (1) all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide, (2) all interstate waters, including interstate “wetlands”, and (3) all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds that the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce. 40 C.F.R. § 122.2.

To the extent an IIAR member operates a facility which discharges ammonia or other pollutants through a point source to waters of the United States, the IIAR member must obtain an NPDES permit for the discharge. The Clean Water Act allows each state to administer its own NPDES program after submission and approval of an equivalent program by EPA. Accordingly, in authorized states, the IIAR member must apply to the state to obtain the NPDES permit.

Discharges to POTWs

A different type of discharge permit must be obtained by parties that discharge pollutants into publicly owned treatment works (POTWs). Such “indirect dischargers” do not require a NPDES permit, but may require a permit from the POTW that receives the discharge. Permit limits will be based on “pretreatment standards” EPA has established for different categories of industrial dischargers. These “categorical standards” ensure that pollutants from indirect dischargers do not damage the treatment systems employed by POTWs and do not pass through the treatment systems. In addition, each POTW establishes local limits to reflect the specifics of the POTW’s treatment capability.

IIAR members that discharge pollutants, including ammonia, to the local POTW must determine whether a permit must be obtained from the receiving POTW.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) is the federal law that regulates the generation, storage, treatment and disposal of solid and hazardous wastes. EPA has promulgated RCRA regulations pursuant to which a waste may be classified as a hazardous waste if: (1) the waste exhibits any of four hazardous waste characteristics, specifically, ignitability, corrosivity, reactivity, toxicity; and three hazardous waste lists (40 C.F.R. §§ 261.21-261.24); or (2) the waste is listed on one of three lists, specifically, hazardous waste from non-specific sources, hazardous wastes from specific sources and discarded commercial chemical products (40 C.F.R. §§ 261.31-261.33).

Relevant to ammonia handlers is the hazardous waste characteristic of corrosivity. A solid waste is defined as corrosive if the waste is:

1. an aqueous material with a pH of less than or equal to 2 or greater than or equal to 12.5, or
2. a liquid that corrodes steel at a rate greater than 0.250 inch per year at a temperature of 130°F.

40 C.F.R. § 261.22(a).
MSDSs for ammonia indicate that the material has a pH in the range of 12.1. Thus, waste ammonia is unlikely to be considered a hazardous waste by the characteristic of corrosivity. However, IIAR members should characterize any waste ammonia to ensure that it is properly handled (i.e., hazardous or non-hazardous). Standards applicable to generators of hazardous waste are set forth in 40 C.F.R. Part 262 and include: (1) obtaining an EPA identification number, (2) managing the waste on-site, either with or without a permit depending on the on-site retention time, pursuant to set standards, (3) transporting, or offering the waste for transport, pursuant to a manifest, and (4) biennial notification requirements.

**Off-Site Transportation Requirements**

The Hazardous Materials Transportation Act (HMTA) is the federal law that restricts the manner in which hazardous materials, such as ammonia, may be shipped in the United States. Under HMTA, the U.S. Department of Transportation (DOT) is assigned responsibility for regulating the transportation of a “hazardous material” in commerce. 42 U.S.C. § 5103(b). DOT, in turn, has delegated its responsibility to various subordinate agencies and administrations. Specifically, DOT delegated to RSPA the responsibility for identifying hazardous materials and promulgating transportation standards for such materials. Responsibility for enforcement of the hazardous materials regulations is divided among the following agencies:

- Federal Aviation Administration (FAA), with respect to the shipment of hazardous materials by aircraft
- United States Coast Guard (USCG), with respect to the shipment of hazardous materials by vessels
- Federal Highway Administration (FHWA), with respect to the shipment of hazardous materials by highway vehicles
- Federal Railroad Administration (FRA), with respect to the shipment of hazardous materials by railroad, and
- The RSPA Office of Hazardous Materials Safety for all other activities.

### Hazard Classification

The starting point for determining the applicable transportation requirements is to determine whether RSPA has classified the material as a “hazardous material.” RSPA’s list of hazardous materials is contained in 49 C.F.R. § 172.101. Ammonia is one of the listed hazardous materials.

RSPA assigns one of nine hazard classes and/or divisions to each hazardous material. These hazard classes and/or divisions link the hazardous materials to specific transportation requirements. **Anhydrous ammonia is classified as non-flammable, non-poisonous compressed gas (“Class 2, Division 2.2” hazardous material) for domestic shipments; and gas poisonous by inhalation (“Class 2, Division 2.3” hazardous material) for international shipments.** These designations subject ammonia to the restrictions described below.
Shipping Paper and Labeling Requirements

For domestic shipments of anhydrous ammonia, the description on the accompanying shipping paper must include the following information in the specified sequence:
(1) the proper shipping name “Anhydrous Ammonia”;
(2) the hazard class “2.2”;
(3) the identification number “UN 1005”; and
(4) the words “Inhalation Hazard.”
49 C.F.R. §§ 172.101, 172.202. In addition, because ammonia is a CERCLA hazardous substance with a 100 pound RQ, if an RQ or more of ammonia is transported in a single container, the letters “RQ” must be entered on shipping papers either before or after the description. 49 C.F.R. § 172.203(c).

Domestic shipments of ammonia, with certain exceptions, must be labeled “NON-FLAMMABLE GAS.” 49 C.F.R. Part 172, Subpart E. Label sizes and color specifications are discussed in 49 C.F.R. § 172.407. Transport vehicles containing anhydrous ammonia must be placarded, with certain exceptions, with a “NON-FLAMMABLE GAS” placard. 49 C.F.R. Part 172, Subpart F. General placard requirements are described in 49 C.F.R. § 172.504.

Shipping papers for international shipments of ammonia must contain the above mentioned information; however, the words “Poison-Inhalation Hazard” and “Zone D” should be substituted for the words “Inhalation Hazard.” 49 C.F.R. §§ 172.101, 172.202. International shipments of ammonia, with certain exceptions, must be labeled “POISON GAS” and transport vehicles containing ammonia must be placarded, with certain exceptions, with a “POISON GAS” placard. 49 C.F.R. Part 172, Subparts E and F.

Handling of Ammonia in MC 330 and MC 331 Cargo Tanks

Ammonia is routinely shipped in DOT specification MC 330 and MC 331 cargo tanks. The maximum filling density for such tanks is 56 percent by weight or 82 percent by volume. 49 C.F.R. § 173.315(a). Ammonia shipped in MC 330 or MC 331 cargo tanks constructed of quenched and tempered (Q & T) steel must contain at least 0.2 percent water by weight and the accompanying shipping paper must include the entry “0.2 PERCENT WATER.” 49 C.F.R. §§ 173.315(a) Note 14, 172.203(h)(1)(i). Cargo tank shipments of ammonia containing less than 0.2 percent water must be shipped in NQT tanks and the accompanying shipping papers must include the entry “NOT FOR Q & T TANKS.” 49 C.F.R. §§ 173.315(a) Note 14, 172.203(h)(1)(ii). MC 330 and MC 331 cargo tank must be labeled in two-inch letters “QT” or “NQT,” as appropriate, near the specification plate and the tank must be marked in two-inch letters on each side and each end with the words “Anhydrous Ammonia.” 49 C.F.R. § 172.328. DOT regulations require that ammonia shipped in Q & T tanks be certified as containing the prescribed amount of water and that the analysis method used be in accordance with the Compressed Gas Association’s publication G2.2, Guideline Method for Determining Minimum of 0.2% Water in Anhydrous Ammonia, latest edition. 49 C.F.R. § 173.315(1). Further, DOT requires that records indicating the analytical results be retained for two years. Id.

Pursuant to 49 C.F.R. § 180.407, cargo tanks transporting anhydrous ammonia must be periodically inspected and leak tested. For example, MC-330 and MC-331 tanks must be annually leak tested.
Chapter 5 — U.S. Regulatory Requirements

Off-Site Transportation Requirements

Tank Car Requirements

The transportation of ammonia by rail is governed by regulations promulgated jointly by RSPA and FRA.

Filling Requirements

Sections 173.24b and 173.314 specify the maximum filling density for tank cars used to transport a compressed gas. Tank cars used to transport anhydrous ammonia must contain at least two percent outage at a reference temperature of 46°C (115°F) for non-insulated tanks and 41°C (105°F) for insulated tanks. *Id.*

Tank Car Requirements

Imposed by HM-175A/201

On September 21, 1995, RSPA and FRA issued a regulation establishing a crash-worthiness standard for tank cars and restricting the continued use of tank cars in hazardous materials service that no longer meet current safety requirements. 60 Fed. Reg. 49,048. The regulation, referred to as the HM-175A/201 rule: (1) expands the use of thermal protection systems and head protection on tank cars transporting Division 2.2 hazardous materials (non-flammable, non-poisonous gases, which includes domestic shipments of anhydrous ammonia); (2) adds new requirements for bottom-discontinuity protection; (3) prohibits the use of self-energized man-ways located below the liquid level of the tank; (4) removes “grandfather” provisions allowing certain uses of tank cars; and (5) improves the puncture resistance of tank cars used for certain high hazard materials, including those that are poisonous-by-inhalation and those determined by EPA to pose health and environmental risks.

Of interest to ammonia shippers, the regulations require all ammonia cars to contain full head shields (with certain exceptions), sufficient thermal protection to withstand a 100 minute pool fire, and 30-minute torch fire and be capable of withstanding 300 psi internal pressure. See 49 C.F.R. § 173.31.

To help ammonia refrigeration facilities to comply with the PSM regulations, IIAR has developed a document, entitled *IIAR Guide to the Implementation of Process Safety Management (PSM) for Ammonia Refrigeration Facilities.*
Glossary

CAA — Clean Air Act
CERCLA — Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFC — Chlorofluorocarbon
C.F.R. — Code of Federal Regulations
CPR — Cardiopulmonary resuscitation
CWA — Clean Water Act
DOT — Department of Transportation
EPA — Environmental Protection Agency
EPCRA — Emergency Planning and Community Right-to-Know Act
ERP — Emergency response plan
FAA — Federal Aviation Administration
FHWA — Federal Highway Administration
FRA — Federal Railroad Administration
HAZMAT — Hazardous materials
HAZWOPER — Hazardous waste operations and emergency response
HMTA — Hazardous Materials Transportation Act
IC — Incident Commander
ICS — Incident Command System
IDLH — Immediately Dangerous to Life and Health
LEPC — Local emergency planning committee
MSDSs — Material safety data sheets
NIOSH — National Institute for Occupational Safety and Health
NPDES — National Pollutant Discharge Elimination System
NQT — Not quenched and tempered
NRC — National Response Center
OCA — Offsite Consequence Analysis
OSHA — Occupational Safety and Health Administration
P&IDs — Piping and instrumentation diagrams
PELs — Permissible exposure limits
PFDs — Process flow diagrams
POTWs — Publicly-owned treatment works
PPE — Personal protective equipment
PRCS — Permit required confined space
PSM — Process safety management
Q & T or QT — Quenched and tempered
RCRA — Resource Conservation and Recovery Act
REL — Recommended Exposure Limit
RMP — Risk Management Program
RQ — Reportable quantity
RSPA — Research and Special Programs Administration
SERC — State Emergency Response Commission
SIC — Standard industrial classification
SNAP — Significant New Alternatives Policy
STEL — Short-term Exposure Limit
TPQ — Threshold planning quantity
TWA — Time Weighted Average
UN — United Nations
USCG — United States Coast Guard