

BSR/IIAR 8-2026

Decommissioning of Closed-Circuit Ammonia Refrigeration Systems

Public Review #1 Draft

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- 1) Provide the commenter's contact information [e.g., name, phone number(s), and e-mail].
- 2) Identify the specific Section (i.e., by its Chapter and Section number) that is the subject of each comment(s).
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- 4) Provide a brief substantiation statement that presents the rationale, justification, and supporting documentation; as well as any technical data and backup. Provide an abstract for lengthy substantiations. If supplementary documents are provided to support your comment(s), electronic files in word processed (MS Word preferred) or scanned form are preferred. Indicate whether attachments have been provided. Highlighting pens should not be used since highlighted text will not reproduce.
- 5) If you do not understand the material, proceed with doing the necessary homework to gain understanding of the material and/or call the IIAR to discuss before commenting. Do not submit comments as opinions or questions.

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Notes on the Standard Text

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Foreword

(Informative)

This standard specifies minimum criteria for removing the ammonia charge in conjunction with the decommissioning of closed-circuit ammonia refrigeration systems. Additional precautions may be necessary because of particular circumstances, project specifications, or other jurisdictional considerations. This standard is not intended to serve as a comprehensive technical design manual and shall not be used as such.

For the purposes of this standard, it is assumed that the refrigeration system was designed for the duty that it was to perform, that all installed piping and electrical equipment is fully functional, and that adequate access is available for the safe removal of the charge. Because this document defines the minimum requirements for the decommissioning of closed-circuit ammonia refrigeration systems, it may not be sufficient to meet other standards and/or regulations that are applicable to specific refrigeration systems.

Experience shows that ammonia is very stable under normal conditions and rarely ignites when a release occurs because the flammability range in air is narrow and the minimum flammable concentration in air is very high as compared with other ignitable gases. Ammonia has a published flammability range of 160,000 ppm to 250,000 ppm (by volume). This concentration far exceeds ammonia's odor detection threshold and the 50-ppm permissible exposure limit (PEL) published by the Occupational Health and Safety Administration (OSHA).

Ammonia's strong odor alerts those nearby to its presence at levels well below those that present either flammability or health hazards. This "self-alarming" odor is so strong that a person is unlikely to voluntarily remain in an area where ammonia concentrations are hazardous.

The principal hazard to persons is ammonia vapor, because exposure occurs more readily by inhalation than by other routes. As with any hazardous vapor, adequate ventilation will dilute the vapor and greatly reduce exposure risk. Ammonia in vapor form is lighter than air. Typically, ammonia vapor rises and diffuses simultaneously when released into the atmosphere. It is biodegradable and, when released, combines readily with water and/or carbon dioxide to form relatively harmless compounds. Ammonia may also neutralize acidic pollutants in the atmosphere. Additional information regarding the properties of ammonia is published in the IIR Ammonia Data Book.

This standard was first issued in January of 2015 by the International Institute of Ammonia Refrigeration (IIR). The standard was approved as an American National Standard by the American National Standards Institute (ANSI) in January 2015 as ANSI/IIR 8-2015. ANSI requires reaffirmation or revision for periodic maintenance requirements of existing standards every five years.

The first cycle of periodic maintenance for this standard began in May 2019, resulting in the approval of ANSI/IIR 8-2020 by ANSI on November 12th, 2020. The current cycle of periodic maintenance began in August 2025 and ANSI/IIR 8-2026 was approved by ANSI on <MM, DD, YYYY>.

Informative Appendix A provides explanatory information related to provisions in the standard. Sections of the standard with associated explanatory information in this appendix are marked with an asterisk “*” after the section number, and the associated appendix information is located in a corresponding section number preceded by “A.”

At the time of publication of this revision of the standard, the IIAR Standards Committee included the following voting members:

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- Lesley Schafer, Chair – C&S Wholesale Grocers
- Ron Worley – MAP Engineering Services
- Michael Garrabrant – Stone Mountain Technologies, Inc.
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Part 1 General

Chapter 1. Purpose and Scope

1.1 **Purpose.** This standard specifies the minimum requirements for the safe decommissioning of closed-circuit ammonia refrigeration systems.

1.2 **Scope.**

1.2.1 This standard is intended for those involved in the decommissioning of closed-circuit ammonia refrigeration systems.

1.2.2 This standard applies to:

1.2.2.1 Decommissioning of a complete closed-circuit vapor compression and/or absorption refrigeration system utilizing anhydrous ammonia or ammonia-water mixtures as the refrigerant.

1.2.3 This standard does not apply to:

1.2.3.1 Packaged absorption refrigeration systems utilizing ammonia-water mixtures as the refrigerant with refrigerant quantities not exceeding 22 lbs (10 kg).

1.2.3.2 The shutdown of closed-circuit ammonia refrigeration systems that operate periodically or seasonally or are otherwise mothballed periodically, whether or not the ammonia charge is isolated or removed.

1.2.3.3 Ammonia charge removal for system maintenance, servicing, or equipment replacement.

1.2.3.4 Equipment decommissioning or portions of the refrigeration system that are addressed through a Management of Change (MOC) or change management.

Chapter 2. Definitions

2.1 **General.** Definitions shall be in accordance with this chapter and ANSI/IIAR 1, *American National Standard for Definitions and Terminology Used in IIAR Standards*.

2.2 ***Defined Terms.** The following words and terms, which are used in this standard, shall be defined as specified in this chapter.

decommissioning: The deactivation of the entire closed-circuit refrigeration system, without a planned reuse or start date, the disabling of pressure-imposing equipment, and the complete removal of the refrigerant.

Chapter 3. Normative References

3.1 International Institute of Ammonia Refrigeration (IIAR), standards as follows:

ANSI/IIAR 1-2022, *American National Standard for Definitions and Terminology Used in IIAR Standards*.

ANSI/IIAR 2-2021, *Standard for Design of Safe Closed-Circuit of Ammonia Refrigeration Systems*.

ANSI/IIAR 4-2026, *Installation of Closed-Circuit Ammonia Refrigeration Systems*.

ANSI/IIAR 5-2025, *Startup of Closed-Circuit Ammonia Refrigeration Systems*.

ANSI/IIAR 6-2025, *Standard for Inspection, Testing, and Maintenance of Closed-Circuit Ammonia Refrigeration Systems*.

Where updates to the above-referenced IIAR standards are published prior to the next periodic maintenance of this standard, they are permitted to be used.

3.2 Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, standards as follows:

29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*.

Section 5(a)(1) of the Occupational Safety and Health Act, *General Duty Clause*.

3.3 Environmental Protection Agency (EPA) regulations as follows:

40 CFR Part 68, *Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act*.

Section 112(r)(1) of the Clean Air Act, *General Duty Clause*.

Part 2 Decommissioning Requirements

Chapter 4. Preparation

- 4.1 ***General.** The requirements in Chapter 4 shall be addressed and documented prior to the start of the decommissioning activities.
- 4.2 ***Purpose of the Decommissioning.** Identify and document the purpose(s) for decommissioning the system.
- 4.3 ***Equipment to Be Decommissioned.** Identify, locate, and document the refrigeration equipment that will be abandoned in place and the refrigeration equipment that will be dismantled and removed from the facility.
 - 4.3.1 Equipment and systems that have been decommissioned but will be utilized again at an unknown future date shall follow, prior to restart of the systems:
 - 1. ANSI/IIAR 2 for modifications;
 - 2. ANSI/IIAR 4 for installation;
 - 3. ANSI/IIAR 5 for startup; and
 - 4. ANSI/IIAR 6, Section 5.6.11 “Out of Service” for inspection, testing, and maintenance (ITM) tasks
- 4.4 ***Ammonia to Be Removed.** Estimate and document the total amount of ammonia that will be removed from the system.
- 4.5 ***Regulatory Requirements.** Identify and document the regulatory requirements that must be met during decommissioning activities.
- 4.6 ***Documentation Retention Requirements.** The documentation shall be retained in compliance with company policies and with applicable codes, standards, and regulations.
- 4.7 **Personnel.** Identify the personnel involved in the decommissioning activities.
 - 4.7.1 ***Coordinator.** The person(s) coordinating the decommissioning activities.
 - 4.7.2 **Decommissioning Team Members.** Facility personnel and/or contractors who perform the decommissioning activities.
 - 4.7.3 ***Response Personnel.** Facility personnel, contractors and/or offsite personnel who would respond to emergencies during decommissioning activities.
 - 4.7.4 ***Affected Personnel.** Facility personnel and/or contractors who could be affected by the decommissioning activities but are not directly involved in them.
- 4.8 ***Supporting Documents.** The following documents shall be readily accessible to the decommissioning team members:
 - 4.8.1 ***Physical Properties.** Documents that describe the physical properties and potential hazards of ammonia, lubricating oil and other chemicals involved in the decommissioning activities.

- 4.8.2 **System Diagrams.** Refrigeration system flow diagrams and/or piping and instrumentation diagrams (P&IDs) depicting the refrigeration system to be decommissioned.
- 4.8.3 ***Pressure Relief Valves.** Information describing the location and setpoint of any pressure relief valves installed on equipment, components, and piping to be decommissioned.
- 4.8.4 ***Emergency Action and/or Response Plan.** Emergency action and/or response plan for the facility.
- 4.8.5 **MAWP and MDMT.** Information describing the maximum allowable working pressure (MAWP) and the minimum design metal temperature (MDMT) for the equipment, components, and piping to be decommissioned. MAWP and MDMT shall not be exceeded during decommissioning activities.
- 4.9 ***Impacts on Safety and Health.** Evaluate and document the potential impacts on safety and health associated with the decommissioning activities.
- 4.10 ***Decommissioning Procedures.** Develop procedures that document the steps that will be taken during decommissioning activities.
- 4.11 ***Inspection, Testing, and Maintenance.** Identify safety systems, transfer components and equipment that need to be functional during decommissioning activities and conduct a review of the latest inspections, testing, and maintenance tasks previously performed on those items.
 - 4.11.1 All safety systems, transfer components and equipment associated with decommissioning activities shall be functional and inspected, tested, and maintained in accordance with ANSI/IIAR 6-2025 throughout the decommissioning process.
- 4.12 ***Training.** Conduct and document training for the decommissioning team members.
 - 4.12.1 **Training Content.** The training shall include the following topics:
 - 4.12.1.1 An overview of the decommissioning activities.
 - 4.12.1.2 A description of the safety and health hazards and the properties of ammonia, lubricating oil, and other chemicals involved in the decommissioning activities, including first aid for exposure to these chemicals.
 - 4.12.1.3 A review of the procedures that document the steps that will be taken during decommissioning activities.
- 4.13 **Overview.** Provide response personnel and affected personnel with an overview of the decommissioning activities.

Chapter 5. Decommissioning Activities

5.1 Final Review.

- 5.1.1 *Conduct a final review prior to the start of the decommissioning activities to ensure that the requirements in Chapter 4 have been addressed.

5.2 Conduct Decommissioning Activities.

- 5.2.1 Follow the steps documented in the procedures to decommission the refrigeration system.
- 5.2.2 *Update decommissioning procedures to address any special or unique hazards that arise during decommissioning activities that were not anticipated during preparation.
- 5.2.3 Ensure that the following precautions are taken during decommissioning activities:
 - 5.2.3.1 Do not use any materials during decommissioning activities that will deteriorate in the presence of ammonia or lubricating oil, or a combination of both, or any normal contaminant such as air or water.
 - 5.2.3.2 Ensure that all equipment and materials used during decommissioning activities are designed for ammonia refrigerant at the coincident temperature and pressure to which the components shall be subjected.
 - 5.2.3.3 *Using an open flame, arc welding, or other hot work requires a hot work permit.
 - 5.2.3.3.1 *Safely applying heat to a system component to evaporate residual liquid ammonia is permitted provided the area is confirmed free from combustibles and flammables.
 - 5.2.3.3.2 Portable tools having open flames are permitted to be used to assist the migration of liquid refrigerant within the closed-circuit system. Such tools shall not be capable of cutting or reducing mechanical integrity of portions of the systems to which they are applied.
 - 5.2.3.3.3 Equipment that is isolated shall not be heated.
 - 5.2.3.3.4 The use of matches, lighters, sulfur sticks, welding equipment, and similar portable devices shall be permitted except when oil or ammonia is being removed from the system.
 - 5.2.3.4 Do not use impact tools such as chisels to remove ice from equipment that may contain residual ammonia.

- 5.2.3.5 Do not physically disconnect and remove system components until the components have been isolated and residual ammonia and lubrication oil have been drained from the components.
- 5.2.3.6 *Ensure that the removal of ammonia vapor from the refrigeration system is properly conducted in accordance with applicable local, state, and federal regulations.
- 5.2.3.7 *Ensure that all individual chemicals removed from the system or those no longer used for system operation are recycled or disposed of in accordance with applicable local, state, and federal regulations.

5.3 **Follow-Up Activities.**

- 5.3.1 Documentation. Obtain and/or update the following documentation after the decommissioning activities have been completed.
 - 5.3.1.1 *Tracking Information. Obtain tracking information to document the removal of chemicals from the facility.
 - 5.3.1.2 *Facility Documentation. Update facility documentation to reflect the decommissioning of the refrigeration system.
- 5.3.2 **Notifications.** The following personnel and government agencies shall be notified after the decommissioning activities have been completed.
 - 5.3.2.1 **Offsite Response Personnel.** Offsite response personnel who were contacted in advance of the decommissioning activities shall be contacted after the decommissioning activities have been completed.
 - 5.3.2.2 ***Government Agencies.** Appropriate government agencies shall be contacted after the decommissioning activities have been completed.

Part 3 Appendices

APPENDIX A. (INFORMATIVE) EXPLANATORY MATERIAL

This informative appendix is not a part of the standard. It provides explanatory information related to provisions in the standard. Sections of the standard with associated explanatory information in this appendix are marked with an asterisk “*” after the section number, and the associated appendix information is located in a corresponding section number preceded by “A.”

A.2.2 Examples of disabling pressure-imposing components may include the removal of motor-drive couplings or belts, disconnection of power sources by following lock-out-tag-out procedures, or removal of equipment from the system.

A.4.1 Documentation that is typically used to support decommissioning activities includes, but is not limited to:

- Management of Change and Pre-Startup Safety Review forms.
- Process Hazard Analysis (PHA) study reports.
- The sample decommissioning checklist contained in Appendix B.
- Jurisdictional requirement(s).

A.4.2 The reason or reasons that the system will be decommissioned may affect the final disposition of the refrigeration equipment. For example, if the refrigeration equipment is old or obsolete, it is more likely to be dismantled and removed from the facility. If the equipment will be decommissioned because the facility is being sold to a new owner, the entire system may be decommissioned but the refrigeration equipment may be left in place.

A.4.3 The purpose of this section is to specify which equipment is being decommissioned and where it is located. To better document the equipment locations, a list may be provided that includes descriptors such as room names or numbers. Alternatively, a facility plan or aerial view may be used to show the layout of the facility and indicate the general location of the ammonia refrigeration system and the specific equipment being decommissioned.

Equipment decommissioned from the refrigeration system may be abandoned in place, relocated to a different location, or scrapped. Where the equipment is scrapped, the owner or the owner’s representative may want to ensure that it cannot be re-used, which may include actions such as demolishing the equipment and removing equipment nameplates.

A.4.4 Refrigerant charge estimates are useful when planning refrigerant storage or means for removal. Estimates may be calculated by determining liquid levels in vessels and approximate volumes in piping and equipment, or by using inventory calculations and charge receipts.

A.4.5 In the United States, refrigeration systems that are subject to the Occupational Safety and Health Administration's (OSHA's) Process Safety Management (PSM) standard (29 CFR 1910.119) and/or to the Environmental Protection Agency's (EPA's) Risk Management Plan (RMP) regulation (40 CFR Part 68) are required to follow Management of Change and Pre-Startup Safety Review procedures to manage changes to process chemicals, technology, equipment, and procedures.

The IIAR's Process Safety Management and Risk Management Program Guidelines contain a Management of Change Plan and a Pre-Startup Safety Review Plan that can be used by facilities subject to OSHA's PSM standard and/or EPA's RMP regulation to manage changes to process chemicals, technology, equipment, and procedures.

In the United States, all refrigeration systems are required to follow the Occupational Safety and Health Act (OSHA) General Duty Clause and the Clean Air Act (CAA -EPA) General Duty Clause requirements.

The IIAR's Ammonia Refrigeration Management (ARM) Program contains a Managing Change Program that can be used by facilities subject to the OSHA General Duty Clause and/or to the EPA General Duty Clause to manage changes to process chemicals, technology, equipment, and procedures.

There may be additional requirements from the authority having jurisdiction (AHJ).

A.4.6 In the United States, refrigeration systems that are subject to the OSHA's PSM Standard and/or EPA's RMP regulation are required to retain process hazards analyses, as well as the documented resolution of recommendations identified during process hazard analyses, for the life of the process.

Once a PSM and/or RMP regulated process is verified as being decommissioned, the owner is not required to retain the related materials for the PSM and/or RMP regulations. However, the owner may need to retain the documentation for company policy requirements. Since the documentation already exists, it is recommended that the owner file the related materials, including the decommissioning verification. The owner could consider putting the documentation to use as training materials.

- A.4.7.1** Though it is ultimately the responsibility of the owner or the owner's representative to meet the minimum requirements for the safe decommissioning of closed-circuit ammonia refrigeration systems, the owner or the owner's representative may choose to delegate some of the responsibilities to the person(s) coordinating the decommissioning activities.
- A.4.7.3** In the United States, offsite response personnel include the local Fire Department personnel and members of the Local Emergency Planning Committee (LEPC).
- A.4.7.4** Examples of facility personnel who could be affected by the decommissioning activities are production employees who will be working within the vicinity of an ammonia refrigeration system while it is being decommissioned but will not be participating in the decommissioning activities.
- A.4.8** The required supporting documents may be part of existing system documentation. They may be available in hard-copy or electronic format. If they do not exist or cannot be located, field verification may be performed for the missing equipment, components, and documents. The findings should be documented and readily accessible.
- A.4.8.1** Safety data sheets (SDSs) and the IIAR's *Ammonia Data Book* are examples of documents that have been used to document the physical properties and the potential hazards of ammonia, lubricating oil and other chemicals involved in the decommissioning activities.
- A.4.8.3** Relief valve data is helpful when performing tasks during decommissioning such as purging, evacuation, or re-pressurization with inert gas. One intent of this information is to identify and prevent potential releases on equipment or components that could equalize at pressures above the relief valve setting, such as low side vessels with 150 psig relief valves installed. Another intent of this information is to identify and address within the decommissioning plan, relief valves that have higher pressure settings than the equipment or component MAWP.
- A.4.8.4** The emergency action and/or response plan may need to be modified to reflect changes at the facility caused by decommissioning activities. Issues that may need to be addressed include release reporting and evacuation procedures.
- A.4.9** Management of Change and Pre-Startup Safety Review forms, Process Hazard Analysis (PHA) study worksheets, and/or the checklist contained in Appendix B may be used to evaluate and document the impacts on safety and health associated with decommissioning activities.

- A.4.10** See Appendix C, Decommissioning Procedure Considerations, for items that could be considered and/or included when developing decommissioning procedures.
- A.4.11** Some examples of safety systems and transfer equipment that should be inspected, tested, and maintained where applicable are as follows:
- Hoses used to transfer ammonia
 - Transfer pumps
 - Eyewash and safety showers
 - Ammonia detectors
 - Emergency shutdown systems
 - Emergency ventilation systems
- A.4.12** Training records may include training dates, list of attendees, content of training, sign-off sheets, and documentation confirming individuals understood the training (written tests, oral tests or demonstrations).
- A.5.1.1** Management of Change and Pre-Startup Safety Review forms are typically used to document the final review prior to the start of the decommissioning activities. (Informative) Appendix B contains an example of a final review checklist.
- A.5.2.2** An example of a special or unique hazard that may not be anticipated during preparation is an isolation valve that does not fully close during equipment isolation steps. For this example, an alternate isolation method would need to be identified and procedures updated accordingly.
- A.5.2.3.3** Open flame devices, including but not limited to gas-fuel or oxy-fuel torches, are sometimes used for decommissioning activities that require heating, cutting, or welding. The decommissioning procedure should include provisions for safely utilizing heat as outlined in Appendix C, item 14.

Where decommissioned equipment removed from the closed-circuit refrigeration system will be considered elsewhere for reuse and/or for sale (i.e., not disposed of), the decommissioning procedure should also address preventing equipment damage due to overheating of metallic or non-metallic materials. For example, cast iron components (e.g., valves or pump casings) and non-metallic components (e.g., gaskets, seals, o-rings, packing, and lubricants) can be damaged when subject to open flames or high-temperatures.

- A.5.2.3.3.1** Appendix C, Item #14 lists options that may be used to apply heat to refrigeration system components to evaporate residual liquid ammonia.
- A.5.2.3.6** For example, federal regulations require reporting if more than 100lbs of ammonia in 24 hours is discharged directly to atmosphere. Local or state regulations may have different thresholds (potentially lower). One method to avoid discharging ammonia vapors directly to the atmosphere is to purge vapor from the refrigeration system into water for absorption. It is understood when purging ammonia vapor into water that a de minimis amount of vapor is likely to be released to the atmosphere without causing a safety hazard.
- A.5.2.3.7** Publicly Owned Treatment Works (POTW), otherwise known as wastewater treatment plants, use ammonia in the treatment of wastewater. They typically accept aqueous-ammonia solutions when contacted in advance so they can arrange for isolation and feeding in as needed.
- For disposing of ammonia-oil solutions or other chemicals no longer used for system operation, refer to Resource Conservation and Recovery Act (RCRA), EPA 40 CFR Part 260 in addition to local and state regulations.
- If not disposing or recycling, proper relocation or transporting methods should be considered if using elsewhere (e.g., at other facilities).
- Examples of other chemicals are water treatment products, lubricants, cleaners, glycols, or other secondary refrigerants.
- A.5.3.1.1** Examples of tracking information that can be considered as documentation for the removal of chemicals from the facility include shipping waybills, endpoint receipts, and waste manifests.
- A.5.3.1.2** The following documents may be updated or documented as retired to reflect the decommissioning of the refrigeration system:
- Ammonia inventory - delivery tickets, recovered ammonia certifications, or bill of lading from ammonia removal contractor are helpful to document adjustments to the ammonia inventory.
 - Refrigeration system flow diagrams and/or piping & instrumentation diagrams (P&IDs)
 - Facility plan(s), aerial view(s), and/or site plan(s)
 - Equipment list
 - Expected operating limits
 - Safety systems
 - Pressure relief system design basis
 - Ventilation system design basis

- Operating procedures
- Safe work practices
- Operator training program
- Management of change and pre-startup safety review forms
- Contractor program
- Visitor safety program
- Preventive maintenance schedules and/or procedures
- Emergency action and/or response plan

A.5.3.2.2 For those facilities subject to US EPA's RMP regulation, an updated Risk Management Plan will need to be submitted if the changes to the refrigeration system require a revised process hazard analysis or if the changes require a revised offsite consequence analysis. In addition, the facility will need to be de-registered from the RMP regulation if the ammonia inventory in the process drops below the threshold in the RMP regulation. RMP guidance may be obtained on-line from the US EPA.

Contact state and local AHJ's to determine decommissioning requirements and follow as appropriate.

Facilities in the United States are required to submit an annual inventory report for each hazardous chemical as defined by the Emergency Planning and Community Right-to-Know Act (EPCRA). The reports may need to be updated to reflect any changes in the ammonia inventory that occurred during decommissioning activities. Forms and instructions may be obtained on-line from the US EPA.

Facilities in the United States may be required to submit a Section 313 report ("Form R") to the US EPA and to the State Emergency Response Commission (SERC). Form R reporting forms and related guidance may be obtained on-line from the US EPA.

The United States Department of Homeland Security's (DHS's) Chemical Security Assessment Tool (CSAT) Top-Screen survey may need to be updated to reflect changes to the refrigeration system. The Chemical Security Assessment Tool (CSAT) Top-Screen Survey Application User Guide may be obtained on-line from the DHS.

If a pressure vessel is removed from service, the authority having jurisdiction (AHJ) may have to be notified if required by applicable codes.

Appendix B. (Informative) Example of a Decommissioning and Final Review Checklist

This informative appendix is not a part of the standard. It is merely informative and does not contain requirements necessary to conform to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process.

Facility Information	
Date of Decommissioning:	
Facility Name:	
Location:	
Description of Decommissioning Activities:	

Decommissioning Checklist					
[Normative Reference] Question	Answer (Y/N)	Comments	Action Items	Party Responsible	Date Completed
The following questions are based on Chapter 4, Preparation:					
[4.2] Has the purpose(s) for decommissioning the system been identified and documented?					
[4.3] Has the refrigeration equipment that will be abandoned in place or dismantled and removed from the facility been identified, located, and documented?					
[4.4] Has the total amount of ammonia that will be removed from the system been estimated and documented?					
[4.5] Have the regulatory requirements that must be met during the decommissioning activities been identified and documented?					
[4.6] Have the documentation retention requirements been identified and followed?					
[4.7] Have the personnel that will be involved in the decommissioning activities been identified as follows?					
[4.7.1] Coordinator?					
[4.7.2] Decommissioning Team Members?					
[4.7.3] Response Personnel?					
[4.7.4] Affected Personnel?					
[4.8] Have the following supporting documents been developed and are readily accessible to decommissioning team members?					

Decommissioning Checklist					
[Normative Reference] Question	Answer (Y/N)	Comments	Action Items	Party Responsible	Date Completed
[4.8.1] Physical Properties of potential hazards?					
[4.8.2] System Diagrams?					
[4.8.3] Pressure Relief Valves?					
[4.8.4] Emergency Action and/or Response Plan?					
[4.8.5] Identification of equipment, components and piping MAWP & MDMT (MAWP and MDMT shall not be exceeded during decommissioning activities)?					
[4.9] Impacts on Safety and Health?					
[4.10] Decommissioning Procedures?					
[4.11] Inspection, Testing, and Maintenance (Equipment and components that need ITM during decommissioning have been identified and documented)?					
[4.11.1] Have Safety Systems, transfer components and equipment been verified to be functional and ITM performed in accordance with ANSI/IIAR 6 throughout the decommissioning process?					
[4.12] Has the training for decommissioning team members been conducted and documented including the following content?					
[4.12.1] An overview of the decommissioning activities?					
[4.12.2] A description of the safety and health hazards and the properties of ammonia, lubricating oil, and other chemicals involved in the decommissioning activities, including first aid for exposure to these chemicals?					
[4.12.3] A review of the procedures that document the steps that will be taken during decommissioning activities?					
[4.13] Have the response personnel and affected personnel been provided with an overview of the decommissioning activities?					

Decommissioning Checklist					
[Normative Reference] Question	Answer (Y/N)	Comments	Action Items	Party Responsible	Date Completed
The following questions are based on Chapter 5, Decommissioning Activities:					
[5.1.1] Has a final review prior to the start of the decommissioning activities been conducted to ensure that the requirements in Chapter 4 have been addressed?					
[5.2.2] Have the decommissioning procedures been updated to address any special or unique hazards that arise during decommissioning activities that were not anticipated during preparation such as?					
[5.2.3.1] Verifying that no materials during decommissioning activities will deteriorate in the presence of ammonia or lubricating oil, or a combination of both, or any normal contaminant such as air or water?					
[5.2.3.2] Ensuring that all equipment and materials used during decommissioning activities are designed for ammonia refrigerant at the coincident temperature and pressure to which the components shall be subjected?					
[5.2.3.3] Are hot work permits for use of an open flame, arc welding, or other hot work being used?					
[5.2.3.3] If necessary to evaporate residual liquid ammonia, is heat being applied to system components safely?					
[5.2.3.4] Have you ensured that appropriate, non-impact methods are used to safely remove ice from equipment that may contain residual ammonia?					
[5.2.3.5] Have you ensured that system components are isolated and that residual ammonia and lubrication oil have been drained before they are physically disconnected?					
[5.2.3.6] Have you ensured that ammonia vapors removed from the refrigeration system were properly handled in accordance with applicable local, state, and federal regulations?					

Decommissioning Checklist					
[Normative Reference] Question	Answer (Y/N)	Comments	Action Items	Party Responsible	Date Completed
[5.2.3.7] Have you ensured that all individual chemicals removed from the system or those no longer used for operations of the system, were recycled or disposed of in accordance with applicable local, state, and federal regulations?					
[5.3.1] Have you obtained and updated the following documentation after decommissioning activities were completed?					
[5.3.1.1] Tracking information to document the removal of chemicals from the facility?					
[5.3.1.2] Facility documentation to reflect the decommissioning of the refrigeration system?					

Final Review Checklist					
[Normative Reference] Question	Answer (Y/N)	Comments	Action Items	Party Responsible	Date Completed
The following questions are based on Chapter 5, Decommissioning Activities:					
[5.3.2.1] After decommissioning activities have been completed, have you contacted offsite response personnel who were contacted in advance of the decommissioning activities?					
[5.3.2.2] After decommissioning activities have been completed, have you contacted appropriate government agencies?					
[5.3.2.2] If decommissioning activities have reduced the ammonia system below the Federal threshold quantity, have you submitted a revised ammonia RMP to EPA within 30 days?					
[5.3.2.2] If decommissioning activities have reduced the ammonia system below the State threshold quantity, have you submitted a revised ammonia RMP equivalent to your State agency within the required timeline?					

Appendix C. (Informative) Decommissioning Procedure Considerations

This informative appendix is not a part of the standard. It is merely informative and does not contain requirements necessary to conform to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process.

The following items should be considered and/or included when developing decommissioning procedures.

1. **PPE.** The personal protective equipment (PPE) that should be worn when performing decommissioning activities. The IAR's Introduction to Ammonia Refrigeration contains a description of personal protective equipment applicable to ammonia refrigeration activities.
2. **Eyewash and Safety Shower Capabilities.** The equipment that may be needed for the emergency drenching and flushing of the eyes and body, such as eyewash/safety shower units, in areas where activities could expose personnel to corrosive materials.
3. **Ammonia Detection.** The procedures and/or equipment that may be used to detect ammonia releases during the decommissioning activities. Options include the use of fixed ammonia detectors or portable ammonia detectors.
4. **Ventilation.** The ventilation equipment that may be needed during the decommissioning activities. Options include setting up ventilation systems so that they turn on automatically when ammonia is detected, running ventilation systems continuously, providing portable ventilation units, and shutting off facility HVAC intake units during the decommissioning activities.
5. **Buddy System.** When the buddy system should be followed during decommissioning activities. The buddy system should be practiced for operations where there is the potential that ammonia could be released, for example, operations that involve opening refrigeration equipment or piping. The buddy system should also be practiced during emergency operations involving ammonia releases.
6. **Portable Equipment and Tools.** The portable equipment and tools that may be needed during decommissioning activities, including:
 - Communication equipment
 - Transfer hoses
 - "Caution" tape and/or barricades
 - Portable pumps or compressors
 - Equipment that can be used to safely apply heat
 - A supply of inert gas, such as nitrogen or air
 - Portable lifts
 - Portable ammonia detection devices
 - Portable ventilation units

7. **Safe Work Practices.** The safe work practices that should be followed during the decommissioning activities. Safe work practices include lockout/tagout, line breaking, hot work permit and confined space entry procedures. Appendix E contains a list of OSHA standards related to safe work practices that apply to facilities in the United States.
8. **Changes to Daily Operations.** The changes to daily operations that may be needed to accommodate the decommissioning activities, including:
 - Whether to suspend and/or modify daily operations at the facility during the decommissioning activities.
 - Areas at the facility that should be restricted and/or evacuated during the decommissioning activities.
 - Changes that should be made to the site security procedures during the decommissioning activities.
 - Whether to limit and/or control access to motorized vehicles such as tank trucks and forklifts during the decommissioning activities.
 - Whether to use “caution” tape, barricades signs and/or posting personnel at key locations to restrict access to the certain areas at the facility during decommissioning activities.
 - Whether any additional labels, signs or placards should be installed during the decommissioning activities such as temporary emergency exit signs.
9. **Changes to the Equipment.** The equipment changes that may be needed to accommodate the decommissioning activities, including:
 - Changes so that the refrigeration equipment can be safely accessed.
 - Additional check valves, vent valves, drain valves, isolation valves and/or pressure relief valves that may need to be installed.
 - Additional instrumentation such as temperature and pressure gauges that may need to be installed.
 - Insulation that may need to be removed.
 - Additional supports that may need to be provided.
10. **Shutting Down and Isolating Equipment.** The steps that should be taken to shut down and isolate the refrigeration equipment during the decommissioning activities, and the order that these steps will be taken. Often ammonia will be removed from the evaporators and the piping manifolds before it is removed from the main vessels in the refrigeration system. Once ammonia has been removed from the evaporators and the piping manifolds, the liquid ammonia that has accumulated inside the main vessels can be removed into a holding vessel and/or a tank truck.
11. **Avoiding Trapped Liquid.** The precautions that should be taken to prevent trapping liquid ammonia when shutting down and isolating the refrigeration equipment. Hydrostatic pressure can develop when liquid ammonia is trapped with no gases present. Whenever this is a possibility, the sequence of steps should assure that liquid

has been removed from the system component(s) to be isolated before the last isolation valve is closed.

12. **Avoiding Improper Valve Opening and Closing.** The precautions that should be taken to ensure that valves will not be inadvertently opened or closed during decommissioning activities. Options include preparing a list of the valves that will be opened and closed, and tagging or locking these valves.
13. **Raising and Lowering Pressure.** The steps that should be taken to raise or lower the pressure on the refrigeration system components during decommissioning activities to transfer liquid ammonia or ammonia vapor. Often the pressure in the refrigeration equipment will be raised or lowered to transfer liquid ammonia to a vessel or tank truck during decommissioning activities. In addition, once liquid ammonia has been removed from the refrigeration equipment, a vacuum is often placed on the equipment to remove residual ammonia vapors.
14. **Applying Heat.** External heat application options include the following:
 1. Water - Where the water temperature is between 32°F and 180°F, provided the ammonia pressure is above 47.6 psig (i.e., above the freezing temperature of 32°F).
 2. Forced hot air devices - Where the air temperature is below 180°F.
 3. Portable tools having an open flame - Where it cannot cut or reduce the mechanical integrity of the surfaces where the heat is applied.

Hot ammonia vapor passing over the surface of liquid ammonia is ineffective for vaporizing liquid ammonia. However, depending on the geometry of the equipment, components, or piping, ammonia vapor can effectively displace liquid ammonia.

During heat application, temperatures above 180°F should not be applied to valves or piping of the closed-circuit refrigeration system to avoid damaging materials.

15. **Minimum Design Temperature.** The precautions that should be taken to ensure that temperatures do not go below the minimum design temperature of the refrigeration system components for extended periods of time during the decommissioning activities, including precautions to address the flashing of subcooled liquid ammonia. During decommissioning activities, equipment, components, and piping being permanently shut down from normal operations may be exposed to lower temperatures and lower pressures due to the evaporation of liquid ammonia during its final removal for short periods of time.
16. **Maximum Allowable Working Pressure.** The precautions that should be taken to ensure that the pressure does not go above the maximum allowable pressure of the refrigeration system components during the decommissioning activities.
17. **Avoiding Abnormal Pressure or Shock.** The precautions that should be taken to avoid component failure caused by abnormal pressure or shock when transferring liquid ammonia or ammonia vapor.
18. **Liquid Levels.** The precautions that should be taken to ensure that the liquid levels stay within expected operating limits in the vessels during the decommissioning activities.

19. **Draining the Components.** The steps that should be used to drain refrigerant and/or lubrication oil from the low points in the refrigeration system.
20. **Flushing the Components.** The steps that should be used to flush the refrigeration system components to remove residual ammonia vapor. Inert gases, such as nitrogen, may be used to flush the refrigeration system components to remove residual ammonia vapor.
21. **Identifying Vessels and/or Tank Trucks.** The vessels and/or tank trucks that may be used to accumulate any ammonia that is being transferred, where portable vessels and/or tank truck(s) should be parked, and what connections should be used on the refrigeration system to transfer ammonia from the system into the vessels and/or tank trucks. Consult Department of Transportation (DOT) regulations for any hazardous materials transportation requirements that may apply.
22. **Disconnecting and Removing the Components.** The steps that should be used to physically disconnect and remove the refrigeration system components.
23. **Shutting Down Equipment in an Emergency.** The steps that should be taken to shut down and isolate the refrigeration equipment in an emergency during the decommissioning activities, including the personnel who would respond to these emergencies.
24. **Accounting for Residual Ammonia in Equipment.** The precautions that should be taken to ensure equipment removed from the refrigeration system does not contain any residual ammonia, lubrication oil, or other chemicals.
25. **Accounting for Residual Ammonia in Lubrication Oil.** The precautions that should be taken to account for the residual ammonia that may be contained in lubrication oil removed from the refrigeration system components. Lubrication oil that contains residual ammonia should be completely de-gassed before it is placed in a sealed container to prevent damage to the container due to pressure increases if the lubrication oil were to increase in temperature while the container is sealed.
26. **Disposing Chemicals.** The steps that should be used to dispose of ammonia, lubrication oils, corrosion inhibitors, and other chemicals removed from the refrigeration system components. Ammonia absorption systems typically contain a corrosion inhibitor, such as sodium chromate, within the sealed refrigeration system. This corrosion inhibitor should be considered when disposing ammonia-water mixtures from an ammonia absorption system.
27. **Protecting the Refrigeration System Components.** The steps that should be used to protect refrigeration system components after the components have been decommissioned. Some system components will not be physically removed from the refrigeration system after they have been decommissioned. Often, after the ammonia has been removed from these components, they will be charged with an inert gas (such as nitrogen) to keep out moisture and other contaminants if there is a possibility that the components may be recommissioned. If/when the components are

decommissioned, the inert gas would have to be removed before the components can be placed back in service.

Appendix D. (Informative) References and Sources of References

D.1 Informative References

D.1.1 International Institute of Ammonia Refrigeration (IIAR):

Process Safety Management and Risk Management Program Guidelines, Volume 1 and Volume 2, Third Edition.

Ammonia Refrigeration Management (ARM) Program, Second Edition.

Ammonia Data Book, Second Edition.

Introduction to Ammonia Refrigeration, Second Edition.

D.1.2 Occupational Safety and Health Administration (OSHA), U.S. Department of Labor:

29 CFR 1910.132, *General Requirements, Personal Protective Equipment.*

29 CFR 1910.133, *Eye and Face Protection.*

29 CFR 1910.134, *Respiratory Protection.*

29 CFR 1910.146, *Permit-Required Confined Spaces.*

29 CFR 1910.147, *The Control of Hazardous Energy.*

29 CFR 1910.252, *General Requirements, Welding, Cutting and Brazing.*

D.1.3 Environmental Protection Agency (EPA):

40 CFR Parts 350 to 372, *Emergency Planning and Community Right-to-Know Act (EPCRA).*

D.1.4 Department of Homeland Security (DHS):

6 CFR Part 27, *The Chemical Facility Anti-Terrorism Standards (CFATS).*

D.2 Sources of References (Informative)

D.2.1 International Institute of Ammonia Refrigeration (IIAR)

1001 North Fairfax Street, Suite 503
Alexandria, VA 22314

www.iiar.org

- D.2.2 U.S. Department of Labor/Occupational Safety and Health Administration (USDOL/OSHA)
Publications Department
200 Constitution Avenue, NW, Room N3101
Washington, DC 20210
www.osha.gov
- D.2.3 Environmental Protection Agency (EPA)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
www.epa.gov
- D.2.4 Department of Homeland Security (DHS)
1880 2nd Street SW
Washington, DC 20024
www.dhs.gov