



# **Progress in Codes and Standards related to Ammonia, Carbon Dioxide, and Hydrocarbon Refrigerants**

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# Today's Host



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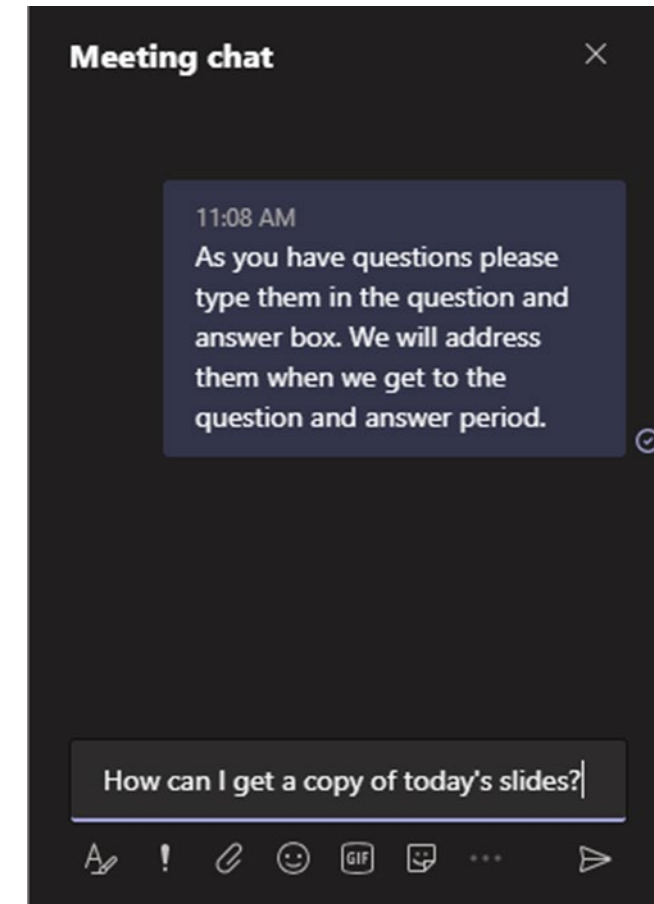
**Annie** is an Environmental Protection Specialist in the Stratospheric Protection Division (SPD) in EPA's Office of Atmospheric Protection, where she works on rulemakings under the American Innovation and Manufacturing (AIM) Act and partnership programs. Prior to SPD, she also worked on EPA's SmartWay program, which helps companies advance supply chain sustainability by improving freight transportation efficiency.

# Questions



## Question and Answer (Q&A) Session

- Participants are muted
- Questions will be moderated at the end
- To ask a question, enter your comment into the chat box



# Webinar Feedback and Materials



## Feedback Form

- We value your input!
- The link to a feedback form will appear in the chat window

## Recording and Slides

- Webinar is being recorded
- Materials will be posted on the GreenChill website under Events and Webinars: [www.epa.gov/greenchill](http://www.epa.gov/greenchill)
- To receive notification when materials are posted email: [EPA-GreenChill@abtassoc.com](mailto:EPA-GreenChill@abtassoc.com)

# Program Overview



[www.epa.gov/greenchill](http://www.epa.gov/greenchill)

**GreenChill is a voluntary partnership program that works collaboratively with the food retail industry to reduce refrigerant emissions and decrease stores' impact on the ozone layer and climate system**

GreenChill works to help food retailers:

- Lower refrigerant charge sizes and eliminate leaks
- Transition to environmentally friendlier refrigerants
- Adopt green refrigeration technologies and best environmental practices



# Become a GreenChill Partner!



**Join your  
Industry Peers!**

*GreenChill is  
actively recruiting  
new Food Retail  
Partners*



Request a  
partnership packet



Sign the partnership  
agreement



Meet eligibility  
requirements



Become a GreenChill  
partner!

**The GreenChill Partnership Process**

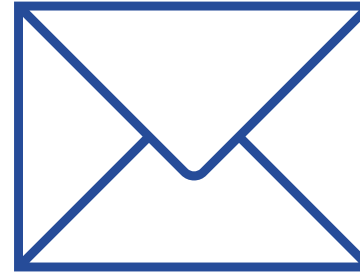
[epa.gov/greenchill/about-greenchill-corporate-emissions-reduction-program](https://epa.gov/greenchill/about-greenchill-corporate-emissions-reduction-program)

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**Today's Speaker...**

# Today's Speaker



## **Tony Lundell**

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Tony has over 40 years of experience in Utilities and Facilities Engineering, Operations, Maintenance, and Management. Beginning as a hands-on technician, he progressed to fulfill many roles in the Heating, Ventilation, and Air Conditioning (HVAC), Refrigeration, Plant Engineering, Facilities Engineering, and Manufacturing Engineering industries. Before joining IIAR, he served in numerous supervisory-to-director level roles at Oscar Mayer Corporation, Sara Lee Corporation, Pepsico at Tropicana, Nestle, the National Archives and Records Administration, and Americold Logistics. At IIAR, he facilitates and develops IIAR Standards, provides refrigeration industry technical assistance, develops and enhances our Process Safety Management/Risk Management Plan activities, helps review and develop the Academy of Natural Refrigerants Educational Program Modules, and he is a veteran presenter at industry related conferences and webinars.



# **Progress in Codes and Standards related to Ammonia, Carbon Dioxide, and Hydrocarbon Refrigerants**

# AGENDA

- Codes and Standards Road Map Overview
- Significant New Alternative Policy (SNAP) Program – U.S. EPA
- IIAR Standards – Ammonia, carbon dioxide (CO<sub>2</sub>), hydrocarbon (HC)
- Model Code Adoptions of International Institute of Ammonia Refrigeration (IIAR) Standards
- Purpose, Scope, & Occupancies:
  - American National Standards Institute (ANSI)/IIAR CO2-2021
  - IIAR HC
    - ✓ Standard in Development
  - ANSI/IIAR 2-2021



# Codes and Standards Road Map

Refrigerant	SNAP Approved <sup>1</sup>	Equipment Safety	Engineering	Service <sup>2</sup>	Building Codes
Ammonia (NH <sub>3</sub> )	Yes	Yes	Yes	Yes	Yes
CO <sub>2</sub>	Yes	Yes	Yes	Yes	Yes
HCs up to 500 grams	In Progress <sup>3</sup>	Yes	Yes	No	In Progress
HCs as primary in Cascade/Secondary Systems	Industrial Process Refrigeration Only	Yes	Yes	No	No

<sup>1</sup> For information about EPA's SNAP program, see [www.epa.gov/snap](http://www.epa.gov/snap)

<sup>2</sup> Service Standards addressed by Contractor & Service Technician Group

<sup>3</sup> For information about EPA's Proposed Rule 26, see [www.epa.gov/snap/snap-regulations](http://www.epa.gov/snap/snap-regulations)

# SNAP Program – U.S. EPA

## EPA SNAP Approvals:

### Refrigeration and Air Conditioning:

Chillers - (these are specific to comfort cooling) R1234ze, R717, R744

Cold Storage Warehouses - R717, R744

Ice Skating Rinks - R717, R744

### Industrial Process:

Air Conditioning - R717, R744

Refrigeration - R1270 (propylene), R290 (Propane), R600a (isobutane), R717, R744

### Retail Food Refrigeration:

Standalone - R290 & R600a (up to 500-gram charge limit), R717 with secondary loop, R744

Remote Condensing Units - R717 with secondary loop, R744

Supermarket Systems - R717 with secondary loop, R744





# IIAR

- **Ammonia (NH<sub>3</sub>)** – Nine (9) Standards
  - ✓ Also know as the Suite of Standards
  - ✓ ANSI Approved
- **Carbon Dioxide (CO<sub>2</sub>)** – Safety Standard
  - ✓ ANSI Approved
- **Hydrocarbons (HC)** – Safety Standard
  - ✓ Standard in Development



# Model Code Adoptions of IIAR Standards

## 2024 International Fire Code (IFC)

IIAR 2, 6, 7, 8, 9, CO<sub>2</sub>

## 2024 International Mechanical Code (IMC)

IIAR 2, 3, 4, 5, 6 and CO<sub>2</sub>

## 2024 National Fire Protection Association (NFPA) 1 Fire Code

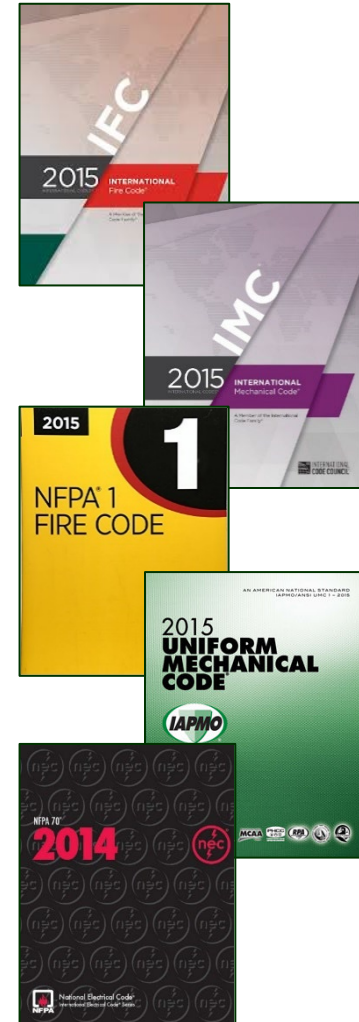
IIAR 2, 6, 7, 8

## 2023 NFPA 70 National Electrical Code (NEC)

IIAR 2

## 2024 Uniform Mechanical Code (UMC)

IIAR 2, 3, 4, 5, 6, and CO<sub>2</sub>

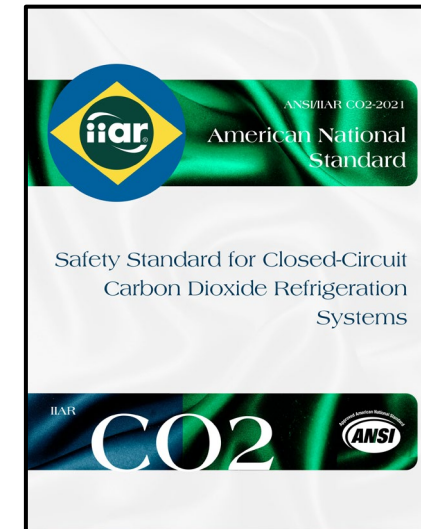


# ANSI/IIAR CO2-2021

## Safety Standard for Closed-Circuit Carbon Dioxide Refrigeration Systems

Specifies minimum requirements:

- Design – General & Specific
- Installation
- Start-up
- Inspection, Testing, & Maintenance



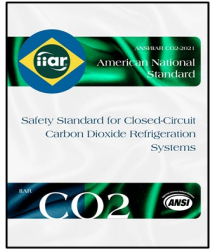
# ANSI/IIAR CO2-2021

## Occupancies

- Public Assembly, Commercial, and Large Mercantile Occupancies
- Industrial Occupancies and Refrigerated Spaces
- Institutional and Residential Occupancies



# ANSI/IIAR CO2-2021



## 1.1 Purpose.

- 1.1.1 This standard specifies minimum requirements for the safe [design](#) of closed-circuit carbon dioxide refrigeration systems.
- 1.1.2 This standard specifies minimum requirements for the safe [installation](#) of closed-circuit carbon dioxide refrigeration systems.
- 1.1.3 This standard specifies minimum requirements for [startup](#) of closed-circuit carbon dioxide refrigeration systems.
- 1.1.4 This standard specifies minimum requirements for [inspection, testing, and maintenance](#) of new and existing closed-circuit carbon dioxide refrigeration systems.

# ANSI/IIAR CO2-2021



## 1.2 Scope.

1.2.1 Stationary closed-circuit refrigeration systems utilizing carbon dioxide as the refrigerant shall comply with this standard.

1.2.2 This standard also applies to:

1. Systems or parts of systems that function as heat pumps utilizing carbon dioxide as the refrigerating or heating medium.
2. The part of refrigeration systems utilizing carbon dioxide as the low temperature refrigerant within a cascade system.
3. The part of refrigeration systems utilizing carbon dioxide as a secondary fluid.
4. Carbon dioxide refrigeration systems and heat pumps operating part-time or full-time with a transcritical cycle.
5. Additions or modifications to existing carbon dioxide refrigeration systems.



# ANSI/IIAR CO2-2021



## 1.2.3 This standard does not apply to:

1. Replacements of refrigeration equipment or piping with functional equivalents.
2. Equipment and systems and the buildings or facilities in which they are installed that existed prior to the legal effective date of this standard. Such equipment, systems, and buildings and facilities shall be maintained in accordance with the regulations that applied at the time of installation or construction.
3. Parts of a refrigeration system or heat pump that do not contain carbon dioxide as a refrigerant or secondary fluid.
4. Listed equipment or systems.

The intent of this standard is not to exempt an entire system based on the listing of individual components used in that system.

# ANSI/IIAR CO2-2021

## Part 2. Design Considerations Affecting Construction

### Chapter 4. Location of Refrigeration Equipment

4.1 **General.** The location of carbon dioxide refrigeration equipment shall comply with this chapter.



# ANSI/IIAR CO2-2021

- Industrial Occupancies and Refrigerated Spaces
- Public Assembly, Commercial, and Large Mercantile Occupancies
- Institutional and Residential Occupancies
- Use of Carbon Dioxide Refrigeration with Secondary Fluids



# ANSI/IIAR CO2-2021

The quantity of refrigerant shall be limited such that a complete discharge from any independent refrigerant circuit **will not result in a carbon dioxide concentration exceeding 15,000 ppm** in any room or area where equipment containing carbon dioxide is located.



# IIAR HC

## Standard in Development

Safety Standard for Closed-Circuit Refrigeration  
Systems Utilizing Hydrocarbon Refrigerants



**SAFE AND SUSTAINABLE USE OF** NATURAL REFRIGERANTS

# IIAR HC Standard in Development

## Safety Standard for Closed-Circuit Refrigeration Systems Utilizing Hydrocarbon Refrigerants

**Purpose:** This standard specifies minimum requirements for stationary closed-circuit hydrocarbon refrigeration systems for:

- Design – General & Specific
- Installation
- Start-up
- Inspection, Testing, & Maintenance
- Decommissioning
- Common Equipment





# IIAR HC Standard in Development

Safety Standard for Closed-Circuit Refrigeration Systems Utilizing Hydrocarbon Refrigerants

## Occupancies

- Industrial Occupancy
- Commercial Occupancy
- Outdoor Installations
- Use with Secondary Fluids



# IIAR HC Standard in Development

## Safety Standard for Closed-Circuit Refrigeration Systems Utilizing Hydrocarbon Refrigerants

### 1.2 Scope.

1.2.1 Stationary closed-circuit refrigeration systems utilizing hydrocarbons as the refrigerant shall comply with this standard.

The standard specifically applies to the following hydrocarbon refrigerants:

1. Propane (R290)
2. N-Butane (R600)
3. Iso-butane (R600a)

Propylene (R1270), Ethane (R170), and Ethylene (R1150): Reserved for future revisions.



# IIAR HC Standard in Development

## Safety Standard for Closed-Circuit Refrigeration Systems Utilizing Hydrocarbon Refrigerant

1.2.2 This standard also applies to:

1. Systems or parts of systems that function as [heat pumps](#) utilizing hydrocarbon as the refrigerating or heating medium.
2. The part of refrigeration systems utilizing hydrocarbon as the low temperature [refrigerant within a cascade system](#).
3. The part of refrigeration systems utilizing hydrocarbons as a [secondary fluid](#).
4. [Additions or modifications](#) to existing hydrocarbon refrigeration systems.

# IIAR HC Standard in Development

## Safety Standard for Closed-Circuit Refrigeration Systems Utilizing Hydrocarbon Refrigerants

### 1.2.3 This standard does not apply to:

1. Replacements of refrigeration equipment or piping with functional equivalents.
2. Equipment and systems and the buildings or facilities in which they are installed that existed prior to the legal effective date of this standard. Such equipment, systems, and buildings and facilities shall be maintained in accordance with the regulations that applied at the time of installation or construction.
3. Parts of a refrigeration system or heat pumps that do not contain hydrocarbons as a refrigerant or secondary fluid.
4. Systems or equipment listed in accordance with Underwriter Laboratory (UL)/Canadian Standards Association (CSA) 60335-2-89, 60335-2-40, or 60335-2-24.

# IIAR HC Standard in Development

**4.3 Refrigerant Restriction.** The total of all hydrocarbon refrigerants on site shall not exceed 1,100 pounds (499 kg) except where approved by the Authority Having Jurisdiction (AHJ).



# IIAR Suite of Standards

## Closed-Circuit Ammonia Refrigeration Systems

**IIAR 1** – Definitions and Terminology Used in IIAR Standards

**IIAR 2** – Design (of a Safe...)

**IIAR 3** – Ammonia Refrigeration Valves

**IIAR 4** – Installation (of...)

**IIAR 5** – Start-up (of...)

**IIAR 6** – Inspection, Testing, and Maintenance (of...)

**IIAR 7** – Developing Operating Procedures (for...)

**IIAR 8** – Decommissioning (of...)

**IIAR 9** – Minimum System Safety Requirements (for Existing...)



# ANSI/IIAR 2-2021

## Chapter 4. Location of Refrigeration Equipment

**Purpose:** This standard specifies minimum requirements for [Design](#) of Safe Closed-Circuit Ammonia Refrigeration Systems.

### 4.1 General.

The location of ammonia refrigeration equipment shall comply with this chapter. Ammonia refrigeration equipment [located in a machinery room](#) complying with Chapter 6 or [located outdoors](#) in accordance with Section 4.2.2 [shall be permitted in conjunction with a secondary coolant that serves any occupancy](#) in accordance with Section 5.4.





# ANSI/IIAR 2-2021

## Chapter 4. Location of Refrigeration Equipment

**Scope.** Stationary closed-circuit vapor compression and absorption refrigeration systems utilizing anhydrous ammonia as the refrigerant shall comply with this standard.

This standard shall not apply to:

1. Replacement in-kind;
2. Equipment and systems and the buildings or facilities in which they are installed that existed prior to the legal effective date of this standard. Such equipment, systems, and building and facilities shall remain in accordance with the codes and standards that applied at the time of installation or construction and in accordance with IIAR 9.



# ANSI/IIAR 2-2021

## 4.2 \*Permissible Equipment Locations.

Ammonia refrigeration equipment shall be located in a machinery room that complies with Chapter 6 unless otherwise permitted by this section.

### 4.2.1 Listed Equipment.

Listed equipment containing not more than 6.6 lbs. (3 kg) of ammonia and installed in accordance with the listing and the manufacturer's instructions [shall be permitted in any occupancy without a machinery room](#). Listed equipment for use in laboratories with more than 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) of floor area is permitted to contain any amount of ammonia if the equipment is installed in accordance with the listing and the manufacturer's installation instructions.



# ANSI/IIAR 2-2021

## 4.2.2 \*Outdoor Installations.

Ammonia refrigeration equipment shall be [permitted to be installed outdoors](#) when installed in accordance with Sections 7.2.2, 7.2.4, 7.2.5, 7.2.6, 7.2.7, 7.2.10 and 7.3.2. Ammonia refrigeration equipment, other than piping, installed outdoors shall be located not less than 20 ft from building openings, except for openings to a machinery room or openings to an industrial occupancy complying with Section 7.2.

### EXCEPTIONS:

1. Packaged absorption or vapor compression systems [for residential and commercial occupancies with refrigerant quantities not exceeding 22 lbs.](#) (10 kg) are permitted to be installed within 20 ft of building openings.
2. Packaged absorption or vapor compression systems with refrigerant quantities such that a [complete discharge would not exceed a concentration of 300 ppm](#) in any room or area in which the refrigerant could enter are permitted to be installed within 20 ft. of building openings. The calculation procedure shall be in accordance with Section 5.3.



# ANSI/IIAR 2-2021

## 4.2.3 \*Industrial Occupancies.

The following ammonia refrigeration equipment shall be permitted to be **installed indoors in areas other than a machinery room in industrial occupancies** complying with Chapter 7.

1. Heat exchangers and associated surge drums (if equipped) used for space cooling, space heating, space dehumidification, process cooling, or process heating;
2. Low-probability pumps;
3. Piping, including but not limited to control and pressure-relief valves;
4. An ammonia refrigeration system with a total connected compressor drive power not exceeding 100 horsepower (HP) (74.6 kW).



# ANSI/IIAR 2-2021

## 4.2.4 \*Public Assembly, Commercial, Residential, and Large Mercantile Occupancies.

Where not prohibited by the AHJ, ammonia refrigeration equipment shall be permitted outside of a machinery room for applications in a public assembly occupancy, commercial occupancy, or large mercantile occupancy. The quantity of ammonia shall be limited such that a **complete discharge from any independent refrigerant circuit will not result in an ammonia concentration exceeding 300 ppm** in any room or area where equipment containing ammonia is located. The calculation procedure for determining the concentration level shall comply with Section 5.3.



# Contacts



## Speakers

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## GreenChill

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