Shaping Tomorrow's Global Built Environment Today

ASHRAE Position Document on

Refrigerants and their Responsible Use

Approved by the ASHRAE Board of Directors February 4, 2026

Expires February 4, 2029

ASHRAE is a global professional society of over 55,000 members, committed to serving humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields (HVAC&R). ASHRAE position documents (PDs) are approved by the Board of Directors and express the views of the Society on specific issues. These documents provide objective, authoritative background information to persons interested in issues within ASHRAE's expertise, particularly in areas where such information will be helpful in drafting sound public policy. PDs are designed to be policy documents that may eventually lead to more operational documents, such as standards, guidelines, policies, and regulations; they are not meant to provide metrics or procedures or be operational. The documents also clarify ASHRAE's position for its members and building professionals.

Refrigerants and their Responsible Use is a Public Interest Issue

Heating, ventilation, air-conditioning, and refrigeration (HVAC&R) systems provide life-saving climate control and refrigeration (e.g., for food, medicine, etc.), but these systems depend on refrigerants to function. Selecting a refrigerant for a given application requires balancing multiple factors, including safety, efficiency, cost, environmental impacts, and material compatibility. Over the past three decades, refrigerant options have shifted significantly as the environmental impacts of certain classes of refrigerants have become better understood. For example, chlorofluorocarbon (CFC) refrigerants once widely used in HVAC&R systems were phased out under the Montreal Protocol because of their role in depleting atmospheric ozone. More recently, hydrofluorocarbon (HFC) refrigerants have been subject to phasedowns and phaseouts due to their comparatively high global warming potential (GWP).

Many of the newer refrigerants developed to replace HFCs are slightly flammable and classified as 2L by ASHRAE Standard 34. To address the flammability characteristics of these new refrigerants, ASHRAE's refrigeration safety standards (Standards 15 and 15.2) have been updated to ensure their safe use in applications. These changes have also been reflected in codes and regulations to ensure their safe final deployment in the built environment.

Beyond known refrigerant environmental impacts, recent broad policy proposals related to health concerns of certain persistent, bioaccumulative, toxic (PBT) fluorinated chemicals could limit available refrigerants, depending on the scope of any per- and poly-fluorinated alkyl substances (PFAS chemicals) regulations.

These factors and others have made refrigerant selection increasingly complex. For example, selecting a lower-GWP refrigerant solely for its reduced global warming potential may also reduce

equipment efficiency, potentially offsetting the environmental benefit associated with direct emissions of the refrigerant. No single refrigerant can satisfy the full range of criteria for all HVAC&R applications. Consequently, selecting a refrigerant often involves trade-offs across multiple factors, including short-term and long-term environmental effects, health and safety (e.g., flammability and toxicity), equipment cost and reliability, system performance, and current and potential future regulations, codes, and standards. Proper system design, operation, and maintenance practices can mitigate refrigerant emissions and their impacts.

Evolution of Refrigerant Selection

Evolving environmental standards are reshaping the HVAC&R industry, with refrigerant choice of ever-increasing importance for new and existing systems. The harnessing of mechanical refrigeration systems in the mid-nineteenth century included refrigerant options such as ammonia, carbon dioxide, sulfur dioxide, methyl chloride, ether, isobutane, propane, and ethyl ether. Except for ammonia in industrial applications, these were replaced by systems using safer chlorofluorocarbons (CFCs) developed in the 1930s. CFCs were followed by hydrochlorofluorocarbons (HCFCs), both of which are phased out under the Montreal Protocol due to their ozone-depleting potential. Hydrofluorocarbons (HFCs) were adopted as replacements for both CFCs and HCFCs, but their high GWP has led to increased restrictions.

Hydrofluoroolefins (HFOs), introduced more recently, offer lower GWP and de minimis ozone depletion potential (ODP), but there remains interest in the emissions of refrigerant precursors and the environmental fate (e.g., atmospheric degradation and deposition) of halogenated gases, including HFOs. Some HFOs are classified as A2L according to ASHRAE Standard 34. The global HVAC&R industry has invested substantially in research to better understand the safety and risks associated with A2L refrigerants. These findings have informed updates to ASHRAE safety standards (Standards 15 and 15.2) and guided revisions to design standards, codes, and regulations to support their safe use in the built environment.

Additionally, early refrigerants such as ammonia, carbon dioxide, propane, and isobutane are now widely selected for use in certain industries with improved system designs to mitigate flammability and toxicity concerns. These refrigerants are also being considered for broader applications due to their ultra-low GWP and de minimis ODP.

The Kigali Amendment to the Montreal Protocol and policies such as the American Innovation and Manufacturing Act (AIM) in the United States and F-gas regulations in Europe have driven the current transition to lower-GWP refrigerants. This shift has led to the increased use of refrigerants with different safety characteristics, including flammability, toxicity, or pressure, requiring updates to safety standards and additional workforce training.

Balancing Trade-Offs

No refrigerant is without trade-offs. Selection must consider many factors, including the following:

- Environmental impact, including effects on the ozone layer and climate
- Health and safety, including flammability and toxicity

- System energy efficiency
- Cost-effectiveness, including first cost and total cost of ownership
- Performance at high and low ambient temperatures
- Thermal stability and materials compatibility
- Future projected availability of the refrigerant

Figure 1 provides additional comprehensive criteria that can be considered depending on the application and context.

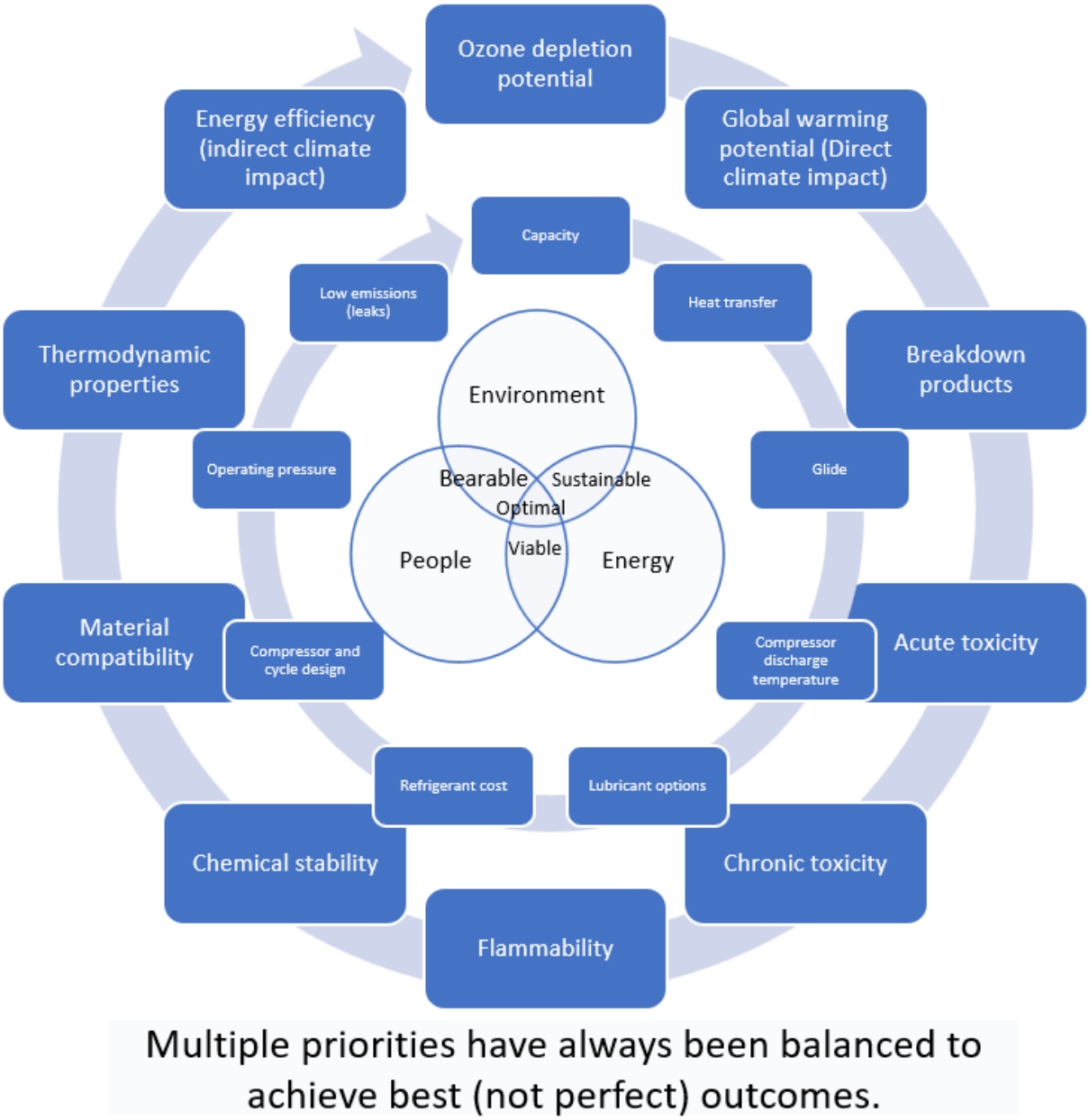

Figure 1 Refrigerant selection: weighing impacts and balancing critical factors.

Lower-GWP refrigerants may introduce additional challenges, including specialized handling requirements, market acceptance, and end-of-life management. Proper refrigerant recovery, recycling, and disposal at system retirement and during operation are essential to minimize environmental impact.

ASHRAE's Role

ASHRAE plays a central role in providing information on refrigerant alternatives and advancing sustainable HVAC&R practices. The organization informs industry professionals, policymakers, and the public about refrigerant choices and their implications through research, standards development, technical publications, training, and outreach. ASHRAE supports a refrigerant-agnostic, balanced approach, ensuring that decisions consider all relevant factors to optimize outcomes, including safety, efficiency, environmental impact, and regulatory compliance. All stakeholders, including equipment end users, must fully understand the trade-offs associated with refrigerant transitions and determine whether these trade-offs are acceptable. To achieve this, information must be communicated using methods tailored to each stakeholder group.

As the industry evolves, ASHRAE and its members continue to drive innovation in sustainable refrigeration. Through research, education, and collaboration with industry partners, ASHRAE promotes responsible refrigerant use, advances environmentally sound practices, and supports the development of solutions that ensure a more sustainable future for HVAC&R systems worldwide.

Why ASHRAE Takes Positions on Refrigerants and their Responsible Use

ASHRAE has a direct interest in refrigerant transitions because the operation of HVAC&R equipment depends on refrigerants. The organization contributed to the successful phaseout of ozone-depleting CFC and HCFC refrigerants and continues to play a significant role in promoting the proper and safe use of refrigerants. ASHRAE is actively involved in research, standards, codes, guidelines, technology transfer, policy, and education to support these efforts.

Positions and Recommendations

ASHRAE Takes the Positions that:

- Refrigerant selection and system design should consider all factors holistically, including current and future global, national, and local policies; employee and public safety; energy efficiency and performance; environmental impacts; and life-cycle operating economics. Decisions should not rely solely on a single feature, such as GWP, operating pressure, efficiency, first cost, or flammability.
- The wide range of HVAC&R application requirements, system types, and regional conditions and regulations necessitates broad understanding and guidance to determine the refrigerants best suited for each application.
- Refrigerant charge should be minimized whenever possible to reduce potential risks to people and the environment in the event of system failure. All refrigerant emissions should be proactively managed through improved technology, operations, and accurate

understanding of release rates and quantities.

- The phaseout of ozone-depleting substances and the phasedown of higher-GWP hydrofluorocarbons presents technical, safety, economic, and environmental challenges for refrigerant selection, especially in the context of rapid international growth in air conditioning and refrigeration and the widely varying impacts across global populations and sectors.
- ASHRAE has an obligation to promote international and regional collaboration toward common fundamental objectives, using scientifically based methods to maximize societal benefits related to refrigerant selection and use in HVAC&R applications.
- Different jurisdictions may prioritize outcomes differently or adopt varying regulatory frameworks, leading to a fragmented approach to refrigerant selection (e.g., European Union Fluorinated Gas Regulations versus Environment and Climate Change Canada).
- The use of refrigerants must comply with relevant standards and codes. Widespread use of flammable refrigerants, including HFOs and hydrocarbon-based refrigerants, requires careful consideration to ensure occupant safety. Standards and codes must be developed using scientifically based methods applicable to all HVAC&R systems.

ASHRAE Recommends Action in the Following Areas:

1. Research, Standards and Guidelines

    - Develop and update standards and guidelines to support safe, effective adoption of lower-GWP refrigerants, including hydrocarbons.
    - Promote global adoption of ASHRAE safety standards and practices for the benefit of society, including developing countries.
    - Conduct research and developing standards to quantify refrigerant advantages and disadvantages, emissions, and leak rates, informing mitigation strategies, policies, and the need for potential future standards.
    - Provide guidance and methodologies to the charge of refrigerant in systems and to reduce leak rates through robust system design, maintenance, and best practices for both packaged and field-built equipment.
    - Support safe and effective use of refrigerants in all applications, from low-charge systems to high-charge indirect air-conditioning and refrigerating systems and heat-pumping systems, considering safety, performance, and environmental impacts.

2. Improved Design Practice

    - Review and update existing standards and guidelines to address gaps related to refrigerant designation, classification, application, and safe use.
    - Promote development of tools and methodologies for life-cycle analysis of refrigerants and system designs, considering energy efficiency, life-cycle climate performance (including direct and indirect emissions and end-of-life impacts), safety compliance, and overall emissions.
    - Promote advancing HVAC&R system design standards and practices that minimize refrigerant charge and reduce leaks throughout equipment life.

3. Field Practices and Training

    - ASHRAE should continue to advance and improve methods to manage on-site emissions including, but not limited to, improved system tightness for leak prevention, sound commissioning and installation practices, regular leak checking, monitoring, labeling, and record keeping.
    - Owners, operators, and contractors should establish a comprehensive, ongoing refrigerant management program—covering retrofits, replacements, and regulatory compliance—aligned with corporate policy and guided by ASHRAE and industry best practices.
    - Programs should define refrigerant recovery, recycling (reuse), reclamation, and safe disposal practices, including at the end of equipment life.

4. Regulations and Long-Range Action: Promotion and Collaboration with Other Organizations

    - Identify research gaps, support a risk mitigation framework (Figure 2), and update standards, including technical metrics, standardization, and support for sector-based sustainable procurement policies. Where ASHRAE has relevant capabilities, the Society should advance standards, training, and other actions to enable faster deployment of responsible low-GWP solutions.
    - Advance the meaningful understanding of refrigerant emissions and their environmental impacts, including breakdown products.

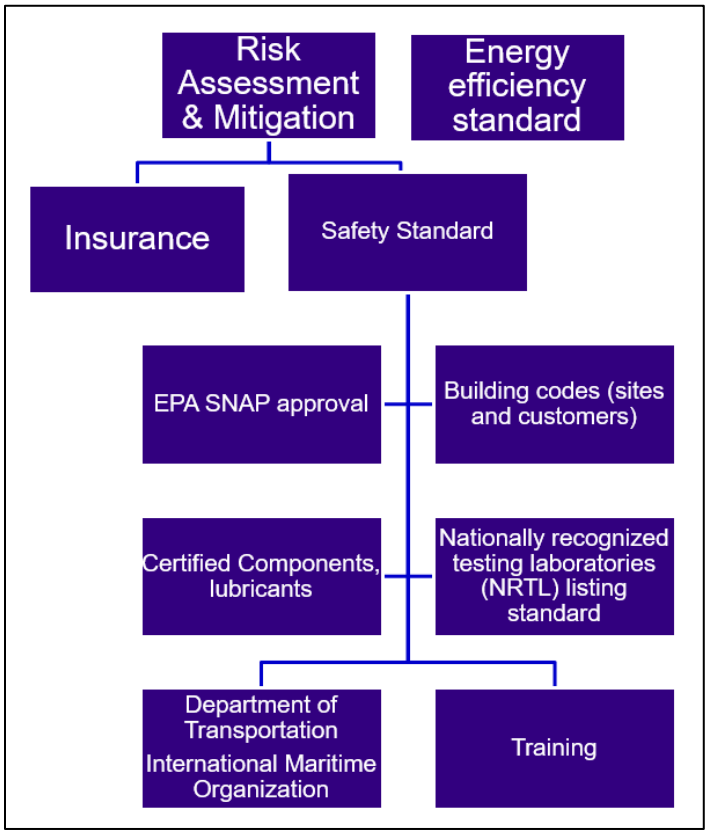

Figure 2 Risk mitigation framework.

- Provide leadership and advocacy for the HVAC&R and heat-pumping industry, supporting long-term alternatives through collaborative research, standards, and training.
- Develop research and standards for refrigerant designation, classification, and application to improve system resilience and reliability under future conditions such as reduced water availability, more frequent extreme weather, and evolving power generation and storage.

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DOCUMENT COMMITTEE ROSTER

The ASHRAE Position Document on Refrigerants and their Responsible Use was developed by the Society's Position Document Revision Committee, formed on February 12, 2024, with Dustin Lilya as its chair.

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DOCUMENT HISTORY

Publication and Revision History

ASHRAE's Technology Council and the cognizant committee recommend revision, reaffirmation, or withdrawal every 30 months. The history of this position document is described below:

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***7/2/2014**—Technology Council approves reaffirmation of Position Document titled Refrigerants and Their Responsible Use*

***1/30/2017**—Technology Council approves reaffirmation of Position Document titled Refrigerants and Their Responsible Use*

***6/27/2018**—BOD approves revision of Position Document titled Refrigerants and Their Responsible Use*

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***2/4/2026**—BOD approves revision of Position Document titled Refrigerants and Their Responsible Use*