6560-50-P

**ENVIRONMENTAL PROTECTION AGENCY**

**40 CFR Part 84**

**[EPA-HQ-OAR-2025-0005; FRL-12166-01-OAR]**

**RIN 2060-AW39**

# Phasedown of Hydrofluorocarbons: Reconsideration of Certain Regulatory Requirements Promulgated Under the Technology Transitions Provisions of the American Innovation and Manufacturing Act of 2020

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Proposed rule.

**SUMMARY:** The Environmental Protection Agency is proposing changes to regulations promulgated under the Technology Transitions section of the American Innovation and Manufacturing Act of 2020, which authorizes the Administrator to restrict the use of particular hydrofluorocarbons in the sectors and subsectors in which they are used. This proposal addresses administrative petitions and other requests from companies and trade associations across a number of subsectors, including refrigerated transport – intermodal containers, industrial process refrigeration and chillers for industrial process refrigeration used in semiconductor manufacturing, retail food refrigeration systems for remote condensing units and supermarkets, cold storage warehouses, refrigerated laboratory centrifuges, laboratory shakers, and condensing units in residential and light commercial air conditioning and heat pumps. This action proposes to allow previously manufactured and imported residential and light commercial air conditioning and heat pump equipment to continue to be installed. The Agency is also seeking advance comment on potential actions to address supply chain issues for a refrigerant blend.

**DATES:** Comments must be received on or before **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. *Public hearing*: If a public hearing is requested on or before **[INSERT DATE 5 DAYS AFTER DATE OF PUBLICATION IN**

**THE FEDERAL REGISTER]**, the EPA will hold a virtual public hearing on **[INSERT DATE 15 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. To request a public hearing, please submit a comment per the instructions in the **ADDRESSES** section. Please refer to the **SUPPLEMENTARY INFORMATION** section for additional information on the public hearing.

**ADDRESSES:** You may send comments, identified by Docket ID No. EPA-HQ-OAR-2025-0005, by any of the following methods:

- Federal eRulemaking Portal: https://www.regulations.gov (our preferred method). Follow the online instructions for submitting comments.
- E-mail: a-and-r-Docket@epa.gov. Include Docket ID No. EPA-HQ-OAR-2025-0005 in the subject line of the message.
- Mail: U.S. Environmental Protection Agency, EPA Docket Center, Air and Radiation Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.
- Hand Delivery or Courier: EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue, NW, Washington, DC 20004. The Docket Center's hours of operations are 8:30 a.m. to 4:30 p.m., Monday – Friday (except Federal Holidays).

*Instructions*: All submissions received must include the Docket ID No. for this rulemaking. Comments received may be posted without change to https://www.regulations.gov, including personal information provided. For detailed instructions on sending comments and additional information on the rulemaking process, see the "**I. Public Participation**" heading of the **SUPPLEMENTARY INFORMATION** section of this document.

**FOR FURTHER INFORMATION CONTACT:** Joshua Silver, Stratospheric Protection Division, Office of Atmospheric Protection (Mail Code 6205A), Environmental Protection Agency, 1200 Pennsylvania Ave. NW, Washington, DC 20460; telephone number: (202) 564-2473; email address: silver.joshua@epa.gov. You may also visit the EPA's website at https://www.epa.gov/climate-hfcs-reduction for further information.

**SUPPLEMENTARY INFORMATION:**

Throughout this document, whenever "we," "us," "the Agency," or "our" is used, we mean the EPA. Acronyms that are used in this rulemaking that may be helpful include:

AC–Air Conditioning

AC/HP System–Air Conditioning and Heat Pump System

AHRI–Air-Conditioning, Heating, and Refrigeration Institute

AIM Act–American Innovation and Manufacturing Act of 2020

ANPRM–Advance Notice of Proposed Rulemaking

ASHRAE–American Society of Heating, Refrigerating and Air-Conditioning Engineers

BTU–British Thermal Units

CAA–Clean Air Act

CBI–Confidential Business Information

CFR–Code of Federal Regulations

$CO_2$–Carbon Dioxide

CUSER–Coalition for the Use of Safe and Efficient Refrigerants, Inc.

EPA–U.S. Environmental Protection Agency

FMI–Food Industry Association

FR–Federal Register

GWP–Global Warming Potential

HARDI–Heating, Air-Conditioning, and Refrigeration Distributors International

HCFC–Hydrochlorofluorocarbon

HFC–Hydrofluorocarbon

HFO–Hydrofluoroolefin

IPR–Industrial Process Refrigeration

ISO–International Organization for Standardization

MCA–Maximum Credible Accident

MMTEVe–Million Metric Tons of Exchange Value Equivalent

NAICS–North American Industry Classification System

OEM–Original Equipment Manufacturer

PBI–Proprietary Business Information

PFAS–Per- and Polyfluoroalkyl Substances

SEMI–Semiconductor Equipment and Materials International

SMRE–Semiconductor Manufacturing and Related Equipment

SNAP–Significant New Alternatives Policy

UL–Underwriters Laboratories (formerly)

U.S.C.–United States Code

VRF–Variable Refrigerant Flow

## I. Public Participation

### *A. Written Comments*

Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2025-0005, at https://www.regulations.gov (our preferred method), or the other methods identified in the **ADDRESSES** section. Once submitted, comments cannot be edited or removed from the docket. The EPA may publish any comment received to its public docket. Do not submit to the docket at https://www.regulations.gov any information you consider to be Confidential Business Information (CBI), Proprietary Business Information (PBI), or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, etc.) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.*, on the web, cloud, or other file sharing system). Please visit https://www.epa.gov/dockets/commenting-epa-dockets for additional submission methods; the full EPA public comment policy;

information about CBI, PBI, or multimedia submissions; and general guidance on making effective comments.

*B. Participation in Virtual Public Hearing*

If a public hearing is requested on or before **[INSERT DATE 5 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, the EPA will post updates, including a link to register to attend the public hearing, at https://www.epa.gov/climate-hfcs-reduction/regulatory-actions-technology-transitions. If a public hearing is requested, the EPA will begin pre-registering speakers for the hearing no later than one business day after a request has been received. To pre-register to speak at the virtual hearing, please contact Joshua Silver at silver.joshua@epa.gov. Please note that any updates made to any aspect of the hearing are posted online at https://www.epa.gov/climate-hfcs-reduction/regulatory-actions-technology-transitions. While the EPA expects the hearing to go forward as set forth above if one is requested within the indicated timeframe, please monitor our website or contact Joshua Silver to determine if there are any updates. The EPA does not intend to publish a document in the *Federal Register* announcing updates.

## II. General Information

*A. Does this action apply to me?*

You may be potentially affected by this rule if you manufacture, import, or use refrigerated transport intermodal containers, chillers and industrial process refrigeration equipment used in the manufacture of semiconductors, retail food refrigeration equipment for remote condensing units and supermarkets, refrigeration systems in cold storage warehouses, refrigerated centrifuge equipment, refrigerated laboratory shakers, condensing units used for residential and light commercial air-conditioning and heat pumps, or residential and light commercial air conditioning and heat pump systems. Potentially affected categories, by North American Industry Classification System (NAICS) code, are:

- 236116; New Multifamily Housing Construction (except For-Sale Builders)

- 236117; New Housing For-Sale Builders
- 236118; Residential Remodelers
- 236210; Industrial Building Construction
- 236220; Commercial and Institutional Building Construction
- 238220; Plumbing, Heating, and Air Conditioning Contractors
- 325120; Industrial Gas Manufacturing
- 333242; Semiconductor Machinery Manufacturing
- 333415; Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
- 333998; All Other Miscellaneous General Purpose Machinery Manufacturing
- 334413; Semiconductor and Related Device Manufacturing
- 335220; Major Household Appliance Manufacturing
- 423620; Household Appliances, Electric Housewares, and Consumer Electronics Merchant Wholesalers
- 423720; Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers
- 423730; Warm Air Heating and Air Conditioning Equipment and Supplies Merchant Wholesalers
- 423740; Refrigeration Equipment and Supplies Merchant Wholesalers
- 424410; General Line Grocery Merchant Wholesalers
- 424420; Packaged Frozen Food Merchant Wholesalers
- 445110; Supermarkets and Other Grocery (except Convenience) Stores
- 445131; Convenience Retailers
- 449210; Electronics and Appliance Retailers
- 452311; Warehouse Clubs and Supercenters

- 483111; Deep Sea Freight Transportation
- 484230; Specialized Freight (Except Used Goods) Trucking, Long-Distance
- 493120; Refrigerated Warehousing Storage
- 531110; Lessors of Residential Buildings and Dwellings
- 531120; Lessors of Nonresidential Buildings (except Miniwarehouses)
- 541380; Testing Laboratories
- 561210; Facilities Support Services
- 811412; Appliance Repair and Maintenance

This list is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table includes the types of entities that the EPA is now aware could potentially be regulated by this proposed action. Other types of entities not listed could also be regulated. To determine whether your entity may be regulated by this action, you should carefully examine the applicability criteria found in the regulatory text at the end of this document. If you have questions regarding the applicability of this proposed action to a particular entity, consult the person listed in the **FOR FURTHER INFORMATION CONTACT** section.

*B. What action is the agency proposing to take?*

This proposal addresses topics raised in administrative petitions and other requests from companies and trade associations with respect to regulatory provisions promulgated in the Code of Federal Regulations (CFR) pursuant to the American Innovation and Manufacturing Act of 2020 (AIM Act) subsection (i) (42 U.S.C. 7675(i)). In particular, the EPA received four administrative petitions[1] to reconsider certain provisions of 40 CFR part 84, subpart B, entitled "Restrictions on the Use of Hydrofluorocarbons," that we finalized in October 2023.[2] We also

[1] *See* administrative petitions for reconsideration included in the docket for this action.
[2] *See* "Phasedown of Hydrofluorocarbons: Restrictions on the Use of Certain Hydrofluorocarbons Under the American Innovation and Manufacturing Act of 2020," 88 FR 73098 (Oct. 24, 2023) (2023 Technology Transitions Rule).

received requests to reassess compliance dates and/or global warming potential (GWP) limits finalized in October 2023. This proposal addresses topics raised in the administrative petitions for reconsideration, the other requests, and other adjustments and clarifications that we believe would be beneficial to the regulated community. To address the administrative petitions for reconsideration, the EPA proposes to:

1. Change two aspects of the intermodal refrigerated transport provisions at 40 CFR 84.54(a)(6) and 84.54(c)(7) to: (a) adjust the lower bound temperature exclusion threshold of -50 °C to -35 °C, and (b) change the location where that temperature is measured.

2. Extend the compliance date for certain chillers used for industrial process refrigeration and certain industrial process refrigeration equipment used to manufacture semiconductors from January 1, 2026, and January 1, 2028, as applicable, to January 1, 2030.

3. Not make the requested change to the treatment of certain condensing units used to replace existing condensing units in the residential and light commercial air conditioning (AC) and heat pump (AC/HP) subsector.

To address a request from a trade association in the retail food industry,[3] the EPA proposes to:

1. Adjust the GWP threshold for remote condensing units at 40 CFR 84.54(c)(11) from 150 or 300, as applicable, to 1,400 starting January 1, 2026, with a later adjustment to a GWP threshold of 150 or 300, depending on charge size or whether it is part of the high temperature side of a cascade system, starting January 1, 2032.

2. Adjust the GWP threshold for supermarket systems at 40 CFR 84.54(c)(12) from 150 or 300, as applicable, to 1,400 starting January 1, 2027, with a later adjustment to a GWP threshold of 150 or 300, depending on charge size or whether it is part of the high temperature side of a cascade system, starting January 1, 2032.

[3] *See* letter from the Food Industry Association (FMI), dated February 11, 2025, included in the docket for this action.

To address a request from a coalition in the cold storage industry,[4] the EPA proposes to adjust the GWP threshold for cold storage warehouses at 40 CFR 84.54(c)(9) from 150 or 300, as applicable, to 700 starting January 1, 2026, with a later adjustment to a GWP threshold of either 150 or 300, depending on charge size or whether it is part of the high temperature side of a cascade system, starting January 1, 2032.

To address requests with supporting information received from two companies that manufacture equipment used in laboratories,[5] the EPA proposes to extend the compliance date for certain industrial process refrigeration laboratory equipment to January 1, 2028.

To address concerns about supply chain issues related to R-454B, the EPA proposes to remove the installation deadline for systems in the residential and light commercial AC/HP subsector, where all specified components of such systems were manufactured or imported prior to January 1, 2025. The Agency is also seeking information through an advance notice of proposed rulemaking section for other potential actions to address supply chain issues.

This rule also proposes to correct a typographical error at 40 CFR 84.58(b).

*C. What is the agency's authority for this proposed action?*

The AIM Act authorizes the EPA to regulate hydrofluorocarbons (HFCs) in three main areas: phasing down the production and consumption of listed HFCs; management of these HFCs and their substitutes; and facilitating the transition to next-generation technologies by restricting use of these HFCs in the sector or subsectors in which they are used. This rulemaking focuses on the third area: the transition to next-generation technologies. Subsection (i) of the AIM Act, titled "Technology transitions," provides that "the Administrator may by rule restrict, fully, partially, or on a graduated schedule, the use of a regulated substance in the sector or subsector in which the regulated substance is used." (42 U.S.C. 7675(i)(1)). For additional

[4] *See* request from the Coalition for the Use of Safe and Efficient Refrigerants (CUSER), dated March 6, 2025, included in the docket for this action.
[5] *See* requests from Thermo Fisher Scientific and Eppendorf, included in the docket for this action.

discussion of the EPA's authorities under subsection (i) of the AIM Act, please refer to the 2023 Technology Transitions Rule (*see* 88 FR 73098).

In addition, subsection (k)(1)(A) of the AIM Act authorizes the EPA to promulgate such regulations as are necessary to carry out its functions under the Act, including its obligations to ensure that the Act's requirements are satisfied (42 U.S.C. 7675(k)(1)(A)). Subsection (k)(1)(C) further provides that Clean Air Act (CAA) sections 113, 114, 304, and 307 apply to the AIM Act and any regulations promulgated thereunder as though the AIM Act were part of title VI of the CAA (42 U.S.C. 7675(k)(1)(C)). Accordingly, this rulemaking is subject to the procedural requirements of CAA section 307(d) (*see* 42 U.S.C. 7607(d)(1)(I)).

Further, unless provided otherwise by statute, an agency may revise or rescind prior actions so long as it acknowledges the change in position, provides a reasonable explanation for the new position, and considers legitimate reliance interests in the prior position.[6]

## III. Background

The EPA promulgated the 2023 Technology Transitions Rule on October 24, 2023 (*see* 88 FR 73098). That rule restricted the use of certain HFCs in three sectors and over 40 subsectors in which they are used by establishing various restrictions based on GWP. It prohibited, among other things, the manufacture and import of factory-completed products and the installation of certain refrigeration, AC, and heat pump systems that use HFCs or HFC blends with GWPs above specified limits. The compliance dates for these restrictions vary by sector and subsector and generally range from January 1, 2025, to January 1, 2028. The rule also prohibited the sale, distribution, and export of factory-completed products that do not comply with the relevant restrictions three years after the prohibition on manufacture and import goes into effect.

[6] *See FDA v. Wages & White Lion Invs., LLC*, 145 S. Ct. 898 (2025); *FCC v. Fox TV Stations, Inc*., 556 U.S. 502 (2009); *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29 (1983); *Clean Air Council v. Pruitt*, 862 F.3d 1, 8 (D.C. Cir. 2017) ("Agencies obviously have broad discretion to reconsider a regulation at any time.").

The EPA received four administrative petitions to reconsider certain aspects of the 2023 Technology Transitions Rule.[7] One petitioner requested that the EPA adjust the temperature threshold and temperature location for transport refrigeration – intermodal containers. Another requested an extension of the compliance date for process refrigeration equipment used in semiconductor manufacturing. Two separate petitioners requested that the EPA consider limiting import, manufacture, and installation of condensing units used for residential and light commercial AC/HP systems. The EPA responded to the administrative petitions in June 2024 by granting reconsideration.[8] This proposed rule proposes to address all four administrative petitions for reconsideration received with respect to the 2023 Technology Transitions Rule.

The EPA also received four requests to make certain adjustments to the restrictions at 40 CFR part 84, subpart B. On February 11, 2025, a trade association in the retail food industry submitted a request to adjust the compliance dates and GWP limits for certain retail food subsectors.[9] On March 6, 2025, a coalition in the cold storage industry submitted a request to adjust the GWP limit for cold storage warehouses.[10] Two companies that manufacture laboratory equipment also submitted requests to extend the compliance date for certain laboratory equipment. One company submitted a request on June 6, 2024, to extend the compliance date for refrigerated laboratory centrifuges.[11] The other company submitted a request on April 16, 2025, to extend the compliance date for laboratory shakers.[12] This proposed rule addresses these four requests as well.

In response to these requests and additional concerns identified within the Agency and by a variety of stakeholders, the EPA announced a general reconsideration of the 2023 Technology

---

[7] Three petitions for judicial review of the 2023 Technology Transitions Rule were also filed in the U.S. Court of Appeals for the D.C. Circuit and are being held in abeyance. *See Semiconductor Equipment & Materials Int'l v. EPA* (Case No. 23-1344, D.C. Cir.); *Chemours Co. FC, LLC v. EPA* (Case No. 23-1345, D.C. Cir.); and *Food Marketplace, Inc. et al. v. EPA* (Case No. 23-1347, D.C. Cir.).

[8] The four administrative petitions for reconsideration and the EPA's responses granting reconsideration are available in the docket for this action.

[9] *See* letter from FMI included in the docket for this action.

[10] *See* request from CUSER in the docket for this action.

[11] *See* request from Thermo Fisher Scientific in the docket for this action.

[12] *See* request from Eppendorf in the docket for this action.

Transitions Rule on March 12, 2025, as one of the deregulatory actions included in the Administrator's "Powering the Great American Comeback" initiative.[13] The EPA is proposing this action as part of the reconsideration process and seeks public input on potential changes to the regulatory program that we believe would better achieve the statute's objectives.

This proposed rule addresses restrictions in numerous distinct subsectors regulated under subsection (i) of the AIM Act. The EPA is independently considering each of those portions of this proposed rule. If the proposed changes are finalized, the EPA proposes that any changes to restrictions in distinct subsectors are severable. If a court were to review the EPA's final action and invalidate any particular change to a restriction, the EPA proposes that the remaining changes remain effective.

## IV. Proposed Action

### *A. Refrigerated Transport – Intermodal Containers*

#### 1. Current Technology Transitions Provisions

Refrigerated transport – intermodal containers are refrigerated containers with an integrated power source that allow uninterrupted storage during transport on different mobile platforms, including railways, road trucks, and vessels (*see* 88 FR 73171). These intermodal containers used for refrigerated transport are regulated as products and systems at 40 CFR 84.54(a)(6) and (c)(7), respectively. As of January 1, 2025, these provisions restrict the manufacture and import of products, and the installation of systems, respectively, for refrigerated transport – intermodal containers to refrigerants with a GWP limit of less than 700. The 2023 Technology Transitions Rule established a temperature threshold and location of temperature measurement such that equipment is restricted when the temperature of the refrigerant entering the evaporator (for direct heat exchange systems) or the temperature of the fluid exiting (for chillers) is -50 °C or higher. These regulations do not apply where temperatures are below -50 °C.

[13] *See* https://www.epa.gov/newsreleases/epa-launches-biggest-deregulatory-action-us-history.

In proposing the 2023 Technology Transitions Rule, the EPA originally proposed a GWP limit of 700 for all intermodal refrigerated transport equipment (*see* 87 FR 76738). We did not originally propose a lower bound temperature threshold (*e.g.*, -50 °C) that would exclude intermodal refrigerated transport equipment that could operate at a temperature below such a threshold. We received only one comment on the proposal about establishing temperature thresholds in this subsector. That commenter suggested that the GWP limit should be 700 for temperatures above -50 °C in this subsector, 2,000 for temperatures in the range of -75 °C to -50 °C, and that there be no restriction for temperatures below -75 °C. The EPA also received several comments on achieving low temperatures in other subsectors, including Industrial Process Refrigeration (IPR) and Chillers for IPR, in which commenters requested that we set a temperature threshold of -50 °C in those subsectors. Based on the information provided in these comments, we adopted a lower bound refrigerant temperature threshold of -50 °C in all of these subsectors in the final rule, and did not establish restrictions in these subsectors for equipment with refrigerant temperatures below -50 °C (*see* 88 FR 73098).[14]

2. Summary of Administrative Petition for Reconsideration

Trane Technologies (Trane), a manufacturer of intermodal containers that maintain a range of temperatures, petitioned the EPA to adjust the temperature threshold and temperature location for transport refrigeration – intermodal containers. Trane did not comment on this issue when the proposed 2023 Technology Transitions Rule was open for public comment. In its administrative petition for reconsideration, Trane requested the regulatory text at 40 CFR 84.54(a)(6) and (c)(7) be changed to, "Effective January 1, 2025, refrigerated transport – intermodal containers *designed to reach and maintain -35 °C box temperature* or higher using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater." In particular, Trane requested that the EPA adjust the temperature threshold to

[14] The EPA issued a No Action Assurance on January 17, 2025, regarding the restrictions at 40 CFR 84.54(a)(6) and (c)(7), which remains in effect until either January 1, 2026, or the date when a rule that addresses such prohibitions is finalized, whichever occurs earlier.

distinguish between refrigerants used for deep frozen cargo and those used for fresh and frozen cargo. Specifically, Trane noted that deep frozen cargo containers are used to transport cargo that require temperatures at or below -35 °C and include critical life sciences products such as blood plasma and pharmaceuticals. The petitioner stated that intermodal containers used to transport deep frozen cargo must use refrigerants with lower boiling points, including R-404A and R-452A.[15] This contrasts with fresh and frozen cargo containers, which Trane noted are used to transport cargo that require temperatures that range from -30 °C to 30 °C, and can use HFC-134a and R-513A.[16] Trane has indicated that there are no available refrigerants with GWPs below 700 that can achieve and maintain box temperatures below -35 °C.

In the administrative petition, Trane also requested an adjustment to the location at which the temperature is measured from the "temperature of the refrigerant entering the evaporator (for direct heat exchange systems) or the temperature of the fluid exiting (for chillers)" to the "box temperature" because this measurement is more commonly used in this subsector. The petitioner requested that the EPA clarify that the temperature measurement be based on the lowest temperature at which the equipment is "designed to reach and maintain." Trane further explained that this subsector uses direct expansion equipment, not chillers, so the reference to chillers in the regulatory text is unnecessary.

3. Proposed Action

The EPA proposes to adjust the temperature threshold and location where the temperature will be measured for restrictions on transport refrigeration – intermodal containers. In particular, the EPA proposes to raise the temperature threshold to -35 °C and adjust the location of the temperature measurement to be the box temperature.

The EPA excluded refrigerated transport – intermodal containers designed to operate at -50 °C and below in the 2023 Technology Transitions Rule based on comments received on the

[15] *See* email from Trane Technologies in the docket for this action.
[16] *See* Trane's materials submitted November 2023, provided in the docket for this action.

proposal on lower bound temperature thresholds for the refrigerated transport – intermodal containers, IPR, and Chillers for IPR subsectors. While we did not receive a comment from Trane about a lower bound temperature threshold for intermodal refrigerated transport during the comment period, Trane provided information shortly after publication of the final rule indicating that there are currently no available refrigerant substitutes that can meet the GWP limit of 700 and which are designed to achieve and maintain a box temperature below -35 °C.

The proposed changes would remove restrictions on certain intermodal containers that carry cargo transported at temperatures below -35 °C, which include blood plasma and pharmaceuticals, and are referred to in this proposal as deep frozen cargo. The EPA evaluated the additional information provided after publication of the final rule and agrees that refrigerants used to reach and maintain such low temperatures in intermodal containers require refrigerants with sufficiently low boiling points and high refrigerating capacities.[17] Thus, the EPA is proposing to revise the restrictions for refrigerated transport – intermodal containers, as described above. Trane also confirmed to the EPA on January 15, 2025, that they have transitioned to equipment operating below -35 °C and above -50 °C from R-404A to R-452A. R-452A has a GWP of 2,140, which is much lower than the GWP of 3,922 for R-404A, but still above the currently applicable 700 GWP limit.[18]

The EPA understands that refrigerated transport – intermodal containers that are designed to reach and can achieve temperatures below -35 °C may, at times, also be operated at higher temperatures. The EPA is clarifying that the lowest temperature at which equipment is designed to operate determines whether it is subject to use restrictions. This means that if a refrigerated transport – intermodal container has the capacity to achieve a box temperature below -35 °C, it would not be subject to restrictions even if at times the container is operated at temperatures at or above -35 °C.

---

[17] *See* table of refrigerants (R-404A, R-452A, R-513A, R-450A, R-744), their boiling points, and refrigerating capacities, included in the docket for this action.

[18] *See* answers to questions from Trane included in the docket for this action.

While manufacturers and users of such equipment may opt to produce or purchase such equipment that has the capacity to operate at lower temperatures to avoid being subject to restrictions at 40 CFR 84.54, refrigerants and equipment that have the capacity to achieve these lower temperatures are more costly and present additional technical requirements that make operation more difficult. Trane has indicated that refrigerated transport – intermodal containers that transport cargo at temperatures above -35 °C are designed per the ISO 668 standard, while similar equipment that transport cargo at temperatures below -35 °C are designed per the ISO 1496-2 standard.[19] As such, the EPA does not expect that regulating equipment based on the temperature it is designed to achieve, rather than the temperature at which it operates, would present a loophole for producers and consumers.

The EPA is also proposing that the location of the temperature measurement for refrigerated transport – intermodal containers be the box temperature. The EPA did not specifically solicit comment on this issue in proposing the 2023 Technology Transitions Rule because we did not propose a temperature threshold (*see* 87 FR 76738). Rather, the EPA finalized the location at which the temperature would be measured based on comments received on the IPR and Chillers for IPR subsectors. The information provided by Trane after finalization of the 2023 Technology Transitions Rule demonstrates that equipment in this subsector is designed based on the air temperatures that can be achieved and maintained inside the intermodal container, also known as the box temperature. The EPA is therefore proposing to change how temperature is measured to align with common industry practice, thereby improving efficiency.

The EPA requests comment on the proposed changes discussed in this section concerning intermodal containers, including on any significant reliance interests on the existing GWP limits and mode of measurement and how we should account for any such reliance interests in any final action.

[19] *See* Trane's materials submitted November 2023, provided in the docket for this action.

*B. Industrial Process Refrigeration and Chillers for Industrial Process Refrigeration in Semiconductor Manufacturing*

1. Current Technology Transitions Provisions

The EPA considers refrigeration equipment used in semiconductor manufacturing to fall within the IPR and Chillers for IPR subsectors (*see* 88 FR 73119). The refrigeration equipment is often built into specialized machines that sort, mark, and cut wafers during the semiconductor manufacturing process, referred to as "Semiconductor Manufacturing and Related Equipment," or SMRE, throughout this proposed rule. SMRE may operate at a range of temperatures depending on the function being performed and typically must maintain precise temperatures to produce high-quality semiconductor wafers.

IPR systems are used to cool process streams at a specific point in manufacturing and other industrial processes (*e.g.*, in the chemical, pharmaceutical, and petrochemical industries). IPR systems are directly linked to the industrial process, meaning the refrigerant leaving the condenser and metering device is delivered directly to the heat source before returning to the compressor (*see* 88 FR 73141-2).

A chiller is a type of equipment that uses refrigerant to cool water or a brine solution that is then pumped to fan coil units or other air handlers to cool the air that is supplied to the conditioned spaces. The heat absorbed by the water or brine can be used for heating purposes and/or transferred directly to the air ("air-cooled"), to a cooling tower or body of water ("water-cooled"), or through evaporative coolers ("evaporative-cooled") (*see* 88 FR 73174). Chillers can be used to cool process streams in industrial applications; in such instances, these chillers are regulated as "Chillers for IPR" and not as "IPR." Throughout this proposed rule, the term IPR refers to IPR equipment that does not use chillers. The term Chillers for IPR refers to IPR equipment that utilizes chillers.

Restrictions on the use of HFCs and HFC blends in IPR and Chillers for IPR, including process equipment used to manufacture semiconductors, are implemented at different GWP

thresholds (150, 300, and 700). The restrictions put in place by the 2023 Technology Transitions Rule begin on either January 1, 2026, or January 1, 2028, depending on charge size and the temperature at which the equipment is designed to operate. These restrictions do not include IPR or Chillers used for IPR at temperatures below -50 °C. For the IPR subsector, restrictions can be found at 40 CFR 84.54(a)(12) and 84.54(c)(10). For the Chillers for IPR subsector, restrictions can be found at 40 CFR 84.54(a)(10)(iii) and (iv), and 84.54(c)(5) and (6).

2. Summary of Administrative Petition for Reconsideration

Semiconductor Equipment and Materials International (SEMI) petitioned the EPA on December 22, 2023, to reconsider the compliance dates that affect SMRE for the IPR and Chillers for IPR subsectors. The administrative petition did not include a request for relief from the restrictions at 40 CFR 84.54(a)(12)(i) (IPR with a refrigerant charge capacity of 200 pounds or greater) or 84.54(c)(10)(i) (Chillers for IPR with a refrigerant charge capacity of 200 pounds or greater). In a supplemental letter, SEMI clarified that the administrative petition seeks relief only for SMRE that have a charge size of 100 pounds or less. The administrative petition also did not include a request to adjust the restriction at 40 CFR 84.54(c)(6). However, in a supplemental letter to the Agency, SEMI clarified their interest in seeking reconsideration of this provision.[20]

SEMI also requested in their administrative petition either that the semiconductor manufacturing industry be exempted from the relevant restrictions at 40 CFR 84.54 or that the relevant compliance dates be extended.[21] SEMI later clarified that it requests the compliance dates for the restrictions on SMRE be extended to 2030. For the relevant restrictions with compliance dates of January 1, 2026, or January 1, 2028, SEMI requested delaying the compliance date to January 1, 2030. SEMI stated that "2030 is a more realistic compliance date given the projected commercial availability of low-Global Warming Potential (GWP) equipment." Five SMRE suppliers also submitted letters to the Agency between May 2024 and

[20] *See* SEMI's letter to the EPA, dated May 3, 2024, in the docket for this action.
[21] *See* SEMI's letter to the EPA, dated May 3, 2024, in the docket for this action.

August 2024 indicating their support of SEMI's request to extend the relevant compliance dates to January 1, 2030.[22]

SEMI asserted that equipment using substitute refrigerants that fit this industry's unique circumstances will not be available by the current compliance dates and estimated that developing and implementing alternatives that are fit for purpose could take five years.[23] In particular, SEMI noted that to manufacture semiconductors, process refrigeration equipment must be able to maintain precise control of narrow temperature tolerances, which can be as small as 0.1 °C ± 0.05 °C for some applications. SEMI explained that precise control is required to realize process performance, including a uniform application of photoresist coatings. They noted that small changes in temperature during production can impact semiconductor device features, product functionality, and product yields. For example, SEMI described how a 1 °C change in temperature in a projection lens can result in a few microns accuracy loss and would be "catastrophic"[24] for semiconductor production. This example supports SEMI's contention that temperature control capabilities must be much more precise than 1 °C.

SEMI also explained that using certain alternatives such as R-744,[25] or mildly flammable or flammable alternatives as a refrigerant in SMRE, would require changing how equipment is integrated into semiconductor manufacturing facilities or limiting the capabilities of the process equipment. For R-744, this could include a larger facility footprint and higher power input than required for current technology, larger compressors operating at high pressure that would require new safety precautions and certifications, shorter lifetime of equipment due to operation at higher operating pressures, and limitations to achieving temperatures below -20 °C.[26] For mildly flammable or flammable alternatives, this could include changing the layout of the facility,

---

[22] *See* letters of support from Haskris, Lam, SMC, Tokyo Electron Ltd., and Advanced Thermal Sciences in the docket for this action.
[23] *See* SEMI's supplemental submission to the EPA, dated June 18, 2024, in the docket for this action.
[24] Ibid.
[25] R-744 is the ASHRAE refrigerant designation for carbon dioxide.
[26] *See* SEMI's supplemental submission to the EPA, dated June 18, 2024, and SEMI's Petition for Reconsideration in the docket for this action in the docket for this action.

increasing ventilation to account for building code compliance, factoring in safety risks, and accounting for floor space that may be lost as a result of reconfigurations.

SEMI has noted that semiconductor manufacturing facilities are typically densely packed and that integrating changes into the facility layout may take additional time. Further, SEMI stated that substitute refrigerants used in this industry require thorough testing to ensure they can meet the safety requirements described above. SEMI also noted that due to the complexity of the manufacturing process and limitations within semiconductor manufacturing facility layouts, testing to verify conformance can result in lengthy qualification timelines and iterative enhancements to meet end process requirements.[27]

The industry is testing substitutes; however, information provided by SEMI and semiconductor equipment suppliers indicates that substitutes will not be available by the current compliance dates. For example, SEMI stated that R-744 offers a potential path, yet some challenges would require further validation and testing, including those challenges listed above.[28]

SEMI has indicated that although R-728[29] may also be a viable refrigerant, it would not be tested and validated in time to meet the current compliance dates.[30] SEMI also indicated that R-32 and R-454C are not immediately viable solutions because they both pose flammability concerns, and R-32 would not meet the GWP threshold for all SMRE use cases.

Finally, SEMI noted that SMRE are custom-engineered and that equipment availability is limited to meet the precise temperature and humidity control requirements, particularly in the range between -50 °C and -30 °C. Due to the combination of factors that present unique circumstances for this industry, SEMI asserted that the development of substitutes for SMRE will take more time than for IPR and Chillers for IPR used in other sectors.[31]

---

[27] *See* SEMI's letter to the EPA, dated May 3, 2024, in the docket for this action.
[28] *See* SEMI's supplemental submission to the EPA, dated June 18, 2024, in the docket for this action.
[29] R-728 is the ASHRAE refrigerant designation for nitrogen gas ($N_2$).
[30] *See* February 20, 2024, SEMI meeting with the EPA in the docket for this action.
[31] *See* SEMI's letter to the EPA, dated May 3, 2024, in the docket for this action.

SEMI's administrative petition also notes adverse impacts that may occur absent the requested changes. These include, but are not limited to, facility and production line downtime, purchase of legacy equipment for replacement purposes to avoid such downtime, stockpiling legacy equipment, facility redesign, and additional testing of compliant refrigerants.

3. Proposed Action

The EPA proposes to delay the compliance dates for SMRE with charge sizes of 100 pounds or less used in the subsectors indicated at 40 CFR 84.54(a)(10)(iii), (iv), 84.54(a)(12)(ii), (iii), 84.54(c)(5), (6), 84.54(c)(10)(ii), (iii), and (iv) from January 1, 2026, or January 1, 2028, as applicable, until January 1, 2030. Based on the information provided after publication of the 2023 Technology Transitions Rule, the EPA agrees that the semiconductor manufacturing industry faces unique circumstances in manufacturing semiconductors, including ensuring that substitutes can satisfy precise temperature control requirements. The EPA reviewed the latest available information provided by industry, including from semiconductor equipment manufacturers, that indicate that the equipment is highly specialized and requires compact footprints and precise temperature controls, and proposes to find that substitutes will not be developed in time to meet the current compliance dates. Thus, the EPA is proposing revisions to the regulations.

Informed by discussions with and information submitted by SEMI, its members, SMRE manufacturers, and other interested parties, the EPA is not proposing to exempt IPR and Chillers for IPR used in semiconductor manufacturing from the requirements at 40 CFR 84.54. Instead, the EPA agrees with the petitioner that although compliance work is underway, additional time is needed to test and qualify the viability of equipment using compliant refrigerants. The EPA also acknowledges the letters submitted by five semiconductor manufacturing equipment suppliers in 2024 that provided additional details on the time needed to test and validate alternatives, and thus

supported SEMI's request to extend the relevant compliance dates to January 1, 2030.[32] Therefore, the EPA is proposing a new compliance date of January 1, 2030, for IPR and Chillers for IPR with charges sizes up to 100 pounds used in SMRE.

The EPA understands that IPR and Chillers for IPR used in the semiconductor manufacturing industry may operate at one temperature while being designed to reach lower temperatures. As stated in section IV.A. of this preamble, the lowest temperature at which equipment is designed to operate determines whether it is subject to use restrictions.

The EPA requests comment on the proposed changes for SMRE, and specifically on the proposed compliance date for SMRE of January 1, 2030, for all affected equipment. We also request comment on the charge size threshold applicable to this use. Although we are not proposing to exempt this equipment from the restrictions at 40 CFR 84.54, we request comment on such an exemption. Finally, we request comment on whether there are any legitimate reliance interests on the current requirements and, if so, how the EPA should account for them in any final action.

*C. Retail Food Refrigeration – Remote Condensing Unit Systems and Supermarket Systems*

1. Current Technology Transitions Provisions

Remote condensing units are a type of retail food refrigeration equipment with refrigerating capacities typically ranging from 1 kW to 20 kW (0.3 to 5.7 refrigeration tons) and are composed of one (and sometimes two) compressor(s), one condenser, and one receiver assembled into a single unit, normally located external to the sales area. This equipment is connected to one or more nearby evaporator(s) used to cool food and beverages stored in display cases and/or walk-in storage rooms. A cascade system might be used, for example, to reach low temperatures in a long-term storage room. A supermarket often uses remote condensing units in food retail environments such as dairy and deli displays. Remote condensing units are also

[32] *See* letters of support (received May-August 2024) from semiconductor equipment manufacturers, included in the docket for this action.

commonly installed in convenience stores and specialty shops, such as bakeries and butcher shops (*see* 88 FR 73157).

Supermarket systems, also known as multiplex or centralized systems, operate with racks of compressors installed in a machinery room where different compressors turn on to match the refrigeration load necessary to maintain temperatures in display cases in the sales area. Two main designs are used: direct and indirect systems. In a direct system, the refrigerant circulates from the machinery room to the sales area, where it evaporates in display-case heat exchangers, and then returns in vapor phase to the suction headers of the compressor racks.[33] Indirect supermarket designs include secondary loop systems and cascade refrigeration systems. Indirect systems use a chiller or other refrigeration system to cool a secondary fluid that is then circulated throughout the store to the cases. Compact chiller versions of an indirect system rely on a lineup of 10 to 20 units, each using small charge sizes. As the refrigeration load changes, so does the number of active chillers. Each compact chiller is an independent unit with its own refrigerant charge, reducing the potential volume of refrigerant that could be released from leaks or catastrophic failures. Despite the term "chiller" used in the description, these systems are considered supermarket systems for purposes at 40 CFR part 84, subpart B. Another type of supermarket design, often referred to as a distributed refrigeration system, uses an array of separate compressor racks located near the display cases rather than having a central compressor rack system. Each of these smaller racks handles a portion of the supermarket load, with 5 to 10 such systems in a store[34] (*see* 88 FR 73157-8).

The 2023 Technology Transitions Rule established restrictions on the use of HFCs in new remote condensing unit systems and new supermarket systems installed starting January 1, 2026, and January 1, 2027, respectively. For both, the GWP limit is 150 for systems with

---

[33] Supermarket walk-in cold rooms are often integrated into the system and cooled similarly, but a dedicated condensing unit can be provided for a given storage room.

[34] A supermarket may also use other types of refrigeration equipment covered by separate subsectors, including stand-alone units, remote condensing units, refrigerated beverage dispensers, and ice machines. Such equipment is not a part of the "supermarket system" subsector for purposes of 40 CFR part 84, subpart B merely by being located in a supermarket.

refrigerant charge capacities greater than or equal to 200 pounds, and 300 for systems with refrigerant charge capacities less than 200 pounds or for the high temperature side of cascade systems irrespective of the total charge capacity. The EPA distinguished between larger and smaller remote condensing units and supermarket systems by their refrigerant charge capacity based on a distinction between charge sizes in the safety standards (*see* 87 FR 76775-6). The EPA also indicated that several new compliant substitutes would soon be listed under the EPA's Significant New Alternatives Policy (SNAP) program for use in these subsectors, as proposed in SNAP Rule 26, and thus would be available before the 2026 or 2027 compliance dates (*see* 88 FR 33722; May 24, 2023). The EPA finalized SNAP Rule 26 on June 13, 2024 (*see* 89 FR 50410). In this rulemaking, the EPA is taking into consideration the listings that were made under the SNAP program since finalization of the 2023 Technology Transitions. Restrictions on remote condensing unit systems are implemented at 40 CFR 84.54(c)(11)(i), (ii), and (iii). Restrictions on supermarket systems are implemented at 40 CFR 84.54(c)(12)(i), (ii), and (iii).

2. Summary of Stakeholder Concerns

Certain food retailers and the Food Industry Association (FMI) expressed concerns about the limited number and types of substitutes that the EPA determined in the 2023 Technology Transitions Rule would be available for use in remote condensing units and supermarket systems by the January 1, 2026, and January 1, 2027, compliance deadlines, respectively. Specifically, they stated that the rule restricts the food industry to a handful of refrigerant alternatives, including R-744, A2Ls, A3s, and ammonia, which they stated are either impractical, infeasible, or create safety concerns.[35]

These food retailers asserted that R-744 technologies in their current state expend a significant amount of energy to function at a cooling level comparable to commonly used HFCs, that such technologies are unreliable, that leaks are difficult to detect and repair, and that such

[35] *See* FMI's letter to the EPA, dated February 11, 2025, in the docket for this action.

leaks can be catastrophic to the system's performance.[36] In a meeting with the EPA on April 18, 2025, the food retailers shared that since water is used to cool R-744 in such systems, some states' water laws, like those in Nevada, would be prohibitive to the effective use of R-744 systems.[37] They also asserted in that meeting that R-744 is not suitable for very large stores, such as those that are 50,000 square feet or larger. They also raised concerns about using ammonia, a regulated, toxic, and flammable substance, in some retail environments for safety reasons.[38] These food retailers have also said that flammable refrigerants, such as A2L and A3 refrigerants, may not be universally available due to delays in updates to local building codes and potential shortages in technicians trained to use these flammable refrigerants. Furthermore, these food retailers are concerned that future regulation of per- and polyfluoroalkyl substances (PFAS) could require retailers to change systems again from certain compliant fluorinated refrigerants to others.[39] Based on these concerns, food retailers requested additional time to allow the technology and building codes to catch up. They requested that the compliance deadlines be pushed back to the end of 2032 with an interim GWP limit of 1,400.[40]

FMI also recently requested clarifications and potential changes to the codified regulations at 40 CFR 84.54(e)(2) and (3) to ensure that routine store refreshes, remodels, or layout changes do not trigger the requirements for new systems.[41] These regulations set forth two scenarios in which the EPA would consider modifications to an existing system to be equal to a new installation requiring the use of compliant refrigerants:

- When an existing system's cooling capacity is increased as measured in British Thermal Units (BTU) per hour, and

[36] Ibid.
[37] *See* meeting memorandum in the docket for this action.
[38] *See* FMI's letter to the EPA, dated February 11, 2025, in the docket for this action.
[39] R-744, hydrocarbons, and ammonia are not considered PFAS. The EPA notes that the federal government has not adopted a specific definition of PFAS and has not included HFCs or HFOs in any PFAS-related restrictions.
[40] *See* FMI presentation dated April 18, 2025, included in the docket for this action.
[41] *See* email from FMI dated April 24, 2025, included in the docket for this action.

- When replacing 75 percent or more of evaporators (by number) and 100 percent of the compressor racks, condensers, and connected evaporator loads of an existing system.

FMI stated that "when grocery stores undergo remodeling activities, it is normal and routine for stores to modestly expand the cooling capacity of existing systems to accommodate additional products and layouts." FMI gave a specific example in which expanding a refrigerated case by 60 inches could trigger the need for a store to install an entirely new system using compliant refrigerant because it might increase the overall cooling capacity of the system. In the same correspondence, FMI also stated that to address this concern, the EPA should allow supermarkets to increase the cooling capacity measured in BTU per hour by up to 25 percent before the equipment is considered a new system. Finally, FMI raised concerns about whether the Agency considers modifications of an existing system to count as "retrofits" under the AIM Act.

3. Summary of Proposed Changes

The EPA is proposing to revise the restrictions finalized at 40 CFR part 84, subpart B, to provide a graduated schedule for the use of HFCs in new remote condensing units and supermarket systems. Specifically, we propose an interim GWP limit of 1,400 starting January 1, 2026, for new remote condensing units and starting January 1, 2027, for new supermarket systems. Starting January 1, 2032, the GWP limit for both remote condensing units and supermarket systems would fall back to 150 or 300, depending on certain characteristics of the system. Consistent with the existing restrictions, the GWP limit of 150 would apply to systems with 200 or more pounds of refrigerant charge, excluding the high temperature side of a cascade system, and the GWP limit of 300 would apply to systems with less than 200 pounds of refrigerant charge, or for the high temperature side of a cascade system. The EPA anticipates widespread adoption of lower-GWP HFC or non-HFC refrigerants in these two subsectors – but not before the current compliance dates of January 1, 2026, and January 1, 2027. An increase in the GWP limit would temporarily extend the use of currently available mid-GWP HFC

refrigerants, limit the use of the highest-GWP HFC refrigerants, and ease the transition to new substitutes as they penetrate the marketplace. This proposal would not prevent anyone from choosing to use the lower-GWP refrigerants that the EPA has previously identified and that continue to be deployed in new systems throughout the United States.

The first step of this proposed approach would be to establish a GWP limit of 1,400 starting January 1, 2026, for remote condensing unit systems, and January 1, 2027, for supermarket systems, lasting until 2032. The EPA is proposing an interim GWP limit on the existing compliance dates instead of just extending those dates. Historically, refrigeration systems in these subsectors have used refrigerants with higher GWPs, including R-404A, R-407A, R-507A, and R-22. These refrigerants' GWPs are 3,922, 2,107, 3,985, and 1,810, respectively, and additionally, R-22 is an ozone depleting substance that has been phased out consistent with the requirements of Title VI of the CAA and its implementing regulations. By maintaining a GWP limit in 2026 and 2027 for remote condensing units and supermarket systems, respectively, the installation of such higher-GWP refrigerants in new systems can be eliminated while providing optionality and flexibility in the near term. Retaining the January 1, 2026, and January 1, 2027, deadlines would align with subsection (i)(4)(D) of the AIM Act by preventing new demand for high-GWP refrigerants (42 U.S.C. 7675(i)(4)(D)).

The EPA is proposing a GWP limit of 1,400 for 2026 and 2027. This GWP limit would allow for the continued use of R-448A and R-449A, which are HFC blends with GWPs of 1,386 and 1,396, respectively. Many supermarkets have transitioned to R-448A or R-449A,[42] and the industry has stated that these options would address their concerns about the availability of substitutes.

R-448A and R-449A are classified under ASHRAE as A1 refrigerants, meaning they are non-flammable and non-toxic. Some industry stakeholders have expressed a need for local

[42] *See* FMI's letter to the EPA, dated February 11, 2025, in the docket for this action, and GreenChill "Partnership Accomplishments" at https://www.epa.gov/greenchill/partnership-accomplishments.

building codes to be updated before A2L refrigerants can be used in designs for new remote condensing unit and supermarket systems. At the time of the 2023 Technology Transitions Rule, a majority of states (41) had made updates to state codes or passed state legislation to allow for the use of these refrigerants. At the time of this proposed rulemaking, 49 states have taken action allowing for the use of A2L refrigerants.[43] While the EPA considered actions taken at the state level to address building codes to be on track and projected that additional changes for the remaining states would occur ahead of the compliance dates (which would set the expectations for localities), food retailers have recently indicated that in some states, the lack of changes to local building codes[44] prevent the use of mildly flammable refrigerants in certain communities for some time. According to information provided by FMI, 30 states allow local jurisdictions to supersede the state requirements for relevant building codes. In other words, even if a state allows for the use of A2L refrigerants, local jurisdictions may still prevent their introduction. To address these concerns identified by these food retailers and FMI, under this proposal, a broader number of A1 refrigerants, including those with GWPs above the current thresholds, could continue to be used in new remote condensing unit and supermarket system installations after 2026 and 2027. This would allow more time for local building codes to be updated, for additional refrigerants to be introduced, and for food retailers to gain further experience with other lower-GWP A1 refrigerants (*e.g.*, R-744).

By proposing these changes to the compliance schedule, the EPA is recognizing regional differences that may affect the adoption of substitutes. As discussed in the 2023 Technology Transitions Rule, the EPA is aware that lower-GWP substitutes are currently used in some supermarkets. However, we acknowledge that the impacted subsectors are large and varied and that additional time will smooth the transition for these subsectors that have diverse needs and circumstances.

---

[43] *See* AHRI building code map data, included in the docket for this action.
[44] *See* FMI presentation dated April 18, 2025, included in the docket for this action.

Supermarkets and grocery stores – and the businesses that run them – range from big to small and are located in all climates. Some supermarkets and grocery stores may prefer one option over another due to capital costs or energy efficiency considerations. For example, installing R-744 systems in stores in colder climates may be preferable given the energy efficiency benefits of R-744 systems in such climates as compared to HFC-containing refrigerants. The EPA understands that certain retailers may choose to use R-744 in warmer climates, too. However, the EPA received information indicating that installing R-744 systems in stores in warmer climates may be less preferred because the energy efficiency benefits can be lower.

Many supermarkets across the United States are already using compliant, lower-GWP substitute refrigerants such as R-744.[45] One manufacturer of supermarket refrigeration systems shared with the EPA that its shipments of R-744-containing systems have risen over the last several years to the extent that in 2024, its shipments of such equipment surpassed that of HFC-containing systems annually for the first time.[46] With approximately 400 new R-744 systems installed in supermarkets across the United States in 2024, the EPA expects the installation of R-744 systems in supermarkets to continue to rise in all climates in the coming years. In addition to R-744, chemical suppliers are advertising lower-GWP substitutes specifically for use in supermarkets[47] and some stores have made the transition to lower-GWP A2L substitutes.[48]

The EPA indicated in the 2023 Technology Transitions Rule that several lower-GWP substitutes, including R-744 and some A1 and A2L refrigerants, were available or would soon be available in time for the remote condensing unit or supermarket subsector compliance dates of 2026 or 2027, respectively (*See* 88 FR 73098). This was based partly on the understanding that SNAP Rule 26 would list several of these identified substitutes as acceptable for the subsectors,

---

[45] *See* Dover Food Retail presentation included in the docket for this action.
[46] Ibid.
[47] *See* information in the docket related to suppliers advertising lower-GWP substitutes specifically for use in supermarkets.
[48] *See* Dover Food Retail presentation and other information included in the docket for this action.

subject to use conditions, soon after finalization of the 2023 Technology Transitions Rule. The EPA subsequently finalized SNAP Rule 26 (*see* 89 FR 50410; June 13, 2024) and listed seven A2L substitutes as acceptable, subject to use conditions, for use in new remote condensing units and new supermarket systems. These are HFO-1234yf, HFO-1234ze(E), R-457A, R-516A, R-454C, R-455A, and R-454A, which have GWPs of 1, 1, 137, 140, 146, 146, and 237, respectively. Notably, all except one have a GWP below the 150 GWP threshold, which satisfies the restrictions for installation in new remote condensing units and supermarket systems that have a charge size of 200 pounds or more. All of these refrigerants could also be installed in such systems that have a charge size less than 200 pounds, or as part of the high temperature side of a cascade system, since they all have a GWP below 300. While increasing the number of refrigerants listed as acceptable under the SNAP program will provide more options in the long term, more time is needed for chemical suppliers to provide acceptable substitutes in sufficient quantities, for equipment manufacturers to develop equipment for these substitutes, and for this equipment to be incorporated into new supermarket system designs and be deployed.

The last step of this proposed approach would therefore be to establish a GWP limit of 150 or 300, depending on certain characteristics of the systems, starting January 1, 2032, for both remote condensing units and supermarket systems. The GWP limit of 150 is for systems with 200 or more pounds of refrigerant charge, excluding the high temperature side of a cascade system. The GWP limit of 300 is for systems with less than 200 pounds of refrigerant charge, or for the high temperature side of a cascade system. In other words, the existing compliance obligations that are in 2026 or 2027 would move to 2032 for both subsectors. Available substitutes in 2032 for these subsectors would be limited to lower-GWP options, including R-744 and a host of A1 and A2L refrigerants, including those described above.

The EPA anticipates that by January 1, 2032, any remaining building code issues would be fully resolved, given that the UL safety standard updates addressing these refrigerants will

have been published more than a decade prior (*i.e.*, 2021).[49] Information provided by food retailers indicates that updating model codes at a local level could take up to eight years.[50] The EPA also expects that other constraints on the availability of identified substitutes, such as concerns with using R-744 due to the efficiency of those systems in warmer climates, will have diminished as technology improves and the number of equipment offerings increase.

We also expect that other forces will continue to encourage the ongoing transition of equipment used in these subsectors. The HFC phasedown established by Congress in the AIM Act will continue to limit the production and consumption of HFCs, with a significant stepdown in 2029 (42 U.S.C. 7675(e)(2)(C)).[51] Extending the compliance date for these subsectors to 2032 preserves optionality and flexibility in the interim period and allows this market pressure and the advantages of many of the new refrigerants to drive the continued transition to identified substitutes as the commercial availability of newer substitutes matures. The EPA thus expects that refrigerant options that have a GWP below 150 or 300, as applicable, including those identified as available substitutes for remote condensing units and supermarkets in the 2023 Technology Transitions Rule and those listed in SNAP Rule 26 for these subsectors, will be available for these subsectors by January 1, 2032.

The EPA requests information regarding challenges associated with local building codes as well as information on the suitability of lower-GWP refrigerants in certain climates and for certain store designs, including whether R-744 is suitable for refrigeration systems in large supermarkets and in warmer climates.

Separately, the EPA understands that although supermarkets routinely refresh, remodel, or make changes to their store layouts, moving refrigerated aisles within a store from one location to another would be a rather significant change. During the hydrochlorofluorocarbon

---

[49] *See* UL 60335-2-89 standard, "Household and Similar Electrical Appliances – Safety – Part 2-89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit of Moror-Compressor." Edition 2, dated October 27, 2021.
[50] *See* presentation from FMI dated April 18, 2025, included in the docket for this action.
[51] *See* "Phasedown of Hydrofluorocarbons: Establishing the Allowance Allocation and Trading Program Under the American Innovation and Manufacturing Act," 86 FR 55116 (Oct. 5, 2021).

(HCFC) phaseout, the CAA and our implementing regulations limited the use of newly produced R-22 only for the servicing of existing equipment, which generated similar questions about what was considered a new system versus an existing system. Through scenarios provided on its website at the time, the EPA explained that virgin R-22 may not be used in a system that has become a newly-manufactured system through an increase in cooling capacity (i.e., expansion).[52] In the 2023 Technology Transitions Rule, the EPA addressed the specific requests for greater specificity by including the provisions at 40 CFR 84.54(e)(2) and (3) regarding an increase in cooling capacity and specifying the number and type of components needed to be replaced to trigger the requirements. The EPA's intention, consistent with past practice, was not to prevent minor changes from occurring that may be part of a refresh, remodel, or change in layout.

To address concerns raised by stakeholders that the provisions at 40 CFR 84.54(e)(2) and (3) may result in supermarkets having to replace legacy systems before the end of their useful life, the EPA is requesting comment on whether expansion of cooling capacity in BTU/hour (*e.g.*, 25 percent) would be allowable during a remodel of a supermarket system without triggering the requirements at 40 CFR 84.54(e). We are considering what the appropriate cooling capacity expansion would be during a store refresh and are soliciting comment on what level would accommodate such system changes. We currently do not have data that would support a particular percentage increase in a supermarket system's cooling capacity that would be typical or expected to occur, as part of a refresh, remodel, or change in layout, and whether these three activities are actually the same. We are aware that during a refresh, remodel, or layout change, improvements such as installing doors can often reduce the BTU output needed.[53] A change in a store layout that results in moving the refrigerated aisles may be more significant than other types of store refreshes or remodels. Refrigerated cases may also be reorganized without adding additional compressors and condensers in the back of the store. Our current understanding is that

[52] *See* static version of the EPA website during HCFC phaseout, included in the docket for this action.
[53] *See* 2021 GreenChill slideshow and ALDI's 2023 corporate report, included in the docket for this action.

such changes would be very different than a layout change that would move the refrigerated aisles. We are interested in better understanding the change in BTU output that typically results from a refresh, remodel, or layout change. Accordingly, the EPA requests comment on the extent to which this is a concern for supermarkets and what an appropriate threshold would be for supermarket systems undergoing a periodic refresh. If possible, such comments should include data from past store remodels for the Agency to understand and act on this concern. We are considering this issue only in the context of supermarket systems and are not proposing changes that would warrant considering the issue in other sectors or subsectors.

For clarity, the EPA also notes that a "retrofit" is distinct from a store "refresh," "remodel," or "layout change." The AIM Act states that for purposes of regulations issued under subsection (i), the term "retrofit" "means to upgrade existing equipment where the regulated substance is changed, which (1) includes the conversion of equipment to achieve system compatibility; and (2) may include changes in lubricants, gaskets, filters, driers, valves, o-rings, or equipment components for that purpose" (42 U.S.C. 7675(i)(7)(A)). Thus, a retrofit, for purposes of the restrictions at 40 CFR part 84, subpart B, requires a change in the type of refrigerant used in a system (*e.g.*, switching from R-404A to R-448A). The EPA adopted that definition in the regulations at 40 CFR 84.52 and stated that the requirements of the 2023 Technology Transitions Rule do not apply to retrofits.[54] Neither the GWP limits nor the provisions at 40 CFR 84.54(e), which specify when a system is sufficiently modified to be characterized as new and subject to the restrictions, currently apply to a retrofit. The EPA understands the request from FMI to allow expansion of cooling capacity in BTU/hour up to a certain percent without triggering the requirements at 40 CFR 84.54(e) to pertain to situations where the same refrigerant is used after the remodel.

[54] The EPA stated that "[w]hile we recognize the Agency's authority to issue restrictions on retrofit applications in subsection (i)(7)(B)(ii), we do not view, and commenters did not suggest, that the EPA has an obligation to issue such restrictions at this time." For further discussion, see 88 FR 73127. See also: https://www.epa.gov/climate-hfcs-reduction/frequent-questions-phasedown-hydrofluorocarbons#supermarket-systems.

*D. Cold Storage Warehouses*

1. Current Technology Transitions Provisions

Cold storage warehouses are refrigerated facilities used for the storage of temperature-controlled substances. Refrigeration systems within cold storage warehouses can be divided into two categories: packaged systems and central plant systems. Central plants are custom-built refrigeration systems that are typically used in large, refrigerated warehouses with cooling capacities that range from 20 to 5,000 kW. Central plant systems deliver cool air to the refrigerated space through evaporators, which are typically suspended from the ceiling in the refrigerated space. The evaporators are connected through a piping network to multiple compressors located in a central machine room, and a condenser, which is typically mounted outside near the compressors. Central plant systems may have a direct or indirect (secondary loop) design. Direct systems circulate a primary refrigerant throughout the refrigerated space. In an indirect system, a primary refrigerant cools a secondary refrigerant in the machine room, and the secondary refrigerant is then circulated throughout the refrigerated space (*see* 88 FR 73162).

The 2023 Technology Transitions Rule established restrictions on the use of HFCs in new cold storage warehouses installed starting January 1, 2026. The GWP limit is 150 for systems with refrigerant charge capacities greater than or equal to 200 pounds, and 300 for systems with refrigerant charge capacities less than 200 pounds or for the high temperature side of cascade systems irrespective of the total charge capacity. These restrictions are found at 40 CFR 84.54(c)(9)(i), (ii), and (iii).

The EPA identified R-717, or ammonia, a 2L refrigerant, as a widely used substitute in the cold storage warehouses subsector that has been used for decades (*see* 88 FR 73162). The EPA also identified five other substitutes[55] for this subsector in proposing the 2023 Technology Transitions Rule. After the rule was finalized, the EPA listed seven additional substitutes with

[55] *See* 2023 Technology Transitions Rule (88 FR 73098; October 24, 2023) TSD "American Innovation and Manufacturing Act of 2020—Subsection (i)(4) Factors for Determination: List of Substitutes."

GWPs below 150 and one with a GWP between 150 and 300 for this subsector in SNAP Rule 26 issued on June 13, 2024 (*see* 89 FR 50410). All seven of the additional substitutes are classified as A2L. Restrictions for cold storage warehouses are implemented at 40 CFR 84.54(c)(9)(i), (ii), and (iii).

2. Summary of Stakeholder Concerns

The Coalition for the Use of Safe and Efficient Refrigerants, Inc. (CUSER) submitted a request to the Agency on March 6, 2025, for the EPA to adjust the GWP limits at 40 CFR 84.54(c)(9)(i), (ii), and (iii) from 150 or 300, as applicable, to 700.

In the request, CUSER highlighted that ammonia, a higher toxicity and flammable refrigerant, can present potential safety concerns particularly when cold storage warehouses are not located in isolated, unpopulated areas. CUSER cited a number of recent examples of fatalities, injuries, and facility evacuations related to the use of ammonia as a refrigerant in cold storage warehouses in the United States.[56]

CUSER's particular request was for an adjustment of the restriction for cold storage warehouses more in keeping with other regulated subsectors that primarily use large equipment with large charge sizes, and specifically, to increase the GWP limit to allow for the use of R-513A, which CUSER identified as a refrigerant in this subsector that met their safety, commercial availability, energy efficiency, and usability requirements. CUSER indicated that in its view, some of the other substitutes identified by the EPA in the 2023 Technology Transitions Rule would not necessarily be available in every situation due to flammability or toxicity concerns, commercial availability, decreased energy efficiency, not being mechanically practical due to excessive displacement, building codes not being updated, and economic costs.[57]

3. Summary of Proposed Changes

[56] *See* appendices to CUSER's request, included in the docket for this action.
[57] *See* CUSER's request, dated March 6, 2025, in the docket for this action.

The EPA is proposing to revise the restrictions at 40 CFR 84.54(c)(9)(i), (ii), and (iii) to provide a graduated schedule for the use of HFCs in new cold storage warehouses. Specifically, the EPA is proposing to raise the GWP limit to 700 starting January 1, 2026. The GWP limit for cold storage warehouses would become 150 or 300, depending on certain characteristics of the system, starting January 1, 2032. Consistent with the existing restrictions, the GWP limit of 150 would be for systems with 200 or more pounds of refrigerant charge, excluding the high temperature side of a cascade system, and the GWP limit of 300 would be for systems with less than 200 pounds of refrigerant charge, or for the high temperature side of a cascade system.

The EPA's proposal does not limit industry from using lower-GWP refrigerants that we previously identified, including ammonia, which is already the most widely used refrigerant in this subsector for large systems.[58] [59] [60] While entities in many areas of the United States can and are already using compliant lower-GWP substitute refrigerants in this subsector, we acknowledge that limitations, such as safety considerations in densely populated areas, could hinder compliance with the 150 and 300 GWP limits on a nationwide scale by January 1, 2026.

The EPA acknowledges that the use of ammonia in a system containing thousands of pounds of refrigerant charge could pose a safety risk in densely populated areas if a leak were to occur, or if such a system were to be handled improperly. As noted above, there is widespread use of compliant refrigerants in this subsector in the United States; however, based on information that we received after finalizing the 2023 Technology Transitions Rule, we acknowledge that in some situations, there may be continued limitations that could hinder compliance with the current requirements for cold storage warehouses.

The EPA understands that other substitutes that were previously identified as available to meet the upcoming January 1, 2026, GWP limit for this subsector may need additional time to

[58] *See* White Paper from the Global Cold Chain Alliance, (2014), included in the docket for this action.
[59] *See* "Refrigerant Options and Recommendations for Designing Cold Storage Facilities," Henderson Engineers, (2023), included in the docket for this action.
[60] *See* Refrigeration Technical Options Committee 2022, p. 206.

develop commercial availability. Based on the EPA's review of the information submitted by industry stakeholders, we agree that adjusting the restriction for cold storage warehouses to a GWP of 700 beginning January 1, 2026, which would allow for the use of R-513A and R-450A in cold storage warehouses in the near-term, would address the availability concerns raised by CUSER regarding the availability of substitutes. In particular, this would address concerns about safety considerations in densely populated areas and availability of sufficient compliant refrigerant options across the subsector.

In the 2023 Technology Transitions Rule, the EPA acknowledged that siting cold storage warehouses in close proximity to densely populated areas might limit the availability of ammonia (*see* 88 FR 73163). At that time, our assessment was that there was a sufficient number of substitutes available, including HCFO-1233zd(E), R-471A,[61] and R-744, all A1 refrigerants, which could support the GWP limit of 150 for those cases in which the use of ammonia may present a safety risk in densely populated areas. The EPA received information after the rulemaking, as recently as March 2025, indicating that while listed as acceptable substitutes under the EPA's SNAP program, HCFO-1233zd(E) and R-471A are not yet commercially available. While CUSER shared in March 2025 that R-744 operates at higher pressures and has lower energy efficiency, we acknowledge that components that are specific for use with R-744 systems must be used for safe and energy efficient systems.

SNAP Rule 26 listed seven A2L substitutes as acceptable, subject to use conditions, for use in new cold storage warehouses (*see* 89 FR 50410). These include HFO-1234yf, HFO-1234ze(E), R-457A, R-516A, R-454C, R-455A, and R-454A, which have GWPs of 1, 1, 137, 140, 146, 146, and 237, respectively. All except one have a GWP below the 150 GWP threshold which satisfies the restrictions at 40 CFR part 84, subpart B, for installation in new cold storage warehouses that have a charge size of 200 pounds or more. All of these refrigerants could also be installed in such systems that have a charge size less than 200 pounds, or as part of the high

[61] R-471A is a blend of HFO-1234ze(E) (78.7%), HFO-1336mzz(e) (17%), and HFC-227ea (4.3%).

temperature side of a cascade system, since they all have a GWP below 300. The EPA recognizes that while some of these substitutes are currently commercially available, including HFO-1234yf, HFO-1234ze(E), R-454C, and R-454A, others will take time to become commercially available. For context, one widely used refrigerant in this subsector, R-513A, took approximately seven years from SNAP approval in 2015 to widespread adoption in 2022.[62]

CUSER also noted that A2L substitutes that were identified in the 2023 Technology Transitions Rule, and many that were listed as acceptable subject to use conditions in SNAP Rule 26, including HFO-1234yf, HFO-1234ze(E), R-457A, R-516A, R-454C, and R-454A, may still face availability challenges. In particular, CUSER noted these availability challenges arise from concerns in certain settings due to their status as mildly flammable refrigerants or because there are certain mechanical concerns related to their use.

The EPA recognizes there are challenges associated with using 2Ls, or mildly flammable refrigerants, in certain settings, including allowing for the necessary amount of time for equipment utilizing these refrigerants to become commercially available. However, given similarities to equipment in other subsectors with large charge sizes that uses 2L refrigerants (e.g., industrial process refrigeration and ice-skating rinks),[63] we do not have information that suggests there are technical barriers to using 2L refrigerants specific to cold storage warehouses. The EPA expects that additional refrigerant options that have a GWP below 150 or 300, including those identified as available substitutes for cold storage warehouses in the 2023 Technology Transitions Rule and those listed in SNAP Rule 26 for this subsector, will be available for cold storage warehouses by January 1, 2032. This timing is similar to the adoption of R-513A, which, as explained earlier in this section, took approximately seven years to become commercially available. Of the available substitutes identified in the 2023 Technology Transitions Rule, some were not approved until June 2024 under SNAP Rule 26. If commercial

[62] *See* CUSER's request included in the docket for this action.
[63] *See* Substitutes in Refrigeration and Air Conditioning webpage under the SNAP program, https://www.epa.gov/snap/substitutes-refrigeration-and-air-conditioning.

adoption occurs at a similar pace as R-513A, these substitutes would be commercially available by mid-2031, such that a January 1, 2032, compliance date would be achievable and the existing compliance date of January 1, 2026, would not.

The EPA is also aware that the industry has a history of changing refrigerants every few years in response to customers' requests. For example, CUSER noted that many cold storage warehouses initially used R-507A, transitioned to R-134a in the 2010s, and then transitioned to R-513A in the early 2020s. Given the industry's adeptness to transition, the EPA expects that a transition to another alternative by 2032 will not cause undue burden.

The EPA is thereby proposing a graduated schedule for the use of HFCs in cold storage warehouses. The EPA proposes an increase to the GWP limit of 700 starting January 1, 2026, and becoming 150 or 300, depending on certain characteristics of the system, starting January 1, 2032. The GWP limit of 150 would be for systems with 200 or more pounds of refrigerant charge, excluding the high temperature side of a cascade system. The GWP limit of 300 would be for systems with less than 200 pounds of refrigerant charge, or for the high temperature side of a cascade system. The January 1, 2032, compliance date provides additional time for substitutes to be safely used in all circumstances, and for additional lower-GWP substitutes to become commercial availability. This proposed adjustment would not apply to any other equipment. The proposal would allow for the use of additional refrigerant options in the near-term, including but not limited to R-513A and R-450A. The EPA requests comment on whether there are other limitations to transitioning to lower-GWP alternatives in cold storage warehouses other than those mentioned in this section.

*E. Condensing Units in the Residential and Light Commercial Air Conditioning and Heat Pump Subsector*

1. Current Technology Transitions Provisions

The 2023 Technology Transitions Rule established restrictions on the use of HFCs in the residential and light commercial AC/HP subsector. This subsector includes many types of

equipment, from self-contained products such as packaged terminal air conditioners and window AC units to unitary split systems such as ducted and non-ducted mini-splits, multi-splits, and ducted air conditioners and heat pumps. This section pertains only to the treatment of certain condensing units used in unitary split AC/HP systems and thus does not discuss other types of equipment in this subsector. Unitary split systems are field assembled and charged. Unitary split systems include an outdoor unit with a condenser and a compressor, refrigerant lines, an indoor unit with an evaporator, and ducts to carry cooled or heated air throughout a building. Mini-split air conditioners or heat pump systems is another type of unitary split system that includes an outdoor unit with a condenser and a compressor, refrigerant lines, and a single indoor unit with an evaporator and air handler. Non-ducted mini-splits provide cooled or heated air directly from the indoor unit rather than being carried through ducts.

The unit in which the condenser and compressor are packaged together is called a "condensing unit." The condensing unit discharges heat and is typically located outside. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines a condensing unit as a "machine designed to condense refrigerant vapor to a liquid by compressing the vapor in a positive displacement compressor and rejecting heat to a cooling medium. A condensing unit usually consists of one or more positive displacement compressors and motors, condensing coils, liquid receivers, and other devices mounted on a common base."[64]

In proposing the 2023 Technology Transitions Rule (*see* 87 FR 76738; December 15, 2022) the EPA proposed that restrictions would apply to "products," which would have included condensing units. Specifically, the proposal stated, "effective January 1, 2025, no person may manufacture or import *any product*… as listed in §84.56(a)" (emphasis added).[65] Likewise, "effective January 1, 2026, no person may sell or distribute, offer to sell or distribute, make

---

[64] *See* ASHRAE Terminology at https://terminology.ashrae.org.

[65] §84.56(a)(24) lists "Residential and light commercial air-conditioning and heat pump systems, when using or intended to use a regulated substance or a blend containing a regulated substance with a global warming potential of 700 or greater, except for variable refrigerant flow air-conditioning systems." The proposed rule did not distinguish between "systems" and "products" like the final rule.

available to sell or distribute, purchase or receive, attempt to purchase or receive, or export *any product*… as listed in § 84.56(a)" (emphasis added). The proposed definition of "product" in 40 CFR 84.56(a) would have contained a non-exhaustive list that included "equipment, appliances, components, [and] subcomponents." A condensing unit is a component of the larger unitary split AC/HP system and therefore, under the proposed rule, would have been subject to restrictions.

The EPA received many comments on the proposal about the effect of restricting components and subcomponents as products. The comments varied depending on the type of restriction placed on the component, including: manufacture and import; sale and distribution; and the purchase and use to maintain existing equipment. Most comments addressed the refrigeration systems context, although one commenter expressed concern about its ability to honor warranties for existing AC systems. Based on these comments, we removed components and subcomponents from the final definition of "product." Instead, we classified condensing units as one of five "specified components" at 40 CFR 84.52 that were not subject to restrictions on manufacture, import, sale, distribution, or export.

2. Summary of Administrative Petitions for Reconsideration

The EPA received two administrative petitions, one from Chemours and the other from the Air Conditioning, Heating and Refrigeration Institute (AHRI), Alliance for Responsible Atmospheric Policy, and Heating, Air-conditioning, & Refrigeration Distributors International (HARDI) (hereafter AHRI et al.), requesting that the Agency reconsider aspects of the finalized regulations at 40 CFR part 84, subpart B, as they apply to the residential and light commercial AC/HP subsector. The two administrative petitions requested reconsideration of separate provisions of the regulations as means to achieve a similar outcome, that is, reconsideration of the treatment of condensing units that use or are intended for use with HFC or HFC blend refrigerants with GWPs above 700.

The administrative petition from Chemours requested that the EPA remove provisions that allow the continued use of specified components that use regulated substances with a GWP

at or above 700 in the residential and light commercial AC/HP subsector. The petitioner stated that the EPA did not propose a definition of "specified component," nor did it propose to exempt specified components from the GWP prohibitions. The petitioner noted that the EPA proposed the opposite by including components and subcomponents in the list of products subject to the proposed restrictions. The petitioner stated that the final rule allows for unlimited replacement of condensers, evaporators, and compressors in this subsector, thereby extending the life of existing systems beyond their designed lifetimes without taking comment on the impacts of such extended use. In meetings with the EPA regarding the petition, Chemours clarified that its concern was limited to the replacement of condensing units used in split AC systems in the residential and light commercial AC/HP subsector, not the other four specified components, nor condensing units used in refrigeration subsectors.[66]

The administrative petition from AHRI et al. requested that the EPA make a determination that replacing a condensing unit in the residential and light commercial AC/HP subsector would be considered the installation of a new system under 40 CFR 84.54(e). The administrative petition is limited to condensing units in this subsector that are designed for use with a single condenser and a single evaporator. The administrative petition requested that the EPA not restrict condensing units used in variable refrigerant flow (VRF) systems,[67] multi-split systems, and commercial AC systems with more than one condenser and/or more than one evaporator. After submitting their initial administrative petition, AHRI et al. submitted a letter to the EPA containing supplemental information that limited their request to condensing units with a capacity less than 65,000 BTUs.[68]

3. Proposed Action

The EPA is proposing to retain the current requirements regarding the treatment of condensing units used in the residential and light commercial AC/HP subsector. This proposal

[66] *See* meeting memorandum in the docket for this action.
[67] *See* 88 FR 73178 for a description of variable refrigerant flow (VRF) systems.
[68] *See* supplemental letter from AHRI et al., included in the docket for this action.

provides an opportunity for the public to comment on the treatment of condensing units in this subsector. In doing so, the EPA is addressing one petitioner's concerns about the inability to comment on changes made between proposal and finalization of the 2023 Technology Transitions Rule regarding the treatment of components.

The EPA is proposing no change to the existing provisions at 40 CFR part 84, subpart B, pertaining to the treatment of certain condensing units used in the residential and light commercial AC/HP subsector. This would include no change to the definitions at 40 CFR 84.52, the installation restriction at 40 CFR 84.54(c)(1), the list of actions that the EPA considers an installation of a new system at 40 CFR 84.54(e), the exemption for components at 40 CFR 84.56(b), or the labeling, reporting, and recordkeeping requirements applicable to specified components. As summarized at the beginning of this section, the EPA finalized provisions of the 2023 Technology Transitions Rule that allow equipment owners to repair their existing AC/HP systems and that such repairs could include the replacement of a condensing unit. In doing so, the EPA was mindful of the cost of replacing an entire system due to the failure of a single component.

Under the existing rules, new residential and light commercial AC/HP systems using legacy refrigerants, such as equipment that uses R-410A, can continue to be installed until January 1, 2026, using condensing units manufactured in the United States or imported into the United States before January 1, 2025. There may be scenarios in which a recently installed residential AC system using a refrigerant with a GWP above 700 has a damaged or defective condensing unit, where a repair of the system would be inadequate or infeasible. In such scenarios, under existing regulations, the owner would be able to replace just the condensing unit. If restrictions were to be placed on replacing the condensing unit, the owner's only recourse would be to replace the entire system. Installing a new system is more costly than replacing just the condensing unit, and in some instances, warranties or insurance will only cover the replacement of like equipment. If R-410A-containing condensing units are not available for

replacement due to regulatory restrictions, that homeowner may have to purchase two entirely new AC systems within a short timeframe.

The EPA's proposal to not change the existing treatment of condensing units is in alignment with subsection (i)(7)(B) of the AIM Act and consistent with the Agency's standard practice with regard to allowing repair of legacy equipment. This proposal is also consistent with the Presidential Memorandum titled *Delivering Emergency Price Relief for American Families and Defeating the Cost-of-Living Crisis,* which directs "the heads of all executive departments and agencies to deliver emergency price relief, consistent with applicable law, to the American people and increase the prosperity of the American worker," including by "pursuing appropriate actions to . . . eliminate counterproductive requirements that raise the costs of home appliances[.]"[69]

*F. Industrial Process Refrigeration in Certain Laboratory Equipment*

1. Refrigerated Centrifuges

a. Current Technology Transitions Provisions

A refrigerated centrifuge is a laboratory device that spins samples at a high speed while keeping them at a low, controlled temperature. Refrigerated centrifuges are a niche subset of equipment used in laboratories and have narrow technical requirements which limit the refrigerants that can be used. The EPA understands that refrigerated centrifuges are critical for blood processing and other essential pharmaceutical and medical industries.

The 2023 Technology Transitions Rule included refrigerated laboratory equipment within the IPR subsector.[70] Specifically, the 2023 Technology Transitions Rule stated that refrigerated laboratory equipment covered by either the 2nd edition of the UL 61010-2-011 standard or the 2nd edition of the UL 60335-2-89 standard are subject to the restrictions in the

[69] *See* https://www.whitehouse.gov/presidential-actions/2025/01/delivering-emergency-price-relief-for-american-families-and-defeating-the-cost-of-living-crisis.

[70] The EPA is not aware of IPR centrifuge configurations used for laboratory applications that would be covered by the IPR chiller subsector as opposed to the IPR subsector in 84.54(a)(10), 84.54(c)(5), or 84.54(c)(6).

rule.[71] [72] The restrictions on the use of HFCs and HFC blends in new IPR equipment vary based on the lowest temperature at which the equipment is designed to operate, charge size, and the configuration of the equipment. IPR equipment with refrigerants entering the evaporator at temperatures between -50 °C and -30 °C have a compliance date of January 1, 2028, while IPR equipment with refrigerants entering the evaporator at temperatures at or above -30 °C have a compliance date of January 1, 2026. These restrictions are codified at 40 CFR 84.54(a)(12) and 84.54(c)(10).

The 2023 Technology Transitions Rule excluded centrifuges with charge sizes above the threshold indicated in UL 61010-2-011 while using a refrigerant with a GWP lower than the IPR HFC use restrictions. To summarize, in the final rule, the EPA recognized that refrigerated centrifuges that contain less than 150 g of flammable refrigerant charge (or 370 g of nonflammable refrigerant charge) can meet the UL standards using refrigerants with a GWP below the limits for IPR and are subject to the HFC use restriction. Conversely, the EPA recognized that refrigerated centrifuges that require more refrigeration capacity than can be achieved using refrigerants that meet the HFC use restrictions while meeting the charge size limits in UL 61010-2-011 are not restricted. This is because the refrigerants that meet the IPR restrictions are either flammable, higher toxicity, or high pressure and as such either require an upper limit on charge size to meet the UL standard's safety requirements or are outside the current scope of the UL standard altogether.

b. Summary of Request

After issuance of the 2023 Technology Transition Rule, the EPA was contacted by a manufacturer concerning refrigerated centrifugal equipment with a NAICS code of 333998 that follows UL 61010-2-011 or UL 61010-2-020. The manufacturer stated that refrigerated centrifuges need to be tested to ANSI/UL standards 61010-2-011 or 61010-2-020 before mass

[71] *See* the EPA's response to the manufacturer, included in the docket for this action.
[72] *See* p. 209 of the Response to Comments document for the 2023 Technology Transitions Rule.

production. The manufacturer described how UL 61010-2-020 requires a particular test for refrigerated centrifuges called the Maximum Credible Accident (MCA) test which assesses the safety of centrifugal equipment in a worst-case mechanical failure. The test simulates an accident scenario where the rotor assembly, a high-speed spinning part of the centrifuge, experiences catastrophic failure or becomes detached during rotation. This test ensures that the design and structure of the equipment are robust enough to contain debris and prevent personnel from hazardous exposure to such an event. The manufacturer explained that the MCA test itself is currently not designed in a manner that allows for testing of flammable or high-pressure refrigerants. We understand that the UL standards committee is currently updating UL 61010-2-020 so the standard can appropriately test refrigerated centrifuges to the MCA test using flammable and high-pressure refrigerants.

The EPA understands that this update to the UL safety testing procedure impacts all centrifuge manufacturers. The manufacturer noted that the MCA test was expected to be updated in 2025, before the January 1, 2026, compliance date, but that additional time would be needed for manufacturers to redesign, test, and certify centrifuges to the revised standards. The manufacturer later stated in a meeting that they anticipate that standards and equipment will be updated by January 1, 2028.[73]

c. Summary of Proposed Changes

The EPA has reviewed information provided by the manufacturer and the UL 61010-2-020 standard for laboratory centrifuges. Based on this review, the Agency agrees that the MCA test required in UL 61010-2-020 cannot be performed until modifications are made to accommodate the safety risks associated with fire hazards, ballistic threats, or toxicity hazards and understands such efforts are underway and that the standards and equipment updates are expected to be completed by January 1, 2028. Therefore, the EPA is proposing to extend the compliance date to January 1, 2028, for refrigerated centrifuges within the IPR subsector. This

[73] *See* meeting memorandum in the docket for this action.

extension applies to refrigerated centrifuges only and does not apply to other types of equipment within the IPR subsector. This extension is to allow additional time for the industry standard setting process to finalize updated test procedures specific to refrigerated centrifuges. The EPA requests comment on the proposed extension of the compliance date to January 1, 2028, including on whether there are any significant reliance interests in the existing compliance date that should be taken into account in any final action.

2. Laboratory Shakers

a. Current Technology Transitions Provisions

Laboratory shakers are specialized pieces of equipment used in scientific and medical laboratories to continuously agitate liquid biological samples at controlled temperatures. These devices are designed for applications that require temperature-sensitive conditions, such as growing microbial cell cultures or eukaryotic tissue cultures. The temperature range can span in some applications from around 4 °C to 80 °C.

As described in section IV.F.1.a. of this preamble, the 2023 Technology Transitions Rule indicated that refrigerated laboratory equipment that use an HFC or blend containing HFC(s) are regulated within the IPR subsector.[74] Refrigerated laboratory shakers are covered by the UL 60335-2-89 standard and are regulated as a part of this subsector.

Under the regulations at 40 CFR 84.54, IPR equipment with refrigerants entering the evaporator at temperatures at or above -30 °C) have a compliance date of January 1, 2026. Further information about the requirements for the IPR subsector can be found in section IV.F.1. of this preamble.

b. Summary of Request

After issuance of the 2023 Technology Transition Rule, a manufacturer contacted the EPA regarding refrigerated laboratory shaker equipment. The manufacturer stated that there are

[74] The EPA is not aware of IPR shaker configurations used for laboratory applications that would be covered by the IPR chiller subsector as opposed to the IPR subsector in 84.54(a)(10), 84.54(c)(5), or 84.54(c)(6).

currently limited alternatives for small, compact IPR systems, such as laboratory shakers.[75] The manufacturer noted that while there are some suitable lower-GWP alternatives currently on the market in some laboratory equipment applications, such as R-290[76] and R-1234yf, these alternatives pose safety, efficiency, and cooling capacity challenges in compact lab environments and in certain laboratory applications. For example, flammability is a particular concern from both a regulatory and safety perspective, as laboratories often have open flames, solvents, or other electronics present that could trigger an ignition.

Since laboratory shakers are used in various cell culture applications, the manufacturer also described how a wide temperature operation range and precise temperature control are crucial to ensure optimal cell growth conditions and experimental accuracy. A temperature operation range that extends as low as 4 °C and up to 80 °C allows for a range of biological laboratory research applications. Currently R-134a is one of the only refrigerants used that can achieve such a wide temperature range. Not all shakers have this wide temperature range, and in particular, some do not extend as high as 80 °C. Shakers that use R-600a[77] or a Peltier cooling method[78] can operate at temperatures as high as 60 °C. This limits the capability of such shakers from operating at temperatures above 60 °C, in which certain niche research processes are conducted.

Further, the manufacturer noted that temperature accuracy to within 0.1 °C is required to maintain the integrity of the cell cultures and reliability of results in certain research applications.[79] The manufacturer shared information that illustrated how not all shakers have this precise temperature control capability. Some laboratory shakers can provide an accuracy within 0.3 °C, and some of those are already using compliant refrigerants, including R-600a.

---

[75] *See* materials from Eppendorf, included in the docket for this action.
[76] Propane
[77] Isobutane
[78] Peltier cooling uses a thermoelectric effect for cooling. It does not contain refrigerant.
[79] *See* pdf file from Eppendorf, including in the docket for this action.

The manufacturer noted that one feasible alternative that could achieve desired temperature specifications is R-744, but that current IPR systems for this refrigerant are primarily designed for large-scale industrial refrigeration systems and that there are limited solutions for small-scale laboratory equipment. Systems are currently in development but are not expected to be available until mid-2027 at the earliest.[80]

c. Proposed Action

The EPA is proposing to extend the compliance date to January 1, 2028, for refrigerated laboratory shakers within the IPR subsector. This extension does not apply to other refrigerated laboratory equipment not discussed in this proposal. This extension is to allow additional time for the development of lower-GWP refrigerants and not-in-kind substitutes (*e.g.*, Peltier cooling) for use in this niche refrigerated laboratory application. The EPA has received information that R-744 is being developed for use in laboratory shakers to have the necessary specifications that can meet manufacturers and researchers' requirements in time before 2028.

The EPA is aware that several refrigerants are currently being used in refrigerated laboratory shakers, but that they do not all have the same temperature operation range or temperature control capacity. The EPA received information from one manufacturer that R-134a, with a GWP of 1,430, is the only refrigerant that is currently being used to meet the wide temperature range and fine temperature control requirements of manufacturers and researchers. It is capable of operating at temperatures as low as 4 °C, and up to 80 °C, with temperature control capability in increments of 0.1 °C. R-600a, with a GWP of 1, is being used in equipment capable of operating at temperatures as low as 4 °C, and up to 60 °C, with a temperature control capability of 0.3 °C increments. One shaker product utilizes Peltier cooling to achieve a temperature range of 5 °C to 60 °C with a temperature control capability of 0.3 °C increments.

While a range of options are used to control temperature in laboratory shakers, including compliant refrigerants that can meet the requirements in some refrigerated laboratory shaker

[80] *See* PowerPoint from Eppendorf, included in the docket for this action.

applications, there remain some use cases in which refrigerants with a GWP of lower than 700 are unable to meet the requirements. This includes achieving temperatures between 60 °C and 80 °C in shakers that also have a temperature control capability as fine as 0.1 °C increments. In addition, based on industry estimation, the EPA understands that new IPR products using R-744 as the refrigerant are currently in development and are not expected to be available around mid-2027. As such, the EPA is proposing to extend the compliance date from January 1, 2026, to January 1, 2028, for all laboratory shakers, to provide additional time for compliant refrigerant options to be developed for all refrigerated laboratory shaker use cases.

The EPA requests comment on the proposed extension of the compliance date to January 1, 2028, as explained in this section, including on whether there are any significant reliance interests in the current requirements that should be taken into account in any final action.

*G. Extending the Installation Compliance Date for Residential and Light Commercial Air Conditioning and Heat Pump Systems*

1. Current Technology Transitions Provisions

The current requirements at 40 CFR part 84, subpart B, restrict the use of certain HFCs in systems in the residential and light commercial AC/HP subsector. Systems in this subsector include unitary split systems such as ducted and non-ducted mini-splits, multi-splits, and ducted air conditioners and heat pumps. This section pertains to the treatment of residential and light commercial AC/HP systems only.

The 2023 Technology Transitions Rule restricted the installation of residential and light commercial AC/HP systems using refrigerants with a GWP higher than 700 beginning January 1, 2025. After the 2023 rule was finalized, the EPA received new information including data concerning how the January 1, 2025, restriction on installation would result in substantial stranded inventory for residential new construction, including both single-family and multi-family dwellings, where builders order heating and cooling equipment well in advance of knowing the exact date of installation. The EPA published an interim final rule on December 26,

2023, to address the unique circumstances of this subsector to prevent equipment from being stranded (*see* 88 FR 88825). That rule extended the installation compliance date for such systems by one year, to January 1, 2026, so long as the equipment was manufactured in the United States or imported into the United States before January 1, 2025.

2. Summary of Stakeholder Concerns Related to Availability of R-454B

The U.S. air conditioning manufacturers are manufacturing new residential and light commercial split AC systems using R-454B (a blend of HFC-32 and HFO-1234yf), and to a lesser extent, HFC-32. While systems using other refrigerants (*e.g.*, R-410A) can currently be installed until January 1, 2026, data suggests the bulk of the systems being sold now use either R-454B or R-32.[81] However, supply chain issues, such as a shortage of 20-lb cylinders rated for transporting A2L refrigerants, affected the availability of R-454B for contractors and technicians throughout the spring and most of the summer of 2025. In addition, one chemical producer announced a surcharge for R-454B early in the cooling season.[82] There has also been some stockpiling contributing to regional shortages. In some cases, refrigerant costs and longer lead times for filling some orders for R-454B have impacted consumers in need of new residential air conditioning systems. While the EPA's current regulations do not restrict the installation of equipment using legacy refrigerants such as R-410A until January 1, 2026, the EPA has been concerned with these potential consumer impacts and has been exploring ways to provide relief.

The EPA recognizes that many trade associations and individual companies have been working to address the supply chain issues for R-454B. These entities cited a number of contributing factors including higher than anticipated demand, shortages of the 20-lb cylinders, and global economic factors as contributing to this unexpected situation. Contractors and technicians have been the most impacted because of how refrigerant is distributed. The original equipment manufacturers (OEMs), which typically receive refrigerant in larger containers (*e.g.*,

[81] *See* materials related to R-454B, included in the docket for this action.
[82] *See* Honeywell's announcement from April 2025, included in the docket for this action.

isotanks), have not had the same experiences as those that typically buy refrigerant packaged into smaller containers (*e.g.*, 20-lb cylinders). In response to these supply chain challenges, OEMs have increased the amount of refrigerant charge in new equipment to cut down on the amount of additional refrigerant that contractors need to appropriately install the equipment. At least one OEM has been repackaging their excess bulk R-454B into 20-lb cylinders for use by distributors and contractors.[83] Worthington Industries, the dominant cylinder manufacturer, has stated that demand for R-454B was more than anticipated. In response to the cylinder shortage, they have increased cylinder production, including adding two production crews to one facility and adding a production shift to another facility.[84]

Despite these actions to make R-454B more available, the EPA understands that in some parts of the country, access to R-454B remains challenging. To provide relief to consumers, the EPA considered extending the installation date for systems using refrigerants with a GWP higher than 700, including R-410A, to January 1, 2027. However, noting the Agency does not have information about the extent of equipment that may remain in company inventories as of January 1, 2026, removing the installation compliance date altogether may be the more appropriate approach. Either of these approaches would also respond to a second concern that has been brought to the EPA's attention. Since publication of the interim final rule on December 26, 2023, some entities have requested additional time beyond January 1, 2026, to install residential and light commercial AC/HP systems.[85] These requesters shared that additional time is needed because of construction delays particularly for certain construction projects (*e.g.*, for multifamily housing) that have long timelines.[86] Without further extension of the installation compliance date, they note that there could be stranded inventory.

---

[83] *See* materials related to R-454B, included in the docket for this action.
[84] Ibid.
[85] *See* comment on the interim final rule (88 FR 88825) from the National Multifamily Housing Council and National Apartment Association, as well as a list of stakeholders who submitted relevant questions and comments to the EPA, included in the docket for this action.
[86] *See* comment on the interim final rule (88 FR 88825) from the National Multifamily Housing Council and National Apartment Association.

3. Proposed Action

The EPA is proposing to remove the installation compliance date for systems in the residential and light commercial AC/HP subsector, using components manufactured or imported prior to January 1, 2025. In light of current supply chain issues, the potential for future supply chain issues, as well as the fact that current rules do not allow for additional import or manufacture of equipment for new systems, the EPA no longer believes that limiting the ability to install new systems is warranted. Removing the installation compliance date allows industry to sell through remaining inventory of R-410A equipment that has been previously manufactured or imported. In light of the supply chain issues related to R-454B experienced this summer, the EPA seeks to provide consumers and contractors with an additional option. The EPA remains mindful, however, of potential impacts to companies that have relied upon the installation compliance date. The EPA does not expect there will be discernible economic impacts from those already modeled in our analysis for the 2023 Technology Transitions Rule since the total number of systems installed using legacy refrigerants would still match what the Agency modeled for that rule.

*H. Labeling Correction*

The EPA is also proposing to correct an erroneous citation in the regulatory text at 40 CFR 84.58(b). The regulatory text should direct the reader to paragraph (d), not to paragraph (c), as currently written. The proposed regulatory text for this rulemaking corrects this to accurately describe the intended labeling requirements.

*I. Proposed interpretation of paragraph (i)(6)*

The EPA is proposing to make this rule effective 30 days after publication of the final rule in the *Federal Register*. Subsection (i)(6) of the AIM Act states that "no rule under this subsection may take effect before the date that is 1 year after the date on which the Administrator promulgates the applicable rule under this subsection" (42 U.S.C. 7675(i)(6)). The EPA is

proposing that the best reading of this statutory text is that the one-year requirement applies only to the creation of new restrictions and not to the relaxation or removal of existing restrictions.

The 2023 Technology Transitions Rule described the EPA's interpretation of this provision as applying to the establishment of restrictions on use of HFCs under subsection (i)(1) of the AIM Act. Based on this interpretation, we established compliance dates for the restrictions on the manufacture and import of products and installation of systems that were at least one year from the date of promulgation. At the same time, we also did not include a delayed compliance or effective date for provisions pertaining to program administration and petitions processing and elected to make those provisions effective 60 days after publication in the *Federal Register* (*see* 88 FR 73104).

Since finalizing the 2023 Technology Transitions Rule, the EPA has issued two rules adjusting existing restrictions based on new information. In those rules, we maintained that changes to the requirements under subsection (i) of the AIM Act, including extending compliance dates, must be finalized at least one year prior to the restriction taking effect (*see* 88 FR 88826). The Agency has reconsidered its position and now proposes that the best reading of the subsection (i)(6) requirement is that it does not apply to modifications of existing restrictions that were originally promulgated under subsection (i) if those modifications provide relief from a restriction. Providing a full year delay between promulgation and application of a compliance deadline is important when a new sector or subsector is being regulated, as with the 2023 Technology Transitions Rule, to provide regulated parties sufficient notice to plan for and adjust to new restrictions. However, when the EPA is revising an existing restriction to provide additional time for compliance or other relief, the need for adequate notice to parties subject to the restriction is less compelling, particularly when the parties are themselves requesting relief from the Agency's restrictions. The Agency is therefore proposing that the best reading of the effective date provision in subsection (i)(6) as not applying to these adjustments to existing restrictions that provide relief from those restrictions, though the provision would still apply to

the creation of new restrictions. Under this proposal, adjusting an existing restriction to extend a compliance date from January 1, 2026, to January 1, 2028, for example, would not need to be completed by January 1, 2025, in order to comply with subsection (i)(6). However, finalizing a new restriction with a compliance date of January 1, 2028, for example, would need to be completed no later than one year in advance, or January 1, 2027, at the latest.

The EPA requests comment on this proposed statutory interpretation that the one-year effective date requirement of subsection (i)(6) not apply to rules relaxing or removing existing restrictions, particularly whether there are any reliance interests that would be negatively affected by a shorter effective date requirement.

*J. Negotiated Rulemaking*

Prior to proposing a rule under subsection (i) of the AIM Act, subsection (i)(2)(A) directs the EPA to consider negotiating with stakeholders in the sector or subsector subject to the potential rule in accordance with negotiated rulemaking procedures established under 5 U.S.C. chapter 5, subchapter III (commonly known as the "Negotiated Rulemaking Act of 1990"). If the EPA makes a determination to use negotiated rulemaking procedures, subsection (i)(2)(B) of the AIM Act requires that the EPA, to the extent practicable, give priority to completing that rulemaking over completing rulemakings under subsection (i) that are not using that procedure. If the EPA does not use the negotiated rulemaking process, subsection (i)(2)(C) requires that we publish an explanation of the decision not to use that procedure before commencement of the rulemaking process.

The EPA noted in the 2023 Technology Transitions Rule that, where appropriate, we will consider recent Agency actions and decisions related to restrictions on the use of HFCs in sectors and subsectors when considering using negotiated rulemaking procedures. We provided the example of not issuing a separate notice to consider using negotiated rulemaking for four petitions submitted under (i)(4) of the AIM Act that the EPA received after a first round of petitions had been subject to public notice and comment. We reasoned that these (i)(4) petitions

were received well ahead of the final action and that the requested restrictions were in the same sectors and subsectors addressed in petitions for which a determination had already been made. The EPA stated that nothing in those four (i)(4) petitions caused us to reconsider that decision and that it was unnecessary for us to reconsider whether to use negotiated rulemaking procedures.

Upon reconsidering the 2023 Technology Transitions Rule, the EPA has determined that this proposed rulemaking does not merit revisiting our prior determination not to use negotiated rulemaking procedures.[87] [88] We are proposing this action in response to specific concerns arising from administrative petitions and other requests to amend certain existing provisions of the 2023 Technology Transitions Rule. As previously noted, we are not proposing to establish new restrictions in this rulemaking. Rather, we are proposing to amend existing regulations to provide more time and flexibility.

## V. Assessment of Economic and Environmental Impacts

The actions proposed in this rule are inherently deregulatory in that the compliance deadlines would be extended and, in some cases, GWP thresholds would be increased. As noted in each of the discussions in section IV. of this preamble, stakeholders are, in many cases, requesting that the EPA relax certain requirements, citing difficulties in compliance due to a variety of reasons including lack of technically achievable alternatives or other barriers, such as building codes. Entities requesting changes to the restrictions provided new information indicating barriers to meeting the existing requirements and implied there would be savings associated with these changes. The requesters of these changes find that these barriers are preventing them from fully complying with the current restrictions at 40 CFR part 84, subpart B. The EPA also received information indicating that relaxing restrictions in the retail food

[87] CUSER suggested in their request that the EPA not use the negotiated rulemaking procedure.
[88] The EPA does not believe that this rulemaking would benefit from the negotiated rulemaking procedure because timeliness is a concern shared by stakeholders.

refrigeration (supermarkets and remote condensing units) subsectors would result in disbenefits for companies that have invested in alternative technologies.

The EPA does not have all the information necessary to quantify the potential net cost savings associated with alleviating the anticipated difficulties raised by entities. The EPA notes such net cost savings would be difficult to quantify with existing data, as they could vary substantially from entity to entity based on a variety of factors. These factors include access to capital, supply agreements, locations of operations, supply chain logistics, short- and long-term agreements or contracts, training practices, availability of personnel trained on new technologies, investments made to develop new technologies, stranded assets from delayed transitions, and more. The EPA welcomes information from stakeholders that is sufficiently quantitative, of sufficient quality, and relevant, which would assist us in quantifying such economic effects.

Further discussion regarding the economic impacts of this proposed rule, as well as a detailed list of additional information that the EPA is seeking in order to better evaluate these impacts, are provided in the draft memorandum titled, "Analysis of Economic and Environmental Impacts – Phasedown of Hydrofluorocarbons: Reconsideration of Certain Regulatory Requirements Promulgated Under the Technology Transitions Provisions of the American Innovation and Manufacturing Act of 2020" (hereafter "Economic Analysis memo"), which is included in the docket for this action.

The EPA notes that it is not able to evaluate the following factors with existing data and welcomes additional information from the regulated community and general public that could be used to evaluate and estimate such costs and cost savings:

- Cost savings resulting from updated transition pathways where changes result in the avoidance of burden not previously assessed by the EPA. Petitioners and requesters indicate that compliance with the requirements at 40 CFR part 84, subpart B, would pose challenges for specific parts of industry related to technical feasibility or commercial readiness. Without the adjustments proposed in this rulemaking, specific entities may

incur additional costs due to supply bottlenecks of alternative refrigerants and technologies, accelerated uptake of nascent and costly technologies, the need to stockpile legacy equipment, engage in costly repairs of legacy equipment in order to extend its useful life in lieu of replacement, and more. The EPA did not quantify such costs for the 2023 Technology Transitions Rule, and the EPA does not have the data to quantify the avoidance of such costs through the changes proposed in this rulemaking. However, the EPA notes that a primary benefit of this proposed rulemaking is to avoid such costs by providing a smoother transition path for the specific subsectors included in this rulemaking.

- Costs resulting from the proposed rulemaking for cases where relaxing compliance requirements result in stranded assets for companies that had made capital and investment planning decisions based on the requirements at 40 CFR part 84, subpart B, finalized in 2023. For example, OEMs may have made capital investments in additional manufacturing capacity for technology necessary to meet the existing requirements in the retail food subsector. These sunk costs may be more difficult to recoup to the extent that future demand for these technologies changes as a result of the proposed changes.

If the EPA acquires the additional information discussed here and in the Economic Analysis memo, and it is sufficiently quantitative, rigorous, complete, and relevant to this rulemaking, the information could be used to evaluate the economic impacts of this proposed rulemaking.

*Preliminary Assessment of Updated Market Transitions and Environmental Impacts based on Proposed Adjustments*

While the EPA does not have sufficient information to quantify aspects of the costs and savings of this proposed rule, the EPA did conduct an analysis of updated market transition assumptions and resulting changes to HFC consumption. To derive the results, the EPA re-ran the analysis it originally completed for the 2023 Technology Transitions Rule, adjusting the

proposed changes to compliance dates and thresholds in this rule. The EPA is taking comment on whether the updated pathways to transition included in this analysis, discussed in detail in the Economic Analysis memo, are realistic and reflective of current market conditions.

Overall, the preliminary analysis of the EPA's updated assumptions—including later transitions to alternatives or transitions to a higher-GWP alternative—result in an estimated 2.9 percent increase in HFC consumption (*i.e.*, reduction in HFC consumption abatement) relative to the 2023 rule analysis (or a 0.02 to 7.8 percent reduction based on the upper and lower bound sensitivities evaluated).[89] Table 1 provides a summary of how the proposed adjustments and updated market transitions affect U.S. HFC consumption. Results are provided in terms of net consumption change relative to the 2023 Technology Transitions Rule for each category of equipment affected by this proposed action. The EPA notes that these results are based on existing models and currently available data.

**Table 1-Incremental Adjustments to Consumption Abatement as Compared to the 2023 Technology Transitions Rule Analysis, Based on Currently Available Data (Million Metric Tons of Exchange Value Equivalent, Cumulative through 2050)**

| Subsector(s) | Cumulative Adjustment to Net HFC Consumption Abatement[a,b] |
|---|---|
| **Refrigerated Transport** | **(0.055)** [0.03 to 0.08][c] |
| **Industrial Process Refrigeration** | **(0.38)**[d] |
| **Cold Storage Warehouses** | **(6.33)** [0 to 12.28][e] |
| **Retail Food Refrigeration** | **(56.05)** [0 to 155.84][e] |
| **Total (for all affected subsectors)** | **(62.815)** [0.41 to 168.58] |

[a] Resulting adjustments to net consumption abatement are negative (*i.e.*, increased consumption).
[b] Bracketed values represent upper and lower bound sensitivity estimates. Bold values represent preliminary point estimates.

[89] As a sensitivity, the EPA's analysis provides upper and lower bound estimates of assumed changes in transition rates to various technology options (and resulting increase in HFC consumption) that may occur in response to the proposed rulemaking. For more details on these assumptions, see the Economic Analysis memo included in the docket for this action.

[c] This range of values is informed by data from industry stakeholders that was shared with the EPA regarding the potential market share represented by the type of equipment for which the proposed rule would provide an exemption.
[d] For the relevant applications this subsector, the EPA did not conduct a sensitivity analysis associated with the uncertainty regarding transitions to various new technology options or market share.
[e] As described in more detail in the Economic Analysis memo, the EPA conducted a sensitivity analysis for these subsectors given the significant uncertainty regarding potential changes in expected transition rates to various technology options.

For more detailed information, see the Economic Analysis memo included in the docket for this rulemaking.

## VI. Request for Comments

In addition to the instances in which the EPA has requested comment above, the EPA is requesting comment on the following:

1. Data regarding which refrigerants are being considered or adopted in new refrigeration equipment for remote condensing units, supermarket systems, and cold storage warehouses.

2. Data about the commercial availability and timeline for adoption of new refrigeration equipment using lower-GWP substitutes in remote condensing units, supermarket systems, and cold storage warehouses as it relates to the second step of the proposed compliance dates which begin in 2032 for these subsectors.

3. Data about costs and savings resulting from the extension of compliance timelines for manufacturers and servicing companies, which are investing in U.S. production of new raw materials, refrigerants, equipment and other technologies, intended to support companies' transition and compliance, across the subsectors in this rule.

4. The EPA requests comment on the proposed removal of the installation compliance date for residential and light commercial AC systems. The EPA is also seeking comment on whether an extension of the installation compliance date by one or more years would be appropriate, noting the Agency does not have information about the extent of equipment that may remain in inventory as of January 1, 2026, as well as any significant reliance interests that should be taken into account in any final action.

## VII. Advance notice of proposed rulemaking to address R-454B supply

As stated in section IV.G., the EPA is aware of recent challenges related to the availability of the refrigerant R-454B, causing potential increases in price, scarcity, and stockpiling. Most U.S. OEMs have chosen to transition to R-454B for use in residential AC systems compliant with the Technology Transitions regulations at 40 CFR part 84, subpart B. As discussed in section IV.G., these OEMs typically purchase refrigerants in larger containers (*e.g.*, isotanks) and are thus much less susceptible to the supply chain issues. However, contractors and technicians experienced significant R-454B supply chain issues this summer which affected consumers purchasing new AC systems. As stated in section IV.G., the EPA is concerned with the impacts on consumers. While the Agency is aware of the efforts by OEMs and the U.S. cylinder manufacturer to address these issues, the EPA is interested in other options that could provide further relief to the consumers.

The EPA is seeking advance comment on possible actions that the U.S. government could consider. The EPA is interested in information and data that may be used to inform future actions that could be taken by the EPA or by other parts of the federal government to address this issue. The EPA acknowledges that many of the topics listed below could involve regulatory changes for which the statutory authority may be vested in other departments or agencies of the federal government. However, in those cases, the EPA would share information with the relevant departments and agencies. The EPA is also interested in advance comment on any significant reliance interests.

Specifically, the EPA is seeking comments and additional information that could be used to inform potential future actions that include but are not limited to:

- A price cap or other mechanisms on R-454B or other refrigerants experiencing supply chain issues to prevent price gouging;
- A requirement that equipment manufacturers provide the necessary amount of R-454B or other refrigerants experiencing shortages for installation of equipment, particularly when contractors and technicians are unable to acquire the refrigerants readily;

- Options for potential revisions to the Pipeline and Hazardous Materials Safety Administration (PHMSA) requirements which regulate the types of cylinders that can be used to transport the relevant chemicals (49 CFR parts 106, 107 and 171 to 180);
- Options to increase cylinder production in the United States, including by encouraging new market entrants or additional production lines for current cylinder manufacturers, to ensure a sufficient supply of cylinders for the U.S. market;
- Options for increasing reclamation of R-454B and information concerning how this might comport or conflict with any relevant patent protections; and
- Options that would require compulsory licensing agreements allowing more entities to blend R-454B or other refrigerants experiences shortages at least on a temporary basis.

The EPA is seeking comments to gain public input and additional information on these topics, including their feasibility, relevant authorities, and to what extent any additional actions would be considered beneficial. The EPA reiterates that there is no concrete proposal in this section as it is solely intended to elicit advance comment.

## VIII. Statutory and Executive Order Reviews

Additional information about these statutes and Executive Orders can be found at https://www.epa.gov/laws-regulations/laws-and-executive-orders.

### *A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review*

This action is a significant regulatory action that was submitted to the Office of Management and Budget (OMB) for review. Any changes made in response to OMB recommendations have been documented in the docket. EPA prepared an economic analysis of the potential costs and benefits associated with this action.[90]

### *B. Executive Order 14192: Unleashing Prosperity Through Deregulation*

[90] *See* Economic Analysis memo included in the docket for this action.

This action is expected to be an Executive Order 14192 deregulatory action. This proposed rule is expected to provide burden reduction by providing industry with additional time and/or flexibility to transition to next-generation technologies, without adversely affecting the phasedown goals under the AIM Act.

*C. Paperwork Reduction Act (PRA)*

This action does not impose an information collection burden under the PRA because it does not contain any information collection activities.

*D. Regulatory Flexibility Act (RFA)*

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. In making this determination, EPA concludes that the impact of concern for this proposed rule is any significant adverse economic impact on small entities and that the Agency is certifying that this proposed rule would not have a significant economic impact on a substantial number of small entities because the proposed rule would relieve regulatory burden on the small entities subject to the rule. EPA is making this determination based on the small business screening analysis that was done for the 2023 Technology Transitions Rule which found that there that there was no significant impact on a substantial number of small entities (SISNOSE). The changes proposed in this rulemaking are deregulatory in nature and do not meaningfully impact that analysis. We have therefore concluded that this action would relieve regulatory burden for all directly regulated small entities.

*E. Unfunded Mandates Reform Act (UMRA)*

This action does not contain any unfunded mandate as described in UMRA, 2 U.S.C. 1531-1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local or Tribal governments or the private sector.

*F. Executive Order 13132: Federalism*

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

*G. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments*

This action does not have Tribal implications as specified in Executive Order 13175. It will not have substantial direct effects on Tribal governments, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes, as specified in Executive Order 13175. Thus, Executive Order 13175 does not apply to this action.

*H. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks*

EPA interprets Executive Order 13045 as applying only to those regulatory actions that concern environmental health or safety risks that EPA has reason to believe may disproportionately affect children, per the definition of "covered regulatory action" in section 2-202 of the Executive Order. This action is narrowly tailored to prevent the stranding of certain air conditioning and heat pump equipment using variable refrigerant flow technology while not affecting the demand for HFCs. Therefore, this action is not subject to Executive Order 13045 because it does not concern an environmental health risk or safety risk. Since this action does not concern human health, EPA's Policy on Children's Health also does not apply.

*I. Executive Order 13211: Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use*

This action is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. This action applies to certain subsectors that use regulated substances, none of which are used to supply or distribute energy.

*J. National Technology Transfer and Advancement Act (NTTAA)*

This rulemaking does not involve technical standards.

**List of Subjects in 40 CFR Part 84**

Environmental protection, Administrative practice and procedure, Air pollution control, Chemicals, Climate change, Emissions, Imports, Reporting and recordkeeping requirements.

**Lee Zeldin,**
*Administrator.*

For the reasons stated in the preamble, the EPA proposes to amend 40 CFR part 84 as follows:

**PART 84-PHASEDOWN OF HYDROFLUOROCARBONS**

1. The authority citation for part 84 continues to read as follows:

**Authority:** Pub. L. 116-260, Division S, Sec. 103.

**Subpart B-Restrictions on the Use of Hydrofluorocarbons**

2. Amend § 84.54 by:

a. Revising paragraph (a)(6).

b. Adding paragraphs (a)(10)(v), (12)(iv) and (v).

c. Revising paragraphs (c)(1), (5), (6), (7), and (9).

d. Adding paragraph (c)(10)(v).

e. Revising paragraphs (c)(11) and (12).

The revisions and additions read as follows:

**§ 84.54 Restrictions on the use of hydrofluorocarbons.**

(a) * * *

(6) Effective 30 days after publication of the final rule, refrigerated transport—intermodal containers with a box temperature of -35 °C (-31 °F) or higher using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

* * * * *

(10) * * *

(v) Chillers subject to paragraphs (iii) or (iv) with a refrigerant charge capacity less than 100 pounds that are used in the manufacture of semiconductors must comply with the restrictions of those paragraphs by January 1, 2030.

* * * * *

(12) * * *

(iv) Products subject to paragraphs (ii) or (iii) with a refrigerant charge capacity less than 100 pounds that are used in the manufacture of semiconductors must comply with the restrictions of those paragraphs by January 1, 2030;

(v) Refrigerated centrifuges and laboratory shaker tables subject to paragraphs (i) or (ii) must comply with the restrictions of those paragraphs by January 1, 2028.

* * * * *

(c) * * *

(1) Effective January 1, 2025, residential or light commercial air-conditioning or heat pump systems using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater, except for variable refrigerant flow air-conditioning and heat pump systems. New residential and light commercial air-conditioning and heat pump systems using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater may continue to be installed where all specified components of that system are manufactured or imported prior to January 1, 2025.

* * * * *

(5)(i) Effective January 1, 2026, chillers for industrial process refrigeration where the temperature of the fluid exiting the chiller is greater than -30 °C (-22 °F) using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

(ii) Effective January 1, 2030, chillers for industrial process refrigeration with a refrigerant charge capacity less than 100 pounds that are used in the manufacture of semiconductors where the temperature of the fluid exiting the chiller is greater than -30 °C (-22 °F) using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

(6)(i) Effective January 1, 2028, chillers for industrial process refrigeration where the temperature of the fluid exiting the chiller is greater than or equal to -50 °C (-58 °F) and less than

or equal to -30 °C (-22 °F) using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

(ii) Effective January 1, 2030, chillers for industrial process refrigeration with a refrigerant charge capacity less than 100 pounds that are used in the manufacture of semiconductors where the temperature of the fluid exiting the chiller is greater than or equal to -50 °C (-58 °F) and less than or equal to -30 °C (-22 °F) using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

(7) Effective 30 days after publication of the final rule, refrigerated transport—intermodal containers with a box temperature of -35 °C (-31 °F) or higher using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

* * * * *

(9)(i) Effective January 1, 2026, cold storage warehouse systems using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 700 or greater;

(ii) Effective January 1, 2032, cold storage warehouse systems using a regulated substance, or a blend containing a regulated substance, as follows:

(A) Systems with a refrigerant charge capacity of 200 pounds or greater, that are not the high temperature side of a cascade system, using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 150 or greater;

(B) Systems with a refrigerant charge capacity less than 200 pounds using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 300 or greater;

(C) Cascade refrigerant systems using a regulated substance, or a blend containing a regulated substance, on the high temperature side of the system with a global warming potential of 300 or greater;

(10) * * *

(v) Systems used in the manufacture of semiconductors with a charge size of less than 100 pounds must comply with the restrictions of paragraphs (ii) – (iv), as applicable, by January 1, 2030.

(11)(i) Effective January 1, 2026, remote condensing units in retail food refrigeration systems using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 1,400 or greater;

(ii) Effective January 1, 2032, remote condensing units in retail food refrigeration systems using a regulated substance, or a blend containing a regulated substance, as follows:

(A) Systems with a refrigerant charge capacity of 200 pounds or greater, that are not the high temperature side of a cascade system, using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 150 or greater;

(B) Systems with a refrigerant charge capacity less than 200 pounds using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 300 or greater;

(C) Cascade refrigerant systems using a regulated substance, or a blend containing a regulated substance, on the high temperature side of the system with a global warming potential of 300 or greater;

(12)(i) Effective January 1, 2027, supermarket systems using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 1,400 or greater;

(ii) Effective January 1, 2032, supermarket systems using a regulated substance, or a blend containing a regulated substance, as follows;

(A) Systems with a refrigerant charge capacity of 200 pounds or greater, that are not the high temperature side of a cascade system, using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 150 or greater;

(B) Systems with a refrigerant charge capacity less than 200 pounds using a regulated substance, or a blend containing a regulated substance, with a global warming potential of 300 or greater;

(C) Cascade refrigerant systems using a regulated substance, or a blend containing a regulated substance, on the high temperature side of the system with a global warming potential of 300 or greater;

* * * * *

3. Amend § 84.58 by revising paragraph (b) to read as follows:

**§ 84.58 Labeling.**

* * * * *

(b) Effective upon the date listed for each subsector in § 84.54(c), or the earliest date should the specified component be used in multiple subsectors, any specified component manufactured or imported and intended for use in those subsectors that uses or is intended to use any regulated substance, or blend containing any regulated substance, regardless of global warming potential, must have a permanent label compliant with paragraph (d) of this section containing the information in paragraph (a)(1) of this section. For specified components that are intended for use with a regulated substance or blends containing a regulated substance that exceed the applicable GWP limit or HFC restriction, the label must state “For servicing existing equipment only” in addition to the other required labeling elements.

* * * * *

[FR Doc. 2025-19438 Filed: 10/2/2025 8:45 am; Publication Date: 10/3/2025]