



Shaping Tomorrow's
Built Environment Today

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Response to Questions for the Record for

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Regarding S. 2754, American Innovation and Manufacturing Act of 2019

From Senator Whitehouse

1. What percentage of total HFCs used in the U.S. are used by the aerospace, semiconductor, composites, foam, and defense sprays industries? Has this percentage of niche uses grown over the last five years, and if so, by how much?

This question is outside of ASHRAE's areas of expertise. Although ASHRAE is aware of the various uses of HFCs, as a professional society, ASHRAE does not have or maintain market data on refrigerant sales or market segmentation. This question can likely be better addressed by the refrigerant manufacturers.

2. Numerous industries have provided written testimony stating that there are no acceptable substitutes for HFCs they use. Please comment on these claims with respect to the aerospace, semiconductor, composites, foam, and defense sprays industries. Please list all HFCs for which such claims have been made and state whether or not you agree with the claim that no acceptable substitute exists. If you do not agree, please provide the name of the substitute and why you believe it to be acceptable.

As a professional society focused on advancing human well-being through sustainable technology for the built environment, ASHRAE cannot comment on matters pertaining to industries outside of ASHRAE's areas of expertise and mission (e.g., aerospace, semiconductor, composites, defense sprays).

For the purposes of HVAC&R equipment, there continues to be emerging refrigerant developments that provide equipment manufactures and end-users with multiple options for refrigerants across wide temperature ranges to serve the application needs. Because there are often multiple choices of candidate refrigerants to replace HFCs, there will; inherently, be trade-offs that need to be considered. This also applies to the use of these fluids as blowing agents for insulation materials that are used within the HVAC&R industry.

Additional information concerning refrigerant selection is available in ASHRAE’s “Position Document on Refrigerants and Their Responsible Use¹” and provided below for your reference:

Throughout the history of air conditioning and refrigeration, numerous substances have been used as refrigerants², and for many years refrigerant choice was not of primary concern when selecting equipment. This changed over the last three decades as choosing a refrigerant became increasingly more complex due to the new environmental criteria applied to refrigerant selection that resulted in many new substances and blends being invented, tested, and commercialized. Earlier generations of commercial refrigerants were mostly fluorinated gases—chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). They contributed to the depletion of stratospheric ozone and are being phased out globally under The Montreal Protocol. CFCs and HCFCs have largely been replaced with hydrofluorocarbons (HFCs), some of which have high global warming potential (GWP) and are being restricted as the world deals with global climate change. More recently, fluorinated alternatives referred to as hydrofluoroolefins (HFOs) have been introduced. They have zero ozone-depleting potential (ODP) and very low GWP, but some of them are mildly flammable.

Nonfluorinated refrigerants (frequently referred to as natural refrigerants) include ammonia, carbon dioxide (CO₂), hydrocarbons, water, and air. Some of them have been used for many decades with varying degrees of adoption. Although their GWP is very low, natural refrigerants are not free of other concerns, such as corrosion, toxicity, high pressures, high flammability, or in some cases lower operating efficiencies. There are also other single components and blends (mixtures of different refrigerants from the same or different class/group) that are available as transitional or long-term solutions with different flammability and GWP value characteristics.

3. For HFCs where users claim that the current substitute is too expensive, based on the country’s prior experience transitioning from CFCs to HFCs, what do you believe will occur with respect to the price of HFC substitutes?

As a technical society focused on technological advancements, ASHRAE declines to comment on speculation concerning the cost of various HFC substitutes. However, ASHRAE does expect the candidate refrigerants being proposed for replacing HFCs will likely undergo a process of consolidation. In some applications, we expect there will initially be a larger list of refrigerants available but over time, that list will decline based on market acceptance.

¹ Approved by ASHRAE Board of Directors June 27, 2018. Expires June 27, 2021.

² Calm, J.M. 2008. The next generation of refrigerants—Historical review, considerations, and outlook. *Int. J. Refrigeration* 31:1123–33