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Ms. Denise Keehner  
Director  
Office of Pollution Prevention and Toxics  
U.S. Environmental Protection Agency  
1200 Pennsylvania Avenue, NW  
Washington, DC 20460

RE: Response to Request for Information (RFI) to Support New Inflation Reduction Act Programs to Lower Embodied Greenhouse Gas Emissions Associated with Construction Materials and Products (Docket ID No. EPA-HQ-OPPT-2022-0924)

Dear Director Keehner:

ASHRAE is submitting this response to the U.S. Environmental Protection Agency's (EPA) Request for Information (RFI) to Support New Inflation Reduction Act Programs to Lower Embodied Greenhouse Gas (GHG) Emissions Associated with Construction Materials and Products. ASHRAE is committed to the halving of 2015 GHG emissions in the built environment by 2030 by advocating for all new buildings to be net zero GHG emission in operation, widespread energy-efficient retrofits of existing assets, and reducing embodied carbon of new construction by at least 40 percent. ASHRAE defines embodied carbon as "*the total greenhouse gas emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of an asset (i.e., building).*" Embodied emissions include GHG emissions associated with building construction, including extracting, manufacturing, transporting, and installing building materials, as well as the emissions generated from maintenance, repair, replacement, refurbishment, and end-of-life activities.

ASHRAE, founded in 1894, is a technical society advancing human well-being through sustainable technology for the built environment. The Society and its more than 53,000 individual

members – comprising engineers, academics and other professionals in the buildings industry – focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry. Through research, standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow’s built environment today.

**Category A. What construction materials/products should EPA prioritize in implementation of IRA Sections 60112 and 60116?**

Mechanical, Electrical and Plumbing (MEP) systems and equipment have significant embodied carbon emissions in new buildings, ranging from 15% to 49%<sup>1</sup> depending on building and equipment type, and up to possibly 75% in retrofits of selected typology<sup>2</sup>. MEP systems and equipment generally have a 15 to 20 year service life<sup>3</sup>, which increases their impact over the lifetime of a building. Heating, Refrigerating, Air-Conditioning, and Refrigeration (HVAC&R) product category rules (PCRs) and environmental product declarations (EPDs), especially those that are U.S.-based, are scarce compared to other building products. Given the vast amount of HVAC&R equipment, it would be useful to develop industry wide EPDs, prioritizing products that have heavy aluminum, steel, and aluminum. Over time, these industry wide EPDs may be replaced by specific product EPDs. The industry-wide EPDs should be developed in consultation with industry and technical experts including ASHRAE.

The embodied emissions of refrigerants in HVAC&R equipment are of particular concern, with on-going refrigerant leakage in the range of approximately 10% to 30% per year<sup>4</sup> also contributing to operational emissions. There is lack of consensus regarding leakage rates, and ASHRAE recommends additional research in this area.

**Category B. What data accessibility and improvement approaches should EPA consider?**

The building industry needs a central repository for HVAC&R emissions-related data ranging from carbon measurement and reporting standards, equipment and materials environmental product declarations (EPDs), refrigerant leakage rates and lifecycle energy use profiles for different equipment types and applications.

ASHRAE is in an excellent position to define the framework in calculating HVAC&R embodied carbon, host the emissions data repository, provide benchmarking data, and sponsor field and laboratory research into refrigerant

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<sup>1</sup> Zallen, N. (2021). *The Radiant Whole Life Carbon Study*.

<sup>2</sup> “Embodied Carbon in MEP Design”, <https://asbp.org.uk/wp-content/uploads/2020/07/ASBP-CIBSE-webinar-LH-slides.pdf>

<sup>3</sup> ASHRAE, HVAC Application Handbook. (2019). *Table 4 – Comparison of Service Life Estimates*.

<sup>4</sup> EPA, Office of Air and Radiation. (2020). *EPA’s Refrigerant Management Requirements*.

leakage and energy-use profiles. Industry access to this data would accelerate decarbonization efforts and improve the validity of PCRs and EPDs.

**B.9) Should EPA consider WBLCA and similar whole project approaches in EPD development and labeling of substantially lower embodied greenhouse gas emission materials/products, and if so, how?**

Whole-building life-cycle assessment (WBLCA) is an important tool for minimizing the environmental impact of buildings and their HVAC&R systems. WBLCA includes assessment of embodied and operational GHG emissions in addition to other environmental impacts. EPA should consider WBLCA in EPD development and labeling of substantially lower GHG emission materials/products. ASHRAE believes WBLCA should be considered in future building codes so that tradeoffs between reducing embodied or operational GHG emissions can be thoughtfully considered and optimal actions planned and implemented.

To standardize this process, ASHRAE recommends that EPA reference ASHRAE/ICC Standard 240, *Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation*, which will provide a whole life carbon approach to support emissions reductions in buildings. The proposed standard establishes how to measure and verify the GHG and carbon emissions of a building, or group of buildings, over the entire life cycle. The goal is to provide consistent procedures and data to be referenced by policies, codes, and other standards that address new and existing building performance. While this standard has not yet been published, it is expected to be finalized this calendar year.

**Category C. What PCR and EPD standardization, measurement, verification, and reporting approaches for use in procurement decision-making should EPA consider?**

EPA should consider working with an industry technical organization, such as ASHRAE, that can organize collaboration of industry organizations, trade associations, non-government organizations (NGOs), government agencies and national laboratories to develop standards and guidelines across the buildings industry for PCR and EPD development. ASHRAE is already collaborating with the International Code Council (ICC) and other stakeholders to develop a net-zero life-cycle carbon building code which would include requirements for equipment and system EPDs to be used as proof of conformance. This work should be done in collaboration with PCR and EPD standardization efforts to harmonize industry activities and streamline measurement, verification, and reporting activities.

These efforts in the U.S. should also be informed with international developments,

so while the data can be U.S.-specific, the framework should be compatible internationally. Currently, ASHRAE is working with our members from over 130 countries, including UK CIBSE ([Chartered Institution of Building Services Engineers](#)) on different standards and also developing an international simplified version of ASHRAE 90.1 *Energy Standard for Buildings Except Low-Rise Residential Buildings*.

**C.18) Other input on standardization, measurement, verification, and reporting approaches that EPA should consider?**

ASHRAE's standards development process is rigorous, and it is one of only six standards-developing organizations in the U.S. that can self-certify that its standards have followed procedures established by the American National Standards Institute (ANSI). ASHRAE develops and maintains standards and other resources that address embodied GHG emissions, including:

- International Green Construction Code® and ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2020, *Standard for the Design of High Performance Green Buildings*

*“9.4.1.4.1 Industry Wide Declaration: A Type III industry-wide environmental product declaration (EPD) shall be submitted for each product. Where the program operator explicitly recognizes the EPD as fully representative of the product group on a national level, it is considered industry-wide. In the case where an industry-wide EPD represents only a subset of an industry group, as opposed to being industry-wide, the manufacturer shall be explicitly recognized as a participant by the EPD program operator. All EPD shall be consistent with ISO Standards 14025 and 21930, with at least cradle-to-gate scope.”*

- ANSI/ASHRAE/ASHE Standard 189.3-2021, *Design, Construction, and Operation of Sustainable High-Performance Health Care Facilities*
- Proposed ASHRAE Standard 240P, *Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation*

Standard 240P will provide a whole life carbon approach to support emissions reductions in buildings. The proposed standard establishes how to measure and verify the greenhouse gas (GHG) and carbon emissions of a building, or group of buildings, over the entire life cycle. The goal is to provide consistent procedures and data to be referenced by policies,

codes, and other standards that address new and existing building performance.

- *Whole-Life Carbon Guide for Building Systems*

As EPA continues to consider embodied GHG associated with construction materials and products we want to draw attention to this forthcoming resource from ASHRAE, expected in October 2023.

**Category D. What factors should EPA consider for the EPD Assistance program?**

EPA should consider providing tools to streamline EPD standardization and development. It should also recommend the use of interim solutions, such as the use of the Chartered Institution of Building Services Engineers (CIBSE) TM65 methodology to support preliminary embodied carbon assessments for MEP given average industry materials content and construction emissions data.

ASHRAE is currently working with CIBSE in the United Kingdom (UK) to develop a North American version of the TM65 tool for performing building project embodied carbon analysis on an interim basis until EPDs are widely available. When the North American version of TM65 is available, ASHRAE recommends its use by EPA and others.

**Category F. What should EPA consider in meeting the goals of IRA Section 60116, which directs EPA to develop a program to identify and label construction materials/products with substantially lower levels of embodied greenhouse gas emissions? What would be the key elements of an effective carbon labeling program?**

In the case of MEP systems and equipment, it will be critical that carbon labeling include the entire life cycle carbon emissions - both embodied carbon and operating emissions. Because HVAC&R equipment consumes significant electrical and fossil fuel energy and contains refrigerants with high global warming potential, selecting equipment based only on low embodied carbon could often result in larger lifecycle carbon emissions.

For example, modern, highly efficient centrifugal chillers have been designed with new hydrofluoroolefin (HFO) refrigerants with a global warming potential (GWP) of 1.0 but they operate at lower pressures than higher GWP refrigerants. These chillers are physically larger than higher GWP chillers, so they have higher embodied carbon from their materials but lower operating emissions from higher efficiency and reduced refrigerant leakage.

It would be poor environmental design to select a lower embodied carbon chiller over a lower lifecycle emissions chiller. There are many MEP design and retrofit examples where an EPD covering the entire product lifecycle should be used to make building system design and equipment purchasing decisions. These EPDs should be based on an industry-standard, scientifically rigorous PCR supported by equipment-specific materials and operating performance data. ASHRAE stands ready to support the EPA and the buildings industry in making this critical decarbonization transition.

Please do not hesitate to contact me for more information, or have your staff contact [GovAffairs@ashrae.org](mailto:GovAffairs@ashrae.org). Thank you again for your consideration of our comments.

A handwritten signature in black ink, appearing to read 'J. Littleton', with a horizontal line extending to the right.

Jeff H. Littleton  
ASHRAE Executive Vice President