December 7th, 2020

Chair Mary Nichols
Executive Officer Richard Corey
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

**BY ELECTRONIC TRANSMISSION**

RE: Comments to CARB's Hydrofluorocarbon (HFC) Regulation for Air Conditioning

Dear Chair Nichols and Mr. Corey:

We are an *ad hoc* coalition of HVAC manufacturers and distributors, California utilities, building designers, energy consultants and environmental organizations committed to supporting California's actions to reduce greenhouse gas emissions from buildings. We believe that success in this space demands a multi-pronged approach: building electrification where possible, with an increasingly clean power supply, continued improvements in energy efficiency, and a transition away from higher global warming potential (GWP) refrigerants. We take this opportunity to highlight a technology that we believe is critical for achieving these goals – Variable Refrigerant Flow (VRF) heat pumps[1] – and to urge CARB to ensure that these systems are available for offices, schools, government buildings, healthcare, hotels and other important commercial uses as you move forward with your HFC regulation.

The Global VRF Market. VRF systems were first developed in Asia and are widely used there and in Europe due to their efficiency and flexibility in installation, as described in more detail below. They entered the U.S. market around 2005 and are estimated to be over 20% of California's commercial HVAC market. In Japan, Europe, and Canada, commercial VRF systems are subject to refrigerant phasedown requirements as part of the Kigali agreement but are not subject to the type of refrigerant ban that CARB is proposing. As such, with some limited exceptions, all VRF systems on the global market today use the refrigerant R410A.

Building Code Barriers. In California and much of the United States, the safety standards that apply to VRF systems, ASHRAE 15:2019 and UL 60335-2-40:2019 (the "ASHRAE/UL requirements"), and the California Mechanical Code, would effectively prohibit the use of most VRF systems given the restrictions on refrigerant concentration levels associated with currently available refrigerants with GWP

[1] "VRF System" and "Heat Pump" as defined in AHRI Standard 1230-2020 "Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment."

less than 750, many of which are classified by ASHRAE 34:2019 as A2L[2]. Even R466A, a proprietary non-flammable refrigerant[3] with GWP less than 750 (announced in the second half of 2019), will not meet the current ASHRAE/UL requirements if used in most VRF applications because of restrictions on refrigerant concentration levels[4].

VRF Offers a Path to Lower Carbon Intensity. Without access to VRF systems, the next most efficient HVAC option for small-to-medium commercial buildings are high-performance packaged systems. According to a Pacific Gas & Electric Company (PG&E) analysis of building energy use for a small office building, VRF systems with R410A have a similar overall carbon footprint[5,4] to high-performance packaged heat pumps with the same refrigerant, but the operational carbon footprint for VRF is approximately 35% less than the operational carbon footprint for high-performance packaged heat pumps. This highlights the potential benefits of VRF systems once the technology and safety codes have evolved to allow use of mildly flammable low-GWP refrigerants. Specifically, PG&E's analysis suggests that VRF systems will represent an overall carbon footprint reduction[6] of ~15% compared to high-performance packaged heat pumps. We note that the Rocky Mountain Institute solution for comfort cooling with five times less climate impact included best-in-class VRF technology, which offers an energy savings opportunity of approximately 60% due to part-load performance improvements[7].

Further, since VRF systems are heat pumps, they provide an alternative to gas-fired heating, an important consideration as cities in California, and the state as a whole, transition toward more electrification. For example, the American Council for an Energy-Efficient Economy (ACEEE) recently identified VRF systems as an important option for electrification of commercial building space heating.[8]

VRF a Useful Tool for High-performance Buildings. VRF heat pump systems also provide an all-electric solution for heating and cooling in new installations and retrofits of existing buildings with attractive part-load efficiency compared to other HVAC options. Architects, developers and building owners increasingly rely upon their high energy efficiency while supporting a high standard of occupant comfort, saving money, and affording great flexibility in space design, as evidenced by the number of LEED-certified and ENERGY STAR®-rated buildings that use VRF systems.

A Potential Freeze of the Market. Given the long-term benefits of VRF systems, we are concerned that CARB's 45-day language regarding HFC use in air conditioning equipment[9] may have the unintended

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[2] A2L refrigerants are defined in Section 6 "Safety Group Classifications" of ANSI/ASHRAE 34:2019. Class A refrigerants have an occupational exposure limit (OEL) of 400 ppm or greater. Class 2L refrigerants have lower flammability.

[3] R466A is classified by ANSI/ASHRAE 34:2019 as A1. Class 1 refrigerants do not demonstrate flame propagation.

[4] ASHRAE Standard 15-2019 limits refrigerant charge in an independent circuit based on the concentration of refrigerant in a complete discharge not exceeding the refrigeration concentration limits (RCLs) set in ASHRAE Standard 34-2019. The RCL for R410A is 26 lb/ Mcf. In contrast, the RCL for R32 is 4.8 lb/Mcf, R466A is 6.2 lb/Mcf. Mcf = thousand cubic feet.

[5] Analysis of VRF installations in California, documented in the Construct Connect database (http://www.constructconnect.com) for the following occupancy types: Commercial, Community, Educational, Government, Residential, Retail

[6] Operational carbon footprint is the CO2-equivalent greenhouse gas emissions generated to operate the system e.g. in power generation. Stationary carbon footprint includes the potential CO2-equivalent greenhouse gas emissions if the full refrigerant charge of the system is released to the atmosphere. Overall carbon footprint is the sum of the operational and stationary carbon footprints.

[7] https://rmi.org/wp-content/uploads/2018/11/Global_Cooling_Challenge_Report_2018.pdf

[8] https://www.aceee.org/sites/default/files/pdfs/b2004.pdf

[9] 45-day language

consequence of effectively banning most VRF heat pump systems if the regulation is implemented prior to updates of safety standards and building code amendments, as well as completion of equipment modifications required to meet all relevant product requirements. Since the next model code cycle will not be finalized until mid-2024, we urge CARB to consider January 1, 2026, as the appropriate compliance date for VRF systems that cannot meet the ASHRAE/UL requirements with currently available low-GWP refrigerants. We note that manufacturers typically only hold three to four months of inventory. Therefore, although the effective date of CARB's proposed HFC regulation is based on manufacture date, manufacturers' inventory is unlikely to support significant sales after a compliance date has passed.

In closing, we reiterate our support for CARB's efforts to transition to lower GWP refrigerants in new stationary air conditioning equipment, while allowing a pathway to continue for cost-effective building electrification using VRF heat pump systems. We strongly encourage CARB to engage with stakeholders to allow for a temporary exemption until January 1, 2026, for VRF systems from CARB's HFC phase-down while creating a roadmap for California to benefit from VRF technologies until the time when safety standards and building codes allow A2L refrigerants to be used in these systems.