To: Oregon Senate Committee on Education
From: Erika Scheffer, Associate Director, Government Relations, Carrier Corporation
Date: February 17, 2023

Re: Senate Bill 414 – Relating to School Indoor Air Quality

Dear Chairman Dembrow,

On behalf of Carrier, the leading global provider of healthy, safe, sustainable, and intelligent building and cold chain solutions, **we support Senate Bill 414 with amendments.**

Thank you for taking action to improve the health and safety of students, teachers, and staff by requiring ventilation assessments and actions based on recommendations that result from these assessments that can improve indoor air quality (IAQ) within Oregon schools. Enhanced air quality within indoor learning environments can both support reduced transmission of airborne illnesses, including COVID-19[1], and improved educational outcomes.[2] IAQ solutions typically include HVAC equipment or controls upgrades to improve and manage air ventilation and filtration, and as of 2021, 41% of districts "required HVAC systems upgrades or replacements in at least half of their schools"[3]. Assessing the current state of IAQ in schools and acting on recommendations is a critical step to making learning environments healthier for all.

We recommend the following amendments to improve the feasibility of meeting the bill requirements for schools and ensuring the improvement of indoor air quality in schools over time:

Section 1.7: We recommend that factory authorized manufacturer service certified technicians of the air handling equipment that provides the ventilation also be qualified to perform ventilation verification assessments on behalf of schools. This increases the availability of technicians and can simplify the execution of any recommendations resulting from the assessments.

Section 2.1: We recommend that ventilation assessments are performed every one-to-two years at a minimum, instead of every five years. Indoor air quality can change based on varying occupancy quantities, equipment performance, and even outdoor air quality. As a result, to ensure air quality consistently meets standards, we recommend more frequent assessments. An alternative option to annual ventilation assessments is to validate air handling equipment and controls settings annually and complete full ventilation assessments every three-or-four years. This alternative approach is less effective and accurate but also less expensive.

Section 2.1B: We recommend clarifying the following language, "testing to determine maximum filter efficiency," because it is not clear. If the intent is to determine the maximum filter efficiency that the air handler can support due to resistance-to-airflow (pressure drop) limitations, a better requirement might be "testing to determine the maximum filter pressure drop permitted at maximum (or rated) operating air flow rate." Filters could then be chosen and changed based on pressure drop, by selecting the highest efficiency filter possible within the measured pressure-drop constraints. On the other hand, if the intent is to test the effectiveness of the filters chosen by the school, then the appropriate text would be "testing to determine <u>minimum</u> filter efficiency", since filter efficiency will vary over the life of the filter. Information for such a requirement should be available from filter manufacturers and wouldn't necessarily require additional testing. The appropriate test would be ASHRAE 52.2, including the optional Appendix J conditioning step.

Section 2.1F: We recommend clarifying the following language, "measurement of all air distribution inlets and outlets," because it is vague and could refer to measuring location, size, or flow rate. Replacing the language with "measurement of air flow rate at all air distribution inlets and outlets," makes the intent clear.

Section 3.1A-E: We recommend that air quality monitors be used to track indoor air quality as opposed to CO_2 only monitors. CO_2 tracking does not measure indoor air quality, but instead measures the concentration of CO_2 in the air and can be used to infer the air ventilation rate relative to CO_2 sources within an indoor space.[4] Indoor air quality is measured by the concentration of pollutants in the air including VOCs, $PM_{2.5}$, and radon, as well temperature and humidity.[5] Choosing a sensor which considers air quality metrics in addition to CO_2 better enables schools to take the right actions to improve IAQ and realize the full scope of IAQ benefits, which can include cognitive function.[6] In addition, while tracking indoor air quality, it is recommended to also track changes to school GHG (greenhouse gas) emissions and energy consumption resulting from ventilation assessment recommendations to understand the environmental impact of increased ventilation and inform the optimal selection of potential IAQ solutions.

Section 3.1A: We recommend updating the current carbon dioxide mounting requirements because they can be overly restrictive and can be effective if placed on ceilings no greater than 12ft above the finished floor. The International WELL Building Institute (IWBI), indicates that ceiling mounting of air quality monitors is permissible in spaces "1) with ceilings are no greater than 3.7 m [12 ft] above the finished floor, 2) that do not utilize displacement ventilation, and 3) there is evidence that the air is evenly mixed."[7]

Section 3.1E: We recommend updating the required carbon dioxide monitor range requirement from "1-5000ppm" to a range of "400-5000ppm" because the current requirement might be too restrictive. A range beginning at 400ppm, would be suitable because CO_2 levels are unlikely to be below the current atmospheric value of 419ppm.

Section 3.1F: We recommend changing the carbon dioxide concentration accuracy requirements of the CO_2 monitors to be consistent with IWBI sensor requirements, which are less restrictive. This is a change from being "accurate within 75 ppm at 1,000 ppm carbon dioxide concentration" to "accurate within 100ppm at 1,000ppm carbon dioxide concentration. The WELL Performance Verification Guidebook specifies CO_2 sensors to ± 50 ppm + 5 % at 500-2000 ppm, which would require only 100 ppm accuracy at 1000 ppm.[7] Furthermore, calibration checks should be performed at the same interval as the ventilation assessments are performed, ideally every one to two years.

For these reasons, **we support SB414 with amendments**. Please feel free to reach out with any follow-up questions or concerns. Thank you for this opportunity to provide written testimony.

Sincerely,

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