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To: California Energy Commission – Docket No. 17-BTSD-01

Re: Addressing concerns raised by CBIA comments on 2019 Residential Standards (TN219885_20170623T152116).

HCHO in homes with ventilation systems

In a recent submission to the Commission, CBIA stated: "With regards to current ventilation practices, preliminary results indicate that "*pollutant concentrations were similar to previous studies in California and the only levels of concern are for Formaldehyde*." This quote from a draft paper by LBNL using the results of the HENGH study. LBNL does not consider that this quote correctly represents the study results.

The HENGH study results show lower Formaldehyde (HCHO) in the 16 homes surveyed so far compared to the previous California new home survey (CNHS) (CEC Report Number CEC-500-2009-085, Offerman (2009)). This is clearly stated in the draft paper referenced by CBIA: "*As a group, formaldehyde concentrations in the HENGH study are lower than those reported by Offermann (2009) for homes built 2002-2004, which had a median of 36 µg/m³, and range of 5 –136 µg/m³) and the 32 µg/m³ from other studies quoted by Offermann*".

The mean HCHO is 28.5 µg/m³compared to 44 µg/m³ (median values are 28.5 and 36 µg/m³) in the previous CNHS study. The peak HCHO is also considerably lower at 52 µg/m³ compared to 135 µg/m³.

Note that this is with homes that are the same average tightness (5 ACH50) as in the CNHS.

Offermann, F.J. (2009) Ventilation and Indoor Air Quality in New Homes. California Air Resources Board and California Energy Commission, PIER Energy-Related Environmental Research Program, CEC Report Number CEC-500-2009-085

Non-Operation of systems

While we share CBIA's concerns regarding system operation, the non-operation of systems does not speak to CBIA's point that: "*Without further (and supporting) evidence that adherence to ASHRAE 62.2 alleviates the formaldehyde issue, CBIA cannot endorse additional requirements that may not address occupant health and*

safety issues while also increasing the cost burden for the builder" because when ASHRAE 62.2 ventilation systems are operating the formaldehyde concentrations are decreased. For "… *adherence to ASHRAE 62.2* …" the systems must be operating according to section 4.1 of the standard. A house with a 62.2 system that is not operating is not in compliance with the standard.

MERV 13 proposal

Studies have shown very small (1%) increases or decreases in energy use using higher MERV filters (M11/12/13) and no significant system performance issues at the MERV 13 level.

1. A study by LBNL for the Commission (Energy Implications of In-Line Filtration in California CEC-500-2013-081) showed that system performance changes were minimal (typically less than 1% in energy use) going to MERV 13 and there were no other system performance issues. However, going to MERV 16 would cause problems unless additional requirements for deep filters and pressure drop were also specified. This study was for 10 homes in CA.

2. A study of 17 homes in ASHRAE RP 1299 Energy Implications of Filtration in Residential and Light-Commercial Construction (2010) showed that air flow reductions were 7-11% going from M2 to M11/12 (and about half this relative to mid-MERV (5-9) which is more relevant for the current discussion) with 1 to 4% fan power reductions, and "Differences in energy use associated with different filters were much smaller than differences that could be ascribed to climatic variation (particularly outdoor temperature) and changes in operation."

Overall the study found very little effect of high efficiency filters on system performance: "The median change in daily energy consumption at the test sites was a decrease of 0.26 kWh ton-1 day-1 (0.07 kWh kW-1 day-1) with high-MERV filters installed, suggesting potential small energy savings associated with higher-efficiency filters. However, the large standard deviation suggests that filters had a small impact on these systems in comparison with other factors."

It is clear from these studies that furnaces are fine with MERV 13 filters and that overall HVAC performance is minimally impacted. There is no need to triple the filter grille area as claimed in the CBIA document.

With regards to the claim that MERV 13 filters will require more frequent replacement, this seems unlikely given the results of the LBNL study where MERV 11 filters fouled only slightly faster than low MERV filters and filter fouling was dominated by particle sources: the filter that fouled the fastest was a MERV 8 filter in a rural home. These results are expected because filters are mainly fouled by larger particles that are captured by both MERV 8 and MERV 11/13 filters. Therefore we expect their loading rates to be similar.