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IAQ Workshop and CASE MFam report, IAQ comments

see attached PDF file

Additional submitted attachment is included below.

TO: California Energy Commission, 2022 Title 24 Pre-Rulemaking

FROM: Thomas J. Phillips, Healthy Building Research

DATE: September 30, 2020

SUBJECT: IAQ Cooking and Ventilation comments, Docket No.19-BSTD-03

Thank your for the initial attempt to address the capture efficiency (CE) of range hoods in building standards. As the author of the IAQ Guideline, Combustion Pollutants in Your Home (CARB 1994) and the Ducted Range Hood guide for best practices (ROCIS.org, 2018 & 2019), I am heartened by the CEC and CASE Team efforts to now apply the research findings of LBNL and others regarding cooking pollution.[1,2] These efforts should greatly improve our indoor environmental health and reduce GHG emissions from operating less effective exhaust ventilation systems.

The need to mitigate pollutant emissions from indoor cooking has also been recognized by government agency actions. In its 2005 peer-reviewed report to the Legislature, CARB identified unvented combustion appliances such as gas ranges as a high priority for mitigation and recommended mitigation options such as automatic range hoods with interlocks of hoods with burner controls.[3] The U.S. Department of Energy has funded a project to develop a pollutant sensor to automatically control range hood operation; the project is nearing completion.[4]

I strongly concur with the comments submitted by RMI et al. on the issues of gas stoves, cooking, effective exhaust ventilation, and decarbonizing the building sector. Furthermore, in order for the CEC to fully comply with CEQA and other mandates to address IAQ and health in its building standards, environmental health experts from state agencies and elsewhere must be involved at the beginning of the standards update process by CASE and the CEC, rather than after a draft CASE report and workshop are completed, as happened in this instance.[5] Such early consultation will

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[1] CARB, 1994. Combustion Pollutants in Your Home. Indoor Air Quality Guideline and Supplement. Research Division. https://ww2.arb.ca.gov/resources/documents/combustion-pollutants-your-home-guidelines. See Download link to 1994 Supplement.

[2] Reducing Outdoor Contaminants in Indoor Spaces (ROCIS) Initiative, 2019. Ducted Range Hoods: Recommendations for New and Existing Homes. http://rocis.org/kitchen-range-hoods. See also: "Healthy Kitchen Ventilation: Best Practices In Low E Homes", NAPHN 2018 presentation, at PDF Downloads.

[3] CARB, 2005. Indoor Air Quality in California. AB 1173 Report to the Legislature. See Sec. 6.1 and 7.1 of the report, and Board presentation. Research Division. https://ww2.arb.ca.gov/resources/documents/comprehensive-indoor-air-quality-report-2005.

[4] Newport Partners, 2019. Development of the Industry's First Smart Range Hood (SRH). 2019 Peer Review, DOE Buildings and Technology Office. https://www.energy.gov/eere/buildings/downloads/development-industry-s-first-smart-range-hood.

[5] CASE, 2017. Energy Commission's Authority & Responsibility Regarding Indoor Air Quality. 2019 Cycle, Residential Ventilation & Indoor Air Quality.

help ensure that the latest scientific information will be adequately considered in the development and environmental review of the standards.

Please consider the following additional comments for the 2022 Title 24 update and the IAQ Workshop on September 30, 2020. The comments focus on the Draft CASE Report, Multifamily Indoor Air Quality.[6] Supporting information and citations for my comments are also in the ROCIS Ducted Range Hood guide for best practices, December 2019 update.[7] I submitted similar comments to the CASE Team at the August 22, 2019 and March 25, 2020 workshops and on June 13, 2020 (written).

KITCHEN EXHAUST SYSTEMS

1. The 70% CE option for range hoods is a pretty low bar – better CE ratings need to be promoted.

The 70% CE minimum requirement recommended in the CASE draft report is a great step forward. But it appears to be toward the lower end of the hoods tested by LBL, as shown in Figure 8 around 200 cfm flow rates.

It also does not have much safety factor for real world factors. For example CE can be greatly reduced by cross drafts, persons near the stove, clogged grease filters, and emissions and pollution that persist after cooking is completed. In the LBNL modeling study that recommended a 70% CE, it was assumed that the whole house ventilation system was operating.[8] However, this is not a very conservative or protective assumption -- another LBNL study found that 75% of new homes were not operating this ventilation system.[9]

Many manufacturers will presumably achieve much better CE's than those that were tested so far. Based on the guidance of expert advisors, the ROCIS Range Hood best practice guide recommends hoods with 80% CE or better. Many of the hoods currently on the market may not reach the 80% CE target yet, but consumer demand could soon increase the availability of better range hoods. In the meantime:

A) **Please include information to encourage selection of higher CE ratings of 80% or more**, e.g., in the Title 24 Compliance Manuals (both MultiFamily and Single Family), in training programs, in Cal Green standards, etc. The CEC has previously included

[6] Code and Standards Enhancement (CASE) Team, 2020. 2022 Cycle Multifamily Indoor Air Quality, Draft Report, https://title24stakeholders.com/measures/cycle-2022/multifamily-indoor-air-quality/.

[7] ROCIS, 2010. Op cit.

[8] Chan et al. 2020a. Simulations of short-term exposure to NO2 and PM2.5 to inform capture efficiency standards. Task 4 Final Report. LBNL-2001332. https://indoor.lbl.gov/publications/simulations-short-term-exposure-no2.

[9] Chan et al. 2020b. Ventilation and Air Quality in New California Homes with Gas Appliances and Mechanical Ventilation. LBNL. CEC Final Report CEC-500-2020-023. https://www.osti.gov/biblio/1509678-ventilation-indoor-air-quality-new-california-homes-gas-appliances-mechanical-ventilation.

more health-protective recommendations in the Compliance Manuals, e.g., to control tobacco smoke in nonresidential buildings (when ASHRAE 62.2 still allowed higher ventilation rates for smoking). As another example of such guidance, the Draft CASE report recommends both required and recommended measures for ERV/HRV measures in the Compliance Manual (p. 191 et seq.), so the Compliance Manual should also do so for kitchen exhaust measures.

B) **Require product labeling of exhaust systems with HVI CE and sound ratings** to help consumers, DIYers, construction trades, asthma and green building groups, and building inspectors easily identify the better hoods. Including the minimum Title 24 requirement for CE is also be needed to distinguish those exhaust systems that are better than the minimum requirement.

2. Duct design specifications need to be spelled out clearly.

Poor duct design and installation can compromise the effectiveness of ventilation systems. Without onsite verification of exhaust flow rates, close attention to duct design and installation is even more important.

A) **Please include detailed design specifications for exhaust and makeup air system ductwork**, such as smooth duct interiors, minimum bends, maximum duct length, duct sealing, end caps, etc. that are necessary to ensure good exhaust performance and reduce grease buildup. The specifications should be items that building inspectors and homeowners can easily verify. Washington state's Ventilation and IAQ code was a good example of such specifications.[10] The ROCIS Ducted Range hood guide also includes installation recommendations that should be considered for the Compliance Manual.

3. Excessive depressurization prevention needs to be clearly addressed.

Excessive depressurization of buildings from exhaust system operation can occur, resulting in intrusions of hazardous pollutants from naturally vented gas appliances, wood stoves, attached garages, adjoining spaces, and soil gas (e.g., radon). Depressurization between multifamily living units and in common rooms with clothes dryers in multifamily buildings are common problems.

Although the International Mechanical Code for homes requires automatic make up air for exhaust flow rates of 400 cfm or more,[11] air tight homes can be depressurized by as little as 100 cfm.[12] Natural draft natural gas water heaters can experience venting failure

[10] Washington State Building Code Council. Ventilation Code. 2006 Washington State Ventilation & Indoor Air Quality Code. Superseded by IMC and IRC.
[11] IMC, 2018. Domestic Kitchen Exhaust Equipment Sec. 505.4. https://codes.iccsafe.org/content/IMC2018P3/chapter-5-exhaust-systems - IMC2018P3_Ch05_Sec505,
[12] Jellen, A.C., Wolfgang, B.M, and Turns, M.A., 2012a. Kitchen Ventilation Systems: Part 1. Evaluating the 2009 IRC Requirement for Makeup Air. The Pennsylvania Housing Research Center, Builder Brief, BB0312, March 2012. http://www.phrc.psu.edu/assets/docs/Publications/BB0312.pdf.

(spillage of combustion products) at as little as 2-5 Pascals depressurization.[13] The requirements for make up air are not well implemented or enforced. Best practice for make up air systems is to use an **interlocked mechanical damper and supply fan, and to test upon installation for proper pressure levels.** Using all electric appliances is the preferred solution, for this reason and climate action needs.

A) **Please include specific requirements for avoiding excessive depressurization**, especially in homes with natural draft combustion appliances, including wood stoves. Minnesota's energy code is one example of how to avoid depressurization problems with kitchen ventilation systems.[14,15]

B) **Please require a warning label on high flow exhaust systems (400 cfm or more) and on systems that require makeup air systems in airtight homes.**

4. The playing field for exhaust system types is not level regarding combustion efficiency and noise, so that high CE range hoods may be at a disadvantage.

It is not clear from the proposed exhaust system requirements (CASE draft report, p. 180 et seq.) what the noise limits are for each option. For example, microwave exhausts over the range (OTR) and downdraft exhausts might be allowed to be much noisier than range hoods at the same airflow rate, and thus would be less likely to be used. Given the lack of good CE and noise data on downdraft exhausts, it is not clear why they should even be considered as an effective exhaust ventilation method.

A) **For all four exhaust system options, please specify low noise limits for all the exhaust system options, and use the same criteria for all options.** Also recommend ways to mitigate the noise, such as a remotely located exhaust fan.

5. Guidance on various design and installation issues is needed to achieve effective kitchen ventilation.

CE requirements are new and likely to encounter confusion and inertia in the building industry in the beginning. Some upfront, preventive effort will help avoid a rash of poorly designed and installed systems that are hard to fix.

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[13] Bohac, D., and Cheple, M., 2002. Ventilation and Depressurization Information for Houses Undergoing Remodeling. Minneapolis, MN: Final Report for the Minnesota Department of Commerce State Energy Office. https://www.mncee.org/getattachment/Resources/Resource-Center/Technical-Reports/Ventilation-and-Depressurization-Information-for-H/Ventilation-and-Depressurization-Information-for-Houses-Underoing-Remodeling.pdf.aspx.

[14] Nelson, B., 2010. Successful Implementation of Air Tightness Requirements for Residential Buildings. Best2 Conference, National Institute of Building Standards, Portland, OR, Session WB6-5. https://www.brikbase.org/sites/default/files/best2_nelson.pdf.

[15] Minnesota, 2015. Minnesota Mechanical and Fuel Gas Codes. The 2015 Minnesota Administrative Rules, Part 1346.0501, Section 501 General, Department of Labor and Industry. https://www.revisor.mn.gov/rules/?id=1346.0501.

A) **Please develop training, public outreach, marketing, technical assistance, Compliance Manual, and auditing programs and Cal Green options to facilitate the implementation of more effective, quiet range hoods.** For example:

Recommendations for minimum hood depth and coverage of burner surfaces, and height above the range. Manufacturer specifications for installation height, coverage, and width over the stove may be lacking or not followed. Excessive heights would largely reduce the benefit of improved CE by range hoods.

Recommended CEs, airflow rates, and hood widths for island and peninsula installations. Installations without adjoining cabinets or walls are less effective than wall installations with adjoining cabinets or side shields/baffles. HVI recommends higher airflow rates for island installations.

Recommend interlocking unvented ovens, such as those installed in walls, to a nearby kitchen exhaust system. Providing a separate exhaust system near the oven exhaust outlet is another option. Unvented wall ovens can also produce indoor health hazards, especially in very airtight homes, over long periods of time.

AIR INTAKE LOCATION

Multifamily buildings are often located near significant outdoor sources of air pollutants such as busy roadways, various commercial activities, urban canyons, construction activities, and emergency generators. These sources can contaminate buildings via the air intakes of ventilation systems, and air filtration may not block all contaminants. Air intakes are also vulnerable to vandalism and hazardous chemical, biological, and radiological releases.

A) **Please recommend a minimum height above ground for air intakes to ventilation systems if they are near a street, parking lot, restaurant, or other pollutant sources**. Air intake level was associated with increased sick building symptoms in the BASE Study, a national office buildings study by EPA. NY City and Seattle had minimum height recommendations for air intake heights of 60 to 100 meters above ground level and as high as possible.

B) **Please recommend placing air intakes on the building side farthest from nearby busy roadways**. The EPA Best Practices for Schools document and the CARB Air Quality and Land Use Handbook provide guidance for reducing the impact of traffic related air pollutants on indoor environments.[16,17] Refer to the ASHRAE Fundamentals Handbook and ASHRAE Standards/Guidelines for calculation procedures and requirements for air inlets and intake/outlet separation; the

[16] EPA, 2017. https://www.epa.gov/sciencematters/living-close-roadways-health-concerns-and-mitigation-strategies.
[17] CARB, 2017. https://ww3.arb.ca.gov/ch/landuse.htm.

calculations may need modification for residential applications with their much lower contaminant emission rates.

Thank you for considering these comments.

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