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Comments on Fume Hood CASE proposal

Additional submitted attachment is included below.

TAYLOR
ENGINEERING

To:	Statewide Codes and Standards Team
From:	Hwakong Cheng
Subject:	Comments on Title 24 2019 CASE Report, High Efficiency Fume Hoods in Laboratory Spaces, Draft Report
Date:	June 23, 2017

We have reviewed the draft CASE report for High Efficiency Fume Hoods in Laboratory Spaces. We are supportive of this CASE measure and applaud the authors and Statewide Codes and Standards Team for identifying and addressing a major opportunity to improve energy efficiency in laboratory buildings.

Below are some additional detailed comments on the draft CASE report:

1. Market Analysis (pg vi). The opening sentence states that automatic sash closers are a mature technology and that "its use is well documented." While that may be true, it may be somewhat misleading and overlook the fact that there is very low market adoption of auto sash closers. Installations are actually quite rare, despite the safety and energy benefits. It may be worthwhile to add more discussion on this topic and explanation for why there is currently so little penetration into the marketplace.
2. Section 2.4.2 Relationship to Other Title 24 Requirements, first paragraph. This discussion references a requirement in a non-mandatory appendix to the CMC, which suggests additional requirements for sustainable practices. The stated reference is incorrect, and should be "Appendix E Section 503.5.11.1". The discussion should also make clear that this is not a mandatory requirement. The stated exhaust flow threshold is also incorrect; it should be 15,000 cfm. The third sentence also lists the wrong section reference and describes the alternate compliance paths inaccurately.
3. Section 2.4.2 Relationship to Other Title 24 Requirements, second paragraph. The referenced Sections 410.1 and 410.3 in the CMC only apply to OSHPD occupancies. That distinction should be noted for clarity.
4. Section 2.4.2 Relationship to Other Title 24 Requirements, fourth paragraph. The exhaust fan CASE measure is no longer about induction exhaust fans. The title of the CASE Report is "Variable Exhaust Flow Control".
5. Section 2.5, Compliance and Enforcement, Design Phase. The description of the impacts to the design phase is not quite accurate. There really is no direct impact to the HVAC or controls design. A VAV lab system will already require the ability to respond to varying sash heights. Whether the sash is closed manually or automatically does not matter. The occupant sensing and closing mechanism are built into the closer system controls and do not necessarily need to be integrated with the HVAC controls in order for the system to work. Auto sash closers in new construction applications would generally be specified by a laboratory consultant, architect or owner.

6. Section 3.2 Technical Feasibility, last paragraph. Technically, Cal/OSHA specifically allows reduced face velocities when a fume hood is unoccupied (and pass the Std 110 test) so no variance is required to implement that measure. However, a variance would be required to use a high efficiency low flow hood, as stated.
7. Section 4.2 Energy Savings Methodology, Ventilation Rates. The description of the model lists 8 ACH occupied and 4 ACH unoccupied. But the analysis actually varies the occupied ACH rate rather than using a single fixed rate.
8. Section 5.4 Lifetime Incremental Maintenance Costs. As we commented previously, we believe the maintenance cost assumptions to be too low. The $100 replacement cost value must surely be the cost of the part. If the cost is meant to include installation too, that would be very optimistic. But failed sensors do not just replace themselves. Their failures must be identified and diagnosed, a service contractor identified, and the contractor must mobilize and do the repair. On the owner's side, there are also associated soft costs. Sensors also don't fail at the same time so there likely would not be any economy of scale. A quick repair for a $100 part may very well involve $1000 in full cost. The fume hood manufacturers that provided this data may have a biased point of view to support this CASE measure and to underestimate maintenance costs. Still, I imagine that increasing the maintenance costs would not significantly change the overall economics.
9. Section 7.1 Proposed Revisions to Code Language. Paragraph 1.a. references ANSI Z9.5. This reference is not needed since the requirement is stated directly in the proposed language. The reference may be appropriate for rationalizing the proposed requirement in Title 24, but is not needed in the actual code language. We recommend deleting the reference for simplicity and clarity. Also, the referenced Z9.5 paragraph is incorrect. Paragraph 3.1.1.4 refers to combination hoods. The intended reference appears to be Z9.5 Appendix 4 paragraph 3.1.1.5.
10. Section 7.1 Proposed Revisions to Code Language. Paragraph 1.b. states that occupancy sensors shall meet requirements of Section 110.9(b)4. Is this reference necessary and appropriate? Do sensors provided with existing automatic sash closer products meet these requirements? That section refers to Title 20, where many of the requirements for occupant sensing devices are specific to lighting control applications:

(G) Occupant sensing devices.

1. All occupant sensing devices shall:

a. be capable of automatically turning off controlled lights in an area no more than 30 minutes after the area has been vacated;

b. allow all lights to be manually turned off regardless of the status of occupancy; and

c. have a visible status signal that indicates that the device is operating properly, or that it has failed or malfunctioned. The visible status signal may have an override switch that turns off the signal.

2. All occupant sensing devices that utilize ultrasonic radiation for detection of occupants shall:

a. comply with 21 C.F.R. part 1002.12; and

b. emit no audible sound, and shall not emit ultrasound in excess of the decibel levels shown in Table L-1 measured no more than five feet from the source, on axis.

TABLE L-1

Ultrasound Maximum Decibel Values

Mid-frequency of Sound Pressure Third-Octave Band (in kHz)	*Maximum db Level within third-Octave Band (in dB reference 20 micropascals)*
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

3. All occupant sensing devices that utilize microwave radiation for detection of occupants shall:

a. comply with 47 C.F.R. parts 2 and 15; and

b. not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device.

Note also that Cal/OSHA does not specify the type of sensing used in regulating face velocity setback but simply states: "no employee is in the immediate area of the hood opening." Title 8 5154.1(c)(2)

11. Section 7.1 Proposed Revisions to Code Language. Paragraph 1.d. references ANSI Z9.5. This reference is not needed since the requirement is stated directly in the proposed language. The reference may be appropriate for rationalizing the proposed requirement in Title 24, but is not needed in the actual code language. We recommend deleting the reference for simplicity and clarity. Also, the referenced Z9.5 paragraph is incorrect. The intended reference appears to be Z9.5 Appendix 4 paragraph 3.1.1.5.
12. Section 7.1 Proposed Revisions to Code Language, Table 140.9-B. How does this proposed requirement apply to combination hoods? Can automatic sash closers be applied to combination hoods? If not, an exception should be provided. If so, the cost effectiveness would clearly deviate from hoods with vertical sashes, since the effective opening area is reduced. Consider adding a note to Table 140.9-B to use the effective open hood width for combination hoods.
13. Section 7.1 Proposed Revisions to Code Language, Table 140.9-B. Consider renaming the first column: "Hood Width, Linear ft / 1000 ft^2 Lab Area".
14. Section 7.1 Proposed Revisions to Code Language, Table 140.9-B. As the fume hood driven determination is specific to each individual room, as opposed to an overall building average, we suggest adding a note to make that point clear since it may not be clear to readers. Evaluating the fume hood driven comparison on a building-wide average basis would generally result in very different outcomes.
15. Section 7.1 Proposed Revisions to Code Language, Exception 1. The exception should be for fume hoods, not the labs. Consider revising the language to: "Fume hoods in

scientific laboratories that are determined to not be fume hood driven per TABLE 140.9-B."

16. Section 7.2 Reference Appendices, 7.2.1.1.2(c). Rather than testing the functionality of buttons that override the sash upward and downward using the motorized mechanism, it may be more relevant and important to test true manual operation, with the sash raised by hand, and perhaps testing the 10 lb force limit. That type of manual operation appears to be the intent in ANSI Z9.56 Appendix 4 paragraph 3.1.1.5.
17. Appendix C, page 56. The text notes that a sash position of 1 is equal to the sash set at the sash stop height of 18". Is this just for the purposes of Figure 5 or does it also apply to the interpretation of the hood diversity data in Table 26? The trended sash position data in the Vargas and Cheng study were based on values of 1 equal to the sash at full open height, typically 28 or 29 inches (NOT at the sash stop). Sash stop heights can be variable and there are not always physical stops. Depending on how these data were set up in each data set and interpreted in the CASE study, the average sash diversities may be different than currently calculated.