

## Taylor Thrush

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**From:** Debra Henning <debrahenning@mac.com>  
**Sent:** Monday, April 12, 2021 10:56 AM  
**To:** Rep. Ryan Berman (District 39)  
**Cc:** Taylor Thrush; Rep. Pamela Hornberger (District 32); Rep. Brad Paquette (District 78); Rep. Phil Green (District 84); Rep. Greg Markkanen (District 110); Rep. Jack O'Malley (District 101); Rep. Andrew Beefer (District 83); Rep. John N. Damoose (District 107); Rep. Bryan Posthumus (District 73); Rep. Darrin Camilleri (District 23); Rep. Brenda Carter (District 29); Rep. Matt Koleszar (District 20); Rep. Nate Shannon (District 25); Rep. Lori Stone (District 28)  
**Subject:** HB 4167 Safety and Inspections in Schools  
**Attachments:** Notes on School Hygiene- Heating, Ventilation, and Temperature.docx

Dear Representative Berman,

Thank you for your advocacy of school health and safety. I am attaching some notes I've collected while studying the history of education research at the University of Chicago, where in 1901 Samuel Bower Sinclair graduated with a Ph.D. in Education after writing a dissertation on "The Possibility of a Science of Education." Sinclair includes temperature, heating, and ventilation as topics that should be addressed in a scientific manner and included in teacher training curricula. That was 120 years ago!

The dissertation is available at  
<<https://babel.hathitrust.org/cgi/pt?id=umn.319510008150454&view=1up&seq=6>>

Much more recently and as noted in the following EPA Guide, changes to air quality standards were made in 1973 during the oil crisis, and many schools are still operating under reduced standards.

***EPA: Reference Guide for Indoor Air Quality in Schools*** <<https://www.epa.gov/iaq-schools/reference-guide-indoor-air-quality-schools>>

### ***Ventilation-Related Regulations***

*[T]he outdoor air flows that ASHRAE's Standard 62 recommends for classrooms were reduced from 30 cubic foot per minute (cfm)/person to 10 cfm/person in the 1930s, and reduced again to 5 cfm/person in 1973 in response to higher heating fuel costs resulting from the oil embargo. Concern about IAQ stimulated reconsideration of the standard, so that its most recent version, Standard 62-2001, calls for a minimum of 15 cfm/person in classrooms. However, many schools that reduced outdoor air flow during the energy crisis continue to operate at ventilation rates of 5 cfm/person or less. This under ventilation is contrary to current engineering recommendations, but, in most jurisdictions, it is not against the law.*

In short, there are two arguments that I hope you will make during the hearing: First, the importance of healthy and safe school environments has been recognized for well over 120 years, and scientific knowledge of heating, ventilation, and temperature in school classrooms has grown for as many

years. We know what to do and how do it; what we lack is the will to provide children a safe and healthy school environment.

Second: There must be clear standards set with data requirements for each subject addressed. Without standards and specific data requirements, HB 4167 will not be effective.

I have serious doubts that the Board members are up to the task outlined in this bill. Because of the proliferation of charter schools, we have hundreds of school board members who lack understanding and knowledge education practices, let alone heating, ventilation, and temperature codes. The way this bill is written, it provides too little guidance for all concerned - school leaders, parents, and tax payers! If the State of Michigan believes in the importance of safe and healthy school environments, oversight and implementation of the bill should be placed under the direction of the Michigan Department of Health and Human Services and appropriate funding provided. As it is written, the bill places the fox too close to the chicken coop.

Before closing, I want to express my opposition to any investment of Covid funds or state tax dollars in school buildings that are owned and operated by private mortgage investment companies, and then leased - for profit - to private management companies that run the schools. If anything in this bill contributes to that kind of funding distribution, "I dissent."

Thank you for your attention. I ask that you give serious consideration to the provisions in the bill for oversight and implementation.

Cordially,  
Debra Henning

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## Notes on School Hygiene: Heating, Ventilation, and Temperature

Excerpt from *A Reference Handbook of the Medical Sciences Embracing the Entire Range of Scientific and Practical Medicine and Allied Science* Volume 7, 1900, p. 70

[https://www.google.com/books/edition/A\\_Reference\\_Handbook\\_of\\_the\\_Medical\\_Sciences/51zwwEACAAJ?hl=en&gbpv=1&bsq=in%20rural%20districts%20a%20supply%20of%20air](https://www.google.com/books/edition/A_Reference_Handbook_of_the_Medical_Sciences/51zwwEACAAJ?hl=en&gbpv=1&bsq=in%20rural%20districts%20a%20supply%20of%20air)

In rural districts a supply of fresh air may be introduced by means of jacketed stoves after the manner described in the nineteenth report of the State Board of Health of Massachusetts, p. 315.<sup>1</sup> The ventilation should be of such efficiency as to provide a supply of thirty feet of fresh air for each pupil per minute. The inlets and outlets should be of such size that the incoming warm air shall not have a velocity of more than four hundred feet per minute, and this inlet, for a room of standard size, should not have an area of less than four square feet. A wire screen of one-eighth inch wire, with meshes of one and one-half inches, is better than a cast-iron register. The inlet and outlet should be on the inner or warm side of the room, the inlet being placed about eight feet above the floor, and the outlet in the floor or very near it.

*Temperature.*—A temperature of 65° to 68° F. should be maintained during school hours. Dr. Lincoln recommends 66° as a proper standard. Most English authorities are in favor of lower temperatures than these.

Pinkham, J.G. : The **Ventilation** of School Rooms. 72 School Hygiene : Schwalbach .

Billings, J.S. 1886. "The principles of ventilation and heating and their practical application 2d ed., with corrections" *Archived copy*. [OL 22096429M](https://www.archive.org/details/ol22096429m).

"The Possibility of a Science of Education." Ph. D. diss., University of Chicago, Departments of Pedagogy and Philosophy, 1901. The dissertation is available at <https://babel.hathitrust.org/cgi/pt?id=umn.319510008150454&view=1up&seq=6>

Wikipedia

[https://en.wikipedia.org/wiki/Ventilation\\_\(architecture\)#History\\_and\\_development\\_of\\_ventilation\\_rate\\_standards](https://en.wikipedia.org/wiki/Ventilation_(architecture)#History_and_development_of_ventilation_rate_standards)

### **History and development of ventilation rate standards**

Ventilating a space with fresh air aims to avoid "bad air". The study of what constitutes bad air dates back to the 1600s, when the scientist Mayow studied asphyxia of animals in confined bottles.[36] The poisonous component of air was later identified as carbon dioxide (CO<sub>2</sub>), by Lavoisier in the very late 1700s, starting a debate as to the nature of "bad air" which humans perceive to be stuffy or unpleasant. Early hypotheses included excess concentrations of CO<sub>2</sub> and oxygen depletion. However, by the late 1800s, scientists thought biological contamination, not oxygen or CO<sub>2</sub>, as the primary component of unacceptable indoor air. However, it was noted as early as 1872 that CO<sub>2</sub> concentration closely correlates to perceived air quality.

The first estimate of minimum ventilation rates was developed by Tredgold in 1836.[37] This was followed by subsequent studies on the topic by Billings [38] in 1886 and Flugge in 1905. The recommendations of Billings and Flugge were incorporated into numerous building codes from 1900–1920s, and published as an industry standard by ASHVE (the predecessor to ASHRAE) in 1914.[36]

Study continued into the varied effects of thermal comfort, oxygen, carbon dioxide, and biological contaminants. Research was conducted with human subjects in controlled test chambers. Two studies, published between 1909 and 1911, showed that carbon dioxide was not the offending component. Subjects remained satisfied in chambers with high levels of CO<sub>2</sub>, so long as the chamber remained cool.[36] (Subsequently, it has been determined that CO<sub>2</sub> is, in fact, harmful at concentrations over 50,000ppm[39])

ASHVE began a robust research effort in 1919. By 1935, ASHVE funded research conducted by Lemberg, Brandt, and Morse – again using human subjects in test chambers – suggested the primary component of "bad air" was odor, perceived by the human olfactory nerves.[40] Human response to odor was found to be logarithmic to contaminant concentrations, and related to temperature. At lower, more comfortable temperatures, lower ventilation rates were satisfactory. A 1936-human test chamber study by Yaglou, Riley, and Coggins culminated much of this effort, considering odor, room volume, occupant age, cooling equipment effects, and recirculated air implications, which provided guidance for ventilation rates.[41] The Yaglou research has been validated, and adopted into industry standards, beginning with the ASA code in 1946. From this research base, ASHRAE (having replaced ASHVE) developed space by space recommendations, and published them as ASHRAE Standard 62-1975: Ventilation for acceptable indoor air quality.

As more architecture incorporated mechanical ventilation, the cost of outdoor air ventilation came under some scrutiny. In 1973, in response to the 1973 oil crisis and conservation

concerns, ASHRAE Standards 62-73 and 62-81) reduced required ventilation from 10 CFM (4.76 L/S) per person to 5 CFM (2.37 L/S) per person. In cold, warm, humid, or dusty climates, it is preferable to minimize ventilation with outdoor air to conserve energy, cost, or filtration. This critique (e.g. Tiller[42]) led ASHRAE to reduce outdoor ventilation rates in 1981, particularly in non-smoking areas. However subsequent research by Fanger,[43] W. Cain, and Janssen validated the Yaglou model. The reduced ventilation rates was found to be a contributing factor to sick building syndrome.[44]

The 1989 ASHRAE standard (Standard 62-89) states that appropriate ventilation guidelines are 20 CFM (9.2 L/s) per person in an office building, and 15 CFM (7.1 L/s) per person for schools, while the 2004 Standard 62.1-2004 has lower recommendations again (see tables below). ANSI/ASHRAE (Standard 62-89) speculated that "comfort (odor) criteria are likely to be satisfied if the ventilation rate is set so that 1,000 ppm CO<sub>2</sub> is not exceeded"[45] while OSHA has set a limit of 5000 ppm over 8 hours.[46]

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NYT February 28, 2021

<https://www.nytimes.com/interactive/2021/02/26/science/reopen-schools-safety-ventilation.html>

