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TESTIMONY IN SUPPORT OF:

LD 1887 "Resolve, To Improve Air Quality and Ventilation in Newly Constructed Schools"

THE JOINT STANDING COMMITTEE ON EDUCATION AND CULTURAL AFFAIRS

Senator Rafferty, Representative Murphy, and esteemed members of the Education and Cultural Affairs Committee, my name is Amy Arata and I represent House District 104, which includes New Gloucester and Part of Gray. It's my pleasure to present to you LD 1887, Resolve, To Improve Air Quality and Ventilation in Newly Constructed Schools.

I became aware of this issue when my local school district, MSAD 15, stated that $9 Million of HVAC upgrades were required by the Department of Education due to a new Chapter 125 rule. I received confirmation from the Department that this is, indeed, the case, which surprised me, because I remembered voting for that legislation with the understanding that it would not be a mandate.

The purpose of this bill, LD 1887, is to amend a law which was passed in the 130th legislature, LD 705. The only change that this bill makes is to add "newly constructed" to the statute. Note that the title to LD 1887 was chosen by the Revisor's office. LD 1887 does not actually change anything regarding newly constructed schools, it merely clarifies that this law only applies to new construction and therefore not existing school buildings.

When LD 705 was discussed, it was understood that this would not be a substantial change to the existing statute and would apply to new construction only. In fact, the committee did not include a fiscal note or a mandate preamble. I have included the

summary of the previous committee's discussion and reasoning. You will find this interesting as it relates to the bill I am presenting.

The interpretation of LD 705 regarding existing schools also conflicts with another statute in Title 20-A, Part 3, Chapter 223, Subchapter 1: Student Health. It states that "Each school Administrative unit shall ensure that the heating, ventilation and air-conditioning system is: A. Maintained and operated to provide at least the quantity of outdoor air required by the state building standards code in effect at the time the building permit was issued, or the heating, ventilation and air-conditioning system was installed, whichever is later;" I have included a copy of the statute with this testimony.

LD 1887 will not have any negative impact on the health of students in Maine. It does not impact any statute or rule regarding asbestos, carbon dioxide, mold, fuel gas, radon, or any other dangerous situations. What was substantially changed by LD 705 was the standard for carbon dioxide (CO2), the air that we breath out. Although companies that provide HVAC upgrades emphasize the impact of moderate increases in CO2 on student performance, this has not been well established by research. I have attached the abstract of a study that shows no reduction in concentration performance in students with CO2 levels of 2115 ppm, which is approximately the level that prompted the HVAC upgrades in my school district, and is not uncommon.

To put concerns about CO2 levels in proper perspective, I have included the first few pages of a study of CO2 levels behind face masks. I do not intend this to be a debate about the risks vs. benefits of masks. However, Maine schools required students to wear masks inside schools for approximately two years and if this were harmful, it would have been obvious. This study shows that the average mask-wearer was breathing 3176 ppm of CO2, with a standard deviation of 1704 ppm. 12% of students had a concentration of over 5000 ppm of CO2 behind their masks, which is higher than the occupational exposure limit. This is substantially higher than the levels of CO2 recommended by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for classrooms, which is outdoor air plus 700 ppm, or about 1100 ppm. If the legislature is going to require schools to spend millions of dollars on HVAC upgrades, rather than on actual education, it should have an observable impact on student health and learning. It doesn't make sense to require CO2 levels in classrooms to be so much lower than the concentrations that students wearing masks experienced.

I voted for LD 705 when I was in the 130th legislature because I did not think it would be a mandate for existing schools. When I served on the Maine State Board of Education, I was on the School Construction Subcommittee, and often observed changes in requirements, so I didn't believe this change would be substantial. I was wrong, and I'd like to correct my error with this legislation. When we passed LD 705, the legislature

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was conducting most of its business on zoom and communication was often inadequate. We also had substantial federal Covid grants to help schools to comply with any new ventilation mandates, so cost wasn't as big of a concern. My school district is already under contract to spend millions of dollars to comply with this mandate, but I hope to spare other schools this cost so that they can focus on paying for actual education and any true emergencies that arise. Thank you for your consideration and I'm happy to answer any questions.

Respectfully,

Amy B. Arata

Amy B. Arata
State Representative

L.D. 705

Date: (Filing No. H-)

EDUCATION AND CULTURAL AFFAIRS

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STATE OF MAINE

HOUSE OF REPRESENTATIVES

130TH LEGISLATURE

FIRST SPECIAL SESSION

COMMITTEE AMENDMENT " " to H.P. 517, L.D. 705, "Resolve, To Improve Air Quality and Ventilation in Maine's Public Schools"

Amend the resolve in section 1 in the 2nd line (page 1, line 2 in L.D.) by striking out the following: "rule" and inserting the following: 'rules Chapter 60: New School Siting Approval, Chapter 61: State Board of Education Rules for Major Capital School Construction Projects and'

Amend the resolve by relettering or renumbering any nonconsecutive Part letter or section number to read consecutively.

SUMMARY

This amendment is the majority report of the committee. It adds language requiring the Department of Education to amend Chapter 60 and Chapter 61 of its rules, in addition to Chapter 125.

The amendment also incorporates a fiscal note. The fiscal note states that, to the extent that the newly defined air quality standards require some schools to upgrade their existing systems or install new systems, expenditure of local revenue may be required, and, as a result, the fiscal note flags the resolve as a potential mandate. The committee reviewed the fiscal note, and the majority of the committee determined that the requirements of the resolve do not amount to a mandate. The department rules in Chapter 125 already require that rooms used for instructional purposes have "sufficient air changes to produce healthful conditions and to avoid odors or concentrations of toxic substances or dust particles." They also state that if the "heating, ventilating, and air-conditioning (HVAC) systems are mechanically driven, they shall be maintained and in compliance with HVAC regulations and rules." The committee notes that the resolve merely directs the department to amend its rules to require standards governing air quality. In other words, the resolve requires the department to better define standards, but the requirement that systems be maintained in compliance with HVAC rules and regulations already exists. As such, the majority of the

committee believes that this is not a new requirement for school districts, but rather a clarification of an existing requirement.

FISCAL NOTE REQUIRED

(See attached)

§6302. School building ventilation

1. Applicability. This section applies to school buildings subject to basic school approval under section 4502 (../20-A/title20-Asec4502.html) in which the heating, ventilation and air-conditioning system is mechanically driven.

[PL 1991, c. 181, §2 (NEW).]

2. Operation. Each school administrative unit shall ensure that the heating, ventilation and air-conditioning system is:

A. Maintained and operated to provide at least the quantity of outdoor air required by the state building standards code in effect at the time the building permit was issued or the heating, ventilation and air-conditioning system was installed, whichever is later; and [PL 1991, c. 181, §2 (NEW).]

B. Operated continuously during school activity hours except:

(1) During scheduled maintenance and emergency repairs; and

(2) During periods for which school officials can demonstrate to the commissioner's satisfaction that the quantity of outdoor air supplied by an air supply system that is not mechanically driven and by infiltration meets the outdoor air supply rate required by paragraph A (../20-A/title20-Asec6302.html). [PL 1991, c. 181, §2 (NEW).]

[PL 1991, c. 181, §2 (NEW).]

3. Inspection and record. Each school administrative unit is responsible for:

A. Inspection of the heating, ventilation and air-conditioning system at least annually and correction of any problems within a reasonable time; and [PL 1991, c. 181, §2 (NEW).]

B. Maintaining written records of heating, ventilation and air-conditioning system inspection and maintenance for at least 5 years. The superintendent shall make these records available for examination upon request. [PL 1991, c. 181, §2 (NEW).]

[PL 1991, c. 181, §2 (NEW).]

SECTION HISTORY
PL 1991, c. 181, §2 (NEW).

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Effect of classroom air quality on students' concentration: results of a cluster-randomized cross-over experimental study

Abstract To assess the effect of indoor air quality as indicated by the median carbon dioxide (CO_2) level in the classroom on the concentration performance (CP) of students, a cross-over cluster-randomized experimental study was conducted in 20 classrooms with mechanical ventilation systems. Test conditions 'worse' (median CO_2 level on average 2115 ppm) and 'better' (median CO_2 level on average 1045 ppm) were established by the regulation of the mechanical ventilation system on two days in one week each in every classroom. Concentration performance was quantified in students of grade three and four by the use of the d2-test and its primary parameter 'CP' and secondary parameters 'total number of characters processed' (TN) and 'total number of errors' (TE). 2366 d2-tests from 417 students could be used in analysis. In hierarchical linear regression accounting for repeated measurements, no significant effect of the experimental condition on CP or TN could be observed. However, TE was increased significantly by 1.65 (95% confidence interval 0.42–2.87) in 'worse' compared to 'better' condition. Thus, low air quality in classrooms as indicated by increased CO_2 levels does not reduce overall short-term CP in students, but appears to increase the error rate.

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Key words: Attention; Carbon Dioxide; Indoor Air; Students; School.

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Practical Implications
This study could not confirm that low air quality in classrooms as indicated by increased CO_2 levels reduces short-term concentration performance (CP) in students; however, it appears to affect processing accuracy negatively. To ensure a high level of accuracy, good air quality characterized, for example, by low CO_2 concentration should be maintained in classrooms.

Introduction

In recent years, indoor environments in schools have come into the focus of discussion. In particular, the impact of indoor air quality on the attention and CP, achievements, well-being, and health of students has been discussed (Daisey et al., 2003; Haverinen-Shaughnessy et al., 2011; Mendell and Heath, 2005; Shendell et al., 2004).

Carbon dioxide (CO_2) has been commonly used as an indicator of indoor air quality. According to The German Working Group on Indoor Guidelines of the Federal Environment Agency and the States' Health Authorities, air quality can be regarded as 'harmless' if CO_2 levels are below 1000 ppm, 'elevated' if between 1000 and 2000 ppm, and 'hygienically unacceptable' if above 2000 ppm (Lahrz et al., 2008). This is in line with guidelines from other European countries (BMLFUW, 2006; UK Department of Education, 2006; NO-Folkehelseinstituttet 1996).

However, particularly in wintertime, increased CO_2 levels have been observed in classrooms. In a Bavarian measurement campaign in 91 classrooms, median CO_2 levels ranged between 598 and 4172 ppm (Fromme et al., 2008). In 25% of the classrooms, the median CO_2 level exceeded 2000 ppm and in 10%, 2700 ppm. Most

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CO_2 Levels Behind and in Front of Different Protective Mask Types

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Abstract

Objectives

Many individuals have difficulty adapting to face mask use and report symptoms while using masks. Our primary objective was to determine whether continuous mask-wearing causes elevated levels of carbon dioxide (CO_2) behind the facemasks.

Methods

CO_2 concentrations were measured behind 3 different types of face masks and were compared to CO_2 concentrations at the mask front in 261 subjects who continuously wore masks for at least 5 minutes. These CO_2 concentrations were also measured in several randomly selected subjects after a 5-minute walk.

Results

There were significantly higher CO_2 concentrations behind the mask (3176 ppm) compared to the front (843 ppm) with an average of 49 minutes of continuous mask use. Of all the subjects, 76.6% had a

behind-the-mask CO_2 concentration of more than 2000 ppm (the threshold for clinical symptoms), and 12.2% had a CO_2 concentration of at least 5000 ppm (occupational health exposure limit). The CO_2 level behind the N-95 masks was highest (especially after exertion) and was lowest behind cloth masks. The combination of warm ambient temperature, an N-95 mask, exercise, and young age appeared to induce exceedingly high CO_2 levels that should be avoided.

Discussion

Although masks might be necessary for healthcare workers or to lessen the spread of airborne disease, we found that elevated CO_2 concentrations were present while wearing them. Elevated CO_2 concentrations have historically caused symptoms of CO_2 toxicity. Periodic mask breaks in designated areas may be needed to avoid adverse effects.

Conclusion

The use of masks increased the CO_2 concentration in the air behind them to levels historically associated with toxicity.

Keywords: face mask, masks, CO_2 level, CO_2 toxicity, carbon dioxide, respiratory protective devices, personal protective equipment, COVID-19, SARS-CoV-2, coronavirus infections, N95 respirators, N95 mask

Background

There is a growing consensus about the value of face masks for reducing the spread of severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2), but this has not always been the case. Initially, little was known about the new virus. Mask policies had to be developed based on the best available evidence, following scientific models that drew on data from earlier epidemics involving similar viruses.[1] Consequently, guidance about mask-wearing has varied from country to country, and some major health organizations, including the World Health Organization (WHO), have changed their advice about masks over time.[2]

Observational studies, systematic reviews, and epidemiologic modeling support the public's use of masks, especially surgical masks, to mitigate coronavirus disease 2019 (COVID-19) transmissions and deaths.[3] However, the practice of mask-wearing has also been controversial and politicized, especially in the United States (US).[4]

Table 2.

Different Masks and CO_2 Concentrations Behind Them (ppm), in Front of Them (ppm), and After a 5-Minute Exertion on a Level Surface

	Total number	Front of the mask CO^2 mean (ppm)	SD	Total number	Behind mask CO^2 mean (ppm)	SD	Total number	Exertion mean CO_2 (ppm)	SD	*P*-
Surgical mask	159	842.5	146.3	159	3191	1610	46	3759	1138	<.(
N-95 mask	22	1029	1240	22	4588	2627	8	4975	2163	<.(
Cloth mask	80	792.9	121.3	80	2759	1345	42	3714	1739	<.(
All masks	261	843	381.1	261	3176	1704	96	3841	1543	<.(

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Post-hoc pair-wise comparison *P*<.05:
[a]Front of the mask vs. behind mask
[b]Front of the mask vs. exertion
[c]Behind the mask vs. exertion

Surgical masks were worn by 159 (61%) of the participants; 80 (30.6%) wore cloth masks; 22 (8.4%) wore N-95 masks (Table 2). We did not encounter any valve masks. Mean CO_2 levels were lowest when sampling behind cloth masks (2759 ppm, Table 2) and highest behind N-95s (4588 ppm). Compared to a surgical mask, a cloth mask was associated with a lower risk of behind-mask CO_2 levels reaching the 2000 ppm level (odds ratio (OR) = 0.52; 95% CI, 0.265–1.003; *P*=.051, NS). Compared to the surgical mask, the N-95s were associated with 6.4 times higher risk of behind-mask CO_2 level reaching the 5000