

TRC compared the average test results within each school building to industry guidelines for acceptable indoor air quality. TRC drew upon industry guidelines established by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the U.S. Green Building Council Leadership in Energy and Environmental Design (USGBC LEED) 2009 criteria for new construction, and the Massachusetts Department of Public Health. These are guidelines aimed at optimizing occupant comfort and well-being, since indoor air quality parameters in schools and outside of industrial or certain types of workplaces are typically not in ranges considered to be a health hazard.

The following comments are noted:

- Average temperatures in each school building were within recommended winter comfort ranges. A few individual measurements very slightly above or below the comfort guideline. The great majority of temperatures were within recommended comfort guidelines.
- Relative humidity was somewhat low as is typical during the heating season and also reflects outdoor variations.
- Carbon dioxide is exhaled by people and concentrations may increase with increased occupancy levels. Average carbon dioxide concentrations in each school building were within recommended guidelines. A few individual measurements were slightly over a stringent Massachusetts guideline, however, all results were below guidelines recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers. Overall ventilation rates appear to be good based on the carbon dioxide measurements.
- Carbon monoxide, a potential fuel combustion product, was non-detect in all buildings and test locations except for one individual measurement slightly above the recommended guideline, but below a health concern in a gym area where supplemental gas-fueled heaters were in the process of being repaired.
- Average airborne particulate matter (PM₁₀) concentrations were below the recommended guideline in all school buildings.
- Average volatile organic compound concentrations were slightly above the indoor air quality guideline in two schools at the time that the measurements were conducted. This clearly was associated with the use of alcohol-containing disinfectant wipes, and spray disinfectants. Peak concentrations were noted shortly after wiping/disinfecting and tended to quickly dissipate. Although some volatile organic compound measurements were greater than indoor air quality guidelines, they were well below occupational exposure limits for isopropyl alcohol (a common component of wipes and other disinfection products) which range from 100 ppm to 400 ppm for all-day exposure, as compared with school measurements being on the order of non-detect (< 0.02 ppm) to less than 1 ppm for the most part.

Based on these results, no health concerns, or corrective actions due to health concerns are indicated.

**Summary of Average Indoor Air Quality Screening Measurements
 Haverhill Public Schools, Haverhill, Massachusetts
 January 28 through February 12, 2021**

Location	Temp (°F)	RH (%)	CO (ppm)	CO ₂ (ppm)	PM10 (mg/m ³)	VOC (ppm)	# of measurements
Bartlett	73	27	ND (<3.0)	737	0.017	0.041 (minus one result of 1.7 in recent disinfection location))	13
Bradford	73	25	ND (<3.0)	653	0.026	0.022	25
Burnham	78	24	ND (<3.0)	587	0.018	0.042	11
Consentino	75	25	ND (<3.0)	677	0.023	0.084	22
Crowell	78	11	ND (<3.0)	541	0.011	0.061	12
Golden Hill	71	10	ND (<3.0)	601	0.011	ND (<0.02)	20
Greenleaf Academy	72	31	ND (<3.0)	613	0.043	0.018	12
High School	70	25	ND (<3.0)	516	0.011	ND (<0.02)	~73
Hunking	71	26	ND (<3.0)	738	0.015	0.261	26
JG Whittier	76	26	ND (<3.0)	712	0.014	0.060	16
Moody	73	26	ND (<3.0)	630	0.023	0.245	13
Nettle	72	24	ND (<3.0)	542	0.008	0.114 (minus one result of 1.42 in stairwell)	26
Pentucket Lake	73	11	ND (<3.0)	603	0.015	0.051	21
Silver Hill	73	25	ND (<3.0)	663	0.017	ND (<0.02)	15
Tilton Lower	73	27	ND (<3.0)	686	0.019	0.077	21
Tilton Upper	74	27	ND (<3.0)	677	0.015	0.042	10
Walnut Square	75	27	ND (<3.0)	642	0.017	0.132	10
Comfort Guideline	70 – 79	< 65%; no minimum limit	< 9	< 800 - ~1,200	< 0.05	< 0.14	

See Appendices for indoor air quality guideline details. Sources of indoor air quality guidelines include:

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- U.S. Green Building Council Leadership in Energy and Environmental Design (USGBC LEED) for New Construction-2009
- Massachusetts Department of Public Health

ppm = parts per million parts of air, by volume

mg/m³ = milligrams per cubic meter of air