

Final Report
Indoor Air Quality Inspections

Prepared for:

Voorhees Township Public Schools
329 Route 73
Voorhees, NJ 08043

Attention: Clark J. Mathes, Director of Buildings and Grounds

Project:

Walk Through Inspections
Signal Hill, Hamilton, Kresson, Osage and Middle Schools
Voorhees, NJ

Inspection Date: August 12 & 19, 2020

Prepared By:

Matthew Hines, Industrial Hygienist

Project No. 20239

August 31, 2020

Scope of Work:

Air quality walk-through inspections were conducted at the five public school buildings in the Voorhees Township NJ school district. The investigation focused on the performance of the ventilation systems in providing fresh air and thermal comfort, and the presence of water damage, dirt and debris. The work included the measurement of the comfort parameters of carbon dioxide, carbon monoxide, temperature and relative humidity. The field investigation was performed on August 12 & 19, 2020 by AIR Consulting Services representative Matthew Hines.

Procedures:

Carbon Dioxide:

The levels of CO₂ were measured with a TSI Q-Trak Portable Monitor, equipped with an infrared sensor. ASHRAE recommends that CO₂ levels be maintained below 1000 ppm to ensure occupant comfort. The federal Occupational Safety and Health Administration (OSHA) has suggested that CO₂ levels below 800 ppm are unlikely to result in occupant complaints of poor air quality. The evaluation of CO₂ levels requires that occupant density is close to the ASHRAE presumptive density of 7 occupants per 1000 square feet, and that the concentration of CO₂ is tracked over the course of the normal work shift to ensure that steady state conditions have been achieved.

Carbon Monoxide:

The levels of carbon monoxide were measured with a TSI Q-Trak Portable Monitor, equipped with a chemical cell detector. The U.S. Environmental Protection Agency has established a primary ambient air quality standard for CO of 9 ppm in outdoor environments. Levels of CO in indoor environments should not exceed this level. In general, CO levels above the ambient concentration of 1 ppm suggest that exhaust fumes from a combustion source have migrated to the occupied space, and indicate the need for further investigation.

Temperature and Relative Humidity:

Measurements of temperature and relative humidity were collected with the TSI Q-Trak Portable Monitor, equipped with digital thermocouple sensors. The ASHRAE Standard 55-1981 (ASHRAE Standard on Thermal Environmental Conditions for Human Occupancy) recommends a cooling season temperature range of 74 to 79°F, and a relative humidity range of 30 to 60%. The growth and amplification of microbiological agents is not supported when levels of relative humidity are consistently maintained below 60%.

Inspection:

Signal Hill Elementary School:

In general the school and mechanical systems appeared to be well maintained. The temperatures in all rooms tested were below the recommended 74 °F. The thermostats in all rooms should be set in the range of 74 to 79°F during the cooling season. This should ensure that relative humidity remains below 60%. Relative humidity levels above 60% may result in biological growth. The relative humidity in the school was recorded in the range of 50.4 to 81.4%. The majority of the rooms were recorded with levels above the recommended 30 to 60% humidity.

The operation of the ventilation systems appeared to be effective. Carbon monoxide levels were measured as not detected. Carbon dioxide levels were measured in the range of 451 to 485 ppm, which is well within the desired range and indicates that adequate fresh air ventilation is provided to the occupied spaces. Temperature was measured in the range of 68.8 to 74.0 °F, and relative humidity was measured in the range of 50.4 to 81.4%.

All ductwork and supply diffusers were in good condition. There are several stained ceiling tiles in Room E that should be removed and replaced. The only other issue observed was the thermostat settings and humidity readings. The recommended temperature range for the cooling season is between 74 to 79°F. All thermostats should be adjusted accordingly. This will help maintain relative humidity levels below 60%. Use of the dehumidifiers should be continued.

ET Hamilton Elementary School:

In general the school appears to be well maintained. During the cooling season, the thermostats should be set at temperatures in the range of 74° to 79°F. The HVAC units in the rooms located off the library were all set to the recommended range, but all units were cooling the rooms to temperatures below 70°F. These rooms and HVAC units should be evaluated to determine proper performance. The HVAC units in these rooms should be cleaned and disinfected.

In Room 15, 18 and 29 we observed dirty HVAC units that require cleaning. In Room 24 we observed that the split unit is very dirty and moisture is actively condensing moisture on the vents. The split unit should be cleaned and disinfected and the unit should be maintained between 74 to 79°f.

The operation of the ventilation systems appeared to be effective. Carbon monoxide levels were measured as not detected. Carbon dioxide levels were measured in the range of 435 to 518 ppm, which indicates that adequate fresh air ventilation is provided. Temperature was measured in the range of 68.3 to 75.7 °F, and relative humidity was measured in the range of 47.3 to 68.9%.

The HVAC controls should be inspected to ensure the temperatures stay above 74° during the cooling season. The dirty HVAC units should be cleaned. All other parameters were acceptable.

Kresson Elementary School:

In general the school and mechanical systems appear to be well maintained. We recorded temperatures below 74°F in all rooms. The thermostats were set at or below 72°F, which is too cold and can result in condensation on cool surfaces. The thermostats should be set so that temperature is maintained between 74° and 79°. This should ensure that relative humidity remains below 60% during the cooling season and condensation does not form inside the HVAC units.

We observed dirty supply diffusers in Rooms 19 and 23. In Room 3 and 33 we observed stained ceiling tiles that should be removed and replaced. In room 32 we observed an accumulation of dust and debris inside the split unit mounted on the wall. The unit should be cleaned and disinfected. In Room 1 we observed a leaves and insect particles that appear to be coming through the outside grill. The grill should be cleaned and inspected for openings.

The operation of the ventilation systems appeared to be effective. Carbon monoxide levels were measured as not detected. Carbon dioxide levels were measured in the range of 369 to 695 ppm, which indicates that adequate fresh air ventilation is provided. Temperature was measured in the range of 66.5 to 75.2 °F, and relative humidity was measured in the range of 38.8 to 66.7%.

The thermostats should be adjusted to between 74 and 79° during the cooling season.

Osage Elementary School:

In general the school and mechanical systems appear to be well maintained. The thermostats in most rooms were generally set at or below 72° and should be raised so that the temperatures are between 74° and 79°. This should ensure that relative humidity remains below 60% during the cooling season and condensation does not form inside the HVAC system. In Rooms 126, 127, 165, 225 and 227 we observed dirty supply diffusers. We recommend that the HVAC and supply diffusers be cleaned and the flex ducts are removed and replaced.

The operation of the ventilation systems appeared to be effective. Carbon monoxide levels were measured as not detected. Carbon dioxide levels were measured in the range of 424 to 584, which indicates that adequate fresh air ventilation is provided. Temperature was recorded in the range of 70.0 to 74.5°F, and relative humidity was recorded in the range of 46.7 to 69.8%.

The majority of the HVAC equipment was observed to be clean. The thermostats should be adjusted to between 74 and 79° during the cooling season.

Voorhees Middle School:

In numerous classrooms the thermostats were set at or below 72°F. The thermostats throughout the school should be set between 74 and 79 °F. This should ensure that relative humidity remains below 60% during the cooling season and condensation does not form inside the HVAC system.

The HVAC units in Rooms A-24, B-3, B-6 and D-9 have dirty supply diffusers and should be cleaned and disinfected. All associated flexible ductwork should be removed and replaced. The dehumidifiers located in Rooms D-2, D-5, and D-7 were not running due to either a full bucket or unit being turned off. In Room B-9 there was a leak in the HVAC unit that had gotten the carpeting wet. The unit should be cleaned and

disinfected and the damaged carpet should be replaced.

The operation of the ventilation systems appeared to be effective. Carbon monoxide levels were measured in the desired range of 0.0 ppm. Carbon dioxide levels were measured in the range of 376 to 500 ppm, which indicates that adequate fresh air ventilation is provided. Temperature was in the range of 70.7 to 77.6°F, and relative humidity was in the range of 48.1 to 78.5%.

Discussion:

In general the air quality conditions in the Voorhees School District were observed to be normal and acceptable. The school buildings were clean and well maintained. Most of the ventilation equipment was observed to be operating properly. With the exception of some dirty HVAC units, the schools were observed to be free of visible dirt accumulation and mold growth.

The classrooms that have had HVAC units cleaned and ductwork changed were in very good condition and there was a clear difference between the cleaned HVAC units and the others. We recommend continuing of the HVAC cleaning throughout the schools.

The carbon monoxide levels were well below the EPA guideline of 9 ppm and reflect acceptable conditions. The carbon dioxide concentrations in the schools were recorded in the range of 369 to 695 ppm. These levels are well within the ASHRAE guideline of 1000 ppm.

In many of the schools temperature settings were too low and relative humidity was elevated. Low temperatures increase relative humidity levels and can result in mold growth. The thermostats in all schools should be set between 74 and 79°F during the cooling season, as specified by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

Please contact us should you have any questions. We look forward to being of continued assistance. Your time and cooperation are greatly appreciated.

Sincerely,



Matthew L. Hines, Industrial Hygienist

Table I
Comfort Parameter Summary
Voorhees Public School District
August 12, 2020

Kresson ES

Room Number	CO2, ppm	CO, ppm	Temp °f	RH %	Comments
Main Office	695	0.7	75	38.8	OK
Room 1	431	0.3	75.2	49.5	Leaves and insects from outside caught in HVAC Grill. Seal of outside intake should be checked.
Room 3	401	0	72.8	64.2	Stained Ceiling Tiles (replace)
Room 9	410	0	72.9	60.4	OK
Room 32	405	0	71.6	52.9	Split unit is dirty and should be thoroughly cleaned.
Room 6	399	0	70.2	65.6	OK
Room 33	397	0	69.4	66.2	Stained Ceiling Tiles (replace)
Room 19	387	0	70.1	74.7	Dirty HVAC diffusers, clean unit.
Room 16	396	0	70.2	52.1	OK
Room 10	390	0	70.5	56.3	OK
Room 14	382	0	71.3	71.7	OK
Room 12	397	0	71.5	73.5	OK
Room 23	375	0	66.5	51.6	Very Cold, Very Dirty HVAC diffusers. (Clean HVAC Unit)
Room 21	369	0	69.9	67.9	OK
Room 151	386	0	70.9	63.4	OK
Room 153	384	0	71.7	64	OK
Room 155	391	0	71.9	59.1	OK
Room 27	397	0	71.5	66.7	OK

Table I (continued)
Comfort Parameter Summary
Voorhees Public School District
August 19, 2020

ET Hamilton ES

Room Number	CO₂, ppm	CO, ppm	Temp °f	RH %	Comments
Room 29	458	0	74.3	52.7	Dirty Diffusers. (Clean supply diffusers)
Room 25	472	0	75.5	52.4	OK
Room 31	464	0	75.7	50.6	OK
Room 35	491	0.2	74.1	58.8	OK
Room 33	518	0	73.3	50.6	OK
Counselor Room (Room 24)	465	0	70.4	56.9	Thermostat set too low. Split unit is dirty and moisture is condensing on the vents. (Clean Split unit)
Room 22	465	0	71.6	62.4	OK
Music Room	440	0	72.4	68.9	OK
Art Room	472	0	72.7	47.3	OK
Room 14	455	0	72.7	53.9	Ok
Room 17	471	0.2	72.8	66.5	Ok
Room 18	435	0	73	67.7	HVAC unit is Dirty. (Clean Unit)
Room 15	441	0	68.8	57.2	Thermostat set too low. HVAC unit is Dirty. (Clean Unit)
Room 12	449	0	71.1	63.2	OK
Room 10	444	0	68.8	56.2	Thermostat set too low. Dirty Diffusers. (Clean supply diffusers)
Room 8	461	0	68.3	56.4	Thermostat set too low.
Room 6	444	0	69	53.9	Thermostat set too low. Dirty Diffusers. (Clean supply diffusers)
Room 4	474	0	71.6	61.2	OK
Room 2	444	0	73.3	64.4	OK
Room 1	446	0	73.1	55.2	Dirty Diffusers. Temperature is too low in classroom. Clean supply diffusers.

Table I (continued)
Comfort Parameter Summary
Voorhees Public School District
August 19, 2020

Osage Elementary School

Room Number	CO₂, ppm	CO, ppm	Temp °f	RH %	Comments
Room 102	465	0	74.3	60.2	OK
Room 103	466	0	74.5	49.5	OK
Room 108	457	0	73.7	46.7	OK
Room 169B	438	0	73.3	62.4	OK
Room 126	429	0	73	69.8	Dirty vent covers. (Clean Vents and replace flex ducts)
Room 127 (Reading room)	424	0	73.6	69.8	Musty Odor. Dirty Supply Diffusers. (Clean Vents and replace flex ducts)
Room 170	445	0	73.3	59.6	OK
Room 171	454	0	72.7	58	OK
Room 165	440	0	70	61.4	Dirty vent covers. (Clean Vents and replace flex ducts)
Room 129	491	0	72.5	66.5	OK
Room 163	426	0	72.9	69.5	OK
Room 161	437	0	70.4	64.4	OK
Room 110	439	0	71.2	52	OK
Room 113	449	0	71.8	49.9	OK
Room 116	456	0	71.9	48.4	OK
Room 118	561	0	72.7	58.6	OK
Room 119	533	0	71.7	49.7	OK
Room 230	559	0	70.5	54.1	OK
Room 227	550	0	70.6	52.3	Dirty vent covers. (Clean Vents and replace flex ducts)
Room 225	584	0	72.5	53	Dirty vent covers. (Clean Vents and replace flex ducts)

Table I (continued)
Comfort Parameter Summary
Voorhees Public School District
August 19, 2020

Signal Hill ES

Room Number	CO₂, ppm	CO, ppm	Temp °f	RH %	Comments
Room 35	485	0	69.8	50.4	Thermostat set too low.
Room 15	466	0	68.8	60	Thermostat set too low.
Room 19	482	0	71.1	71.2	OK
Room 17	465	0	72.3	74.8	OK
Room 31	481	0	73.3	81.4	OK
Room 9	459	0	73.2	75	OK
Room 11	468	0	72.9	64.5	OK
Room 7	469	0	73.2	77.5	OK
Room 5	464	0	72.2	61.8	OK
Speech Room	458	0	71.9	68	OK
ESL Room F	453	0	72.1	61.4	OK
Room 3	450	0	73.1	75.5	OK
Room 1	470	0	74	67.5	OK
Room 22	465	0	74	68.7	OK
Room 24	467	0	73	69.8	OK
Room 28	455	0	73.5	72.7	OK
Room 26	451	0	72.5	66.4	OK
Room E	454	0	72.2	61.9	Stained Ceiling Tiles (Replace damaged ceiling tiles)
Room C	457	0	72.6	62.4	OK

Table I (continued)
Comfort Parameter Summary
Voorhees Public School District
August 12, 2020

Voorhees Middle School

Room Number	CO2	CO	Temp °f	RH %	Comments
A-26	418	0	70.7	62.1	OK
A-10	404	0	72.9	63.7	OK
A-14	407	0	70.7	58	OK
A-18	397	0	72.5	70.3	OK
A--19	401	0	74.1	67.1	OK
A-24	450	0	73.1	64.5	Dirty Diffusers, (Clean vent covers, replace flex duct and clean HVAC unit)
D-9	387	0	71.7	67.4	Dirty Diffusers, (Clean vent covers, replace flex duct and clean HVAC unit)
D-7	378	0	71.2	78.5	OK, very humid, dehumidifier not running.
D-5	393	0	73.1	78.8	OK, very humid, dehumidifier not running.
D-2	394	0	74	76.6	OK, very humid, dehumidifier not running.
B-9	384	0	71.9	62	Leak at HVAC unit. Carpet is wet at HVAC. (Replace damaged carpeting and fix leak).
B-6	379	0	72.5	65.8	Dirty Diffusers, (Clean vent covers, replace flex duct and clean HVAC unit)
B-3	386	0	77.6	77.8	HVAC Unit does not appear to be getting cold. Unit set at 73deg.
B-2	394	0	76.3	58.6	OK
B-10	409	0	76.9	51.8	OK
B-14	399	0	75.1	59.6	OK
B-17	466	0	74.5	65.5	OK
B-20	376	0	76.9	72.4	OK
C-2	411	0	72.6	53.8	OK
C-4	447	0	72.5	68.4	OK
C-8	384	0	72.2	75	OK
C-9	405	0	73.4	68.9	OK
E-13	500	0	71	62.6	OK
E-2	462	0	73.3	61.7	OK
E-4	405	0	72.6	56.5	OK
E-10	419	0	73.7	63.9	OK
E-5	392	0	73.7	72.1	OK
E-7	401	0	70.6	48.1	OK