Narrative

City of Stamford, Public Schools
Westhill High School
125 Roxbury Road
Stamford, CT 06901

Inspection #1365538 - E5404 - 500

An inspection was conducted at the City of Stamford Public Schools, Westhill High School beginning on December 13, 2018. The purpose of the inspection was to investigate a complaint in the 200 series rooms alleging:

- there is mold, leaking ceilings, musty, moldy air;
- there are still tiles black with mold;
- people are coughing, sneezing, tiredness, headaches, etc.;
- the solution used to clean moldy surfaces is causing tearing of eyes, and burning throat sensations.

According to management representatives and school employees, Westhill High School has had a history of moisture issues and water leaks in various areas throughout the school. In addition, employees reported that when they returned to school in the fall of 2018, visible mold was present. In October of 2018, the City of Stamford created a Mold Task Force to address concerns about mold and air quality throughout the school district. Because of concerns about these issues at Westhill High School, the Mold Task Force had begun to address items related to mold, moisture, and air quality beginning in early December. As of the time of the inspection, the roof had been patched in a number of locations, a contractor was hired to clean supply diffusers and perform remediation of potential mold-affected and water-damaged building materials in school rooms (which began on or about December 4, 2018), and another contractor was hired to evaluate the ductwork in the school (who began the evaluation on or about December 11, 2018).

It was reported to the compliance safety and health officer (CSHO) that the building was constructed in 1970 and the two air handling units that serve the interior core rooms are original to the building. The perimeter rooms have unit ventilators, also original to the building, that provide heating and ventilation only.

During a walkthrough of the 200 wing on December 13th and December 18th, the CSHO observed a number of areas where ceiling tiles (presumably those that had sustained water-damage) had been removed, as well as areas where water-stained ceiling tiles still were present. In a few locations, a black material, in conjunction with water staining, was present on ceiling tiles. Appendix A includes a list of locations where these conditions were observed. This list also includes locations with other conditions that may negatively impact air quality. The list is not all inclusive.

In order to evaluate the general indoor air quality in areas of concern, direct reading air samples were collected on December 13th and December 18th using a "TSI Q-Trak, Indoor Air Quality Monitor, Model 7575x." Measurements were collected for carbon dioxide (CO_2), carbon

monoxide (CO), temperature, and relative humidity. Sample locations and substances analyzed are summarized in Tables I and II.

The Connecticut Department of Labor, Division of Occupational Safety and Health (CONN-OSHA) eight-hour time weighted average permissible exposure limit (PEL) for CO_2 is 10,000 parts per million parts of air (ppm) and for CO is 35 ppm. During the inspection, CO was either not detected or concentrations were very low. On December 13th, when occupancy in the areas was low, CO_2 levels were between 592-742 ppm. On December 18th, when occupancy levels were higher, CO_2 levels were between 576-2153 ppm.

The National Institute for Occupational Safety and Health (NIOSH), in its document "Guidance for Indoor Air Quality Investigations" states that "carbon dioxide is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh outdoor air are being introduced into a building or work area." The outdoor, ambient concentration of CO_2 is normally 250-350 parts per million (ppm). Usually the CO_2 level is higher inside than outside, even in buildings with few complaints about indoor air quality. If indoor CO_2 concentrations are more than 1000 ppm (three to four times the outside level), there may be a problem of inadequate ventilation and complaints such as headaches, fatigue, and eye and throat irritation are frequently found to be prevalent. This does not mean that if this level is exceeded the building is hazardous or that it should be evacuated, but rather this level should be a guideline that helps maximize comfort for all occupants. This document also states that ensuring an adequate fresh outdoor air supply is the single most effective method of correcting and preventing problems and minimizing complaints relating to poor indoor air quality. Ventilation systems should provide a supply of outdoor air to dilute contaminants that otherwise build up in an enclosed space occupied with people.

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) Standard 62.1-2016, entitled "Ventilation For Acceptable Indoor Air Quality" states that "carbon dioxide concentrations in acceptable outdoor air typically range from 300-500 ppm" and where dilution ventilation is used to control indoor air quality, an indoor to outdoor differential concentration not greater than 700 ppm of carbon dioxide indicates occupant comfort. CONN-OSHA does not have standards that regulate ventilation rates in office buildings or schools. Rather, ventilation rates appropriate for individual buildings should be determined in accordance with the Ventilation Procedure or Indoor Air Quality Procedure described in this consensus standard.

During the inspection, employees reported symptoms (e.g. headaches, lethargy) that are consistent with elevated levels of CO_2. Although the CO_2 levels all were below the CONN-OSHA PEL of 10,000 ppm, some of the levels measured on December 18th were approaching or were above the 1000 ppm level at which people may begin to experience some of these symptoms. Of the 21 rooms where CO_2 levels were measured on December 18th, 10 of the rooms had CO_2 concentrations which measured greater than 1000 ppm. An additional 5 rooms had CO_2 concentrations which measured between 900 and 1000 ppm. Of the remaining 6 rooms, at least 3 had windows open at the time the measurement was collected.

While CO_2 levels are not considered hazardous at concentrations above 1000 ppm (but below 10,000 pm), concentrations above 1000 ppm may be an indication of inadequate fresh air being supplied to the area. In areas where CO_2 levels are approaching or are above 1000 ppm, the employer should evaluate the heating, ventilating, and air conditioning system (HVAC) to ensure it is functioning as designed. The employer also should evaluate ways to ensure adequate concentrations of fresh air are being introduced into the rooms to accommodate the number of occupants that may be present. In rooms that receive fresh air through perimeter heating units, it is strongly encouraged that the occupants of the rooms do not block the air flow of the units by placing items on top of or in front of them. Furthermore, the units should continue to be maintained by clearing them of debris, changing filters at appropriate intervals, and periodically vacuuming the entire length of the unit to prevent dust from accumulating.

While inspecting the condition of the air handling units that provide ventilation to the rooms in the 200 wing interior core, the CSHO observed gaps between some of the filters and the filter bank. If the filters are not fitted properly, air will bypass the filters. Therefore, it is strongly recommended that only filters designed and sized for that unit be used.

CONN-OSHA does not have standards that regulate temperature or humidity limits in a work area; however, ASHRAE Standard 55-2013, entitled "Thermal Environmental Conditions for Human Occupancy," recommends that indoor temperature ranges be based on a number of factors including, but not limited to, clothing insulation and activity levels. In workplaces where activity levels and clothing worn are similar to most office environments, and the outdoor environment is cool, ASHRAE recommends a temperature range of approximately 68.5 to 75 degrees Fahrenheit. Under similar conditions when the outdoor environment is warm, ASHRAE recommends a temperature range of approximately 75 to 80.5 degrees Fahrenheit. (These temperature ranges are based on relative humidity levels falling within recommended ranges.) On December 13th, the temperature indoors was between 70 and 76 degrees Fahrenheit. On December 18th, the temperature indoors was between 69 and 80 degrees Fahrenheit.

There is considerable debate among researchers, indoor air quality professionals, and health professionals concerning recommended levels of humidity. In general, the range of relative humidity recommended by a number of organizations, including the United States Environmental Protection Agency (U.S. EPA), is 30-60%. ASHRAE recommends that relative humidity levels be maintained at or below 65% (Standard 62.1-2016). Persistent high humidity levels foster the growth of mold or mildew. With regard to thermal comfort, ASHRAE does not specify a minimum humidity level. Instead they state, "non-thermal comfort factors, such as skin drying, irritation of mucus membranes, dryness of the eyes, and static electricity generation may place limits on the acceptability of very low humidity environments" (Standard 55-2013). The concerns associated with dry air must be balanced against the risk associated with humidification. On December 13th, the relative humidity levels indoors were between 19-24%. On December 18th, the relative humidity levels indoors were between 15-26%.

In order to determine levels of airborne fungi, biological sampling was performed on December 13th in areas of concern. An evaluation of viable airborne fungal spores was performed using a "Buck" Model B30120 Bio-Culture Constant Flow Bioareosol sampling pump at an approximate flow rate of 30 liters per minute (L/min) onto a standard petri dish filled with "Malt Extract

Agar" (MEA) for three minutes. The samples were sent to the Wisconsin Occupational Health Laboratory (WOHL) for analysis. Analysis was accomplished through enumeration and classification of incubated colonies. The results are expressed in terms of numbers of colony forming units per cubic meter of air (CFU/m^3). The sample locations and results are summarized in Table III.

There is no Permissible Exposure Limit for fungi established under either the CONN-OSHA or the United States Department of Labor, Occupational Safety and Health Administration (USDOL-OSHA) regulations. There is also no Threshold Limit Value (TLV) for fungi established as a recommended guideline by the American Conference of Governmental Industrial Hygienists (ACGIH). Current reference sources indicate that indoor air fungal levels should be equal to or less than outdoor air fungal levels.

According to "OSHA Instruction TED1.15," outdoor spore levels may range from 1000 – 10,000 CFU/m^3. Contamination indicators are 1000 viable CFU/m^3, 1,000,000 fungi per gram of dust or material, or 100,000 bacteria or fungi per milliliter of stagnant water or slime. Levels in excess of the above do not necessarily imply that conditions are unsafe or hazardous. Rather, it is the types and concentrations of airborne microorganisms that will determine the hazard to employees. Many variables affect microbial concentrations in indoor air. It should always be kept in mind that air sampling for fungi in itself may not be used to predict potential adverse health responses in an indoor environment for a microbial agent.

As a general rule, fungal spores collected indoors should be equal to or less than those collected outdoors. If no visible evidence of mold growth is observed and the spores found indoors are equal to or less than the spores found outside, it is assumed that fungal contamination is not a concern. Spores of fungi are almost always present; however, the types and quantities of fungi vary with the time of day, weather, season, and geographical location. If there is no source for fungal growth in a building, similar types of fungi are found indoors as are found outdoors. Different genera or increased levels of fungi present indoors as compared to outdoors may indicate fungal growth indoors. It should be noted that fungi are ubiquitous in the environment. Low quantities of fungi may not be significant, especially in bulk and wipe samples.

On the day the samples were collected, airborne concentrations of fungi were relatively low both indoors and outdoors. Concentrations of airborne fungi in most indoor locations, with the exception of Rooms 221 and 222, either were not detected or were below the levels found outdoors (fungi was not detected in the second outdoor sample which was collected outdoors while it was lightly misting). The total concentrations of fungi found in Rooms 221 and 222 were somewhat higher than the concentrations found in the first outdoor sample collected. In these indoor locations, as well as in the other indoor locations where airborne fungi was detected, aerobic actinomycetes were the predominant microbe identified. Aerobic actinomycetes are gram-positive bacteria which commonly are found in soil, plant surfaces, and decaying vegetation. This group of bacteria encompasses a variety of species which have properties that vary from one species to another. The laboratory analysis did not identify the type(s) of species present in these samples.

In Room 208, where a ceiling tile containing a black material was accessible, the CSHO collected wipe samples of the material using "Fisherfinest" Microorganism Transport and Collection swabs. The samples were sent to WOHL for analysis. The sample results are listed in Table IV. The samples confirmed the presence of *Cladosporium* species of mold. As such, a violation of 1910.141, *Sanitation*, has been proposed for this location.

Although airborne fungi either were not detected or concentrations were low at the time of the inspection, the evidence of leaks/water damage are better indicators of potential health hazards. According to the National Institute for Occupational Safety and Health (NIOSH) Alert, *Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings*, "The best current evidence suggests observations of dampness, water damage, mold, or mold odors are the best indicators of dampness-related health hazards, rather than microbiologic measurements." The document further states, "Research studies have shown consistent associations between the presence of dampness and mold in buildings and respiratory symptoms in building occupants." Therefore, it is strongly recommended that the employer continue to remove and replace any building materials that show signs of water damage, whether visible fungal growth (or suspected growth) is present or not. In the future, any potential and/or observed sources of moisture that are identified should be corrected as soon as possible. Wet or water-damaged building materials should be dried within 24-48 hours.

During the inspection, it was reported to the CSHO that the remediation contractor was performing the remediation work outside of normal school hours and was using a product called "Shockwave" to clean surfaces. Information on the manufacturer's safety data sheet (SDS) for this product (SDS version dated August, 2016) identifies the product, at "use concentration," as a "serious eye irritant," a "mild skin irritant," and "may be harmful if swallowed." CONN-OSHA does not regulate the products that may be used in a workplace. However, all products should be used in accordance with the manufacturer's recommendations for use and storage. Where complaints about eye and skin irritation are present, and whenever possible, the contractor should use these products in well ventilated areas.

While on site, the CSHO requested a copy of the SDS for the product used by the remediation contractor to clean surfaces. It was not provided to the CSHO. Furthermore, when the SDS was made available, the version was not compliant with the current requirements of 1910.1200, *Hazard communication*. In addition, the employer's written Hazard Communication program was not site specific to Westhill High School or the Stamford Public Schools. As such, violations of 1910.1200, *Hazard communication*, have been proposed.

During the inspection, the CSHO was requested to look at the storage/custodial closet in the Main Office where a "musty odor" was present. At the time the CSHO was in that area, a musty odor was not detected. However, old mops and dusters were present in that area, and may be the source of the odors. Also, boxes and papers were stored in this room and an old water stain was observed on the floor. It is recommended that the mops and dusters in this area be replaced with new ones and the boxes and papers be evaluated to determine if any sustained water damage.

While in this closet, the CSHO observed electrical panels, in front of which boxes were stored. CONN-OSHA requires that the working space around electrical equipment be clear; the space may not be used for storage. A violation has been proposed for this condition.

A closing conference was held on February 5, 2019. At that time, the apparent violations were discussed and the abatement dates were set.

Table I.
Indoor Air Quality Measurements
December 13, 2018

City of Stamford Public Schools
Westhill High School

Sample Location	Time	Carbon Dioxide (ppm)[1] PEL[2] 10,000	Carbon Monoxide (ppm) PEL 35	Temp (°F)	Relative Humidity (%)	Number of Occupants
Outdoors	2:42 pm	421	0.3	33.9	79.9	---
Room 223	3:00 pm	592	0	70.6	24.8	1
Room 222	3:20 pm	742	0.2	72.8	24.1	2
Room 216	3:35 pm	689	0	73.3	20.5	1
Room 214	3:50 pm	631	0	74.7	20.1	2
Room 210	4:10 pm	607	0	72.3	23.0	2
Room 208	4:25 pm	619	0	74.7	20.7	1
World Language Office	5:05 pm	705	0.1	76.2	22.2	2
Room 204	5:10 pm	608	0.9	75.8	19.8	2
Room 221	5:32 pm	698	0	74.5	21.4	2

Notes:
1. ppm – parts per million parts of air
2. PEL – permissible exposure limit

Table II.
Indoor Air Quality Measurements
December 18, 2018

City of Stamford Public Schools
Westhill High School

Sample Location	Time	Carbon Dioxide (ppm)[1] PEL[2] 10,000	Carbon Monoxide (ppm) PEL 85	Temp (°F)	Relative Humidity (%)	Number of Occupants
Outdoors	10:40 am	404	0.7	34.7	26.2	---
Room 221	10:53 am	892	0.1	76.2	17.8	16
Room 220	11:04 am	2153	0	75.5	26.4	24
Room 219	11:10 am	1208	0	73.2	17.8	25
Room 217	11:20 am	1024	0	74.1	16.3	23
Room 215	11:26 am	926	0	80.1	15.6	19
Room 214	11:30 am	918	0	74.5	15.4	9
Room 213	11:35 am	1193	0	73.9	21.1	23
Room 212	11:40 am	1203	0	75.9	19.0	21
Room 211	11:43 am	1371	0	72.6	19.0	23
Room 210	11:50 am	1008	0	70.7	16.4	18
Room 208	11:55 am	948	0	71.3	17.4	16
Room 206	12:01 pm	1150	0	69.5	20.5	29
Room 218	12:25 pm	1071	0	74.9	17.5	27

Table II
Indoor Air Quality Measurements
December 18, 2018

City of Stamford Public Schools
Westhill High School

Sample Location	Time	Carbon Dioxide (ppm)[1] PEL[2] 10,000	Carbon Monoxide (ppm) PEL 35	Temp (°F)	Relative Humidity (%)	Number of Occupants
Room 200	12:32 pm	1578	0	74.3	20.2	22
Room 222	12:36 pm	989	0	74.2	19.4	16
Room 216	12:40 pm	576	0	74.3	10.9	2
Room 201	1:10 pm	796	0	69.8	15.7	16
Room 203	1:20 pm	750	0	70.7	14.8	17
Room 205	1:25 pm	796	0	70.2	15.8	15
Room 207	1:30 pm	932	0	71.2	17.4	18
Room 209	1:40 pm	687	0	70.6	15.5	7
Outdoors	2:00 pm	404	0	38.1	20.9	---

Notes:
1. ppm – parts per million parts of air
2. PEL – permissible exposure limit

Table III.
Fungal Speciation and Quantification
Air Sample Results
December 13, 2018

City of Stamford Public Schools
Westhill High School

Sample Location	Time	Total Concentration (CFU/m^3)[1]	Type of Fungi	Concentration (CFU/m^3)
Outdoors	2:42 pm	44	Cladosporium species Alternaria species Basidiomycete	22 11 11
Room 223	3:00 pm	11	aerobic actinomycetes	11
Room 222	3:20 pm	78	aerobic actinomycetes Cladosporium species	67 11
Room 216	3:35 pm	11	aerobic actinomycetes	11
Room 214	3:50 pm	ND[2]	---	---
Room 210	4:10 pm	ND	---	---
Room 208	4:25 pm	11	aerobic actinomycetes	11
World Language Office	5:05 pm	ND	---	---
Room 204	5:10 pm	ND	---	---
Room 221	5:32 pm	88	aerobic actinomycetes Cladosporium species Rhodotorula species Yeast Phaeoannellomyces species	
Outdoors	5:45 pm	ND	---	---

Note:
1. CFU/m^3 – colony forming units per cubic meter of air
2. No fungi detected – airborne concentration of fungi are below detectable limits

Table IV.
Fungal Speciation and Quantification
Wipe Sample Results
December 13, 2018

City of Stamford Public Schools
Westhill High School

Sample Location/ Description	Type of Fungi	Concentration
Room 208 Black material from water-stained ceiling tile	Cladosporium species	6000 CFU[1]
Room 208 Black material from water-stained ceiling tile	Cladosporium species	270 (CFU/in^2)[2]

Note:

1. CFU – colony forming units
2. CFU/in2 – colony forming units per square inch

Appendix A.
List of locations with conditions that may negatively impact air quality

Hallway outside Room 200, Room 202, and Room 207 – water-stained ceiling tiles

World Language Office – particle board beneath sink appears to have sustained water damage.

Room 201 – water-stained ceiling tile near return; return may be slightly exhausting air.

Room 203 – possible water stain on ceiling tile along front of room where others were removed.

Room 205 – multiple areas of water-stained ceiling tiles; room also felt drafty.

Room 207 – multiple areas of ceiling tiles and braces with black particulate present.

Room 208 – black material present on water-stained ceiling tile adjacent to return grille; water-staining present on side of return duct above drop ceiling.

Room 209 – water-stained ceiling tiles near windows and old hood.

Room 213 – plants present in room, one with a moderate amount of dead leaves. (Although some people feel that *well maintained* plants contribute to improved air quality, soil and decaying plant matter may promote microbial growth. It is up to the employer to determine the benefits versus the costs associated with allowing plants in the workplace.)

Room 216 – papers stored on unit ventilator.

Room 218 – louvers in supplies appear to be open only a small amount (possibly by design); black material on ceiling tile in center of room; possible water-stained ceiling tile near desk.

Room 219 – possible water-stained tile adjacent to partition doors.

Room 221 – evidence of leaks that appear to be associated with duct work; insulation discolored (possibly from dust).

Room 222 – water-stained ceiling tiles present (according to employer, as of time of inspection, could not remove these because of proximity to sprinklers); books stored on top of unit ventilators.

Room 223 – trash in unit ventilator.

Main office storage closet – old water stain on floor; old mops/dusters present.