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Indoor Air Quality Investigation

LeRoy Central School District
Middle/High School Building

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Prepared by:
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Background

This initial investigation was conducted on December 21 and December 29, 2010 in response to a request from Ms. Kim Cox, District Superintendent, LeRoy Central School. The investigation was performed to address concerns regarding the indoor air quality and building environment as possible causal factors in several student cases of neurological symptoms.

Prior to the investigation, district records were checked to determine any building related conditions or historical issues that may lend themselves to possible air or other environmental complaints. No history of building water damage or site contamination was found and the building air handling units were determined to be in good working order based on past maintenance history.

Further visual inspection of the building prior to sampling, indicated a clean, well lit building with no signs of roof leaks or other water infiltration. A slight natural gas odor was noted during this visual inspection, nearest to the boiler room entrance to the building. Although this problem did not extend beyond the immediate entryway, I performed sampling here to determine safe levels of any possible contaminants.

Ventilation is provided to the district classrooms through individual unit ventilators and to the hallways through several air-handling units located on the roof of the building. According to District Superintendent of Buildings/Grounds air filters in the units are changed on a preventative maintenance schedule and at the time of the investigation the air-handling units appeared to be operational and filters clean.

After consultation with district staff, including the building nurse, it was determined that several "common" areas and classrooms would be sampled for the presence of volatile organic compounds (solvents, etc.), formaldehyde, carbon dioxide, carbon monoxide, molds, relative humidity, temperature, and overall lighting levels. The first 7 items chosen are typical for any indoor air investigation where the presence or absence of contaminants is unknown. The lighting levels were taken since poor lighting can occasionally be associated with neurological symptoms in sensitive individuals.

All air samples except for mold, were taken utilizing "direct read", instant read out sampling equipment, calibrated immediately prior to use. The mold samples were taken utilizing an air pump and a non-culturable media cassette. These samples have been forwarded to a lab for microscopic and analysis, with full results pending within 5-7 days of this report.

Sampling Areas

The areas investigated included: the Library/Computer Lab, Room 360 (Art Room), the Computer Lab immediately across the hall from the Room 360 Art Room, the Girls Bathroom adjacent to Room 360, the Girls Locker Room, and the Biology Classroom. These rooms all have carpeting on the floor, plaster walls, and acoustical tile drop ceilings, except for the locker room/bathroom which have tile floors and walls. Additionally, samples were drawn in the hallway area outside each of these rooms. These areas were chosen due to their distribution throughout the building and due to several being commonly used areas by all students.

No odors were observed at the time of the investigation in any of the areas, with the exception of the natural gas odor mentioned earlier and a faint odor of rubber or plastic in the Library and Computer Lab.

The inspection involved a walk-through of the areas to visually look for potential sources of biological agents (mold) and evidence of current or past water damage or excessive moisture. Evidence that active mold (fungal) growth is occurring is most often sensory (visual identification or odor perception) and may be confirmed by source sampling.

There was no visual mold or water damage observed. There were no active water leaks at the time of the investigation. There was no standing water observed inside or outside the perimeter of the building. There was no condensate or moisture observed on indoor surfaces or walls. There was no visual indication of possible mold growth in any of the areas inspected.

Destructive methods were not used to investigate for mold. Generally, destructive methods are only used when conditions indicate that mold may be present in an inaccessible area. There was no visual indication of any mold presence in the areas investigated.

Ventilation Adequacy as a Source of Good Indoor Air Quality

Inadequate fresh air ventilation can cause carbon dioxide and minor air contaminants to increase in concentration. This is due to inadequate dilution of indoor air by fresh outside air. Carbon dioxide is a normal component of exhaled air and levels inside occupied buildings are usually higher than the outside air. Carbon dioxide concentration has been widely used as an indicator of indoor air quality. Complaints of nuisance odors, headaches, fatigue, and eye and throat irritation are more likely to occur when ventilation is inadequate and carbon dioxide levels are elevated. However, carbon dioxide itself does not typically cause health problems in indoor air concentrations; it is simply being used as a surrogate to determine adequate ventilation.

ASHRAE, the American Society of Heating, Refrigeration and Air Conditioning Engineers, is the primary association involved with indoor air quality. ASHRAE Standard 62-2001 suggests that an indoor to outdoor differential concentration greater than about 700 ppm (parts per million) of

carbon dioxide may indicate that the fresh air ventilation does not meet the minimum requirements of the standard. For example, with an outdoor level of 350 ppm, which is within normal range for outside air, the indoor levels should be maintained below 1050 ppm.

Carbon Monoxide is a by-product of fuel combustion and should not typically be present in a classroom/school setting. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for carbon monoxide is 50 parts per million (ppm) parts of air as an 8-hour time-weighted average (TWA) concentration. Levels were undetectable at the time of the investigation.

Ventilation distribution and adequacy were verified on-site by measuring the air concentration of carbon dioxide and carbon monoxide using a fully calibrated IAQ-Calc Indoor Air Quality Meter, which is manufactured by TSI Incorporated. This test method has an error of +/- 3% for readings at 77°F or +/- 50 ppm, whichever is greater; thus the data need to be interpreted accordingly.

Carbon Dioxide (CO_2) and Carbon Monoxide (CO) Results

Location	CO_2 PPM	CO PPM	Number of Occupants	Comments
Art Room	550	0	2	Immediately After Occupied
Library	575	0	2	Immediately After Occupied
Girls Bathroom	650	0	3	Immediately After Occupied
Girls Locker room	800	0	5	Immediately After Occupied
Computer Lab	655	0	2	Immediately After Occupied
Biology Room	625	0	2	Immediately After Occupied
Hallways	400-750	0	~Varied	N/A
Outside	395	0	N/A	N/A

The data (with consideration for the potential error in the test method) indicate that on December 21, 2011 all areas sampled were within ASHRAE Standards and NYS Education Department Recommendations for CO2 levels. Further, no detectable levels of CO were identified in any of the samples.

Temperature and Relative Humidity

According to ASHRAE, the primary association involved with indoor air quality, in winter for people typically clothed; temperatures should range between 68-76 °F. Relative humidity should be maintained within the range of 30-50%.

When the relative humidity levels fall below this range, problems arise in three major areas: health and comfort, static electricity and moisture stability. Health and comfort levels become compromised as bacteria, viruses, allergic rhinitis, asthma and respiratory infections become more evident due to low humidity levels.

During the heating months, less moisture is present in indoor environments. Schools do not humidify their facilities during winter months for several reasons.

Excess moisture can cause the growth of biological organisms, including dust mites and fungi. Dust mites are microscopic animals that can cause allergic reactions. Fungi in indoor environments can produce allergic reactions or may be toxic. The negatives of humidification are worse than the trade off for comfort. Adding moisture to the air only makes it a better environment for fungi, bacteria, and dust mites to proliferate.

Temperature and Relative Humidity

Location	Temperature °F	Relative Humidity %
Art Room	70.5	46.5
Library	70.0	49.5
Girls Bathroom	69.2	48.5
Girls Locker room	69.8	43.0
Computer Lab	70.3	49.0
Biology Room	68.5	45.6
Hallways	68.0	45.5

The data (with consideration of the potential error in the test method) indicate that on December 21, 2011 all areas sampled were within ASHRAE Standards for temperature.

The data (with consideration of the potential error in the test method) indicate that on December 21, 2011 all areas were within ASHRAE Standards ranges for relative humidity.

Volatile Organic Compounds and Formaldehyde

There are numerous indoor sources of contaminants that may be potential irritants and may cause allergic reactions, or symptoms such as dizziness, fatigue, and headaches. During this investigation volatile organic compounds and formaldehyde were sampled.

- **Volatile Organic Compounds (VOC's)**

  Potential Sources: Paints, cleaning compounds, moth-balls, glues, photocopiers, "spirit" duplicators, signature machines, silicone caulking materials, insecticides, herbicides, combustion products, asphalt, gasoline vapors, tobacco smoke, dried out floor drains, cosmetics and other personal products.

  Potential Acute health effects: Nausea; dizziness; eye, respiratory tract, and mucous membrane irritation; headache; fatigue.

  Potential Long-Term health effects: Varies depending on substance, but may include neurological symptoms and/or multiple organ failures.

- **Formaldehyde**

  Sources: Off-gassing from urea formaldehyde foam insulation, plywood, particle board, and paneling; carpeting and fabric; glues and adhesives; and combustion products including tobacco smoke.

  Acute health effects: Hypersensitive or allergic reactions; skin rashes; eye, respiratory and mucous membrane irritation; odor annoyance.

  Potential Long-Term health effects: Cancers.

Volatile organic compounds were sampled for using a fully calibrated MiniRae 3000 broadband VOC gas monitor. The MiniRae 3000 measures the concentration of airborne photoionizable gases and vapors and instantly displays these concentrations. The MiniRae 3000 does not determine the specific contaminants present, only total concentrations in parts per million (ppm).

Volatile Organic Compound levels were non-detectable (0.0 ppm) in all of the areas, except for the girl's locker room, where the level was 0.1 ppm. This level can likely be attributed to the presence of hair sprays, deodorants, and perfumes in the lockers and is within generally recognized acceptable levels for indoor air.

Formaldehyde was sampled utilizing a Draeger Hand pump with colorimetric tubes.
The tubes have a sampling range of 0.2 – 5.0 ppm. **Formaldehyde was undetectable in all of the sample areas.**

Lighting Levels

All lighting illuminance levels were determined with a handheld Light Meter and were determined to be within both the design ranges and within generally accepted appropriate ranges for the specific areas measured. The accepted authority for appropriate illuminance values is the Illuminating Engineering Society of North America (IESNA). The IESNA publishes a comprehensive Handbook along with supplemental Recommended Practice Guides that provide tables of appropriate illuminance data.

Mold Spore Air Sampling

Background Information on Mold

From the document *"Mold Remediation in Schools and Commercial Buildings", United States Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division (6609-J) EPA 402-K-01-001, March 2001:*

Molds can be found almost anywhere; they can grow on virtually any organic substance, as long as moisture and oxygen are present. There are molds that can grow on wood, paper, carpet, foods, and insulation. When excessive moisture accumulates in buildings or on building materials, mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed. It is impossible to eliminate all mold and mold spores in the indoor environment. However, mold growth can be controlled indoors by controlling moisture.

Molds reproduce by making spores that usually cannot be seen without magnification. Mold spores waft through the indoor and outdoor air continually. When mold spores land on a damp spot indoors, they may begin growing and digesting whatever they are growing on in order to survive. Molds gradually destroy the things they grow on.

Many types of molds exist. All molds have the potential to cause health effects. Molds can produce allergens that can trigger allergic reactions or even asthma attacks in people allergic to mold. Others are known to produce potent toxins and/or irritants. Potential health concerns are an important reason to prevent mold growth and to remediate/clean up any existing indoor mold growth.

Since mold requires water to grow, it is important to prevent moisture problems in buildings. Moisture problems can have many causes, including uncontrolled humidity. Some moisture problems in buildings have been linked to changes in building construction practices during the 1970s, 80s, and 90s. Some of these changes have resulted in buildings that are tightly sealed, but may lack adequate ventilation, potentially leading to moisture buildup. Building materials, such as drywall, may not allow moisture to escape easily. Moisture problems may include roof leaks, landscaping or gutters that direct water into or under the building, and unvented combustion appliances.

Sampling Method

Sampling for airborne mold spores was conducted in the building on December 29, 2011 using Air-O-Cell™ Air Sampling cassettes. Three air samples were taken; 1 each in the Computer Lab, Biology Classroom, and an outdoor baseline sample.

Air-O-Cell™ Air Sampling cassettes are a sampling device designed for the rapid collection and analysis of a wide range of airborne aerosols. These include fungal spores, pollen, insect parts, skin cell fragments, fibers, and inorganic particulates. Air enters the cassette, particles suspended in the air become impacted on the sampling substrate, and the air leaves through the exit orifice. Air was sampled at a flow rate of 15 liters per minute (lpm) for 10 minutes resulting in

150 total liters of air sampled. Samples are then analyzed by microscopic examination at an EMLAP certified lab and the results are reported in fungal spores per cubic meter of air (spores/m^3).

Sampling Interpretation

At this time there are no U.S. Environmental Protection Agency, OSHA or other Federal standards or threshold limits for mold or mold spores in an indoor environment. This is due to naturally diverse and variable exposure, the absence of measurement and health response data, and differing immunogenic susceptibilities of individuals. Relationships between health effects and environmental microorganisms must be determined through the combined contributions of medical, epidemiological, and environmental evaluations.[1]

Air sampling for mold and mold spores is interpreted by:

- Comparing indoor airborne concentrations to outdoor mold spore concentrations. Total indoor airborne concentration levels higher than levels outside the building would indicate the possible presence of a fungal reservoir and amplification inside the building.
- Comparing species of mold inside and outside the building. Mold spores found inside and not outside the building could indicate a possible fungal reservoir and amplification inside the building.
- The presence of high airborne concentrations of indicator species, such as *stachbotrys*, *aspergillus*, or *penicillium*, which can indicate an excessive moisture problem or a possible health hazard that should not typically be present in healthy indoor environments.

Sampling Results

These results are pending and will be provided to the district within 5-7 days. A full interpretation of those results will follow with .

Summary

- There was no visual evidence of fungal growth or water damaged building materials observed. There were also no odors detected that would normally be attributed to mold. Further, there was no evidence of standing water in or around the areas investigated.

- At the time of the investigation carbon dioxide levels, carbon monoxide levels, formaldehyde levels, and volatile organic levels were at or below any generally accepted normal levels for indoor environments, including ASHRAE and NYSED guidelines.

- Temperature readings, relative humidity readings, and ventilation indicators all indicate a properly functioning and well maintained HVAC system within the building.

- On the dates sampled, no substances were detected within the school building that might be expected to cause any health issues in the student or staff population.

- Mold sampling results are pending.

[1] ACGIH [1999]. Bioaerosols: Assessment and Control. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

Recommendations

1) Although no detectable levels of contaminants were identified in the entryway area, the natural gas odor issue should be resolved through contact with the district HVAC contractor. This would appear to be a negative air related issue and easily abated.
2) I will immediately notify the district of pending mold sampling results and will follow-up on any abnormal levels, if identified.
3) As a preventive measure, future VOC and CO/CO2 sampling should be scheduled on an ongoing basis over the next few weeks, in order to isolate any possible "unique" contaminant occurrences as they may arise.
4) All future complaints of any building related odors, conditions, or suspected health symptoms should be immediately reported to the SOBG for action and logged for future reference.

If you have any questions or need additional information, please feel free to contact our office at (585) 346-4108.

Respectfully Submitted,

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