

**LITCHFIELD SCHOOL DISTRICT
AIR QUALITY REPORT**

MAY 10, 2017

Indoor air quality is a term which refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Indoor air quality can be affected by gases (i.e. carbon monoxide, radon, volatile organic compounds), particulates, microbial contaminants (mold, bacteria), or any mass or energy stressor that can induce adverse health conditions.

Determination of indoor air quality involves the collection of air samples, monitoring exposure to pollutants, collection of samples on building surfaces, and monitoring air flow inside buildings.

Common Pollutants

Radon: an invisible, radioactive atomic gas that results from the decay of radium, which may be found in rock formations beneath buildings or in certain building materials themselves.

Molds, Other Allergens: moisture induced growth of mold colonies and natural substances released into the air such as animal dander and plant pollen can trigger allergic reactions or episodes in persons that already have asthma.

Carbon Monoxide: a colorless, odorless gas that is a byproduct of incomplete combustion of fossil fuels

Volatile Organic Compounds: emitted as gases from certain solids or liquids and include a variety of chemicals, some of which may have short or long term adverse health effects. Examples include: paints, varnishes, waxes, cleaners, disinfectants, hobby produces, building materials.

Carbon Dioxide: a relatively easy to measure surrogate for indoor pollutants emitted by humans.

Asbestos Fibers: many common building materials used before 1975 contain asbestos, such as floor tiles, ceiling tiles, shingles, fireproofing, heating systems, mastic, insulation materials. Significant releases of asbestos fiber do not typically occur unless the building materials are disturbed (cutting, sanding, drilling, remodeling).

Particulates: microscopic solid or liquid matter suspended in the atmosphere (i.e. aerosol) and can be man-made or natural.

Second-hand Smoke: a mixture of the smoke given off by the burning of tobacco products. Schools are required to have a Smoking Ban policy according to the law.

Common Causes of Poor Indoor Air Quality

- Inadequate Ventilation
- Improper HVAC system design
- Ineffective humidity control
- Inadequate pest management program

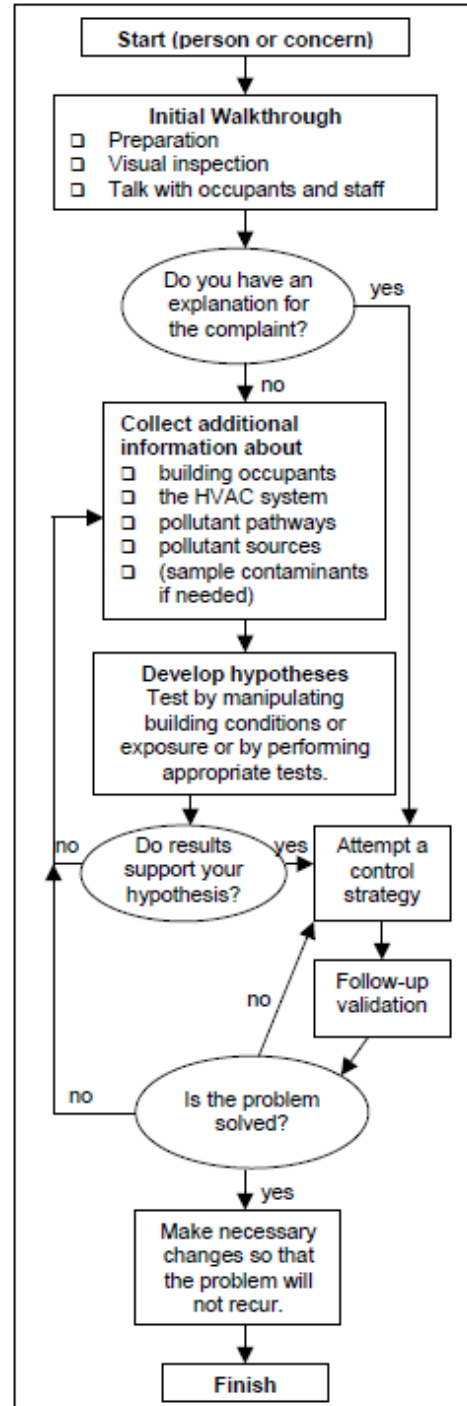
Conducting an Air Quality Investigation

Air quality investigations begin with a complaint about poor air quality in a classroom or building.

Air quality testing is done according to a pre-determined schedule and if there is a complaint in the school building by students, parents or staff.

An air quality test vendor is hired to conduct an air quality investigation. This investigation can be done for a specific classroom or collection of classrooms, or for the whole building.

A typical process is provided to the right.



Air Quality Testing in the Litchfield Schools

The Litchfield School District has been conducting air quality testing for many years. Reports go back as far as 1990 for Griffin Memorial School. In our research, we have only been able to procure reports back to 1997.

In 2010, the Litchfield School Board approved an Indoor Air Quality policy (EBBD). The policy states:

In order to ensure that all school buildings have adequate indoor air quality, the Litchfield School Board directs the Superintendent to address methods of minimizing or eliminating emissions from buses, cars, delivery vehicles, and other motorized vehicles. The Superintendent may delegate the implementation of these methods to building principals.

In addition to addressing methods eliminating emissions, building principals are directed to annually investigate air quality in their respective school buildings using a checklist provided by the New Hampshire Department of Education. Following the annual inspection, the completed checklist shall be filed with the New Hampshire Department of Education, the Litchfield School Board, and the Town of Litchfield Health Officer. Checklist shall remain on file for five (5) years.

In support of this policy, the Superintendent is authorized to establish regulations and/or administrative rules necessary to implement anti-idling and clear air measures aimed at improving indoor air quality.

Legal References

RSA 200:11-a, Investigation of Air Quality

RSA 200:48, Air Quality in Schools

NH Code of Administrative Rules, Section Ed. 306.04(a)(24), Air Quality in School Buildings

NH Code of Administrative Rules, Section 306.07(a)(4), School Facilities

Reference: New Hampshire Department of Education School Indoor Air Quality Inspection Checklist

A checklist is provided with the policy, which building principals are required to complete and file with the New Hampshire Department of Education annually.

To view the policy and checklist in its entirety, please go to the link provided below:

<http://www.litchfieldsd.org/SchoolBoardPolicyManual.aspx>.

Air Quality Testing

Below is a table of air quality testing frequency in the Litchfield School District:

GMS	LMS	CHS
October 1990	May 2006	April 2006
December 1990		April 2010
September 1996		
February 1997		
June/July 1997		
August 1997		
December 1998		
December 1999		
December 2004		
March 2008		
March 2010		
August 2012		
September 2013		
March 2015		

In 2004, it was decided by the Litchfield School Board that air quality testing in each school building would be conducted on a rotating schedule every three years.

Air Quality Tests and Results

GMS:

1990: high carbon dioxide levels; high humidity levels

- Recommendations:
 - maintain/clean ventilation system
 - use of dehumidifiers
 - disposal of area rugs
 - use of a recommended disinfectant
 - more portable furniture for better cleaning.

1996: single radon-in-water analysis performed; results within EPA recommended levels.

1997: particulate building, elevated carbon dioxide, inadequate ventilation, elevated humidity for the time of year, dehumidifiers present but not operating, no water stains, peeling paint due to moisture, cluttered rooms, poorly maintained, poor housekeeping, some biological growth.

- Recommendations: (long-terms)
 - further examine moisture problem
 - investigate roof and site drainage
 - moisture remediation
 - roof repair/replacement
 - install HVAC system that includes dehumidification
 - expand school building for current occupancy
 - remove porous materials (ceiling tiles, insulation, carpet) and replace with tile
- Recommendations: (short-term)
 - install room dehumidifiers that run continuously and empty daily
 - remove all carpeting and replace ceiling tiles
 - clean/disinfect all surfaces with commercial biocide
 - increase cleanliness of building
 - action plan for water infiltration.

Dave Ross was hired in March 1998. Improvements occurred under his management. Tools for Schools cleaning methods enacted in 1998.

1998: temperature was within guidelines; humidity was not within recommended guidelines; carbon monoxide and total dust concentrations within recommended guidelines; volatile organic compounds were low.

1999: temperature and relative humidity within recommended comfort guidelines; carbon dioxide close to upper limit; carbon monoxide within recommended guidelines; volatile organic compounds low; microbial concentrations were low and within recommended guidelines.

- Improvements from previous report:
 - relative humidity readings
 - reduction in carbon dioxide levels
 - volatile organic compounds and microbial concentrations remained below or at suggested guidelines
 - bio-aerosols remain within acceptable range
 - classroom carpeting found to contain low levels of microorganism activity, but within acceptable range
 - lead based paint found present on window components; paint in good condition, but some flaking on exterior
- Recommendations:
 - further increase amount of fresh outdoor makeup air
 - provide fresh air supply diffuser in guidance office
 - repeat air sampling for microbial concentration in one year for changes
 - correct flaking exterior window paint and restore to intact condition.

2004: overall indoor air quality within acceptable range; no major concerns regarding temperature, relative humidity, carbon dioxide, carbon monoxide, mold, bacteria or dust.

- Recommendations:
 - continue daily maintenance of bathroom floors (use disinfectant)
 - clean floor drain on regular basis to prevent build-up of rust/organic debris
 - replace water stained ceiling tiles
 - limit storage and eating of food to designated areas
 - include bathroom ventilation fans with maintenance of other HVAC equipment.

2008: overall indoor air quality within acceptable range; no major concerns regarding temperature, relative humidity, carbon dioxide, carbon monoxide, mold, bacteria or dust. Some carbon dioxide measurements were slightly above recommended levels, but can vary within a room based on occupancy.

A single microbial concentration revealed an elevated level of 1-Butanol and a review of cleaning products/items stored or used in subject room is recommended.

- Recommendations:
 - further increase amount of fresh outdoor makeup air
 - provide fresh air supply diffuser in guidance office
 - install a fan in the restroom adjacent to room 11
 - replace water stained ceiling tiles.

2010: overall indoor air quality is within acceptable range. Compared with the previous reports, there has been significant improvement in ranges for temperature, relative humidity, carbon dioxide, carbon monoxide, mold, bacteria and dust.

2012: air sampling conducted in conjunction with removal of asbestos floor tile and mastic removal. No visible residue was found within the work area that was dismantled. Air sampling conducted was below detectable limits. All fiber samples from carpets, clothing, etc. were below suggested parameters.

2013: mold sampling conducted Room #22 and Gymnasium on September 25, 2013. A dripped stain on the face of the unit ventilator in Room #22 [from potted organic matter] showed some mold growth and should be cleaned with a simple disinfectant/biocide. Observation: organic matter in pots stored on or near the unit ventilator. Air sampling performed in building in second sampling October 3, 2013.

Gym mats and storage showed deposited dust and debris on the stored equipment, but did not indicated mold growth when tested. All spore counts inside the building were less than the outside control sample. An air sample collected in the gym showed a higher percentage of Penicillium/Aspergillus types compared to the outside sample and a sample from Room #22, which could indicated a mold amplification may be present in that area.

- Recommendations:
 - clean unit ventilator with disinfecting/biocide cleaner
 - pots with organic matter stored on or near the unit ventilator should have trays to capture excess water; any organic matter may be aerosolized when located within the air flow of the ventilator; occupants with allergies could be affected by the aerosolized organic matter.
 - gym mats and contents within gym storage area should be cleaned with disinfectant/biocide.

2015: overall indoor air quality was within acceptable range. Three rooms had elevated carbon dioxide (Rooms 6, 7, 20).

- Recommendations:
 - Rooms 6, 7 and 20 unit ventilators should be investigated to insure adequate outside air is being introduced
 - If ventilator is functioning properly, staff should be instructed to open windows slightly during high occupancy periods
 - Overall building heat can be scaled back in afternoons to compensate for occupant heat.

Further Recommendations:

- **CO₂:** increased levels in air sampling in 2010 and 2015.
 - *Recommendations were made to remedy the elevated levels.*
- **Mold:** Room #22 and Gym mats tested 2013.
 - *Mold testing should not be conducted on a routine basis.*

Extensive testing was performed in 2010 that included Carbon Dioxide, Carbon Monoxide, Temperature, Relative Humidity, Mold, Mold-related Volatile Organic Compounds and Dust Characterization. These tests are typically not warranted and not recommended unless a particular concern warrants that type of testing.

Note: All testing concludes there has not been a mold issue at GMS.

LMS:

2006: overall air quality was within acceptable range; sampling results of Fungi are at normal levels; classrooms, offices clean; some dust components exceeded recommended guidelines, but did not present significant health concern; complaints regarding ventilation in Rooms 6, 13, 26 and FACS.

- Recommendations:
 - Indoor environment should continue to be observed to ensure complaints associated do not escalate
 - Although classrooms and offices were clean, use of enhanced housekeeping/cleaning practices are suggested (HEPA equipped vacuums)
 - Unit ventilators or HVAC that supplies Rooms 6, 13, 26 and FACS should be adjusted to increase levels of fresh outside air.

CHS:

2006: samples were collected for airborne Fungi and Bacteria; levels were within recommended guidelines; no suspected microbial growth on floor tiles; carbon monoxide levels below recommended guidelines; no major concerns with relative humidity or temperature.

- Recommendations:
 - Although sampling results indicate overall concentrations of Fungi are at normal levels, water infiltration through the floor slab has been noted and should be observed.
 - Relative humidity levels were not within recommended guidelines, but during the drier winter and spring months it is not uncommon for these levels to fall below comfort levels. Occupants should hydrate themselves, use moisturizers, eye and nose drops.

2010: samples were collected for bioaerosols in Room B102 (Multi-Purpose Room) and Room 162 (Art). Visual inspection revealed growth on the underside of the flooring within Room B102 and behind the mop board and on the bottom supports of the cabinetry within the Art Room. Evidence of water seepage through the concrete was identified upon visual inspection, as well as water damaged cardboard boxes and curling flooring. Mold spore traps samples showed the presence of *Penicillium/Aspergillus* structures in the Art Room. The tape lift from the mop board in Room 162 showed growth present.

- Recommendations:
 - Current mold amplification is beginning to take hold in a new building that should be free of these issues suggesting a design flaw. Alert original designer.
 - Moisture is trapped beneath the floor of the slab emanating into building envelope. A civil engineer should be engaged to determine a solution.
 - Remove cellulose containing materials off floors; use plastic containers.
 - Clean all floors and materials that cannot be removed with commercial biocide.
 - Carbon monoxide detector is not adequate in current location and should be moved to recommended location. Additional detectors needed.

Indoor Air Quality Testing Schedule

According to past practice, indoor air quality testing should be done every year at each school on a three year rotating schedule.

GMS is slated to be tested in 2018. LMS and CHS have not been tested for several years.

Cost of Air Quality Testing

Air quality testing can be costly subject to the type of testing that is performed. An annual indoor air quality test is less costly than a test for a specific complaint or issue.

GMS

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Budgeted	\$8,500	\$0	\$0	\$1,000	\$0	\$2,860	\$1,200	\$1,200	\$1,200
Expended	\$5,880	\$0	\$0	\$0	\$885*	\$2,330	\$1,196*	\$0	

LMS

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Budgeted	\$0	\$0	\$0	\$0	\$0	\$1,600	\$1,200	\$1,200	\$1,200
Expended	\$0	\$0	\$0	\$445*	\$0	\$0	\$710*	\$500*	

CHS

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Budgeted	\$0	\$0	\$3,000	\$0	\$0	\$0	\$13,200	\$1,200	\$1,200
Expended	\$2,010	\$0	\$0	\$445*	\$885*	\$0	\$585*	\$1,768*	

Note: * denotes no air quality testing in that year.

GMS is due to be tested in 2018. Quotes for testing for LMS and CHS: \$1,170 for each building.

What Have We Done to Address Air Quality Issues in our Schools?

GMS

- Asbestos tiles have been removed throughout the building. Only the hallway tiles remain and they have been encapsulated in wax, which complies with safety standards. One hallway portion is due to be completed over the summer of 2017. Ongoing until completed.
- Carpeting has been removed and replaced with VCT tile in every classroom.
- Rooms 1-10 hallway carpet removed, asbestos tiles abated, installed carpet blocks.
- Dehumidifiers are used in the classrooms during the months of May through September (subject to humidity levels) to alleviate moisture from humidity. Dewatering study 2008.
- Walls are washed with biocide once per year during the summer.
- Floors are stripped and waxed annually.
- All classroom windows, with the exception of rooms 1-10, have been replaced. At the time of replacement, windows in rooms 1-10 were not in need of replacement.
- Cafeteria duct work cleaned.
- HVAC filters changed on monthly basis.
- Portion of roof completed 2010. Large section of roof replaced 1998.
- All exterior doors replaced.
- 60% of exterior brick repointed and sealed (moisture issue).

Tools for Schools cleaning methods continue to be used.

LMS

- Approximately half of all carpeting has been removed and replaced with VCT tile. Ongoing until completed.
- Carpets are shampooed with mildewcide annually.
- Floors are stripped and waxed annually.
- Duct work cleaned in 2014.
- 178 stained ceiling tiles replaced in 2014.
- Increased HVAC filter changes (approximately 6 times per year), working toward monthly schedule.
- 95% of all exterior doors have been replaced.
- Window replacement is ongoing until completed.
- Roof replaced 2007.

CHS

- Moisture study performed and completed in 2010; design flaw in slab.
- Areas with mold (Art Room storage, Multi-purpose room) have been addressed; new floor that is mold, moisture and mildew resistant installed in multi-purpose room in 2013.
- Cove base removed in hallways; walls cleaned and painted; new cove base installed.
- Floors being stripped to bare tile and waxed annually.
- Increased HVAC filter changes (approximately 6 times per year) in 2016, working toward monthly schedule.
- Waiting for recommendations from building conditions assessment to address CO detectors.

Note: *In 2012, Dan Langelier performed and completed a re-roof report on roof conditions at all schools. Recommendations include repair of leaks on all roofs, replacement of LMS gymnasium roof, repair seams GMS and CHS, and continue monthly inspections.*