

SECOND REPORT

SPECIFIC TASKS
INDOOR AIR QUALITY EVALUATION
BIDDEFORD HIGH SCHOOL
BIDDEFORD, MAINE

ON-SITE VISITS CONDUCTED
APRIL 14, 25, 28, & 29, & MAY 25, 2011

JUNE 3, 2011

TURNER BUILDING SCIENCE & DESIGN, LLC

TURNER
GROUP

MECHANICAL ENGINEERS • BUILDING SCIENTISTS • IAQ CONSULTANTS

June 3, 2011

Ms. Sarah-Jane Poli
Superintendent
Biddeford School Department
205 Main Street, P.O. Box 205
Biddeford, ME 04005

Via Email: sjpoli@biddschools.org
pradding@biddefordmaine.org

SUBJECT: Second Report: Specific Tasks of Indoor Air Quality Evaluation
Regarding Expressed Occupant Concerns in Certain Areas of
Biddeford High School During Construction Activity
TBS Project #S0967-02

Dear Ms. Poli:

Background: In accordance with our approved Addenda #1: Additional Forensic Indoor Air Quality Services, dated February 24, 2011, we are pleased to offer this report concerning results of authorized services as defined in the enclosed Appendix D. This Addenda #1 Scope was proposed based on the results of findings from our initial evaluations previously conveyed to the District.

The specific scope of the current efforts we have completed are:

- A) Review the current Construction Containment Plan, evaluate as it may relate to current ventilation system function, and be available for future reviews and audits at various phases of the ongoing construction project.
- B) Conduct additional occupant interviews, meetings with the school nurse, and initial diagnostic room evaluations to evaluate if there are signs of current mold reservoirs in specific room locations.
- C) Conduct reviews of the District's cleaning protocols and the City's fugitive moisture management procedures.

Our recommendations made herein are based on our general knowledge concerning indoor air quality (IAQ), HVAC systems, building science, and our historical experience conducting IAQ and HVAC diagnostics in buildings with expressed occupant concerns.

In addition, we have also drawn on our rather extensive experience regarding the design and monitoring of construction containment during renovation activities (in or adjacent to occupied buildings) and our experience with addressing IAQ concerns in buildings with water intrusion.

The intent of these services is to assist the District with determining the need for any short or long-term mitigation, evaluation, or management strategies to minimize current occupant concerns during a rather extensive, complicated, construction and renovation project. The enclosed report is of a technical nature; therefore, the reader will need to have some technical knowledge of the facility to properly evaluate the recommendations made herein.

We are pleased to serve as professional consultants to the Biddeford School District and look forward to the opportunity to continue to assist the District with resolution of occupant concerns. Please contact me if there are any questions on subjects presented here that need further clarification at (207) 583-4571, ext. 11, or Steve Caulfield at ext. 14 in our Harrison, Maine office.

Sincerely,

TURNER BUILDING SCIENCE & DESIGN, LLC



William A. Turner, P.E.
President/CEO



Steven M. Caulfield, P.E., C.I.H.
Senior Vice President

WAT/___

Attachments



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1.0 EXECUTIVE SUMMARY

1.1 General Scope: The Biddeford School Department previously retained Turner Building Science & Design, LLC (TBS) to make recommendations concerning evaluation of the indoor air quality at the high school. As previously reported, occupant concerns range from concerns associated with historic and ongoing water intrusion, potential mold contamination, and possible health effects, to concerns for exposure, to construction dust and fumes or cleaning products. In accordance with our approved Addenda #1 (Appendix D), TBS has completed the initial services of our additional evaluation current scope. Services related to auditing of future construction containment remains to be completed.

1.2 Room Evaluation Scope: Additional occupant interviews and a meeting with the school nurse supported the need to investigate several room locations that had previously been identified for evaluations during our initial services, and resulted in a few more being added. A total of 20 rooms were evaluated with semi-aggressive diagnostic airborne mold spore testing. In rooms where diagnostic air sampling was conducted, tape lift samples of representative suspect water stained materials were collected for lab processing. Given the history of water intrusion within the building and historic reported occupant concerns, as a precaution we carefully visually rechecked several rooms, adjoining rooms, and spaces below rooms equipped with unit ventilators for signs of mold reservoirs. Results of the mold testing data are discussed in Section 2.4 of this report and the lab data in Appendix B. Representative photos are located in Appendix A.

1.3 Overall Results of Room Evaluations: Testing of 20 (twenty) rooms for airborne mold as found after school and with semi-aggressive diagnostic airborne mold testing methods (to dislodge settled dust), did not reveal elevated mold levels in any location, nor marginally elevated types of indicator mold species that would suggest a health concern for occupancy. This is an important finding, given the long history of water intrusion within the facility, especially when compared to the moderate outdoor levels that were occurring during our test period. Results of the 39 tape lift samples confirmed that stained ceiling tiles, although very unsightly, are not a current indicator of mold growth. Six of the tape lift samples (not from ceilings) did show an indication of some mold growth; two mold reservoirs were found on damp heating system pipes in (Room 13), and were recommended for prompt professional removal. A few, very small mold reservoirs were also confirmed on hallway window mullions (second floor, above Door 17) and in the lower sections of unit ventilator cabinets (Rooms 113, 114, 107). We requested debris (that did not appear moldy) to be removed from heating pipes in one basement classroom (Room 13) prior to testing. Normal room cleaning was maintained prior to testing. Better water intrusion management, increased cleaning in certain locations, and increased cleaning in heating and ventilating units has been recommended.



1.4 Reviews of City and District Plans: We completed initial reviews of the current Cleaning Plan, Moisture Control Plan, and IAQ Construction Control Plan, and audited the current Construction Containment. We offered suggestions for improvement in all the above, which were accepted, and recommended rigorous and full implementation of all the plans which we reviewed. The current plans are located in Appendix C.

1.5 Listing of Recommendations Contained within Report: Below is a listing of the titles of recommendations as they appear in the report (not in order of priority). The reader is encouraged to read each one for its entire content as it appears in the report.

Recommendation #1: Fully Implement the City of Biddeford Moisture Control Plan within the High School.

Recommendation #2: Continue to Provide Defined Ongoing Reporting Mechanism for Occupant Health Concerns Regarding Indoor Air Quality, Perceived Poor Housekeeping, or Moisture Intrusion.

Recommendation #3: Provide Ongoing HVAC Maintenance of Ventilation Equipment Including Cleaning.

Recommendation #4: Provide Ongoing Hard Surface Cleaning.

Recommendation #5: Restrict Potted Plants.

Recommendation #6: Fully Implement the City of Biddeford IAQ Construction Control Plan for Biddeford High School Renovation.

Recommendation #7: Rapidly Dry Out Areas that Continue to Get Wet During the Non-Heating Season.

Recommendation #8: Maintain Storage Areas Such That They Can Readily be Routinely Cleaned.

Recommendation #9: Continue the Use of Current Cleaning Protocols and Low Toxicity Cleaning Products.

Recommendation #10: Continue the Current Training Provided by the Distributor of the Cleaning Products.

2.0 CURRENT OBSERVATIONS, DISCUSSION, AND RECOMMENDATIONS

2.1 Building Historic Water Damage: As previously reported, the Biddeford High School building appears to have a long and ongoing history of moisture intrusion in multiple locations, especially related to certain window wall areas with West exposures, (See photo #7, Appendix A). TBS evaluated 20 rooms during and immediately after a wind driven rain event on April 28, 2011 confirming significant ongoing moisture intrusion related to window areas. It is expected that this intrusion can be prevented by completion of the ongoing renovation efforts. Moisture intrusion is a concern in occupied buildings because of the potential for creating mold reservoirs, by promoting active mold growth within or on porous materials, or debris that gets wet and remains wet for more than 48 hours. It is reasonable to assume that the ongoing renovations will eventually eliminate these historic water intrusion problems. Until the renovations are completed, water intrusion management to prevent mold growth remains a high priority in the short-term, especially during the non-heating season months when the outdoor air is humid and thus materials take much longer to dry out. Rigorous implementation of the City of Biddeford Moisture Control Plan, as submitted, is expected to correctly manage the moisture intrusion during the interim.

Recommendation #1: Fully Implement the City of Biddeford Moisture Control Plan within the High School.

The City of Biddeford Moisture Control Plan builds upon widely accepted US EPA guidelines regarding appropriate responses for water intrusion events in schools and commercial buildings. Full implementation of the plan is expected to both reduce the likelihood of mold growth within the high school and lead to its prompt and proper remediation if mold growth is located.

2.2 Historic and Ongoing Occupant Health Concerns: As previously reported, student and staff complaints indicate concerns for their health associated with general indoor air quality, effective cleaning, construction dust, and water intrusion management. The complaints cover pre-renovation and post-start of renovation timeframes. Health complaints include allergic reactions and historic exacerbation of various health symptoms; the primary being upper respiratory-related symptoms with occasional lower respiratory symptoms. TBS is currently not under contract to evaluate the medical accuracy of reported allergic reactions, nor has there been a review of occupant medical records. TBS utilized interviews, meetings with the school nurse, the historic reports, and our historic expertise to identify various rooms within the school for focused diagnostic evaluation. These rooms include those identified by occupants as concerns, and additional rooms selected by TBS based on proximity and identified building features.



The TBS evaluations did not find any extensive evidence of current mold exposures using semi-aggressive diagnostic mold testing procedures. (See Representative Photos, Photo #1, Appendix A).

It should be noted that although very unattractive in appearance, extensive sampling of stained ceiling tiles did not reveal mold growth on the tiles. (See Photos # 2 and #6, Appendix A) However, the following conditions and recommendations were identified:

1. Two small exposed mold reservoirs (on wet heating pipe insulation, Room 13, Photo # 3 and #4, Appendix A), were identified and noted for prompt remediation.
2. Dark staining below some hallway window mullions (above Door 17), was also noted for increased cleaning. (Photo #5, Appendix A)
3. In addition, we have recommended the following:
 - a. Increased cleaning in difficult to access lower sections of unit ventilators and air sealing between floors. (Photo #8, Appendix A)
 - b. Until renovations are completed, it is very important to continue to provide ventilation, normal effective cleaning, and proper construction containment. In some areas of the school that have no unit ventilators, the use of a varying degree of operable windows for ventilation is the only ventilation option.
 - c. Where unit ventilators are located and operational, the units should be properly operated and maintained.

Reporting Structure: Any ongoing medical concerns in the facility should be addressed through the procedures established to provide health care to the concerned individual. We understand the following to be the current directions that have been conveyed to the staff from the District:

1. Air Quality Concerns: If it is an air quality problem, they are to report to the school nurse who completes a report, administers proper treatment, or directs the staff to Work Well. The nurse then notifies the principal.
2. Dust/Dirt Accumulation or Poor Housekeeping: The staff is to complete a work order on School Dude, a computer based reporting system. The computer program is maintained by the Maintenance Supervisor (Joe Fairfield) and Facilities Manager (Phil Radding). Any problems relating to this topic are prioritized and addressed.



3. Water Infiltration: Water infiltration is reported through the School Dude program unless it is pouring into the building, then the staff person needs to contact the office and speak to the building administrators who in turn will call Phil Radding, Joe Fairfield, or the building custodial supervisor.

Recommendation #2: Continue to Provide Defined Ongoing Reporting Mechanism for Occupant Health Concerns Regarding Indoor Air Quality, Perceived Poor Housekeeping, or Moisture Intrusion.

The three statements above have been conveyed to us as the information currently conveyed to the staff of the school. In addition, we suggest that the District consider options for ongoing team relationships regarding Indoor Air Quality as included in US EPA's Tools for Schools Programs.

Recommendation #3: Provide Ongoing HVAC Maintenance of Ventilation Equipment Including Cleaning.

We understand that Honeywell currently performs ventilation system maintenance as a contract service. We have recommended expanding Honeywell's scope of work to include cleaning inside unit ventilator equipment to reduce debris accumulation in the air intake and lower regions of the unit. Keeping the units cleaner will reduce any likelihood of mold growth during very humid, rainy, and warm weather. Outside air should be delivered to all rooms when they are occupied either via unit ventilators, or operable windows and doors.

Recommendation #4: Provide Ongoing Hard Surface Cleaning.

Washable surfaces that get damp or wet should be cleaned on a frequent enough basis to keep visible staining at bay. This includes the bottom of window mullions where condensation occurs during cooler months.

Recommendation #5: Restrict Potted Plants.

Potted plants typically contribute to indoor levels of mold, due to the natural soils that they grow in. In a school with a history of water intrusion and occupant reported health concerns; the presence of potted plants should be discouraged.

2.3 Construction Containment Review: We have reviewed the current "IAQ Construction Control Plan" for the Biddeford High School and also audited the current major containment area of ongoing construction. Some suggestions were made for both improvement and clarity of the containment. The intent of our improvement comments have been incorporated into the plan and implemented by the contractor. The current documents are contained in Appendix C. The plan includes the use of the proven principles previously conveyed and recommended by TBS outlined in "Indoor Air Quality



Guidelines for Occupied Buildings Under Construction”¹ developed by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA). Rigorous full implementation of the plan would be expected to minimize exposures to future construction related emissions (including fumes, dust particles, and odors) by “containing” the materials in the construction area and preventing migration of the materials into the non-construction areas.

Recommendation #6: Fully Implement the City of Biddeford IAQ Construction Control Plan for Biddeford High School Renovation.

Rigorous implementation of the plan as currently reviewed would be expected to provide appropriate management of the construction process to minimize occupant exposures to construction emissions in non-construction areas. If occupants report exposures to dust or odors, or accumulation of dust or debris is observed in non-construction areas, the situation should be promptly investigated and corrective action taken as outlined in the plan as warranted. Plan for future auditing of containment by TBS at major construction phases.

2.4 TBS Room Evaluation Results: Based on previous and current interview results and meetings with the school nurse, we compiled an initial list of rooms to evaluate for the presence of possible mold reservoirs.

This list included rooms: 223, 218, 216, 215a, 215b, 213, 203, 116, 115, 114, 113, 107, 105, 14, 13, 9, 7, 6, 4 and two (2) girls locker rooms.

1. Diagnostic Airborne Mold Testing: We conducted standardized diagnostic airborne mold testing within all of these locations and also collected four (4) outdoor samples for comparison; two at the beginning and two at the end of the sampling period. A total of 44 airborne samplers (20 indoor locations and 1 outdoor location) were submitted to EM Labs for evaluation. After we make sure all windows in the room where closed, the Diagnostic Testing Air Sampling was done in the room “as found” condition, and repeated after operating a 20 inch window fan in the center of the room on a medium setting for 2 minutes. During the fan operation, settled dust or mold spores on walls, windows, shades and belongings would be expected to be disturbed in a manner similar to lots of occupant activity within the room. Having used this procedure in other buildings with both a history of water intrusion and a history of elevated mold levels, we are confident that this disturbed dust testing protocol is a reasonable approach for determining if there is airborne evidence of a potential for concern in any room. The airborne sample collection consisted of collecting a 5 minute spore trap

¹ The SMACNA document is available at http://www.smacna.org/bookstore/index.cfm?fuseaction=search_results&keyword=IAQ%20Guidelines%20for%20Occupied%20Buildings%20Under%20Construction%2C%202nd%20Edition
Biddeford High Schoolwatfinal 06-03-11
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sample at 15 L/min. flow. (See photo #1, Appendix A) We toured the rooms on April 25th prior to testing, and conducted the testing on April 28th. The district was instructed to conduct normal weekly cleaning activities as our goal was to conduct our diagnostic testing under normal “as found” room conditions for the time or year. We are not aware of any special cleaning activity being conducted in the rooms prior to our testing period, other than the accumulated debris we requested to be removed from the perimeter heating pipes in Room #13, which we would recommend be removed regardless of any air testing results.

Results: Based on the lab results obtained, the outdoor air mold spore levels were moderate, and the levels indoors were generally low. Based on the overall results, and our initial observation, in ten of the twenty rooms tested (Rooms 223, 216, 116, 115, 113, 107, 14, 13, 7, 4), we conducted a second round of visual observations to make sure we had not missed any suspect materials, and we looked in additional rooms below rooms with unit ventilators, inside the ceiling cavities. We expanded our observations to ceiling cavities below rooms we had tested which had unit ventilators, as during or initial observations, we determined that several unit ventilators had holes below them that would allow them to suck some air from the ceiling cavity below. (See photo #11, Appendix A) We carefully observed Room 4 in the basement as it yielded two spores from molds that may be an indicator of mold growth. Careful re-inspection of Room 4 revealed no obvious sources within the room; however, the two storage rooms attached to the room were in such a state that they could not be routinely cleaned. (See Photo #9, Appendix A) We observed one under sink storage area in Room #6 (located below Room #107) with visible signs of past mold growth. (See Photo #10, Appendix A) We have recommended corrective action for these types of storage areas.

2. Suspect Visual Tape Samples: While conducting the Diagnostic Airborne Sampling as noted above, we conducted a visual assessment of stains or other signs of possible mold activity in the rooms. A total of 39 tape lift samples were sent to EM Labs for microscopic analysis.

Results: Of the samples collected, based on lab results, only six (6) showed indication of mold growth. Two samples were from wet heating pipe insulation above the ceiling in Room 13, one from a window mullion (above entry Door 17, and two from inside unit ventilators in Rooms 114, 113, 107). The mold materials on the pipe insulation and mullions were recommended for prompt professional mitigation and we have recommended increased cleaning inside the unit ventilators.



Conclusions from Detailed Room Evaluations:

1. **Diagnostic Airborne Mold Spore Testing:** Results of our diagnostic semi-aggressive airborne testing, (conducted at the completion of the heating season) did not reveal elevated mold levels in any location, nor marginally elevated types of mold that would suggest a health concern for occupancy, or a large mold reservoirs of a particular species indoors.
2. **Tape Lift Samples:** Results of tape lift samples confirmed that ceiling water damage stains, although very unsightly, are not a current indicator of mold growth.
3. **Visual Observations:** Visual observations of suspect mold growth in three (3) damp or wet locations was confirmed with laboratory analysis, confirming that careful visual observations for wet, damp, or soiled areas could likely identify action items for cleaning or mold mitigation.

Based on the durable moisture resistant materials the school is constructed from (very little sheetrock), and the observation that our testing is being conducted at the end of the heating season (where hot water heat has been available for nine (9) months to dry materials that may get wet), the data suggests that at least in recent time periods there is not a high likelihood of potential for unusual mold exposures within the areas tested, that would be significantly different than exposures that would occur in the outdoors.

Given the above results it is reasonable to assume that keeping porous materials dried out and clean in the non-heating season (May through September) should yield similar results. This objective should be achievable by rigorous implementation of the City's Moisture Control Plan.

Recommendation #7: Rapidly Dry Out Areas that Continue to Get Wet During the Non-Heating Season.

Any porous areas of the facility that continues to get wet from wind driven rain after the heating system (turned off in May), needs to be carefully monitored and dried out within the first 24-48 hours in accordance with the City of Biddeford Moisture Control Plan. This may require use of air moving devices such as fans or blowers, or use of high capacity drying units to drop the local relative humidity to allow drying to occur. Any area that develops a musty smell needs to be carefully evaluated for the presence of mold reservoirs, and if currently present, contained and removed.

Recommendation #8: Maintain Storage Areas such that they can Readily be Routinely Cleaned.



The storage rooms located off Room 4 are maintained in a manner that prevents routine cleaning. In addition the rooms are at a basement level where dampness can accumulate. If the floors get damp, or if moisture rises from damp concrete below the tile, mold amplification may occur. Reorganization and initial cleaning by the staff responsible for the room is recommended. Once organized, routine cleaning by housekeeping staff of storage areas is recommended. This same principle applies to the storage area under the sink in Room #6 or other locations where materials are stored.

2.5 Effective Cleaning Review: We have reviewed information supplied by the District and the cleaning materials distributor. The current cleaning procedure used in daily cleaning at the high school is a team cleaning approach. We understand that the cleaning team includes a light duty specialist, vacuum specialist, bathroom specialist, and a hallway and stairwell specialist that also takes out trash (See Appendix C__ for descriptions). It is reported that the same cleaning takes place each day throughout the school. During our on-site visits the school appeared to be cleaned, with the exception of some of the storage areas we visited, and an under sink storage cabinet.

Cleaning supplies and training are provided by Clean O Rama. Chemical certification information is provided by Genesan Product Specialist, Steven E. Powers, and cleaning and safety training is provided by Kathryn Risotti of Clean O Rama.

Below is a listing, provided by the District, of the major chemicals in daily use and the quantities used. The MSDS sheets for the chemicals have been made available and are reported to be kept on file by the District. Current chemicals and amount used per year (Supplied by District and Distributor):

ENZYSAN 4050	32 Gal.	(dilute version of 2000 below)
DELTA ULTRA	48 Gal.	Not yet certified.
DELTA MILD	48 Gal.	Greenseal certified, www.greenseal.org
POLGREEN indoor	32 Gal.	Greenseal certified, www.greenseal.org
ENZYSAN 2000	6 Gal.	Ecologo certified, www.ecologo.org
LINPOL GREEN	6 Gal.	UK Ecolabel with Pollet, www.ecolabel.be

District reports that they will be trying out a product from Buckeye which is a Green Seal certified degreaser which is also fragrance free until the Delra Ultra is certified.

We understand that all chemicals are dispensed at vendor provided dilution stations to ensure proper mixing of the concentrated cleaners for staff use. The dilution stations are reported to be checked annually by Clean O Rama.



It is reported by the distributor that all but two of the chemical cleaners, meet either the Green Seal Certification Standards (USA) or Ecolabel Certification Standards (European Standard). Web site links for the chemicals are provided in the Appendix C. It is reported that in order to meet the green standards listed above, the cleaning chemicals must contain no Volatile Organic Compounds and use only minimal natural fragrances. The Germicide used for restroom disinfecting is not certified to meet either standard as it is a strong disinfectant typically used by hospitals to meet certain germ kill guidelines. Only staff trained in its proper use, are reported to utilize the disinfecting product. The district protocol for utilizing the Germicidal material is currently being revised to reflect the current training provided by Clean O Rama.

During our observations in rooms, we observed several cleaning products that are clearly not supplied by the district. See photo # 12, Appendix A. Use of non-certified products that are not approved by the district should be avoided.

Recommendation #9: Continue the Use of Current Cleaning Protocols and Low Toxicity Cleaning Products

Based on information provided, the current cleaning products are used by Harvard University and reported to be state of the art. The current cleaning protocol, as reported, appears to be effective at removing dirt from the school. Use on non-approved district cleaning products should be avoided.

Recommendation #10: Continue the Current Training Provided by the Distributor of the Cleaning Products The current training provided by the chemical distributor appears to be state of the art. We also recommend that the distributor review the proper functioning of the dilution equipment more frequently than annually to assure their correct operation.

2.6 Limitations of TBS Review: The data collection, analysis, conclusions, and recommendations contained within this report are based on a review of what are believed to be materials generally representative of the current building situation. We have made recommendations based on the information available to us at this time. Our current analysis is based on what is believed to be representative test data for the time of year and reported operation of the HVAC systems by others and information provided by District Personnel, and information gained in occupant interviews. We believe all of the test data to be accurate and representative of the specific conditions encountered within the facility during the various evaluation periods; however, it is impossible to know if it is a good representation of all of the various zones or areas within the facility.