

# **INDOOR AIR QUALITY ASSESSMENT MOLD INVESTIGATION**

**Golden Living Center at Oak Hill  
76 North Street  
Middleborough, Massachusetts**



Prepared by:  
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Bureau of Environmental Health  
Indoor Air Quality Program  
December 2011

## **Background/Introduction**

At the request of Nancy Hannah, South Regional Manager for Survey Operations, Massachusetts Department of Public Health (MDPH), Division of Health Care Quality, (DHCQ), the MDPH Bureau of Environmental Health (BEH) provided assistance and consultation at the Golden Living Center (GLC) at Oak Hill, located at 76 North Street, Middleborough, Massachusetts. Concerns related to mold growth and insect infestation in basement areas prompted the assessment. On November 18, 2011, a visit was made to this building by Cory Holmes, Environmental Analyst/Regional Inspector in BEH's Indoor Air Quality (IAQ) Program. Mr. Holmes was accompanied by DHCQ Surveyors Julie Nantais and Colleen Poyant.

The GLC was originally built as a one-story red brick building with basement/crawlspace in 1966. A single story addition on slab was built in 1981. The ground floor is made up of resident/patient rooms, common areas and clinical/office space. The basement contains an employee break room, a maintenance shop, a housekeeping storage area, the boiler room and access to crawlspace.

## **Methods**

BEH staff performed visual inspection of building materials for water damage and/or microbial growth and other conditions that may potentially impact indoor air quality.

## **Discussion**

### **Microbial/Moisture Concerns**

As mentioned previously, DHCQ staff requested the assistance of BEH's IAQ Program due to environmental conditions observed at the GLC. DHCQ staff reported what appeared to be

mold growth observed on concrete walls, building materials and stored items, primarily within basement areas of the GLC. At the time of the IAQ Program visit, basement walls had been reportedly cleaned and disinfected with a one in ten bleach/water solution and painted (Pictures 1 and 2). Water-damaged stored items (some with mold colonization) were observed in the housekeeping store room and maintenance shop (Pictures 3 through 5). Mold growth was also observed on fiberglass pipe insulation in the housekeeping store room (Pictures 6 and 7). All water-damaged materials should be removed and discarded. The pipe insulation should be replaced.

In order for building materials to support mold growth, a source of water exposure is necessary. Identification and elimination of the source of the water moistening building materials is necessary to control mold growth. The most likely sources of chronic moisture conditions in the basement are water infiltration and elevated relative humidity. Due to a high water table in the area and the contour of the land around the GLC (grounds and paved areas sloping toward the basement, Picture 8) the building foundation is subjected to chronic water impingement, resulting in moisture infiltration. Sump pumps are reportedly used as needed to remove standing water from the basement. The slope adjacent to the building has been covered with tarmac which directs rainwater away from the building foundation (Pictures 9 and 10). At the time of the IAQ inspection, the tarmac on the southwest side was damaged and in need of sealant between the tarmac and foundation (Picture 10). Without sealant, water can penetrate through the junction between the tarmac and the foundation.

It is likely that relative humidity levels in the basement are elevated and compounded by a lack of mechanical ventilation in occupied areas of the basement (i.e., break room and maintenance shop) as well as a lack of dehumidification. An additional source of moisture in the basement is the crawlspace. Breaches exist in several areas that share a common wall with the crawlspace, including utility holes (Pictures 11 through 13), an access hatch sealed with

cardboard (Picture 14) and the access door that did not shut properly (Picture 15). Each of these breaches may act as pathways for moisture, odors, mold spores and insects in the crawlspace to migrate into adjacent areas (Picture 16).

Several water-damaged ceiling tiles were observed in the basement and around the ceiling-mounted AC unit in the ground floor “men’s shop” (Picture 17). Water-damaged ceiling tiles can provide a source of mold. As water leaks are discovered they should be repaired and any impacted ceiling tiles should be replaced.

The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials (e.g., carpeting, gypsum wallboard) be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed.

Light could be seen penetrating beneath the boiler room door (Picture 18). This type of space can provide access for rodents and insects to enter the building. To penetrate the exterior of a building, rodents require a minimal breach of ¼ inch (MDFFA, 1996).

Window-mounted air conditioners (ACs) were observed in several areas. These units are normally equipped with filters, which should be cleaned or changed as per manufacturer’s instructions to avoid the build-up and re-aerosolization of dirt, dust and particulate matter. Filters in several of the units were in need of cleaning. In addition, the cooling fins were occluded with dust and debris (Picture 19), which can provide a mold growth media when moistened. Spaces were also noted around the ACs, which can allow for uncontrolled drafts, moisture and pest entry into the building.

## **Conclusions/Recommendations**

At the time of the assessment basement walls had been cleaned, painted and appeared to be free of visible mold growth. In addition, the majority of mold-contaminated stored items identified by HCQ staff had been discarded. Several **short-term** and **long-term** recommendations to address potential/future mold/moisture concerns at the GLC were given at the time of the assessment, and are reiterated below along with other recommendations to improve air quality. Some of the conditions observed can be remedied by actions of building occupants. Other remediation efforts will require alteration to the building structure and equipment. For these reasons, a two-phase approach is recommended for remediation.

### **Short-term Recommendations:**

1. Discard any remaining water-damaged/mold-colonized porous materials (e.g., cardboard, paper).
2. Remove/replace water-damaged/mold-colonized pipe insulation in the housekeeping store room.
3. Ensure leaks are repaired and remove/discard water-damaged/mold-colonized ceiling tiles throughout the building.
4. Seal all wall penetrations and breaches in common wall between the crawlspace and adjacent areas with an appropriate fire-rated sealant.
5. Seal all floor penetrations in patient rooms and common areas above crawlspace with fire-rated sealant. Ensure tightness by monitoring for light penetration and drafts.
6. Repair or replace crawlspace door. Ensure door fits flush with threshold. Seal doors on all sides with foam tape and/or weather-stripping. Ensure tightness of doors by monitoring for light penetration and drafts around doorframes.
7. Remove dead insects and clean/disinfect floors.

8. Ensure cardboard boxes and other porous items are not stored directly on concrete floors or against interior walls; allow approximately 2 to 4 inches for airflow.
9. Continue to use sump pumps as needed to remove standing water.
10. Monitor conditions in basement areas as needed to activate dehumidifiers to avoid elevated relative humidity (>70%) conditions that contribute to condensation and/or mold growth during humid, spring/summer months. Ensure dehumidifiers are cleaned and maintained as per the manufacturer's instructions to prevent standing water and mold growth.
11. Clean/change filters in AC units per the manufacturer's instructions or more frequently if needed. Clean and disinfect cooling coils with an appropriate antimicrobial. If ACs cannot be adequately cleaned/maintained consider replacing units.
12. Seal around ACs to prevent water penetration, drafts and pest entry. Ensure tightness by monitoring for light penetration and drafts.
13. For more information on mold consult "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001). This document can be downloaded from the US EPA website at:  
[http://www.epa.gov/iaq/molds/mold\\_remediation.html](http://www.epa.gov/iaq/molds/mold_remediation.html).
14. Refer to resource manuals and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. These materials are located on the MDPH's website at <http://mass.gov/dph/iaq>.

**Long-Term Recommendations:**

1. Contact an HVAC engineering firm to (a) determine best methods to provide mechanical ventilation to occupied basement areas (i.e., break room and maintenance shop) and (b) determine best methods to provide local exhaust ventilation to crawlspace.
2. Contact a landscaping specialist, town DPW and/or a hydro-geological firm to inspect/redesign drainage system around building to mitigate flooding/water infiltration.

## References

ACGIH. 1989. Guidelines for the Assessment of Bioaerosols in the Indoor Environment. American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

BOCA. 1993. The BOCA National Mechanical Code/1993. 8<sup>th</sup> ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL.

MDFA. 1996. Integrated Pest Management Kit for Building Managers. Massachusetts Department of Food and Agriculture, Pesticide Bureau, Boston, MA.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

US EPA. 2001. "Mold Remediation in Schools and Commercial Buildings". Office of Air and Radiation, Indoor Environments Division, Washington, DC. EPA 402-K-01-001. March 2001. Available at: [http://www.epa.gov/iaq/molds/mold\\_remediation.html](http://www.epa.gov/iaq/molds/mold_remediation.html)

**Picture 1**



**Cleaned and Painted Basement Break Room Walls**

**Picture 2**



**Cleaned and Painted Basement Break Room Walls**

**Picture 3**



**Water-Damaged/Mold Colonized Box in Maintenance Shop**

**Picture 4**



**Water-Damaged/Mold Colonized Materials in Housekeeping Store Room**

**Picture 5**



**Water-Damaged/Mold Colonized Materials in Housekeeping Store Room**

**Picture 6**



**Water-Damaged/Mold Colonized Pipe Insulation in Housekeeping Store Room**

**Picture 7**



**Water-Damaged/Mold Colonized Pipe Insulation in Housekeeping Store Room**

**Picture 8**



**Basement Wing, Where Water Accumulates (Arrows Indicate Water Flow)**

**Picture 9**



**Northeast Side Sloped Tarmac**

**Picture 10**



**Southwest Side Sloped Tarmac, Note Damage and Space between Tarmac and Foundation**

**Picture 11**



**Breach in Common Wall for Utility Pipes between Housekeeping Store Room and Crawlspace**

**Picture 12**



**Breaches in Common Wall for Utility Pipes between Housekeeping Store Room and Crawlspace**

**Picture 13**



**Breach in Concrete Crawlspace Wall, Note Towel Stuffed into Hole**

**Picture 14**



**Cardboard Sealing Crawlspace Access Hatch in Maintenance Shop**

**Picture 15**



**Ill-Fitting Door to Crawlspace, Note Duct Tape around Door**

**Picture 16**



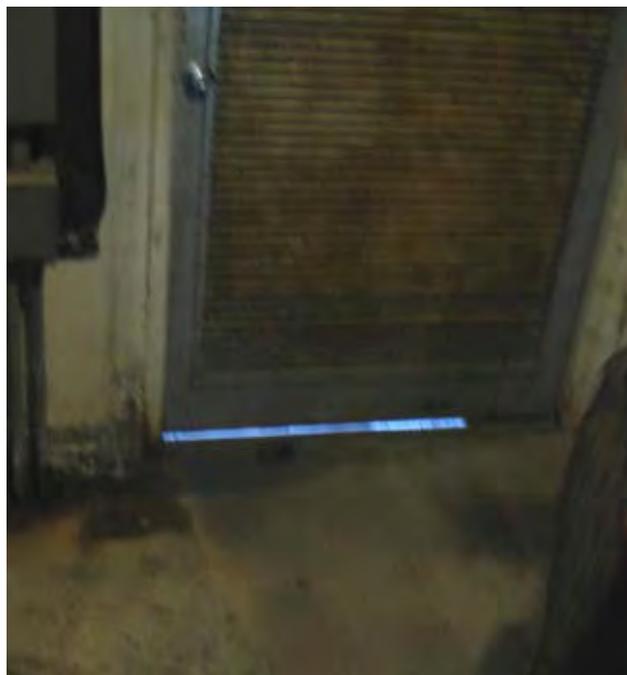
**Dead Insects (Dark Spots) on Floor of Maintenance Shop**

**Picture 17**



**Water-Damaged/Mold Colonized Ceiling Tiles around AC Unit in Men's Club**

**Picture 18**



**Light Penetrating under Boiler Room Exterior Door**

**Picture 19**



**Cooling Fins for Breakroom AC Occluded with Dust and Debris**