**INDOOR AIR QUALITY ASSESSMENT**

**Barnstable District Court**

**Route 6A**

**Barnstable, MA**

Barnstable District Court
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Barnstable, MA


Prepared by:

Massachusetts Department of Public Health

Bureau of Environmental Health

Indoor Air Quality Program

February 2017

# Background

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| --- | --- |
| Building: | Barnstable District Court (BDC) |
| Address: | Route 6A, Barnstable, MA |
| Assessment Requested by: | Christopher McQuade, Administrative Office of the Trial Court (AOTC) |
| Reason for Request: | Microbial growth and general indoor air quality (IAQ) concerns. |
| Date of Assessment: | January 27, 2017 |
| Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment: | Mike Feeney, Director, IAQ Program |
| Building Description: | One story cement courthouse. First floor and lower level/basement area consists of courtrooms, offices, waiting areas and a lockup. Building has a flat roof. |
| Building Population: | Approximately 87 employees at this location. The building is visited by several hundred members of the public daily. |
| Year of Construction: | 1971 |
| Windows: | Openable in most areas. |

# Methods

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

Note that this building was previously visited by the BEH/IAQ program in 1998 and 2003 and recommendations were made in those reports to improve IAQ (MDPH, 1998; MDPH, 2003). These reports are available on request.

# IAQ Testing Results

The following is a summary of indoor air testing results (Table 1).

* ***Carbon dioxide levels*** were below 800 parts per million (ppm) in all areas tested, indicating adequate fresh air supply.
* ***Temperature*** was within or close to the recommended range of 70°F to 78°F in areas tested.
* ***Relative humidity*** was below of the recommended range of 40% to 60% in all areas tested.
* ***Carbon monoxide*** levels were non-detectable in all indoor areas tested.
* ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 μg/m3 in all areas tested.

This sampling indicates that the ventilation system is providing adequate fresh air for the occupancy in the building.

## Ventilation

A heating, ventilating, and air conditioning (HVAC) system has several functions. First, it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants by not only introducing fresh air, but also filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals. The following analysis examines and identifies components of the HVAC system and likely sources of respiratory irritant/allergen exposure due to water damage, aerosolized dust, and/or chemicals found in the indoor environment.

Several different types of ventilation systems supply air to the building. Upper levels in both wings, as well as the lobby and some lower level offices have fresh air provided by unit ventilators (univents). Univents draw air from outdoors through a fresh air intake located on the exterior walls of the building and return air through an air intake located at the base of each unit. Fresh and return air are mixed and filtered, then heated or cooled before it is provided to rooms through an air diffuser located in the top of the unit. In order for univents to provide fresh air as designed, air diffusers and return vents must remain free of obstructions. Mechanical ventilation for lower level areas is provided by air handling units (AHUs) connected by ductwork.

## Bat Colonization/Waste Remediation

Concerns were raised concerning bat colonization of the BDC that was discovered in 2015. According to documents and court staff, bats had colonized the exterior wall in the general vicinity of Courtrooms 2 and 3 in the northeastern portion of the building (Map 1). Bats entered the wall through spaces in the pebble board fascia below the roof edge (Pictures 1 and 2), which filled the wall cavity with bat guano over time.

The exterior wall system was designed to prevent moisture penetration into the building through the use of a drainage plane within the wall system to redirect water outdoors and allow for building components to dry. An exterior wall system should have the following components in order to drain water (Figure 1):

* An exterior curtain wall forming the outer cladding of the building.
* Behind the curtain wall is an air space that allows for water to drain downward and allow for the exterior cladding system to dry.
* Holes at the base of the curtain wall that allow for water drainage (called weep holes).
* Opposite the exterior wall, across the air space, is a continuous, water-resistant material adhered to a wall (the backup wall) which forms the drainage plane. The purpose of the drainage plane is to prevent moisture that crosses the air space from penetrating into interior building systems and to direct that moisture downward to the weep holes. The drainage plane can consist of a number of water-resistant materials, such as tarpaper or in newer buildings, plastic wraps. The drainage plane should be continuous.
* Where breaks exist in the drainage plane (e.g., window systems, door systems, and univent fresh air intakes), the penetrations have materials added (e.g., copper flashing) to direct water to weep holes.

The drainage plane in a wall system is designed to keep water outside the building. This design would also contain bat guano inside the exterior wall system and prevent any bat-related wastes from entering the interior of the building.

The BDC has two separate wings (upper and lower) that are separated by a two story main lobby (Map 1). The design of the building separates the upper wing where the bat roost was located from the lower wing, which also includes the HVAC system. Based on this design, it would not be possible for bat guano from the upper wing to be transferred to the lower wing of the building via the ventilation system.

A number of guidelines/procedures exist for removal of bat guano. The University of Connecticut makes the following recommendations regarding removal and cleaning of bat guano from a building:

* Moisten the droppings with a light mist of water to keep dust and spores from becoming airborne.
* Put droppings into doubled plastic garbage bags, seal the bags, and place them in a dumpster for disposal as normal trash.
* Use a 10% bleach solution to disinfect the area after the droppings have been removed.
* Modify the structure to prevent birds or bats from re-establishing the roost. (UConn. unknown).

As reported by court officials, the exterior curtain wall was removed in order to remove accumulated bat guano from the drainage plane. A wire mesh system to prevent bats from reentering the space behind the pebble board fascia was installed around the entire perimeter of the building (Picture 2).

The Massachusetts Department of Labor Standards (MDLS) and Barnstable County Department of Health and Environment (BCDHE) both provided technical assistance to the Barnstable County Facilities Department regarding the bat remediation project. Documents regarding this project are included as Appendices A and B.

## Other Microbial/Moisture Concerns

BEH/IAQ staff examined the ceiling plenum above the juvenile court section of the BDC. No evidence of water damage/mold was observed on pipe insulation or ceiling tiles. Metal pipe hangers were found rusted, however insulation in contact with these hangers was free of water damage. This condition indicates that the corrosion on the hangers was a result of moisture exposure that predates the observations detailed in the MDPH IAQ assessment of the BDC in 2003. The lack of water damage to the insulation indicates that conditions detailed in the 2003 MDPH assessment were successfully remediated.

Plants were observed in a few areas (Table 1). Plants can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans to prevent water damage to porous materials. Plants should also be located away from air diffusers to prevent the aerosolization of dirt, pollen, and mold. Water coolers, fountains, and small refrigerators were found located on carpet, where they can moisten the carpet and lead to microbial growth.

# Conclusions/Recommendations

It is important to note the MDLS Technical Assistance Report concluded “there were no violations observed which require corrective action” (MDLS, 2015). DPH/IAQ staff concur with this finding. In addition, the Recommendations made by MDPH regarding remediation of pipe insulation and removal of carpet in the juvenile court area in previous assessment document were completed.

Based on observations at the time of this assessment, the following recommendations are made.

1. Continue to operate the ventilation system to provide adequate fresh air in the building.
2. Have the HVAC system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994).
3. Keep plants in good condition, avoid overwatering, and avoid placing them on porous items such as carpets or paper.
4. Refer to resource manual and other related IAQ documents located on the MDPH’s website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: <http://mass.gov/dph/iaq>.

# References

MDLS. 2015 Technical Assistance Report DLS File W-16S-007, July 30, 2015. Massachusetts Department of Labor Standards, Taunton Career Center Building, 72 School Street, Taunton, MA.

MDPH. 1993. Massachusetts Department of Public Health. Indoor Air Quality Assessment, Barnstable First District Court. 1993.

MDPH. 2003. Massachusetts Department of Public Health. Indoor Air Quality Reassessment, Barnstable First District Court. 2003.

MDPH. 2015. Massachusetts Department of Public Health. Indoor Air Quality Manual: Chapters I-III. Available at: <http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/>.

SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors’ National Association, Inc., Chantilly, VA.

UConn. Unknown. Removal and Cleanup of Bird and Bat droppings. University of Connecticut, Storrs, CT. <http://ehs.uconn.edu/Biological/Removal%20and%20cleanup%20of%20bird%20and%20bat%20droppings.pdf>

**Map 1**

**Location of Bat Guano**

Map 1 - Location of Bat Guano (arrow pointing to courtroom 2, bat guano tremoval area)


Bat Guano Removal

**Picture 1**

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**Pebble board fascia at roof edge (arrow)**

**Picture 2**

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**Space between fascia and exterior wall, (Note: wire mesh installed to prevent bat ingress into wall**

| Location | **Carbon**  **Dioxide**  **(ppm)** | **Carbon Monoxide**  **(ppm)** | **Temp**  **(°F)** | **Relative**  **Humidity**  **(%)** | **PM2.5**  **(µg/m3)** | **Occupants**  **in Room** | **Windows**  **Openable** | **Ventilation** | | **Remarks** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Supply** | **Exhaust** |
| Background (Outdoors) | 396 | ND | 44 | 46 | 18 |  |  |  |  |  |
| D2 | 775 | ND | 72 | 22 | 5 | 4 | Y | Y | Y |  |
| D3-10 | 712 | ND | 73 | 22 | 2 | 10 | Y | Y | N | Plants |
| DE-13A | 653 | ND | 74 | 23 | 2 | 0 | N | Y | N |  |
| D3-13C | 700 | ND | 74 | 23 | 2 | 0 | N | Y | N |  |
| D3-13B | 641 | ND | 73 | 19 | 3 | 0 | N | Y | N | Plants |
| D3-13D | 625 | ND | 73 | 20 | 3 | 0 | N | Y | N |  |
| D13-15 | 741 | ND | 74 | 23 | 3 | 0 | N | Y | N | Plants |
| D3-16 | 579 | ND | 74 | 19 | 3 | 0 | Y | Y | Y |  |
| Session 1 | 683 | ND | 73 | 21 | 4 | 50+ | N | Y | Y |  |
| Library | 533 | ND | 73 | 21 | 3 | 5 | N | Y | Y |  |
| Library Storeroom | 487 | ND | 73 | 20 | 3 | 0 | N | Y | Y |  |
| D2-5 | 605 | ND | 73 | 23 | 10 | 3 | N | Y | Y | Old carpet |
| D2-5D | 642 | ND | 72 | 24 | 3 | 0 | N | N | Y |  |
| D2-5F | 640 | ND | 73 | 24 | 3 | 0 | N | Y | Y |  |
| D2-A | 659 | ND | 73 | 24 | 3 | 0 | N | Y | Y |  |
| V1 | 556 | ND | 71 | 25 | 3 | 0 | N | Y | Y |  |
| D1-19 | 629 | ND | 72 | 24 | 4 | 0 | N | Y | Y |  |
| D-18 | 641 | ND | 73 | 23 | 3 | 0 | N | Y | Y | Plants |
| Juvenile session | 525 | ND | 73 | 22 | 4 | 0 | Y | Y | Y |  |
| D-17 | 543 | ND | 73 | 20 | 4 | 0 | Y | Y | N |  |
| D1-18F | 562 | ND | 73 | 19 | 4 | 1 | Y | Y | Y |  |
| D1-8G | 566 | ND | 73 | 21 | 4 | 0 | N | Y | Y |  |
| D1-18H | 613 | ND | 73 | 22 | 4 | 0 | N | Y | Y |  |
| D1-18I | 630 | ND | 74 | 23 | 4 | 1 | N | Y | Y |  |
| D1-18J | 670 | ND | 74 | 23 | 4 | 1 | N | Y | Y |  |
| D1-19D | 698 | ND | 74 | 22 | 5 | 1 | N | Y | Y | Photocopier |
| D1-7 | 700 | ND | 74 | 23 | 3 | 1 | N | Y | N |  |
| D1-4 | 598 | ND | 73 | 22 | 6 | 0 | N | Y | N |  |
| D1-19B | 668 | ND | 72 | 24 | 4 | 0 | N | Y | N |  |
| D1-9A | 701 | ND | 73 | 24 | 4 | 0 | N | Y | Y |  |
| AA-4 | 670 | ND | 72 | 24 | 5 | 1 | N | Y | N |  |
| PRI-1 | 647 | ND | 72 | 24 | 4 | 0 | N | N | Y |  |
| V2 | 582 | ND | 66 | 28 | 4 | 0 | N | N | N |  |
| D1-15 | 645 | ND | 69 | 28 | 2 | 0 | N | Y | Y |  |
| D4-2 | 768 | ND | 72 | 24 | ND | 4 | Y | Y | Y |  |
| D4-2K | 680 | ND | 72 | 23 | ND | 1 | Y | Y | N |  |
| D4-2N | 619 | ND | 72 | 22 | 1 | 0 | Y | N | Y |  |
| D4-2J | 731 | ND | 72 | 24 | ND | 1 | N | N | N |  |
| D4-2I | 641 | ND | 72 | 21 | ND | 0 | N | N | N |  |
| D4-2H | 577 | ND | 72 | 20 | ND | 0 | N | N | N | Plants |
| D4-2G | 517 | ND | 71 | 21 | ND | 0 | N | Y | N |  |
| D4-2F | 490 | ND | 72 | 19 | ND | 0 | N | Y | N |  |
| D4-2E | 532 | ND | 72 | 20 | 1 | 0 | N | Y | N |  |
| D4-2D | 619 | ND | 72 | 23 | ND | 0 | N | N | N |  |
| D4-2C | 619 | ND | 72 | 23 | ND | 0 | N | Y | N |  |
| D4-2B | 621 | ND | 72 | 23 | ND | 0 | N | Y | N |  |
| D4-2A | 726 | ND | 73 | 21 | 1 | 0 | N | Y | N |  |
| 415 | 730 | ND | 73 | 24 | 1 | 1 | N | Y | N |  |
| D4-11 | 750 | ND | 73 | 22 | 2 | 0 | N | Y | Y |  |
| Session 3 | 742 | ND | 74 | 23 | 1 | 1 | N | Y | Y |  |
| D4-5A | 786 | ND | 74 | 24 | 1 | 3 | N | Y | Y |  |
| Session 2 | 741 | ND | 74 | 23 | 1 | 7 | N | Y | Y |  |
| D4-1 | 716 | ND | 73 | 21 | 1 | 1 | N | Y | N |  |
| Main lobby | 683 | ND | 72 | 20 | 2 | 20+ | N | N | N |  |