**INDOOR AIR QUALITY ASSESSMENT**

**Department of Mental Health**

**Cain Building**

**Taunton State Hospital Campus**

**Taunton, Massachusetts**



Prepared by:

Massachusetts Department of Public Health

Bureau of Environmental Health

Indoor Air Quality Program

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# Executive Summary:

Elevated relative humidity conditions, resulting from the inadequacy of the mechanical ventilation system to dehumidify outside air, are contributing to condensation/mold growth and comfort concerns experienced in the building. Dehumidification is necessary to improve occupant and building health, as well as extend the life of building components.

# Background

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| --- | --- |
| Building: | Cain Building Department of Mental Health (DMH) |
| Address: | Taunton State Hospital Campus |
| Assessment Requested by: | Deborah Coleman, Facilities DirectorExecutive Office of Health and Human Services (EOHHS) |
| Reason for Request: | General indoor air quality (IAQ) assessment |
| Date of Assessment: | September 8, 2016 |
| Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment: | Cory Holmes and Sharon Lee, Environmental Analysts/Inspectors |
| Date of Building Construction:  | 1930s |
| Building Description: | The Cain Building is a four-story, red brick building with basement. Renovations including the installation of heating, air conditioning, and ventilation (HVAC) components were conducted in the 1990s. |
| Building Population: | Approximately 100 employees work in the building 24/7 in three shifts. The DMH also leases space to private mental health vendors. |
| Windows: | Many areas do not have openable windows. |

# Methods

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

# Results and Discussion

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

* ***Carbon dioxide*** measurements were below the MDPH recommended level of 800 parts per million (ppm) in all but one area surveyed.
* ***Temperature*** was within or very close to the MDPH recommended range of 70°F to 78°F in all areas at the time of assessment.
* ***Relative humidity*** ***(RH)*** was above the MDPH recommended range of 40 to 60% in all areas tested. In some cases, indoor RH exceeded 80%.
* ***Carbon monoxide*** levels were non-detectable in all areas tested.
* ***Particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality (NAAQS) level of 35 μg/m3 in all areas tested.

These test results, primarily RH levels, indicate that the system is grossly inadequate/unable to remove moisture from the air.

## 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. The act of cooling/providing AC is two-fold; the system chills the air via cooling coils while also typically removing moisture from the air. As seen from the testing results, *RH levels were significantly above the recommended guidelines building-wide*, indicating that the system in place *lacks the ability to dehumidify air* supplied to the building.

Moisture removal is important since the sensation of heat conditions increases as RH increases (the relationship between temperature and RH is called the *heat index*). As indoor temperatures rise, the addition of more RH will make occupants feel hotter. If moisture is removed, the comfort of the individuals is improved.

While temperature is mainly a comfort issue, RH in excess of 70 percent for extended periods of time can provide an environment for mold and fungal growth (ASHRAE, 1989). As discussed further in the **Microbial/Moisture Concern** portion of the report, visual evidence and staff reports indicate elevated indoor RH levels at the Cain Building have resulted in condensation formation on the surface of metal supply/return vents and poorly insulated HVAC/plumbing components throughout the building. Condensation moistening dust/debris collected on diffuser surfaces can become a source of mold growth.

It should be noted that BEH/IAQ staff observed open windows at the time of the assessment. During periods of high RH (late spring/summer months), windows and exterior doors should be closed to keep moist, unconditioned air out of the building when the HVAC system is in cooling mode.

The HVAC system consists of four main air-handling units (AHUs), two in the attic/two in the basement (Pictures 1 and 2), and over 40 fan coil units (FCUs) located throughout the building (Picture 3). AHUs draw outside air into the building (Pictures 4 and 5). One of the AHU draws air from a subterranean pit into which a condensation pipe was emptying water (Picture 6). Air drawn directly from moist environments makes humidity control increasingly difficult. The FCUs circulate and distribute air to occupied spaces via ducted ceiling vents (Picture 7). Return air is vented through ceiling or wall-mounted vents back to AHUs. Differentiating between supply and return vents was difficult, since both types were fitted with the same vent coverings (e.g., Picture 7). Several areas had weak airflow via both supply and return vents (Table 1).

The AHU/FCUs were reportedly installed in the 1990s, which makes them over 20 years old. Efficient function of equipment of this age is difficult to maintain, since compatible replacement parts are often unavailable. According to the American Society of Heating, Refrigeration, and Air-Conditioning Engineering (ASHRAE), the service life[[1]](#footnote-1) for a unit heater, hot water or steam is 20 years, assuming routine maintenance of the equipment (ASHRAE, 1991). Despite attempts to maintain the equipment, the optimal operational lifespan of this equipment has been exceeded. Due to the inefficacy of the system, additional window AC units are in a number of areas to supplement cooling.

## Microbial/Moisture Concerns

As mentioned, reducing indoor humidity is important, since molds can grow when indoor RH levels exceed 70% for longer than 24 hours. Symptoms commonly associated with molds include allergic reactions and respiratory irritation. Some people with chronic respiratory conditions, such as asthma, are more likely to experience health symptoms. Controlling moisture is the key to preventing mold growth and potential health symptoms.

In order for building materials to support mold growth, a source of water is necessary. The main source of water in the building is uncontrolled moisture brought in from the outside by the HVAC system. This moisture is leading to wide-spread condensation issues on cool, uninsulated metal surfaces and pipes throughout the building. In numerous areas, dust/debris has built up on vents, which can grow mold if wet repeatedly (Pictures 7 through 9). Compounding this issue is the security grills installed over vents (Picture 10), which prevents easy access for cleaning. Screws of the security grills are painted over in many areas indicating that the fresh air diffusers have not been recently cleaned. Some areas have a different type of vent cover installed (Picture 11), which appear easier to clean and maintain.

Water-damaged and missing ceiling tiles were observed in a number of areas, which can indicate current or historic roof leaks, plumbing leaks, and/or condensation from HVAC components (Table 1). Active leaks were also reported in some areas (Picture 12). If repeatedly moistened, water-damaged ceiling tiles can provide a source of mold. These tiles should be replaced after a water leak is discovered and repaired.

Visible mold was observed in the 4th floor west women’s shower area along the floor, which appeared in need of re-caulking (Picture 13). Although this room was equipped with a local exhaust vent to remove excess moisture, there was no passive vent installed in the door (nor undercut) to allow for transfer air.

Plants were observed in a number of 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 and should be located away from air diffusers to prevent aerosolization of dirt, pollen, and mold.

## Other Conditions

Other conditions that can affect IAQ were observed during the assessment. Some areas have area carpets. The Institute of Inspection, Cleaning, and Restoration Certification (IICRC) recommends that carpeting be cleaned annually (or semi-annually in soiled high traffic areas) (IICRC, 2012). Regular cleaning with a high efficiency particulate air (HEPA) filtered vacuum in combination with an annual cleaning will help to reduce accumulation and potential aerosolization of materials from carpeting.

In several areas, items were observed on the floor, windowsills, tabletops, counters, bookcases, and desks. The large number stored items provide a source for dusts to accumulate. These items (e.g., papers, folders, boxes) make it difficult for custodial staff to clean. Once aerosolized, they can act as irritants to eyes and the respiratory system. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up.

A supply vent in one area was sealed with cardstock and tape (Picture 14). Blocked supply vents can reduce fresh air supply to the office. As discussed previously, decreases in fresh air can reduce dilution of normally occurring pollutants, which can contribute to headaches.

A space heater was observed operating in an unoccupied office (Picture 15). Space heaters are a fire hazard, particularly when operating unattended.

Items were observed hanging from the ceiling tile system (Picture 16). The weight of hanging items can damage or create gaps in the ceiling tile system, which may result in dust/debris falling from the ceiling plenum.

Air deodorizing and fragrant products were observed in a number of office spaces. Air deodorizers contain chemicals that can be irritating to the eyes, nose, and throat of sensitive individuals. Many air fresheners contain 1,4-dichlorobenzene, a VOC which may cause reductions in lung function (NIH, 2006). Deodorizing agents do not remove materials causing odors, but rather mask odors that may be present in the area. Typically, an adequate HVAC system serves to dilute and remove odors.

# Conclusions and Recommendations

The conditions noted at the Cain Building raise a number of IAQ concerns. The general building design and inadequacy of HVAC equipment (AHUs and FCUs), particularly to dehumidify air, present conditions that could affect IAQ. These factors can be associated with a range of IAQ related health and comfort complaints. Some remediation efforts will alteration to the building structure and equipment. For these reasons a two-phase approach is recommended, which consists of **short-term** measures to improve air quality and **long-term** measures that would likely need planning and resources to adequately address overall IAQ concerns.

## Short-Term Recommendations:

In view of the findings at the time of the visit, the following recommendations are made:

1. Continue with plans to have ductwork cleaned. This should be carefully planned in stages for both thermal comfort and work disruption reasons. In addition, the system should be thoroughly “blown out” and all areas should be thoroughly cleaned (using a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces) to prevent exposure to airborne dust/debris prior to reoccupancy.
2. Clean and disinfect supply/return vents and surrounding ceiling tiles throughout the building. If they cannot be adequately cleaned, resurface/paint or replace. Due to the scope of this project building-wide, it may be beneficial to contract out to a professional cleaning/restoration firm.
3. Do not drain condensate from AHU/FCUs into air intake pits.
4. Ensure vents/louvers are open/adjusted to allow airflow in areas where weak airflow was detected (e.g., end of duct line/rooms 302, 304).
5. Ensure windows are closed during times at which the air-conditioning system is operating in the cooling mode.
6. Install passive vents in shower room doors (e.g., 4th floor west) or undercut doors to allow transfer air/facilitate exhaust.
7. Consider adopting a balancing schedule of every 5 years for all mechanical ventilation systems, as recommended by ventilation industrial standards (SMACNA, 1994).
8. For buildings in New England, periods of low RH during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the RH is low. To control for dusts, a HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritation).
9. Clean/disinfect visible mold in 4th floor west women’s shower area. Re-caulk wall/floor tiles as needed.
10. Ensure that procedures are in place for occupants to report leaks, wet tiles, and other maintenance conditions so that they can be logged and dried/repaired promptly.
11. Ensure building envelope/exterior and plumbing leaks are repaired and replace any remaining water-damaged ceiling tiles. Examine the area above these tiles for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial, as needed.
12. Clean personal fans periodically of accumulated dust.
13. Clean carpeting annually or semi-annually in soiled high traffic areas as per the recommendations of the Institute of Inspection, Cleaning and Restoration Certification (IICRC, 2012).
14. Consider reducing the amount of stored materials to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.
15. Remove items hanging from the ceiling tile system.
16. Ensure space heaters are turned off when room is unoccupied, even for short periods of time.
17. Discontinue the use of air deodorizing products.
18. Refer to resource manual and other related indoor air quality documents located on the MDPH’s website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at [http://www.mass.gov/dph/iaq/](http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/).

## Long-Term Recommendations:

1. Work with an HVAC engineering firm to evaluate the system for repair/replacement of the system in a manner that regulates/dehumidifies outside air. This may include methods such as building pressurization, longer cooling coil time/re-heating, latent heat/energy recover, and/or desiccant system.
2. Consider replacing supply diffusers/return vents with those shown in Picture 11 to improve regular cleaning.

# REFERENCES

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). 1989. Ventilation for Acceptable Indoor Air Quality. ANSI/ASHRAE 62-1989.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). 1991. ASHRAE Applications Handbook, Chapter 33 “Owning and Operating Costs”. American Society of Heating, Refrigeration and Air Conditioning Engineers, Atlanta, GA.

Institute of Inspection, Cleaning and Restoration Certification (IICRC). 2012. Carpet Cleaning: FAQ. Retrieved from <http://www.iicrc.org/consumers/care/carpet-cleaning/>.

Massachusetts Department of Public Health (MDPH). 2015. 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/>.

National Institute of Health (NIH). 2006. Chemical in Many Air Fresheners May Reduce Lung Function. NIH News. National Institute of Health. July 27, 2006. <https://www.nih.gov/news-events/news-releases/chemical-many-air-fresheners-may-reduce-lung-function>

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

**Picture 1**

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**Air handling unit (AHU) in the basement**

**Picture 2**

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**AHU in Attic**

**Picture 3**

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**Fan coil unit**

**Picture 4**

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**Ground level fresh air intakes**

**Picture 5**

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**Attic level fresh air intake**

**Picture 6**

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**Subterranean air intake pits, note draining condensation pipe**

**Picture 7**

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**Supply diffuser, note discoloration on louvers from chronic moisture**

**Picture 8**

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**Soiled vent, likely mold/discoloration from chronic moisture**

**Picture 9**

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**Rust/corrosion on metal supply louver due to chronic moisture**

**Picture 10**

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**Security grill installed over vent, making access/cleaning difficult**

**Picture 11**



**Metal mesh installed over supply and exhaust vents**

**Picture 12**



**Ceiling tile drainage inset used to divert leak**

**Picture 13**

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**Visible mold (dark staining) along shower floor/wall**

**Picture 14**



**Supply vent sealed with cardstock and tape**

**Picture 15**



**Standalone electric heating unit**

**Picture 16**



**Structure hanging from ceiling tile system**

| Location | CarbonDioxide(ppm) | Carbon Monoxide(ppm) | Temp(°F) | RelativeHumidity(%) | PM2.5(µg/m3) | Occupantsin Room | WindowsOpenable | Ventilation | Remarks |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Supply | Exhaust |
| Background | 372 | ND | 78 | 82 | 18 |  |  |  |  | Hot, Humid, overcast |
| **4th Floor West** |  |  |  |  |  |  |  |  |  |  |
| 404 | 621 | ND | 73 | 85 | 6 | 1 | N | Y | Y |  |
| 412 | 586 | ND | 74 | 78 | 5 | 1 | N | Y | Y | PF-dusty, D/D CT |
| 413 | 605 | ND | 73 | 77 | 5 | 1 | N | Y | Y | PF |
| 451 | 546 | ND | 72 | 78 | 5 | 1 | N | Y | Y | D/D vents |
| 460 | 558 | ND | 73 | 82 | 6 | 0 | N | Y | Y |  |
| 461 | 588 | ND | 73 | 82 | 8 | 2 | N | Y | Y |  |
| Womens Restroom |  |  |  |  |  |  | N | Y | Y |  |
| Shower |  |  |  |  |  |  | N | N | Y | Recommend passive door vent or undercut door |
| Nurses Station | 581 | ND | 73 | 77 | 6 | 4 | N | Y | Y |  |
| Chart Room | 567 | ND | 73 | 77 | 6 | 2 | N | Y | Y | WAC, 1 WD CT  |
| TV Room | 546 | ND | 73 | 79 | 8 | 5 | N | Y | Y |  |
| Med Room | 556 | ND | 71 | 82 | 6 | 0 | N | Y | Y | WAC |
| Dining Room | 535 | ND | 72 | 85 | 5 | 4 | N | Y | Y | D/D CTs |
| **4th Floor East** |  |  |  |  |  |  |  |  |  | WD CT in Patient room hallway below drip pan |
| Med Room | 600 | ND | 76 | 76 | 9 | 0 | Y | Y | Y | DO, water cooler, refrigerator, WAC |
| Chart Room | 400 | ND | 75 | 66 | 10 | 1 | Y | Y | Y | WAC, DO, food storage, DEM |
| Nurses Station | 530 | ND | 75 | 75 | 11 | 3 | N | Y | Y |  |
| TV Room | 500 | ND | 75 | 77 | 10 | 4 | Y | Y | Y | Missing floor tile, water cooler, D/D vent |
| Staff Bath |  |  | 73 | 80 | 9 |  |  |  |  |  |
| Shower C434 |  |  | 74 | 85 | 10 |  |  |  |  |  |
| 428 | 518 | ND | 73 | 80 | 8 | 0 | Y | Y | Y | PF, DO |
| 427 | 582 | ND | 73 | 80 | 20 | 2 | Y | Y | Y | PF, strong deodorant material odor |
| 425 | 556 | ND | 73 | 87 | 7 | 0 | Y | Y | Y |  |
| 421 | 578 | ND | 73 | 82 | 7 | 0 | Y | Y | Y |  |
| 420 | 516 | ND | 73 | 83 | 8 | 0 | Y | Y | Y |  |
| Soil Work Room | 514 | ND | 73 | 83 | 8 | 0 | Y | Y | Y | Damaged CT |
| Laundry Room |  | ND |  |  |  |  |  |  |  |  |
| 442 Office | 614 | ND | 75 | 80 | 7 | 0 | Y | Y | Y | Fridge, PF, D/D vent |
| 416 | 503 | ND | 75 | 74 | 6 | 0 | Y | Y | Y | Fridge, PF, food storage |
| 441 Staff Room | 635 | ND | 75 | 79 | 12 | 1 | Y | Y | Y | Cooler |
| **3rd Floor West** |  |  |  |  |  |  |  |  |  |  |
| 302 | 715 | ND | 74 | 78 | 5 | 1 | N | Y | Y | Heat complaints, weak airflow from vents |
| 304 | 644 | ND | 73 | 83 | 6 | 0 | N | Y | Y | Weak airflow from vents |
| 307 | 601 | ND | 73 | 78 | 5 | 0 | N | Y | Y |  |
| 312 | 630 | ND | 74 | 77 | 9 | 0 | N | Y | Y |  |
| 313 | 612 | ND | 76 | 73 | 5 | 0 | N | Y | Y | D/D vents |
| Nurses Station | 548 | ND | 74 | 79 | 5 | 2 | N | Y | Y | D/D vents |
| Med Room | 568 | ND | 74 | 80 | 7 | 1 | N | y | Y | WAC |
| Chart Room | 591 | ND | 73 | 73 | 7 | 2 | N | Y | Y | WAC |
| TV Room | 449 | ND | 74 | 85 | 7 | 2 | N | Y | Y | D/D vents/CT |
| **3rd Floor East** |  |  |  |  |  |  |  |  |  | WD CT in Patient room hallway below drip pan |
| Chart Room | 688 | ND | 74 | 69 | 8 | 2 | Y | Y | Y | WAC, photocopier, shredder |
| Med Room | 615 | ND | 73 | 61 | 4 | 0 | N | Y | N | WD T, WAC |
| TV Room | 564 | ND | 74 | 76 | 12 | 6 | Y | Y | Y | Water cooler, D/D CT |
| Bathroom 336A  |  |  | 73 | 77 | 12 |  |  | N | Y |  |
| Shower 334A |  |  | 73 | 76 | 21 |  |  | N | Y |  |
| 328 | 612 | ND | 73 | 75 | 7 | 0 |  | Y | Y | DO |
| 327B | 571 | ND | 73 | 74 | 8 | 0 | Y | Y | Y |  |
| 327A | 555 | ND | 72 | 74 | 7 | 0 | Y | Y | Y | DO |
| 325 | 560 | ND | 72 | 75 | 7 | 0 | Y | Y | Y |  |
| 324 | 574 | ND | 73 | 75 | 7 | 0 | Y | Y | Y | DO |
| 321 | 578 | ND | 72 | 75 | 8 | 0 | Y | Y | Y |  |
| 318 | 522 | ND | 71 | 76 | 8 | 0 | Y | Y | Y |  |
| 316 | 906 | ND | 73 | 83 | 8 | 0 | Y | Y | Y |  |
| 343 | 620 | ND | 74 | 76 | 8 | 0 | Y | Y | Y |  |
| 341 | 604 | ND | 75 | 73 | 16 | 0 | YOpen | Y | Y |  |
| **2nd Floor West** |  |  |  |  |  |  |  |  |  |  |
| 201 | 436 | ND | 74 | 83 | 6 | 0 | N | Y | Y |  |
| 204 | 477 | ND | 72 | 78 | 6 | 0 | N | Y | Y | D/D vents |
| 207 | 527 | ND | 72 | 78 | 5 | 0 | N | Y | Y |  |
| 212 | 529 | ND | 76 | 77 | 4 | 0 | N | Y | Y |  |
| 213 | 588 | ND | 76 | 78 | 5 | 0 | N | Y | Y |  |
| 244 | 576 | ND | 75 | 86 | 8 | 5 | N | Y | Y |  |
| 245 | 550 | ND | 72 | 80 | 13 | 1 | N | Y | Y |  |
| Nurses Station | 506 | ND | 73 | 70 | 4 | 4 | N | Y | Y |  |
| Chart Room | 540 | ND | 73 | 70 | 4 | 0 | N | Y | Y | D/D vents |
| Staff Lounge | 560 | ND | 72 | 72 | 4 | 0 | N | Y | Y |  |
| TV Room | 429 | ND | 71 | 74 | 6 | 0 | N | Y | Y |  |
| **2nd Floor East** |  |  |  |  |  |  |  |  |  | 2 MT in office hallway |
| Med Room | 609 | ND | 75 | 77 | 7 | 0 | N | Y | N | WAC off, PF |
| Chart Room | 500 | ND | 76 | 75 | 4 | 2 | Y | Y | Y | PF, WAC |
| TV Room | 386 | ND | 73 | 74 | 9 | 0 | Y | Y | Y | D/D CT |
| C236 Bath |  |  | 73 | 80 | 9 |  | N | N | Y |  |
| Visiting Room | 524 | ND | 71 | 80 | 12 | 0 | Y | Y | Y |  |
| C234 Shower |  |  | 73 | 84 | 11 |  | N | N | Y |  |
| 228 | 476 | ND | 73 | 84 | 16 | 0 | Y | Y | Y | AD |
| 227 | 547 | ND | 74 | 84 | 18 | 0 | Y | Y | Y |  |
| 226 | 431 | ND | 74 | 85 | 9 | 0 | Y | Y | Y |  |
| 225 | 427 | ND | 74 | 84 | 8 | 0 | Y | Y | Y |  |
| 224 | 444 | ND | 74 | 79 | 6 | 0 | Y | Y | Y |  |
| 222 | 621 | ND | 73 | 77 | 5 | 0 | Y | Y | Y |  |
| 220 | 438 | ND | 72 | 77 | 5 | 0 | Y | Y | Y |  |
| 218 | 452 | ND | 72 | 79 | 7 | 0 | Y | Y | Y |  |
| 216 | 500 | ND | 73 | 83 | 5 | 0 | Y | Y | Y | PF, plants |
| 243 | 531 | ND | 74 | 82 | 8 | 0 | Y | Y | Y | 1 WD CT |
| 242 | 444 | ND | 74 | 80 | 8 | 0 | Y | Y | Y | PF |
| 241 | 454 | ND | 75 | 79 | 11 | 0 | Y | Y | Y |  |
| **1st Floor West** |  |  |  |  |  |  |  |  |  |  |
| 104 | 457 | ND | 74 | 82 | 5 | 0 | N | Y | Y | D/D vents, PF |
| 106 | 445 | ND | 74 | 81 | 5 | 0 | N | Y | Y | D/D vents |
| 111 | 565 | ND | 75 | 75 | 4 | 0 | N | Y | Y |  |
| 132 | 487 | ND | 75 | 78 | 6 | 0 | N | Y | Y |  |
| 143 | 424 | ND | 75 | 75 | 7 | 0 | N | Y | Y | D/D vents |
| 149 | 451 | ND | 75 | 83 | 5 | 0 | N | Y | Y | Little airflow, D/D vents |
| Office 1 | 458 | ND | 74 | 75 | 7 | 0 | N | Y | Y | D/D vents |
| Reception Area | 488 | ND | 74 | 75 | 6 | 0 | N | Y | Y |  |
| Classroom Main Open Area | 494 | ND | 75 | 75 | 7 | 6 | N | Y | Y | D/D vents |
| Wilkens | 458 | ND | 75 | 76 | 7 | 0 | N | Y | Y | PF |
| **1st Floor East** |  |  |  |  |  |  |  |  |  |  |
| 130 | 597 | ND | 78 | 71 | 6 | 0 | Y | YSealed | Y | Space heater – on, plants, WD and D/D CT |
| 129 | 476 | ND | 74 | 66 | 10 | 0 | Y | Y | Y | D/D vent |
| 128 | 437 | ND | 74 | 69 | 8 | 0 | Y | Y | Y | 1 ajar CT, AD |
| 127 | 449 | ND | 75 | 71 | 8 | 0 | Y | Y | Y | PF, plants |
| 126 | 463 | ND | 74 | 79 | 8 | 0 | Y | Y | Y | AD |
| 125 | 444 | ND | 74 | 79 | 8 | 0 | Y | Y | Y | Plants |
| 124 | 417 | ND | 74 | 84 | 8 | 0 | Y | Y | Y | Plants |
| 123 | 478 | ND | 74 | 81 | 9 | 1 | Y | Y | Y | Plants |
| 122 | 457 | ND | 75 | 81 | 7 | 0 | Y | Y | Y | Plants, PF, musty, WD and D/D CT |
| 119 | 424 | ND | 75 | 79 | 7 | 0 | Y | Y | Y | 5 WD CT, photocopier, water cooler |
| 118 | 478 | ND | 75 | 77 | 6 | 1 | Y | Y | Y | Plants, 1 MT – water leak during wind driven rain |
| Crafts Room | 568 | ND | 75 | 73 | 7 | 3 | Y | Y | Y | DO, PF |
| Sensory Room | 586 | ND | 75 | 68 | 6 | 0 | Y | Y | Y | Items hanging from ceiling, PF |
| Group Room | 529 | ND | 75 | 71 | 7 | 0 | Y | Y | Y |  |
| **Basement** |  |  |  |  |  |  |  |  |  |  |
| G 12 | 443 | ND | 76 | 74 | 7 | 0 | N | Y | Y | WD ceiling/CTs |
| G 26 | 421 | ND | 76 | 78 | 6 | 0 | N | Y | Y | WD ceiling/CTs |
|  G 27 | 391 | ND | 74 | 80 | 6 | 0 | N | Y | Y | Rusty vents |
| G 30 | 742 | ND | 75 | 71 | 6 | 5 | N | N | N | PF |
| G 31 | 492 | ND | 72 | 74 | 5 | 0 | N | Y | Y | D/D vents |
| Womens Locker Room | 419 | ND | 71 | 79 | 7 | 0 | N | Y | Y | D/D vents |
| Mens Locker Room | 423 | ND | 69 | 78 | 7 | 0 | N | Y | Y | D/D vents |

1. The service life is the median time during which a particular system or component of …[an HVAC]… system remains in its original service application and then is replaced. Replacement may occur for any reason, including, but not limited to, failure, general obsolescence, reduced reliability, excessive maintenance cost, and changed system requirements due to such influences as building characteristics or energy prices (ASHRAE, 1991). [↑](#footnote-ref-1)