**INDOOR AIR QUALITY ASSESSMENT**

**Goshen Town Offices**

**40 Main Street**

**Goshen, MA**



Prepared by:

Massachusetts Department of Public Health

Bureau of Environmental Health

Indoor Air Quality Program

November 2017

# Background

|  |  |
| --- | --- |
| Building: | Goshen Town Offices (GTO) |
| Address: | 40 Main StreetGoshen, MA |
| Reason for Request: | General indoor air quality (IAQ) |
| Date of Assessment: | November 3, 2017 |
| Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment: | Michael Feeney, Director, IAQ Program |
| Building Description: | Originally constructed as a one-story school. The building currently serves both the Police Department and town Offices |
| Building Population: | Approximately 5 employees |
| Year of Construction: | Late 1800s, renovated in 2000s |
| Windows: | Openable |

# Methods

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

This report details conditions found in the GTO section of the building. IAQ assessment results and recommendations regarding the Goshen Police Department are detailed in a separate report.

# 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 assessed, indicating adequate fresh air in the space.
* ***Temperature*** was within the recommended range of 70°F to 78°F in all areas assessed.
* ***Relative humidity*** was within the recommended range of 40% to 60% in all areas assessed.
* ***Carbon monoxide*** levels were non-detectable in all areas assessed.
* ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 μg/m3 in all areas assessed.

## 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 by 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.

The assessment results indicate that the ventilation system is providing adequate fresh air for the occupancy in the building. Note that many areas had low occupancy, which can reduce the creation of carbon dioxide. To maximize air exchange, the BEH recommends that mechanical ventilation systems operate continuously during periods of occupancy. Without the system operating as designed, normally occurring pollutants cannot be diluted or removed, allowing them to build up and lead to IAQ/comfort complaints.

Fresh air is provided to occupied areas by an HRV EKO 1.5 air exchanger (AE) located in the men’s restroom (Picture 1). According to the manufacturer, “[The AE at] its core absorbs both heat and moisture from the air streams passing through it (without mixing). In the summer, the heat and humidity of the outdoor fresh air is transferred to the exhaust air stream, meaning your home stays cooler inside. In the winter, the opposite is true” (Venmar, 2017). The device contains a desiccant wheel. The AE functions in the following manner:

*The [AE] continually exchange[s] air within a building utilizing fresh air supply and stale air exhaust fans within the cabinet. In winter, as exhaust air passes through the AE, energy is captured by the wheel. As the wheel rotates into the incoming airstream, energy is released by the wheel to heat and humidify the incoming airstream closer to indoor conditions, reducing unit workload and energy consumed by the heating system. Under summer conditions, heat and humidity are captured from the fresh outdoor air. Rotation of the wheel allows the heat and humidity to be transferred to the cooler, drier exhaust air as it passes through the wheel. As a result, the outdoor air is conditioned closer to building conditions, reducing unit workload and energy consumed by the cooling system. In both winter and summer, as the difference between outdoor and indoor conditions (temperature and humidity) increase, the energy reduction and resulting cost savings increase* (AE, 2017).

According to industry recommendations, “[f]ield experience shows that offices, schools and other ‘clean’ environments will often go 10 years before any build up of dust and dirt is noticed. Restaurants, Casinos, factory environments experience fairly rapid build up of contaminants and require multiple cleanings a year to maintain airflow and recovery” (AE, 2006).

 Several issues can occur with the installation and maintenance of the AE and desiccant wheel technology in general.

* According to the installation guide, the Venmar HRV Eko 1.5 is for residential use only. It is not designed for use in public buildings (Venmar, unknown).
* The installation of the AE appears to be designed for use in tandem with a forced hot air or fully ducted heating system (Venmar, unknown). It appears the AE is used as a stand-alone device.
* The installation of the AE appears to have two purposes: to provide air exchange for occupied space and to provide exhaust ventilation for bathroom/shower rooms. IAQ staff do not recommend use of an AE as exhaust ventilation for restrooms or showers. Debris and soap residue can accumulate in the desiccant wheel to be transferred into the supply air of a building.
* The filters provided minimal filtration of particles. According to town officials, the filters are cleaned and reused. Filters of this type should be completely replaced and not reused since the filter medium cannot be cleaned of microscopic particles. If reused, the filters can become a source of pollutants.

Based on these observations, it appears that the AE may the source of pollutants that is affecting IAQ in the GTO.

It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). The date of the last time the AE was balanced was not available.

# Conclusions/Recommendations

Based on observations at the time of assessment, the following is recommended:

1. It is advisable to stop using the AE until it is serviced/repaired or replaced with a suitable system.
2. Service the AE in a manner consistent with manufacturer’s instructions. If the AE will continue to be used, do not reuse filters and obtain a supply of new filters that should be replaced every six months.
3. Examine the feasibility of reconfiguring the AE fresh air intake to enable installation of a pre-filter to prevent the draw of debris into the vent. Change this pre-filter at least every six months, and more frequently if it is found to be clogged.
4. It would be advisable to relocate the return vent from the restroom to the wall of Room 4 to prevent restroom water vapor from impacting the AE and to limit draw of air from the floor drain.
5. Have the AE system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994).
6. 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

AE. 2006. Cleaning Airxchange Wheels. Airxchange Inc. September 2006. <http://www.airxchange.com/Collateral/Documents/English-US/Cleaning%20Airxchange%20Wheels.pdf>

AE. 2017. Energy Recovery Ventilation FAQs. Airxchange Inc. 2017. <http://www.airxchange.com/faqs.htm>.

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.

Venmar, 2017. VENMAR AVS, EKO 1.5 ERV, EKO SERIES (product literature). <https://www.venmar.ca/111-air-exchangers-eko-1-5-erv.html>.

Venmar. Unknown. Installation Guide. <https://www.venmar.ca/DATA/DOCUMENT/21_5_en~v~installation-manual.pdf>.

**Picture 1**

****

**The AE, note return vent on AE**

| 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) | 371 | ND | 67 | 69 | 8 |  |  |  |  |  |
| Food pantry | 568 | ND | 75 | 54 | 9 | 1 | Y | N | Y |  |
| Selectman | 519 | ND | 71 | 59 | 6 | 0 | Y | N | N |  |
| 1 | 518 | ND | 71 | 59 | 6 | 2 | Y | N | N |  |
| 2 | 478 | ND | 71 | 57 | 5 | 0 | Y | N | N |  |
| 3 | 534 | ND | 71 | 57 | 6 | 0 | Y | N | N | Photocopier |
| 4 | 491 | ND | 71 | 58 | 6 | 0 | Y | Y | N |  |