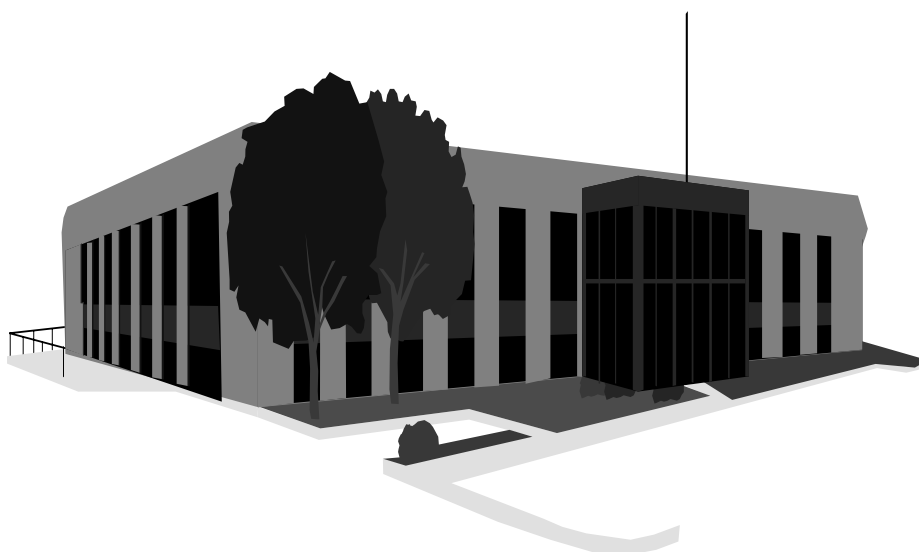


# **INDOOR AIR QUALITY ASSESSMENT**

**Winthrop Town Hall  
Winthrop, Massachusetts**



Prepared by:  
Massachusetts Department of Public Health  
Bureau of Environmental Health Assessment  
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## **Background/Introduction**

At the request of Paul Frazier, Director, Winthrop Board of Health, the Bureau of Environmental Health Assessment (BEHA) provided assistance and consultation regarding indoor air quality issues and health at the Winthrop Town Hall, Winthrop, MA. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA). On March 21, 2000 a visit was made to this building by Michael Feeney, Chief of the Emergency Response/Indoor Air Quality (ER/IAQ) Program, BEHA. Accompanying Mr. Feeney during the assessment were Cory Holmes, BEHA, ER/IAQ program, Mr. Frazier, Tim Lesile, Job Superintendent and Leo Schiavuzzo, Public Facilities Coordinator. Concerns about pollutants generated by renovation efforts and the potential impact on occupied areas in the building prompted this request. Previous BEHA correspondence regarding recommendations for improved control measures to prevent renovation/construction generated pollutants from migrating into occupied areas of the building has been provided (MDPH, 2000). This correspondence is included as Appendix A.

The Winthrop Town Hall is a three-story brick building originally built in 1926 as a police station. Floors 1-3 consist of town office space with openable windows and closeable doors in each office. The basement houses a meeting room, restrooms, office space and storage areas.

## **Methods**

Air tests for carbon dioxide were taken with the Telaire, Carbon Dioxide Monitor and tests for temperature and relative humidity were taken with a Mannix, TH Pen PTH

8708 Thermo-Hygrometer. Wind speed and direction were measured with a Davis, Wind Wizard, Wind Speed Indicator.

## **Results**

These offices have an employee population of approximately 30-40 and are open to the general public. The tests were taken under normal operating conditions. Test results appear in Tables 1-3.

## **Discussion**

### **Ventilation**

It can be seen from the tables that carbon dioxide levels were elevated above 800 parts per million of air (ppm) in fourteen of twenty-four areas surveyed, which is indicative of a ventilation problem in the building. Office space and common areas in the building are not equipped with mechanical ventilation, but use radiators in combination with openable windows to provide heat and fresh air.

Ventilation was originally provided by a natural/gravity feed system, which has been abandoned. A number of these vents were seen throughout the building (see Picture 1). Care should be taken to ensure ventilation shafts are sealed in the basement, on the roof and in office space to prevent the egress of dirt, dust and drafts into occupied areas.

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (BOCA, 1993, SBBRS, 1997). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and

maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature readings ranged from 65° F to 77° F, which was below the BEHA recommended comfort range in several areas. The BEHA recommends that indoor air temperatures be maintained in a range of 70° F to 78° F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an

adequate fresh air supply. Temperature control is difficult in an old building without a functioning ventilation system.

The relative humidity in this building was below the BEHA recommended comfort range of 40 - 60 percent in all of the areas sampled on the day of the assessment. Relative humidity measurements ranged from 16 to 24 percent. Relative humidity measurements would be expected to drop during the winter heating season. The sensation of dryness and irritation is common in a low relative humidity environment. For buildings in New England, periods of low relative humidity during the winter are often unavoidable.

### **Other Concerns**

Several conditions that can potentially affect indoor air quality were also observed. No detectable levels of carbon monoxide (CO) were measured indoors. TVOCs within occupied portions of the building were elevated above background levels in several areas (background TVOCs = 0.3 ppm). CO and TVOC testing results are listed in Table 4. Elevated TVOC levels were noted in the wall space behind tile installed in the first floor restrooms, however, measurements taken within the restroom matched outdoor levels measured. Elevated levels of TVOCs were attributed to office equipment and/or cleaning products (i.e., air freshener) used inside the building. Increased TVOC levels in the 1<sup>st</sup> floor were traced to the Town Clerk's office, which contained a liquid toner photocopier. Volatile organic compounds (VOCs) and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. Ozone is a

respiratory irritant (Schmidt Etkin, D., 1992). Without mechanical exhaust ventilation, pollutants and waste heat produced by office equipment can build up.

A strong odor of deodorizer was detected upon entry into the Treasure's Office. The source was identified as a spray air freshener/deodorizer. Air fresheners and cleaning products contain chemicals that can be irritating to certain sensitive individuals. In addition, air fresheners do not remove materials causing odors, but rather mask odors which may be present in the area.

Office areas contained window-mounted air conditioners. Portable air-conditioning units are normally equipped with filters, which should be cleaned or changed as per the manufacturer's instructions to avoid the build up and re-aerosolization of dirt, dust and particulate matter.

A strong odor of cigarette smoke and ashtrays was noted in an area located at basement level, which appears to be used as a smoking room. Environmental tobacco smoke is an indoor air pollutant, a respiratory irritant and can exacerbate the frequency and severity of symptoms in asthmatics. The most effective method of preventing exposure to environmental tobacco smoke is to have smoke free buildings. M.G.L. Chapter 270, Sec. 22 prohibits smoking in public buildings, except in an area which has been specifically designed as a smoking area (M.G.L., 1987). The American Society of Heating, Refrigeration, Air-Conditioning Engineers (ASHRAE) recommends a ventilation rate of 60 cubic feet per minute per occupant in smoking lounges (ASHRAE, 1989). The ASHRAE recommendation is designed to prevent odors of cigarette smoke from penetrating areas outside the designated smoking area.

Also of note was the amount of materials stored in the building. In areas throughout the building, items were seen piled on windowsills, tabletops, counters, bookcases and desks. The large number of items stored in this manner provides a means for dusts, dirt and other potential respiratory irritants to accumulate. In addition it is difficult for custodial staff to clean around these areas. Dust can be irritating to the eyes, nose and respiratory tract. These items should be relocated and/or cleaned periodically to avoid excessive dust build up.

## **Conclusions/Recommendations**

In view of the findings at the time of the visit, health and building complaints are consistent with what might be encountered in a dry environment without mechanical ventilation. In order to improve indoor air quality the following recommendations are made:

1. For buildings in New England, periods of low relative humidity 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 relative humidity is low. To control for dusts, a HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
2. Consider replacing liquid toner photocopier with a newer model. Examine the feasibility of providing local exhaust ventilation for odor producing office equipment or move to a well-ventilated area.

3. Change filters in window-mounted air conditioners as per the manufacturer's instructions to prevent the re-aerosolization of dirt, dust and particulate matter.
4. Ensure ventilation shafts are sealed in the basement, on the roof and in office areas to prevent the egress of dirt, dust and drafts into occupied areas.
5. If a designated smoking area is established in this building, provide local exhaust ventilation at a rate of 60 cubic feet per minute per occupant in accordance with the recommendations set forth in ASHRAE 62-1989.
6. Refrain from using strong scented materials in office areas and restrooms.
7. Relocate or consider reducing the amount of materials stored to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.



## References

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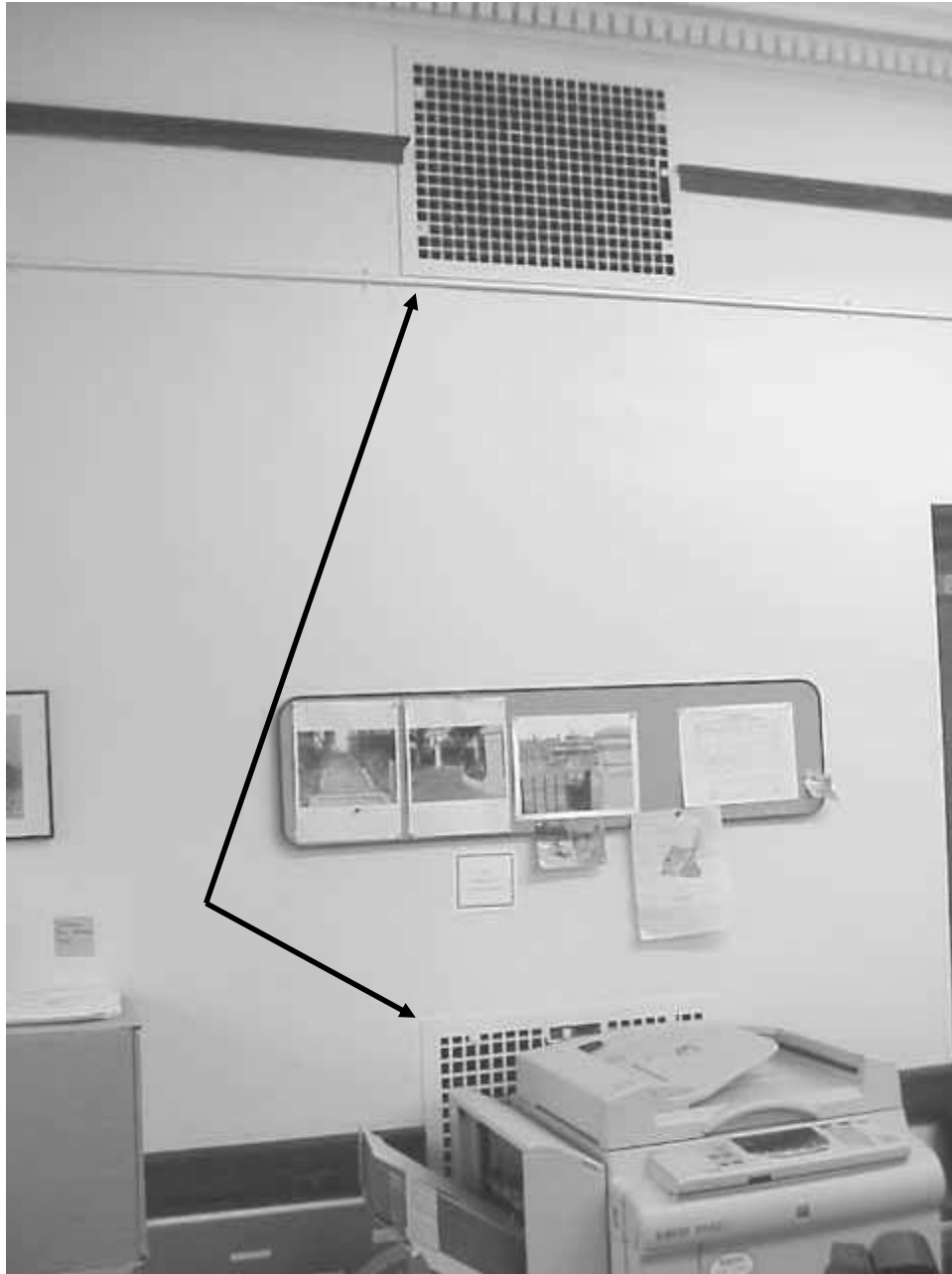
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**Picture 1**



**Abandoned Natural/Gravity Feed Vents Noted in Office Space**

**TABLE 1**

**Indoor Air Test Results –Winthrop Town Hall, Winthrop, MA – March 21, 2000**

Remarks	Carbon Dioxide *ppm	Carbon Monoxide *ppm	TVOCs	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
								Intake	Exhaust	
Outside (Background)	432	0	0.3	42	64					
Clerk of the Works	769	0	0.5	69	21	4	yes	yes	yes	gravity exhaust, window mounted air conditioner (a/c)
Town Clerk Reception	1008	0	4.7	75	17	2	no	no	no	a/c, photocopier toner odors
Town Clerk's Office	1065	0	4.8	75	18	1	no	no	no	a/c, photocopier toner odors
Assistant Town Clerk's Office		0	5.2							a/c, photocopier toner odors
Break Room	792	0	2.4	72	20	0	yes	no	no	a/c
Board of Health Office	1072	0	0.6	70	20	0	yes	no	no	
Building Inspector's Office	846			77	16	2	yes	no	no	
MIS Office	594			73	16	2	yes	no	no	window mounted a/c-on

\* ppm = parts per million parts of air  
CT = water-damaged ceiling tiles

**Comfort Guidelines**

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

**TABLE 2**

**Indoor Air Test Results –Winthrop Town Hall, Winthrop, MA – March 21, 2000**

Remarks	Carbon Dioxide *ppm	Carbon Monoxide *ppm	TVOCs	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
								Intake	Exhaust	
Basement Auditorium	555	0	0.3	72	16	0	yes	no	no	a/c
Smoking Room	549	0	0.3	70	19	0	yes	no	no	window open, cigarette smoke odor, dirty ashtrays
Veteran's Services	632	0	0.3	71	16	0	yes	no	no	a/c, dust residue
Town Counsel	582	0	0.3	65	22	0	yes	no	no	2 ceiling tiles ajar, window open, a/c
Selectman's Secretary	819	0	0.3	70	24	1	yes	no	no	door open, a/c
Selectman's Office	729	0	0.3	71	21	0	yes	no	yes	gravity exhaust, a/c
Executive Secretary's Office	765	0	0.3	72	21	0	yes	no	no	
Conference Room	695	0	0.3	72	18	0	yes	no	no	a/c
Accounting	1108	0	0.3	72	20	2	yes	no	no	2 computers, a/c

\* ppm = parts per million parts of air  
 CT = water-damaged ceiling tiles

**Comfort Guidelines**

Carbon Dioxide - < 600 ppm = preferred  
 600 - 800 ppm = acceptable  
 > 800 ppm = indicative of ventilation problems  
 Temperature - 70 - 78 °F  
 Relative Humidity - 40 - 60%

**TABLE 3**

**Indoor Air Test Results –Winthrop Town Hall, Winthrop, MA – March 21, 2000**

Remarks	Carbon Dioxide *ppm	Carbon Monoxide *ppm	TVOCs	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
								Intake	Exhaust	
Accounting-Private Office	1147	0	0.3	73	21	1	yes	no	no	2 computers, a/c
Retirement	962	0	0.3	74	19	0	yes	no	no	a/c
Assessor's Office	1007	0	0.3	77	21	2	yes	no	no	a/c
Assessor's Private Office	1042	0	0.3	77	17	0	yes	no	no	a/c
Treasurer's Office	1035	0	0.8	74	21	3	no	no	no	air freshener odors
Treasurer's Private Office	1148	0	0.3	73	22	1	no	no	no	a/c-on floor
Board of Health Main Room	1113	0	0.7	69	21	3	yes	no	no	
Martin	810	0	0.7	70	20	0	yes	no	no	

\* ppm = parts per million parts of air  
 CT = water-damaged ceiling tiles

**Comfort Guidelines**

Carbon Dioxide - < 600 ppm = preferred  
 600 - 800 ppm = acceptable  
 > 800 ppm = indicative of ventilation problems  
 Temperature - 70 - 78 °F  
 Relative Humidity - 40 - 60%

**TABLE 4**

**Indoor Air Test Results –Winthrop Town Hall,  
Winthrop, MA – March 21, 2000**

<b>Location</b>	<b>Carbon Monoxide *ppm</b>	<b>TVOCs *ppm</b>	<b>Windows Openable</b>	<b>Remarks</b>
Outside (Background)	Non-Detectable	0.3		
Clerk of the Works	Non-Detectable	0.5	yes	gravity exhaust
Town Clerk Reception	Non-Detectable	4.7	no	photocopier toner odors
Town Clerk's Office	Non-Detectable	4.8	no	photocopier toner odors
Assistant Town Clerk's Office	Non-Detectable	5.2		photocopier toner odors
Break Room	Non-Detectable	2.4	yes	
Board of Health Office	Non-Detectable	0.6	yes	
Building Inspector's Office			yes	
MIS Office			yes	window mounted a/c-on
Basement Auditorium	Non-Detectable	0.3	yes	
Smoking Room	Non-Detectable	0.3	yes	window open
Veteran's Services	Non-Detectable	0.3	yes	
Town Counsel	Non-Detectable	0.3	yes	window open, 2 ceiling tiles ajar
Selectman's Secretary	Non-Detectable	0.3	yes	door open
Selectman's Office	Non-Detectable	0.3	yes	gravity exhaust
Executive Secretary's Office	Non-Detectable	0.3	yes	
Conference Room	Non-Detectable	0.3	yes	
Accounting	Non-Detectable	0.3	yes	

\* ppm = parts per million parts of air

**TABLE 4****Indoor Air Test Results –Winthrop Town Hall,  
Winthrop, MA – March 21, 2000**

<b>Location</b>	<b>Carbon Monoxide *ppm</b>	<b>TVOCs *ppm</b>	<b>Windows Openable</b>	<b>Remarks</b>
Accounting-Private Office	Non-Detectable	0.3	yes	
Retirement	Non-Detectable	0.3	yes	
Assessor's Office	Non-Detectable	0.3	yes	
Assessor's Private Office	Non-Detectable	0.3	yes	
Treasurer's Office	Non-Detectable	0.8	no	air freshener odors
Treasurer's Private Office	Non-Detectable	0.3	no	
Board of Health Main Room	Non-Detectable	0.7	yes	
Martin	Non-Detectable	0.7	yes	

\* ppm = parts per million parts of air