

Lexington Community Center

COVID-19 Building Re-entry Ventilation Report

*Report generated by Town of Lexington Department of Public Facilities, with information from the
EH&E COVID-10 HVAC Assessment for Town of Lexington Buildings Report (24211)*

April 22, 2021

Summary

This report gives a brief overview of the Heating, Ventilation, and Air Condition Systems in place at the Lexington Community Center to give some background of how ventilation and temperature control are provided to the building.

The report then goes on to summarize the scope of work completed by EH&E, which included visual inspections of HVAC primary air equipment, recommendations for corrective action and/or enhanced ventilation/filtration measures, air measurements on the primary air systems, and an assessment of air exchange rates.

EH&E's findings can be found in this report, along with information to interpret the findings.

Lastly, the report touches on additional measures taken by the Department of Public Facilities to go above and beyond the recommendations of EH&E.

Brief Overview of Heating, Ventilation, Air Conditioning Systems at Lexington Community Center

There are various systems within the building to provide temperature comfort (heating/cooling)

Heating and cooling for many spaces are accomplished via fan coil units (FCUs). These units have a fan, and a coil that either utilizes hot water or chilled water supplied from the central plant (boiler for hot water, chiller for chilled water) to condition the space. Air is pulled from the space, passes through a filter, is then conditioned (warmed or cooled) via the coil, and redistributed to the space.

Other spaces in the building utilize heat pump (HP) systems to provide temperature comfort (heating/cooling). Similar to fan coil units (FCUs), Heat Pumps (HPs) pull the air from the space via a fan, the air passes through a filter, then it is conditioned through a coil, and redistributed to the space. The difference with this unit is that the coil is not fed via the hot water from the central boiler or chilled water from the central chiller plant, but via refrigerant from a condensing unit.

Outdoor air is supplied to the building via four (4) energy recovery units (ERUs). The outdoor air is pulled into the unit via a fan. This air first passes through filters, then the energy wheel, then through a coil before

being distributed to the space. The coil can either heat or cool the air depending on the temperature of the building. The air is then distributed throughout the building via ductwork and into each space via ceiling registers. These units also exhaust the air from the spaces. Air is pulled from the individual spaces via an exhaust grille. The exhaust air is then pulled back to the unit via a fan and rejected out of the building via a damper. Energy recovery units utilize an energy wheel. When the supply air requires to be heated, the wheel will absorb the heat from the exhaust air before it is rejected from the building. The wheel then transfers the heat to the outdoor air on the supply side, essentially preheating the air before it is heated by the coil. When the air requires to be cooled, the energy wheel works in a similar way. The wheel absorbs heat from the warm outdoor air that is being pulled into the unit, and transfers that heat to the exhaust side where it is rejected from the building. This helps pre-cool the air before it is cooled by the coil. These units do have the ability to recirculate the return air back into the supply airstream where it mixes with outdoor air, however this feature has been disabled to allow for the supply air to be 100% outdoor air, and for the exhaust to be 100% rejected from the building.

Ventilation System Performance Assessment and Guidance

The Town of Lexington contracted with Environmental Health & Engineering, Inc. (EH&E) to conduct an assessment of the heating, ventilating, and air conditioning (HVAC) systems. EH&E was also tasked with reviewing the ventilation system performance as it relates to published guidance on occupying buildings during the COVID-19 pandemic. This included an inspection of HVAC systems to identify performance related items associated with ventilation and air filtration. It involved the on-site measurement and reporting of primary HVAC system airflow and space ventilation rates.

EH&E's assessment focused on review of the airside components and followed the recommendations for system performance from the U.S. Centers for Disease Control and Prevention and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) related to operation of HVAC systems in buildings to help reduce the spread of SARS-CoV-2.

The HVAC system assessment and performance measurements performed by EH&E included the following elements.

1. **Airside Mechanical Systems Assessment:** EH&E visually inspected all primary air handling systems serving the Buildings to document the condition and operation of key components including outdoor air damper operation and position, air filter condition and rating, and fan system operation.
2. **Air Handling Unit Airflow Verification Measurements:** EH&E made airflow measurements on all primary air handling systems at the Buildings to document total air supply and outdoor air supply to the zones served.
3. **Assessment of Target Air Exchange Rates in Occupied Spaces:** EH&E made airflow measurements in 25% of the municipal spaces to document ventilation rates in terms of air changes per hour and to document outdoor air ventilation rates relative to ASHRAE Standard 62.1.¹

Findings from the HVAC System Assessment and Measurements

Airside Mechanical System Assessments.

EH&E provided an 'Action List' of items that were identified as needing to be addressed for the Post COVID-19 building reentry.

At the Lexington Community Center, three (3) items were identified from EH&E during their Airside Mechanical Systems Assessment. The Department of Public Facilities has followed EH&E's guidance and implemented the recommended corrective measures.

Below are the three items identified during the Airside Mechanical Systems Assessment at Lexington Community Center;

Item #	Mechanical Issue	Issue Priority	Issue Location	Noted Date	Noted By	Issue	Action	Responsible Party	Status
27	Filtration	1	Community Center ERU-1	10/8/2020 10/9/2020	TSM & CC	OA intake screen is clogged restricting flow.	12/2/2020 EH&E re-inspected the issue and found it to be resolved; issue closed.	Lexington	Closed
28	Filtration	1	Community Center ERU-2	10/8/2020 10/9/2020	TSM & CC	OA intake screen is clogged restricting flow.	12/2/2020 EH&E re-inspected the issue and found it to be resolved; issue closed.	Lexington	Closed
29	Filtration	1	Community Center ERUs	10/8/2020 10/9/2020	TSM & CC	All ERUs have MERV10 or lower. Replace with MERV13 or higher filters.	12/2/2020 EH&E re-inspected the issue and found it to be resolved; issue closed.	Lexington	Closed

Air Handling Unit Airflow Verification Measurements

EH&E took airflow measurements at all primary air handling systems at the Lexington Community Center.

At Lexington Community Center there are four (4) energy recovery units (ERUs) that serve as the primary air handling units for the building.

Table 1 Number of Primary Air Handling Systems by Type Serving Lexington Public Buildings		
Building	Mixed Air AHUs	Energy Recovery
Community Center	–	4

Below is the measurement data recorded by EH&E;

AIR HANDLING UNIT AIRFLOW MEASUREMENT DATA

School	Measurement Date	Unit ID	Area Of Service	Measured Supply Air (cfm)	Measured Outdoor Air (cfm)	Outdoor Air Percentage (%)	Comments
Community Center	8/21/2020	ERU-1		2,503	2,503	100%	
	8/21/2020	ERU-2		5,300	5,300	100%	
	8/21/2020	ERU-3		1,039	1,039	100%	
	8/21/2020	ERU-4		1,095	1,095	100%	

Prior to the measurements being taken by EH&E, The Department of Public Facilities made sequence of operations adjustments to all four units so they would run at 100% outdoor air percentage at all times with no recirculation.

DPF had also made adjustments, so supply air flow meets or exceeds design. These adjustments to bring in 100% outdoor air and increase supply air flow have remained in place since before testing, and will continue to remain in place to provide the maximum outdoor air ventilation rates that the existing equipment will allow for.

Assessment of Target Air Exchange Rates in Occupied Spaces

Consistent with the assessment of all Municipal Buildings, EH&E collected airflow measurements from 25% of the spaces to document ventilation rates. At Lexington Community Center, air exchange rate measurements were collected in fifteen (15) spaces.

Table 2 Breakdown of Space Air Exchange Rate Measurements in Lexington Public Buildings	
Building	Number of Spaces Measured
Community Center	15

The goal for ventilation in town buildings is to meet ASHRAE standard 62.1. ASHRAE standard 62.1 specifies the “minimum ventilation rates and other measures intended to provide indoor air quality (IAQ) that is acceptable to human occupants and that minimizes adverse health effects” (ANSI/ASHRAE standard 62.1-2019).

Although ASHRAE standard 62.1 applies only to new buildings, additions, and changes to existing buildings, the Department of Public Facilities are holding all of our building to this standard of minimum ventilation rates.

ASHRAE standard 62.1 determines minimum ventilation ‘outdoor air rate’ by ‘occupancy category’. Categories are fairly specific, such as ‘office space’, ‘breakrooms’, main entrance lobbies’, ‘libraries’, etc.

When a space is assessed, the occupancy category is determined. For instance a typical office in a town building would fall under the occupancy category of ‘office space’. Based on the occupancy category, the minimum ventilation ‘outdoor air rate’ is determined using a table from ASHRAE standard 62.1. This table takes into account both the area of the space (ft²), and the number of occupants the space can hold (cfm/person). This then determines the required minimum ventilation rate for the space (cfm/ft²).

To determine if a space is meeting the ASHRAE 62.1 standard for minimum ventilation rates we need three pieces of information

- Occupancy category (e.g. Office space, breakroom, etc.)
- Space area (the square footage of the space; length x width)
- The outdoor airflow (measured in cubic feet per minute [cfm])

The town contracted with Environmental Health And Engineering Inc. (EH&E) to gather this information from representative spaces in our town-owned buildings.

At Lexington Community Center, 13 of the 15 spaces measured met the ASHRAE Standard 62.1 for minimum ventilation 'outdoor air rate'.

See the findings from the airflow measurements taken at the Lexington Community Center below;



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Meets ASHRAE 62.1 Meets Target
 Below ASHRAE 62.1 Below Target

Target Air Exchange Rate
 3

Building	Room/Space	Code Building Category	Code Occupancy Category	Space Area (ft2)	Space Ceiling Height (ft)	Space Volume (ft3)	ASHRAE 62.1 Target (cfm/ft2)	HVAC Service	Filter Type	Measured Supply Airflow (cfm)	% OA	Outside Airflow (cfm)	ASHRAE 62.1 Outdoor Air (cfm/ft2)	As-Found Clean Air Exchange Rate
Community Center	B Fitness Room 006	Sports and Entertainment	Health club/weight rooms	1,517	7.9	11984	0.260	ERV	MERV 13	497	100%	497	0.33	2.5
Community Center	B Ping pong 015	Sports and Entertainment	Game arcades	609	8.4	5116	0.330	ERV	MERV 13	211	100%	211	0.35	2.5
Community Center	L1 Multi Purpose 123	Food and Beverage Service	Conference/meeting	200	9.5	1900	0.310	ERV/FCU	MERV 13	249	33%	82	0.41	7.1
Community Center	L1 Dining Room 139	Food and Beverage Service	Restaurant dining rooms	1,725	8.7	15008	0.705	ERV/FCU	MERV 13	1,435	100%	1,435	0.83	5.7
Community Center	L2 Multipurpose 221	Food and Beverage Service	Conference/meeting	34	7.8	262	0.310	ERV	MERV 13	264	100%	264	7.86	60.4
Community Center	L2 Multi purpose 242	Food and Beverage Service	Conference/meeting	605	9.6	5811	0.310	ERV/FCU	MERV 13	490	41%	200	0.33	4.6
Community Center	Multi Purpose 246	Food and Beverage Service	Conference/meeting	205	9.6	1968	0.310	ERV/FCU	MERV 13	490	41%	200	0.98	13.6
Community Center	Multi Purpose 245	Food and Beverage Service	Conference/meeting	93	9.6	889	0.310	ERV/FCU	MERV 13	352	19%	66	0.71	20.9
Community Center	Workshop 014	Educational Facilities	Wood/metal shop	347	8.2	2849	0.380	ERV	MERV 13	290	100%	290	0.83	6.1
Community Center	L1 TV / Gaming A 108	Sports and Entertainment	Game arcades	332	9.0	2988	0.330	ERV/FCU	MERV 13	901	8%	73	0.22	15.6
Community Center	L1 Game Room 107	Sports and Entertainment	Game arcades	198	8.9	1760	0.330	ERV/FCU	MERV 13	652	12%	76	0.38	19.3
Community Center	L1 Human Services Manager & Transportation Manager 134	Office Buildings	Office space	445	8.6	3827	0.085	Exhaust	MERV 13	328	100%	328	0.74	5.1
Community Center	L1 Billiards Room 105	Sports and Entertainment	Game arcades	641	8.6	5514	0.330	ERV and FCU	MERV 13	775	8%	65	0.10	7.3
Community Center	L2 Arts & Crafts 230 / 232B	Educational Facilities	Wood/metal shop	912	8.4	7661	0.380	ERV	MERV 13	347	100%	347	0.38	2.7
Community Center	Multi Purpose 217	Food and Beverage Service	Conference/meeting	258	8.0	2062	0.310	ERV/FCU	MERV 13	432	26%	112	0.43	11.2

In spaces that still did not meet ASHRAE standard 62.1 for minimum outdoor air ventilation rates, additional steps were taken to insure proper indoor air quality. This was accomplished through increased air filtration.

Higher efficiency air filters, filters with a higher minimum efficiency reporting value (MERV) rating, were installed in these spaces. Filters with higher MERV ratings are able to capture smaller particles, and thus provide better air filtration.

To determine the effectiveness of the filtration, clean air changes per hour (CACH) is measured.

Clean air changes are the number of times the air in the space is cleaned/replaced based on outdoor air and/or filtration. This is determined by the airflow in cubic feet per second and the cubic space of the room.

When a space is not able to meet the ASHRAE standard 62.1 for minimum outdoor air ventilation rates, the goal is for three (3) clean air changes per hour (CACH).

After installing filters with higher MERV ratings, all of the spaces at Lexington Community Center that did not meet the ASHRAE 62.1 standard were able to meet or exceed 3 clean air changes per hour (CACH).

In the event that spaces that still did not meet three (3) clean air changes per hour (CACH) after installing higher MERV rating filters, supplemental air filtration units are added. In most cases, these supplemental air filtration units are small portable units with high-efficiency particulate air (HEPA) filters.

HEPA filters are not MERV rated, as they exceed the ASHRAE test protocol 52.2.

Per ASHRAE standard 170, HEPA filters are designed to filter at least 99.97% of particles with a diameter of 0.3 microns.

At the Lexington Community Center, supplemental air filtration units are not required.

Additional Action Steps taken

The Department of Public Facilities has been completing regularly scheduled preventative maintenance on all HVAC equipment. The Department of Public Facilities has followed EH&E's recommendation to increase the filters to MERV-13 filters on the primary air handling equipment.

In addition, the Department of Public Facilities has ordered and installed custom MERV-13 filters for the Fan Coil Units (FCUs), which were previously MERV-8 filters. This is above and beyond the recommendation from EH&E.

Also, the Department of Public Facilities have put two portable HEPA units in place in two areas that have a higher concentration of employees working. Again, this is above and beyond the recommendation of EH&E