

MONTGOMERY SISAM ARCHITECTS INC.

KAHLER SLATER

**UNIVERSITY OF TORONTO  
DENTISTRY BUILDING – CLINIC 2 RENOVATION**

124 EDWARD ST  
TORONTO, ON M5G 1G6

**PROJECT MANUAL  
VOLUME 3 of 3**

UofT Project No. P065-21-050  
MSA Project No. 24082

**SPECIFICATIONS**

**Reports**

**ISSUED FOR TENDER**

May 29<sup>th</sup>, 2026

*Entuitive*  
**Structural**

*EXP Services Inc.*  
**Mechanical / Electrical / IT / Sustainability**

*LRI Engineering Inc.*  
**Building Code / Life Safety**

*Soberman Engineering Inc.*  
**Elevator Consultant**

*Thornton Tomasetti*  
**Acoustic Consultant**

*Allegion*  
**Hardware Consultant**

*Oktus Developments Inc.*  
**Logistics Consultant**

## VOLUME 3

### (Reports and Information)

#### DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Document	Title	Discipline	Pages
	Cover Page	A	1
00 01 10	Table of Contents (Volume 3)	A	1

#### REPORTS AND REFERENCE DOCUMENTS

Document	Title	Discipline	Pages
REF 01	MSA's Data Transfer Agreement	A	1
REF 02	Acoustic Report	O	13
REF 03	Sustainability and Energy Modelling Report	O	26
REF 04	Code Report	O	25

## VOLUME 1

Refer to Volume 1 for Divisions 0 - 14.

## VOLUME 2

Refer to Volume 1 for Divisions 20 - 33.

END OF DOCUMENT

MONTGOMERY SISAM ARCHITECTS INC.

KAHLER SLATER

**UNIVERSITY OF TORONTO**  
**DENTISTRY BUILDING – CLINIC 2 RENOVATION**  
124 EDWARD ST  
TORONTO, ON M5G 1G6

**REF 01**

DATA TRANSFER AGREEMENT

**Montgomery Sisam Architects Inc.**  
*197 Spadina Ave., Suite 301, Toronto, ON M5T 2C8*

# Data Transfer Agreement

MontgomerySisam

Entity Requesting Data ('Transferee') \_\_\_\_\_

Project No. \_\_\_\_\_

Project \_\_\_\_\_

Date \_\_\_\_\_

Montgomery Sisam Architects and/or its consultants (collectively, 'MSA') have prepared drawings, specifications, and/or other documents for the Project (collectively 'Documents'). The Transferee has requested MSA to transfer, or provide access to, electronic files containing graphic or other data-based representations of certain Documents, which may include computer-aided design ('CAD') data files and/or building information modeling ('BIM') data files (collectively, 'Data'). MSA agrees to provide Transferee with the requested Data subject to the terms and conditions of this Data Transfer Agreement ('Agreement').

1. The transfer of the Data is not a sale. The Data is provided as-is and MSA makes no representations or warranties, either express or implied, regarding the Data or its suitability for any purpose, including that of merchantability or fitness for any particular purpose. Transferee accepts all risks associated with the use of Data. MSA is the author of the Data and retains all rights in the Data, including proprietary rights, except as otherwise set out in this Agreement.
2. Transferee may transfer the Data to its contractors, subcontractors, suppliers and consultants (collectively, 'Others'), provided Transferee requires the Others to be bound by this Agreement as if they were the Transferee in this Agreement. Transferee and Others may use the Data for purposes related to the Project only and not for any other use.
3. The Transferee acknowledges that the Documents may be updated or revised at any time, but that MSA shall have no duty to modify or update the Data. To the extent of any conflict between information contained in or generated by the Data and the Documents, the latter shall govern.
4. The Data are intended for the purpose of communicating design intent only. To the extent the Data include BIM, the Transferee acknowledges and agrees that BIM may not detect or illustrate all conflicts or inconsistencies. The BIM, as part of the Data, are provided as-is and Transferee accepts all risks associated with use of the BIM. The Data or the BIM are not to be used for generating quantity take-offs or cost estimates, dimensioning, or for fabrication or construction purposes including, but not limited to, design, layout, arrangement, manufacture, or installation. To the extent that the Data contain, or are based upon, data or information provided by others, the construction contractor, and not MSA, will remain responsible for dictating construction means or methods.
5. Transferee shall indemnify, defend and hold MSA, its officers, directors, shareholders, employees, agents and consultants harmless from and against any and all third party claims and associated liabilities of any kind arising out of or resulting from the Transferee's or Other's use, reuse, transfer, or modification of the Data, except to the extent that a court determines MSA is liable.
6. If Transferee breaches any of the terms of this Agreement, MSA may demand, and Transferee shall immediately cease use of and return the Data and any copies thereof.
7. The laws of the Province of Ontario shall govern this Agreement. The terms, conditions and undertakings expressed in this Agreement apply to partners, employees, agents, successors, assigns and legal or other representatives of the Transferee.
8. Except where agreed to in writing, this Agreement shall apply to any and all future data transfers to Transferee by MSA.

**Transferee**

**Montgomery Sisam Architects Inc.**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Print Name and Title

\_\_\_\_\_  
Print Name and Title

MONTGOMERY SISAM ARCHITECTS INC.

KAHLER SLATER

**UNIVERSITY OF TORONTO**  
**DENTISTRY BUILDING – CLINIC 2 RENOVATION**  
124 EDWARD ST  
TORONTO, ON M5G 1G6

**REF 02**

ACOUSTIC, NOISE AND VIBRATION CONTROL REPORT

**Thornton Tomasetti**  
*23-366 Revus Ave, Mississauga, ON L5G 4S5*

January 9, 2026

## **University of Toronto Dentistry Building, Clinic 2 Renovation**

**124 Edward St, Toronto, ON**

**TT Project #25013203.01**

**Prepared For**

**Julian Marabelli  
Montgomery Sisam Architects Inc.  
197 Spadina Avenue, Suite 301  
Toronto, ON M5T 2C8  
jleriche@montgomerysisam.com**

**ACOUSTIC, NOISE AND VIBRATION CONTROL  
Issued for 100% CD**

**Prepared By**

**Paul Vanoostveen  
Engineer  
Thornton Tomasetti  
23-366 Revus Ave  
Mississauga, ON L5G 4S5  
Office: 905-271-7888  
pvanoostveen@thorntomasetti.com**

**January 9, 2026**

## Table of Contents

1.0	Introduction .....	1
2.0	Interior Sound Isolation .....	1
3.0	Room Acoustics.....	2
4.0	Mechanical Noise & Vibration Control .....	2
5.0	Concluding Comments .....	3

## List of Tables

Table 1: Recommended STC ratings and door types by room adjacency type.....	1
Table 2: Typical door types to achieve STC ratings.....	1
Table 3: Recommended reverberation times for various room types .....	2
Table 4: Background sound level criteria by room type .....	2

## 1.0 Introduction

At the request of Montgomery Sisam Architects, Thornton Tomasetti (TT) presents this acoustic review report for the University of Toronto Dentistry Building Clinic 2 Renovation (the Project), located at 124 Edward Street, Toronto, ON. TT understands that the project consists of a 5-storey building. This report was prepared based on the “Issued for Building Permit” drawing set, dated December 5, 2025. The acoustic requirements and recommendations established in this report are based on past TT experience, industry best practices, and commonly referenced guidelines such as those published by ASHRAE.

Refer to Appendix A for definitions of acoustic terms used throughout this report.

## 2.0 Interior Sound Isolation

Wall and floor/ceiling assemblies provide a certain level of sound isolation between two spaces depending on the assembly, which is specified by sound transmission class (STC) ratings. Recommended partition STC ratings, and door types based on typical adjacencies are provided in Table 1. Door types are described in Table 2.

Table 1: Recommended STC ratings and door types by room adjacency type

Critical Room	Adjacent Room	Partition STC	Door Type
Clinic / Lab / Xray Room / Dispensary / Operator / Surgery	Corridor / Stair	45	2
	Washroom	45	N/A
	Office	45	2
	Seminar Room	50	N/A
	Clinic / Lab / Xray Room / Dispensary / Operator / Surgery	50	2
Office	Corridor / Stair	45	2
	Office	50	N/A
	Waiting / Reception	45	N/A
Meeting Room / Training Room / Seminar Room	Corridor / Stair	50	3
	Washroom	50	N/A
	Waiting / Reception	50	3

Table 2: Typical door types to achieve STC ratings

Assembly Type	STC Target	Typical Construction
1	20	Glass frameless or sliding doors. Avoid for spaces that require sound isolation or speech privacy
2	30	Solid core wood or insulated metal doors with door bottom fitted for minimal clearance to finished floor. No return air undercut, or louvers are permitted. Provide acoustical seals such as Pemko Series 88 Sound Seals or equal on the jambs and head and overlapping astragals such as Pemko 355S or equal for double lead doors.



Assembly Type	STC Target	Typical Construction
3	35	Same as above, with the replacement of the door bottom with automatic door bottom such as Pemko 430 or 434 (RL/PKL) or equal and ADA compliant threshold hardware.

### 3.0 Room Acoustics

Occupied spaces should include appropriate quantities of sound-absorptive surfaces to control reverberant noise, promote good speech intelligibility in speech sensitive spaces, and control sound propagation in open plan areas and corridors. Reverberation criteria and guidelines for room finishes in each space type are summarized in Table 3.

Table 3: Recommended reverberation times for various room types

Room Type	Mid-Frequency (500, 1000, 2000 Hz) Reverberation Time (s)	Room Finish Recommendations
Private Offices	0.6	- Acoustic ceiling tile (ACT) covering a minimum 90% of the ceiling area. ACT should have a minimum NRC rating of 0.75.
Meeting Room, Training Room, Seminar Room	0.8	- Acoustic ceiling tile (ACT) covering a minimum 90% of the ceiling area. ACT should have a minimum NRC rating of 0.75. - 25mm thick acoustic wall panels with minimum NRC 0.8 covering a minimum area of 25% of two adjacent walls.
Clinic, Lab, Xray Room, Dispensary, Operatory, Surgery	0.6 – 0.8	- Acoustic ceiling tile (ACT) covering a minimum 90% of the ceiling area. ACT should have a minimum NRC rating of 0.75. - Acoustically absorptive barriers between adjacent workstations, extending to typical head height or higher.
Waiting / Reception	1.0	- Acoustic ceiling tile (ACT) covering a minimum 50% of the ceiling area. ACT should have a minimum NRC rating of 0.75.

### 4.0 Mechanical Noise & Vibration Control

Noise Criteria (NC) ratings are used to specify background sound levels. Table 4 gives background sound level criteria for the applicable space types. Meeting this criteria will depend on the specifics of mechanical equipment locations, sound levels and duct layouts.

Table 4: Background sound level criteria by room type

Room Type	NC Level (dBA)
Office, Meeting Room, Training Room, Seminar Room	NC 30 - 35 (35 dBA)
Clinic, Lab, Xray Room, Dispensary, Operatory, Surgery	NC 35 - 40 (40 dBA)
Storage	NC 40 - 45 (50 dBA)
Waiting / Reception	NC 40 - 45 (50 dBA)
Corridors	NC 35 - 40 (45 dBA)

## 5.0 Concluding Comments

We trust that these general recommendations meet the needs of the current phase of the design.

Please do not hesitate to contact us if there are any questions.

Yours Truly,

Thornton Tomasetti

Paul Vanoostveen, P.Eng.  
Engineer

Reviewed by:  
Stephen McCann, P.Eng.  
Senior Associate

Disclaimer: Achieving the required noise control requirements relies on correct incorporation of noise control recommendations into Architectural and Mechanical drawings and specifications, as well as correct installation during construction. On Request, TT will conduct drawing reviews and onsite reviews of noise control measures and provide observations as appropriate; however, notwithstanding the foregoing, it is expressly understood and agreed that TT shall not have control or charge of and shall not be responsible for the acts or omissions, including but not limited to means, methods, techniques, sequences and procedures, of the Design Professionals and/or Contractors performing design and/or construction on the Project. Accordingly, TT shall not be held responsible for the failure of any party to properly incorporate the noise control measures stated in this report.

## Appendix A

**Decibel, dB** – A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure (20  $\mu$ Pa).

**Ambient Noise** – The sound level in a given environment usually comprised of many sources in many directions near and far with no particular sound dominant.

**A-weighted Sound Level, dBA** – The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.

**Community Noise Equivalent Level, CNEL** – The average A-weighted noise level during a 24-hour day, obtained after addition of 5 dB in the evening (7:00 pm to 10:00 pm) and after addition of 10 dB to sound levels measured in the night (between 10:00 pm and 7:00 am).

**Day/Night Noise Level, LDN (or DNL)** – The average A-weighted noise level for a 24-hour period, obtained after addition of 10 dB to levels measured in the night (10:00 pm to 7:00 am).

**Background Noise** - The total noise from all sources other than a particular sound that is of interest.

**Sound level meter** - An instrument that measures sound in dB. Various features are incorporated into such instrument including frequency bands, integration of sound over time and display of average, minimum, and maximum levels.

**Sound pressure level** - the ratio, expressed in decibels, of the mean-square sound pressure level to a reference mean-square sound pressure level that by convention has been selected to approximate the threshold of hearing (0.0002  $\mu$ bar)

**Frequency** – The number of times per second that the oscillation of a wave of sound or that of a vibrating body repeats itself, expressed in Hertz (Hz).

**Octave band** - The frequency range of one octave of sound frequencies. The upper limit is always twice the frequency of the lower limit. Octave bands are identified by the geometric mean frequency or center between the lower limit and the upper limit.

**Sound Transmission Class (STC)** – A laboratory measured single-number rating system used to compare the sound isolating characteristics of partitions used to separate occupied spaces.

**Noise Isolation Class (NIC)** - A field measured single number rating used to compare the sound isolating characteristics of the total construction between two enclosed spaces that are acoustically connected by one or more paths.

**Noise Criteria (NC) Curves** – These curves define the limits that the octave-band spectrum of a noise source must not exceed to achieve a level of occupant acceptance.

## **Appendix B: Summary of Recommendations**

	Design meets acoustic recommendation
	Coordination in Progress
	Design does not meet acoustic recommendations.

100% CD Review

Item	Area of Concern	Discipline	Drawing/ Specification	Current Design	Point of Concern	Criteria	Recommendation	Status
<b>General</b>								
AC-0.01	STC-rated partitions	ARCH	A0110	-	STC Rating	-	All STC-rated partitions should be constructed full-height slab-to-slab with batt insulation in stud cavities. Apply multiple layers of drywall with staggered joints.	This is noted in Drawing A0110, General Note E.
AC-0.02	Acoustic sealant at STC-rated partitions	ARCH	A0110	-	STC Rating	-	Ensure that the STC rated walls are completely sealed around the full perimeter. Wherever gypsum board meets another material, seal with acoustical sealant.	This is noted in Drawing A0110, General Note J.
AC-0.03	Steel Studs in STC Rated Partitions	ARCH	A0110	-	STC Rating	-	Stud gauge for acoustically rated partitions must be 25 gauge or lighter. Use of heavier gauge studs will reduce the acoustic performance.  If heavier gauge studs are required, then resilient channel or equivalent acoustically resilient construction should be used.  Stud gauge should be indicated on drawings for STC-rated partitions.	Stud gauge is noted in Drawing A0110, Table C.
AC-0.04	Gypsum Board	ARCH	A0110	-	STC Rating	-	Gypsum board in acoustically rated partitions should be 5/8" Type X, with a minimum surface mass of 2.2lb/sq.ft.  Lightweight gypsum board must not be used in STC-rated partitions.	15.9mm Type X GWB is noted in Drawing A0110, Project Defaults Table.
AC-0.05	Flanking walls	ARCH	-	-	STC Rating	-	Flanking walls should not be continuous across STC-rated separating walls (i.e. interior GWB should be interrupted by the separating wall). See sketch ACSK-01 for schematic.	Sketch to be included in arch details.
AC-0.06	Junction Boxes in Wall	ARCH ELEC	-	-	STC Rating	-	Do not provide back to back outlets in STC-rated walls. Provide at least one full cavity space between junction boxes on opposite sides of the wall. See sketch ACSK-02, Detail 01.	Sketch to be included in arch/elec details.
AC-0.07	Large Junction/Media Boxes in wall	ARCH ELEC	-	-	STC Rating	-	For junction boxes larger than 4-Gang located in STC-rated walls, ensure that the junction box is completely sealed on 5 sides and that there is minimum 38mm space between the back surface of the box and the opposite gypsum board layer. Use Hilti CP-617 putty pad or equal to seal boxes where applicable. See sketch ACSK-02, Detail 02.	Sketch to be included in arch/elec details.

	Design meets acoustic recommendation
	Coordination in Progress
	Design does not meet acoustic recommendations.

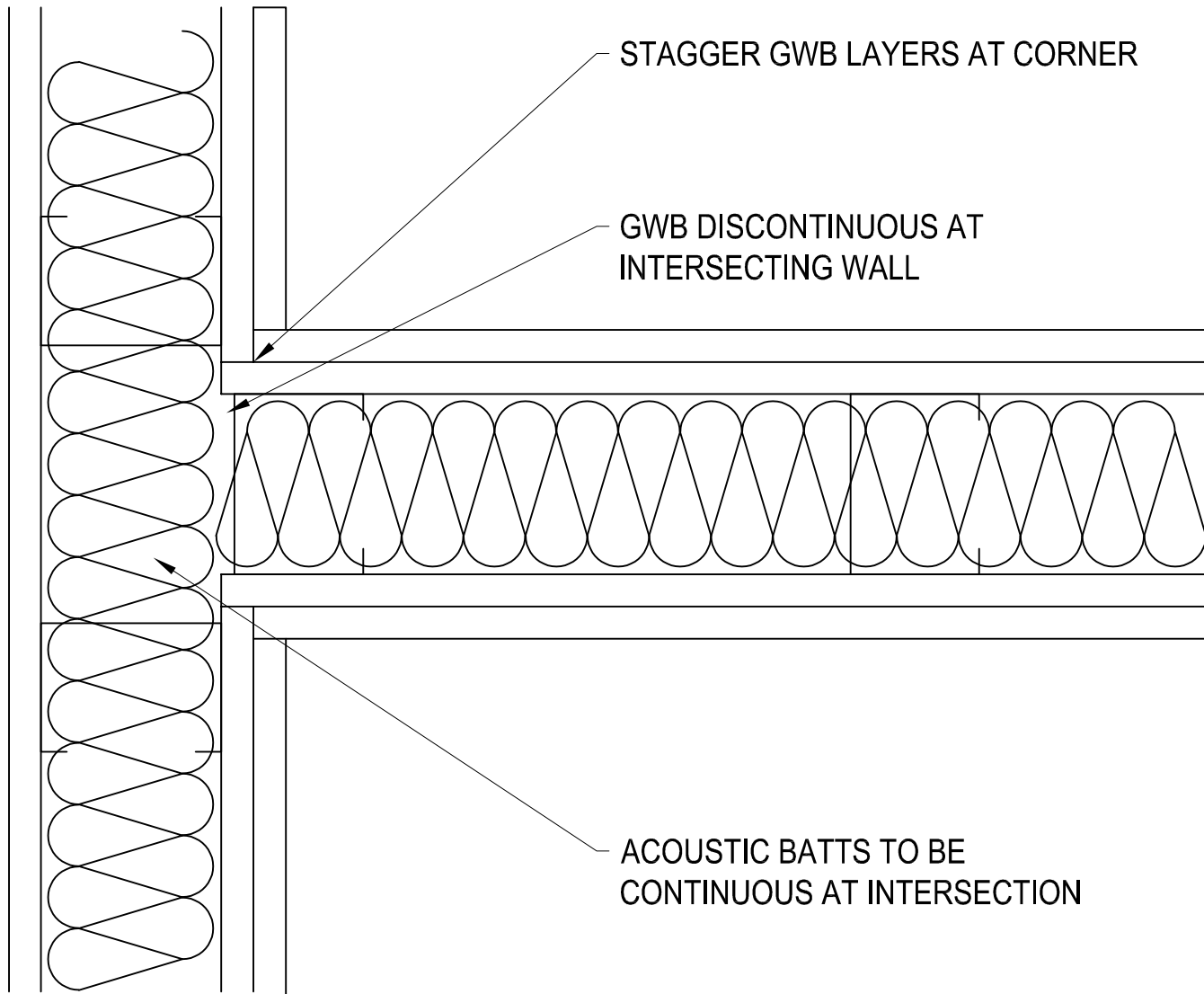
100% CD Review

Item	Area of Concern	Discipline	Drawing/ Specification	Current Design	Point of Concern	Criteria	Recommendation	Status
AC-0.08	MEP penetrations in acoustically sensitive walls	ARCH MECH	-	-	STC Rating	-	<p>All penetrations through acoustically sensitive walls to be sealed airtight as follows:</p> <ul style="list-style-type: none"> <li>- provide 1/4" to 1/2" gap between pipe/duct and gypsum board or CMU, and ensure no contact between wall framing materials and pipe/duct penetration</li> <li>- seal gap on both sides with non-hardening acoustic caulk (paintable silicone caulk may be used where aesthetic finish is required).</li> </ul> <p>Where gaps are too large to be sealed with caulk, apply gypsum board patch achieve sealable gap as described above. Refer to sketch ACSK-02</p>	Sketch to be included in arch/mech details.
Partitions								
AC-01.01	Clinic 2 (207) partitions between open workstations	ARCH	A1403	Wall Type A41 (STC-47) Wall Type A61 (STC-51)	STC Rating	-	The partial partitions between adjacent open workstations do not need to be STC rated, since there will be significant sound transfer through the open ends of the workstations regardless of the STC rating.	Coordination ongoing. Partition can be revised to exclude insulation
Room Acoustics								
AC-02.01	Training Room (134) room acoustics	ARCH	A1502	ACT-2 - acoustic ceiling tile	Reverberation Time, RT60	RT60 < 0.8s	<p>Acoustic ceiling tile covering a minimum 90% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75.</p> <p>Acoustic wall panels with minimum NRC 0.8 are recommended on 25% of two adjacent walls.</p>	<p>NRC of ceiling tile ACT-2 to be confirmed.</p> <p>Wall finishes to be confirmed.</p>
AC-02.02	Clinic 1 (133), Pediatrics Clinic (102) room acoustics	ARCH	A1502	ACT-2 - acoustic ceiling tile	Reverberation Time, RT60	RT60 < 0.6-0.8s	Acoustic ceiling tile covering a minimum 90% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75.	NRC of ceiling tile ACT-2 to be confirmed.
AC-02.03	Clinic 2 (207) room acoustics	ARCH	A1503, A1504	EXP - exposed ceiling	Reverberation Time, RT60	RT60 < 0.6-0.8s	Acoustic ceiling tile covering a minimum 90% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75.	ACT or equivalent ceiling finish recommended. Equivalent ceiling finishes may include acoustic spray or ceiling treatment directly attached to the underside of the ceiling slab.
AC-02.04	Xray room acoustics	ARCH	A1502	ACT-2 - acoustic ceiling tile (Room 133A/B/C)	Reverberation Time, RT60	RT60 < 0.6-0.8s	Acoustic ceiling tile covering a minimum 90% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75.	NRC of ceiling tile ACT-2 to be confirmed.
AC-02.05	Dispensary room acoustics	ARCH	A1503	ACT-2 - acoustic ceiling tile (Room 217, 218)	Reverberation Time, RT60	RT60 < 0.6-0.8s	Acoustic ceiling tile covering a minimum 90% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75.	NRC of ceiling tile ACT-2 to be confirmed.

Design meets acoustic recommendation  
Coordination in Progress  
Design does not meet acoustic recommendations.

100% CD Review

Item	Area of Concern	Discipline	Drawing/ Specification	Current Design	Point of Concern	Criteria	Recommendation	Status
AC-02.06	Operating room acoustics	ARCH	A1503	ACT-1/1A - acoustic ceiling tile	Reverberation Time, RT60	RT60 < 0.6-0.8s	Acoustic ceiling tile covering a minimum 90% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75	NRC of ceiling tile ACT-1/1A to be confirmed.
AC-02.07	Waiting / reception room acoustics	ARCH	A1503	ACT-1 - acoustic ceiling tile (Room 219A/B/C) ACT-2 - acoustic ceiling tile (Room 227)	Reverberation Time, RT60	RT60 < 1.0s	Acoustic ceiling tile covering a minimum 50% of the ceiling area is recommended. ACT should have a minimum NRC rating of 0.75.	NRC of ceiling tile ACT-1 and ACT-2 to be confirmed.

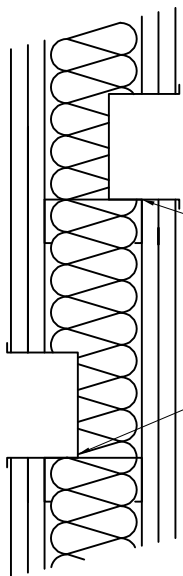


STAGGER GWB LAYERS AT CORNER

GWB DISCONTINUOUS AT INTERSECTING WALL

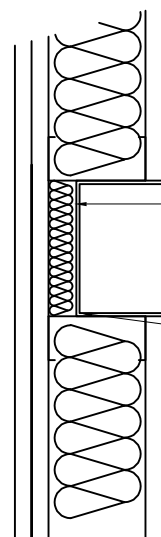
ACOUSTIC BATTS TO BE CONTINUOUS AT INTERSECTION





JUNCTION BOXES LOCATED ON  
SEPARATE STUDS AND IN  
SEPARATE CAVITIES

01 OPPOSITE JUNCTION BOXES OFFSET BY STUD SPACE DIMENSION  
PLAN

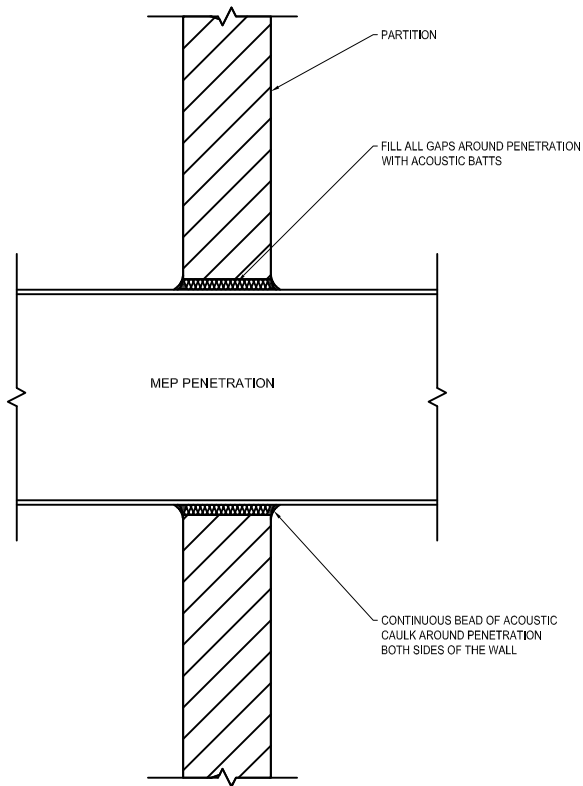


INSTALL CHIEF BOX ON THE  
SIDE OF THE WALL WITH 1  
LAYER OF WALLBOARD

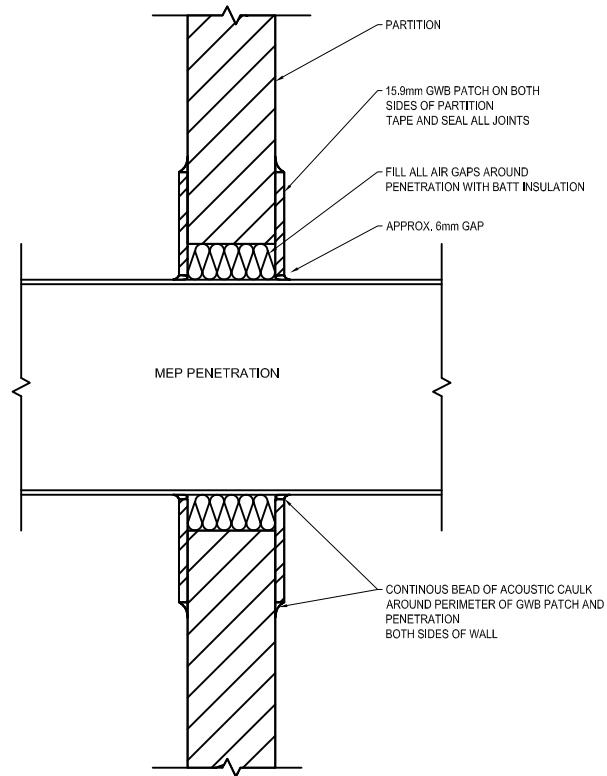
ENSURE 38mm (MIN) GAP BETWEEN  
THE BACK OF THE CHIEF BOX AND  
THE OPPOSITE WALLBOARD  
FILL GAP WITH BATT INSULATION

ENSURE CHIEF BOX IS COMPLETELY  
SEALED ON 5 SIDES  
USE HILTI CP-617 PUTTY PAD TO SEAL  
BEHIND CHIEF BOX

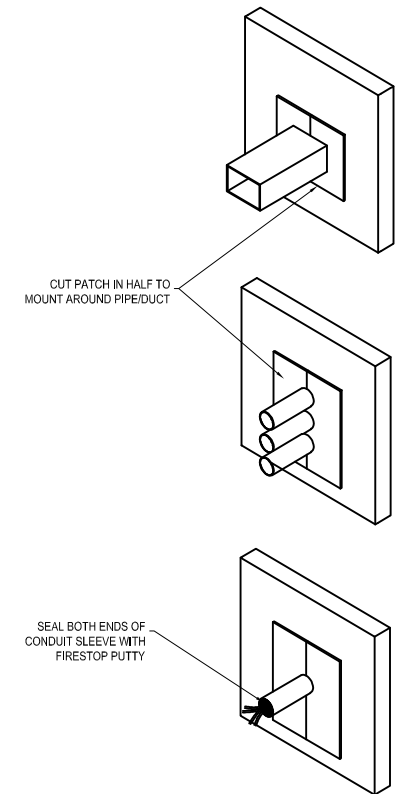
02 DEMISING PARTITION AT CHIEF BOXES  
PLAN



01 TYPICAL MEP PENETRATION ACOUSTIC SEAL



02 GWB PATCH FOR OVERSIZED PENETRATIONS



- NOTES:
1. CONDITIONS APPLY TO BOTH SIDES OF THE PARTITION
  2. GWB PATCH SHALL NOT TOUCH DUCT OR PIPE. SEAL AIR GAP WITH ACOUSTIC CAULK
  3. PROVIDE SUFFICIENT SPACE BETWEEN PENETRATIONS TO ALLOW GWB PATCH BETWEEN PENETRATIONS

MONTGOMERY SISAM ARCHITECTS INC.

KAHLER SLATER

**UNIVERSITY OF TORONTO**  
**DENTISTRY BUILDING – CLINIC 2 RENOVATION**  
124 EDWARD ST  
TORONTO, ON M5G 1G6

**REF 03**

SUSTAINABILITY AND ENERGY MODELLING REPORT

**EXP Services Inc.**  
*220 Commerce Valley Drive West, Suite 110, Markham, ON L3T 0A8*

January 9, 2026



# UNIVERSITY OF TORONTO FACULTY OF DENTISTRY

University of Toronto – Faculty of Dentistry

## SUSTAINABILITY AND ENERGY MODELLING REPORT

**Project Name:**

**University of Toronto – Faculty of Dentistry –  
Clinic 2 Implementation (P065-20-110)**

**EXP Project Number:**

**MRK-21019389-A0**

**Prepared By:**

**EXP SERVICES INC.**

**220 Commerce Valley Drive West, Suite 110  
Markham, Ontario, L3T 0A8**

**Original Date Submitted: 2026-01-09**

**Revised: 2026-01-09**

## Table of Contents

<b>1. General Overview.....</b>	<b>3</b>
<b>2. Sustainability.....</b>	<b>4</b>
2.1. Codes & Standards .....	4
2.2. Sustainable Design Strategies .....	4
2.3. Strategies for Climate Change Adaptation .....	4
2.4. Strategies for Energy Conservation, Efficiency, and Carbon Reduction .....	5
2.5. Environmental Strategies .....	5
2.5.1. Sustainable Design – LEED ID+C.....	5
<b>3. Energy Modeling .....</b>	<b>6</b>
3.1. Modelling Approach and Methodology.....	6
3.2. Simulation Details .....	6
3.2.1. Modelling Geometry.....	6
3.2.2. Weather file .....	6
3.2.3. Zoning .....	7
3.2.4. Schedules.....	7
3.2.5. Envelope .....	7
3.2.6. Heating, Ventilation and Air-Conditioning System .....	8
3.2.7. Internal Lighting and Receptacle.....	9
3.2.8. Miscellaneous Loads .....	9
3.2.9. Domestic Water .....	9
3.2.10. CO <sub>2</sub> e Emission Factors.....	10
3.2.11. Utility Rates .....	10
3.2.12. Simulation Software Package .....	10
<b>4. Energy Modeling Results .....</b>	<b>11</b>
4.1. General.....	11
<b>5. Appendices.....</b>	<b>14</b>
5.1. Appendix A – IESVE Model Summaries.....	14
5.2. Appendix B – LEED V4: Indoor Water Use Reduction Calculator.....	15
5.3. Appendix C – LEED ID+C V4 Checklist.....	16
5.4. Appendix D – Renovation Project Charter.....	17

## 1. General Overview

The University of Toronto (UofT) – Faculty of Dentistry have retained EXP to:

- Facilitate the design requirements/strategies with regards to sustainability, energy efficiency, carbon emission reduction, as well as water usage reduction.
- Perform the building energy modelling of the baseline and proposed design.

EXP has been tasked with the redesign of the University of Toronto's Dentistry building located at 101 Elm Street, Toronto ON. More specifically, the double-heighted Clinic 2 space on the second floor which consists of exam rooms, student lockers, classroom space, and additional support spaces.

The intent of EXP facilitating the sustainability design requirements and strategies is to ensure that the University of Toronto's goals/targets are met where possible. These include:

- LEED ID+C Silver Rating
- 47.9% reduction in energy consumption
- 50% reduction in indoor water use
- 60% reduction in outdoor water use

The intent of EXP developing energy models is to help assist the design of Clinic 2 by providing detailed estimates with regards to the design's energy consumption, and greenhouse gas emissions. It is important to note that "actual building energy consumption will vary from these calculations due to deviations on occupancy, building operation and maintenance, weather, energy use not covered by this report, changes in energy rates between design of the building and occupancy, and precision of the simulation tool.

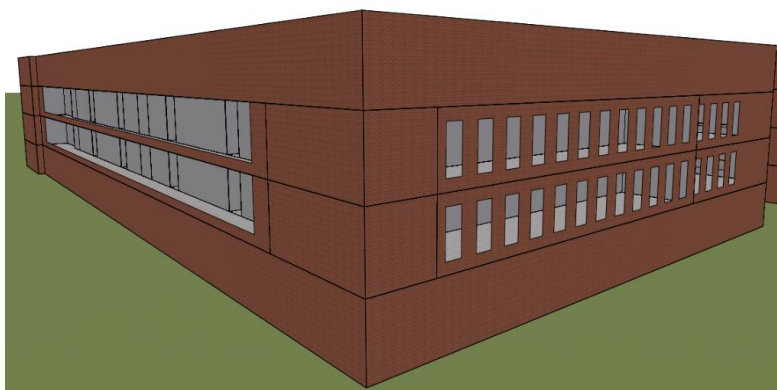


Figure 1: IES VE Energy Model of Clinic 2

## **2. Sustainability**

### **2.1. Codes & Standards**

The mechanical, electrical and technology systems, equipment, material, and installation shall conform to the latest version of all the applicable codes, standards, regulations, and guidelines. The codes, standards, regulations, and guidelines shall include, but not be limited to the following:

- Public Hospitals Act
- Ontario Building Code
- ANSI/ASHRAE/IESNA Standard 90.1-2013
- ANSI/ASHRAE/IESNA Standard 62.1-2013
- CAN/SCA Z317.5, Illumination design in health care facilities
- CSA Standard Z317.1, Special Requirements for Plumbing Systems in Health Care Facilities
- CSA Standard Z317.2, Special Requirements for Heating, Ventilation and Air Conditioning in Health Care Facilities
- Latest revision of CAN/CSA Z8001 “Commissioning of Health Care Facilities”
- City of Toronto Bylaws
- CSA standard Z317.5, Illumination Systems in Health Care Facilities.
- IESNA RP29, Lighting for Health Care Facilities.
- University of Toronto – Design Standards
- University of Toronto – Tri-Campus Energy Modeling & Utility Performance Standard
- U.S. Green Building Council LEED Interior Design + Construction Rating System

### **2.2. Sustainable Design Strategies**

EXP is committed to providing a sustainable design that meets or exceeds the University of Toronto’s requirement of designing to LEED v4 ID+C Silver standards for the project. A successful Sustainable Design requires collaboration from all disciplines and project team members. Features are incorporated throughout all sections of the project narrative and summarized within the LEED Interior Design + Construction Checklist presented for the project.

### **2.3. Strategies for Climate Change Adaptation**

Strategies for adaptation of climate change will be developed as the design progresses.

## 2.4. Strategies for Energy Conservation, Efficiency, and Carbon Reduction

Strategies for energy conservation, efficiency, and carbon reduction include the use of an air source heat pump heat recovery ventilator for ventilation paired with AV boxes for air supply to the space. The air source heat pump will utilize electric pre-heat coil and electric humidifiers. Refer to the Mechanical Design Brief for further details.

The lighting system will utilize new LED luminaires with a lighting control system.

Per the project charter, the Baseline Energy and Water consumption is as follows:

Table 1: Project Charter – Baseline Energy Consumption

Fuel Type	Annual Usage
Electricity	524,563.0 kWh
Natural Gas	0.0 kWh
District Heating	511,641.9 ekWh
District Cooling	0.0 ekWh
<b>Total</b>	1,036,204.9 ekWh

Table 2: Project Charter – Domestic Water Reduction

Location of Water	Percentage Reduction
Indoor Water Use	50%
Outdoor Water Use	60%

EXP will work to ensure that the proposed design meets or comes as close to the following targets:

- 47.9% reduction in total energy consumption.
- 50% reduction in indoor water use.
- 60% reduction in outdoor water use.
  - Note: Given the current exterior landscape of the University of Toronto Faculty of Dentistry building, it is not apparent if outdoor water is currently utilized as there appears to be no greenscape. We do not anticipate any reduction in outdoor water use.

## 2.5. Environmental Strategies

### 2.5.1. Sustainable Design – LEED ID+C

Overall, the LEED ID+C has 110 points total as described below. Prerequisites must be met for credits to be awarded. The project is being designed to a LEED Certification level of Silver, which requires at least 50 points be achieved within the rating system, along with meeting all Minimum Program Requirements and Prerequisites.



### **3. Energy Modeling**

#### **3.1. Modelling Approach and Methodology**

The IESVE 2024 energy modeling software is a tool used to assess the total end use of energy of a facility on an annually, monthly, and hourly basis. The methodology of energy modeling in this project includes:

- Creating building geometry using the architectural drawings and setting up the mechanical and electrical systems.
- The occupancy schedule of the building will be determined for building and other equipment operation will be adjusted with that.
- Zone type will be selected by considering architectural drawing and then, occupant density and required cfm per person will be found from ASHRAE 62.1.
- Compare three (3) modelling options and recommend the option that would comply with the target.
- Compare the recommended option to LEED reference model to see the energy cost savings and annual energy use reduction.

#### **3.2. Simulation Details**

##### **3.2.1. Modelling Geometry**

The energy modeling software IESVE 2024 will be used to construct the geometry for all energy models created for this project. Architectural drawings and their CAD files will be used to ensure that the modeled geometry is accurate to the proposed design area.

##### **3.2.2. Weather file**

Given the location of the building, the energy modeling weather file “CWECC 2020 Toronto City – University of Toronto” will be used for IESVE 2024.

### 3.2.3. Zoning

The modeled building encompasses all the elements as determined by 100% SD. The thermal templates used for the proposed model are per SB-10 while the LEED model were matched with their NECB 2011 counterparts.

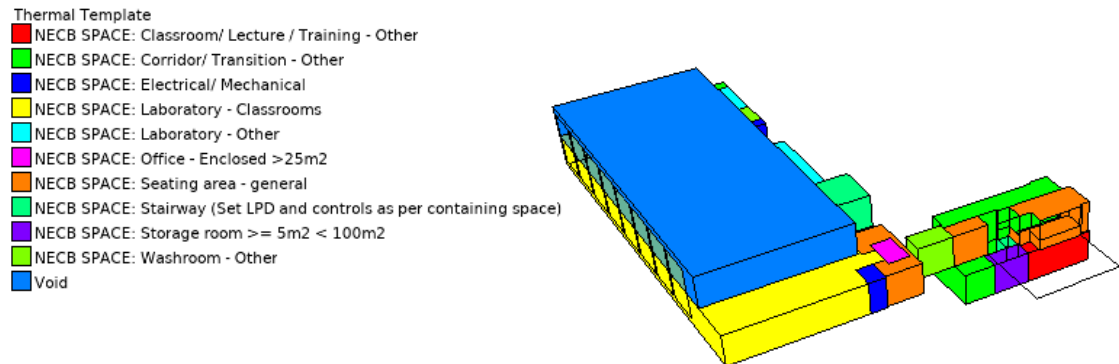


Figure 2: IESVE UofT Clinic 2 – Zoning

### 3.2.4. Schedules

Unless provided in the proposed design, the baseline and proposed models shall adhere to the schedules set forth in SB-10 Division 3 Chapter 2 “Additional Requirements to 2013 ANSI/ASHRAE/IES 90.1”.

### 3.2.5. Envelope

The proposed envelope was assumed based on the proposed envelope used for Lab 4. The LEED envelope was established based on NECB 2011 table 3.2.2.2. and table 3.2.2.3.

Table 3: Building Envelope Insulation ( $R_{IP}$ )

Construction Type	Proposed ( $\text{ft}^2 \cdot ^\circ\text{F} \cdot \text{h} / \text{BTU}$ )	LEED ( $\text{ft}^2 \cdot ^\circ\text{F} \cdot \text{h} / \text{BTU}$ )
Exterior Wall	R-10	R-20.4
Roof	R-15	R-31
Exposed Floor	R-7.5	R-31

Table 4: Window Insulation ( $U_{IP}$ )

Window Inputs	Proposed	LEED
Windows U-Value ( $\text{BTU} / \text{ft}^2 \cdot ^\circ\text{F} \cdot \text{h}$ )	U-0.20	U-0.38
Windows SHGC	0.40	0.40

Until air leakage testing is completed, the infiltration rate for all energy models shall adhere to NECB 2015 which states an air leakage rate of  $0.25 \text{ L}/(\text{s} \cdot \text{m}^2) @ 5\text{Pa}$ .

### 3.2.6. Heating, Ventilation and Air-Conditioning System

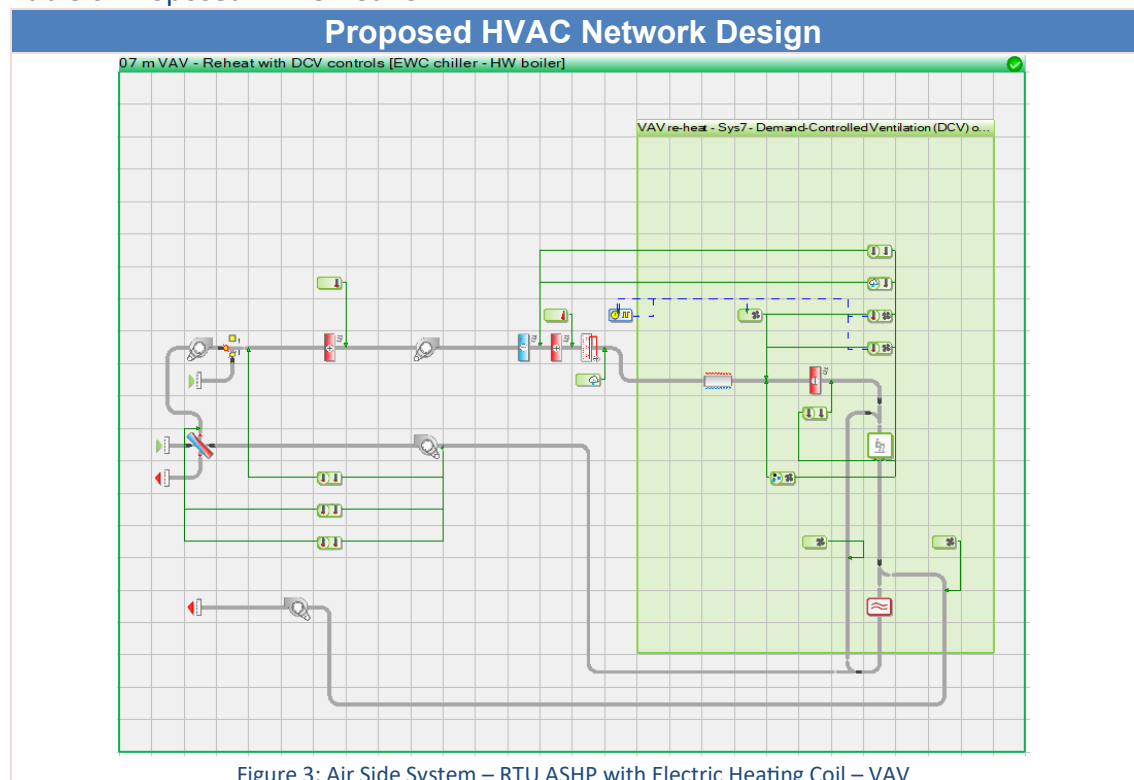
The following system was used to develop the proposed model:

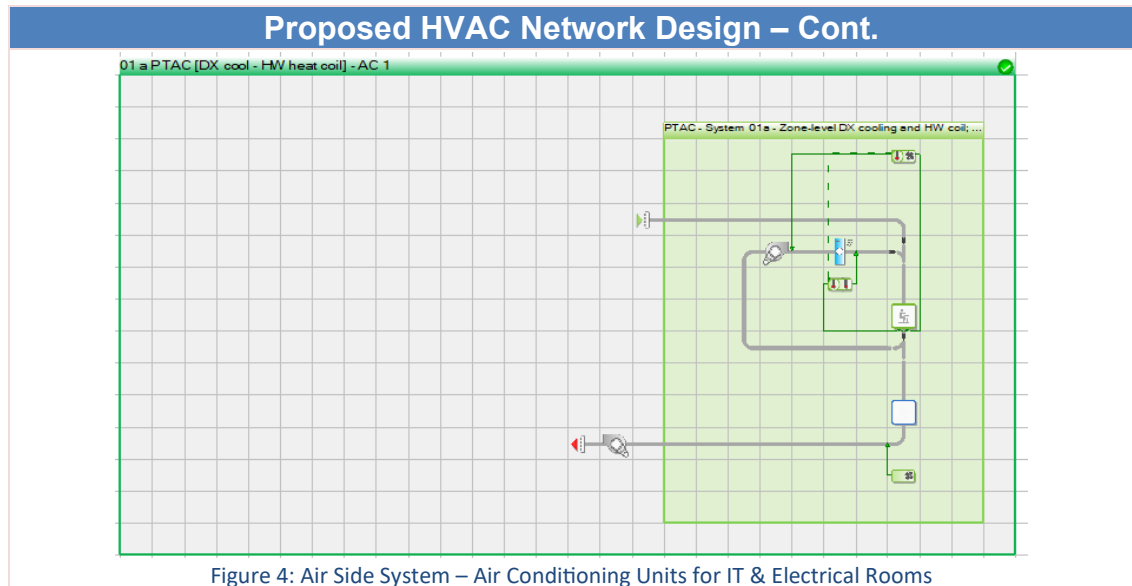
Table 5: Proposed HVAC System

Proposed HVAC System	
Mechanical System	HVAC: ASHP VAV + Heat Pipe
Heating	AWHP COP 3.45 / District Steam (Back-up) / Preheat Coils COP 1.0
Cooling	AWHP COP 2.98
Humidification	Electric COP 1.0
Ventilation	CSA Z317.2:19 / 100% Outside Air / Exhaust
Heat Recovery	Sensible = 58.2% eff. Latent = 0% eff.

Overall, heating and cooling for the proposed design will consist of an air-to-water heat pump heat recovery ventilator for ventilation paired with VAV boxes for air supply to the space. The air-to-water heat pump will utilize electric pre-heat coil and electric humidifiers. Located in the one (1) IT Room and three (3) Electrical Rooms are air conditioning units.

Table 6: Proposed HVAC Network





The ventilation for the proposed building model for healthcare application are as per CAN/CSA 317.2:19, for all the other areas not covered under CAN/CSA 317.2: 2019 the design outdoor air calculations will be based on ANSI/ASHRAE Standard 62.1-2013 Ventilation for Acceptable Indoor Air Quality.

### 3.2.7. Internal Lighting and Receptacle

Lighting and receptacle loads for the energy models are per to the schedules set forth in SB-10 Division 3 Chapter 2 “Additional Requirements to 2013 ANSI/ASHRAE/IES 90.1”.

### 3.2.8. Miscellaneous Loads

The process load for dental chairs was calculated to be 24.3 W/m<sup>2</sup>.

### 3.2.9. Domestic Water

#### 3.2.9.1. Domestic Hot Water System

An instantaneous electric water heater was used for the proposed model. The service hot water heating loads are per SB-10 Division 3 Chapter 2 “Additional Requirements to 2013 ANSI/ASHRAE/IES 90.1”.

#### 3.2.9.2. Indoor Water Reduction

The proposed water fixtures provide an estimated 26% reduction in domestic water consumption. The fixtures include the following:

Table 7: Proposed Water Fixture

Fixture	Water Consumption
Toilets	4.2 lpf
Sinks – Washroom	1.9 lpm
Sinks – Laboratory	5.7 lpm

### 3.2.10. CO<sub>2</sub>e Emission Factors

The carbon emission factors for electricity and natural gas used for the model are per the University of Toronto – Tri-Campus Energy Modelling & Utility Performance Standard. The carbon emission factor for district steam was established based on recent projects which also utilized district steam supplied by Enwave.

Table 8: CO<sub>2</sub>e Emission Factors

Fuel Source	Carbon Emission Factor
Electricity	0.043 kgCO <sub>2</sub> e/kWh
Natural Gas	1.899 kgCO <sub>2</sub> e/m <sup>3</sup>
District Energy – Steam	76.6 kgCO <sub>2</sub> e/Mlbs

### 3.2.11. Utility Rates

Utility rates are not yet established. EXP requests that the University of Toronto either provide the utility rates for the various metered sources or that they provide the utility data for at least one (1) complete year to us to assess.

### 3.2.12. Simulation Software Package

IESVE 2024 simulation software will be utilized to develop the energy model results. The IESVE software package is an approved software package for demonstrating compliance under LEED v4.

## 4. Energy Modeling Results

### 4.1. General

The purpose of an energy model is to predict the energy consumption of a building, but the model is limited by the energy modeling software inputs and algorithms, the actual operation of the building, weather condition, etc. In other words, the simulated end-use energy values predicted in this model can and should be used for the sole purpose of sustainability compliance.

Overall, the proposed design outperforms both the project charter baseline and LEED reference model. Compared to the project charter baseline, the proposed design sees energy and carbon emission reductions of 28% and 77% respectively. Compared to the LEED reference model, the proposed design sees energy and carbon emission increase of 15% and 17% respectively.

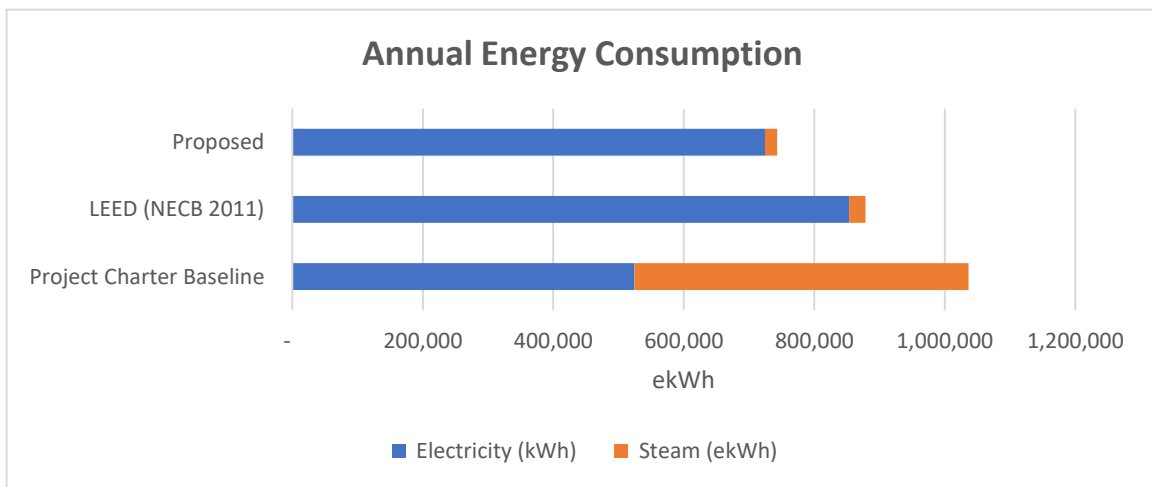


Figure 5: Annual Energy Consumption (ekWh)

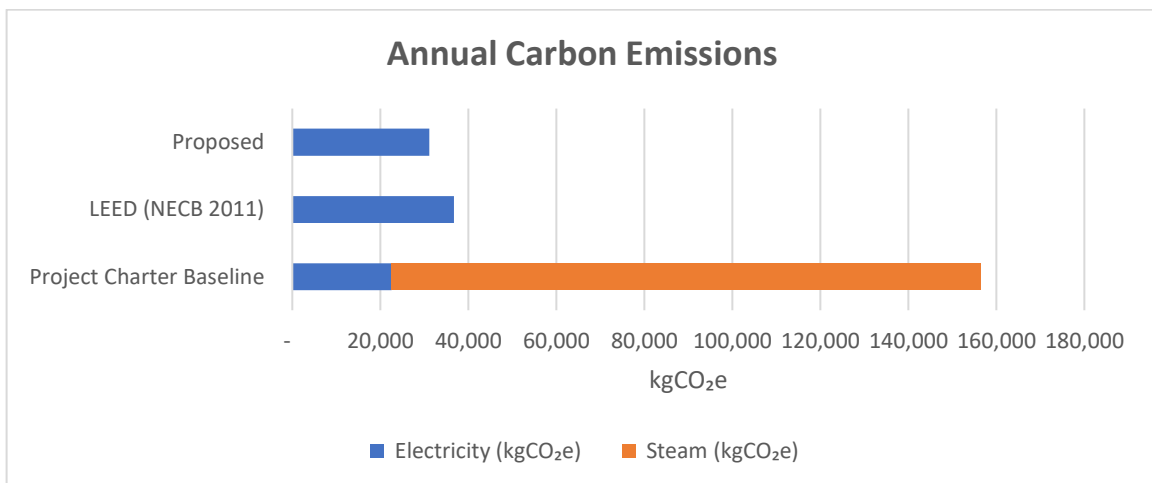


Figure 6: Annual Carbon Emissions (kgCO<sub>2</sub>e)

Table 9: Energy Consumption by End-Use

	Project Charter Baseline	LEED (NECB 2011)		Proposed		
	Energy/ Emission/ Metric	Energy/ Emission/ Metric	% Savings vs. Baseline	Energy/ Emission/ Metric	% Savings vs. Baseline	% Savings vs. LEED
Electricity (kWh)	524,563	853,671	-63%	724,541	-38%	15%
Steam (ekWh)	511,642	24,981	95%	18,646	96%	25%
<b>Total Energy (ekWh)</b>	<b>1,036,205</b>	<b>878,652</b>	<b>15%</b>	<b>743,187</b>	<b>28%</b>	<b>15%</b>
Interior Lighting (kWh)	-	72,211	-	27,097	-	62%
Receptacle Equipment (kWh)	-	118,071	-	109,697	-	7%
Space Heating (kWh)	-	423,489	-	316,090	-	25%
Service Water Heating (kWh)	-	2,647	-	22,277	-	-742%
Space Cooling (kWh)	-	64,911	-	59,436	-	8%
Heat Rejection (kWh)	-	4,143	-	3,794	-	8%
Humidification (kWh)	-	100,736	-	69,919	-	31%
Interior Central Fans (kWh)	-	91,790	-	129,756	-	-41%
Pumps (kWh)	-	654	-	5,122	-	-683%
Electricity (kgCO <sub>2</sub> e)	22,556	36,708	-63%	31,155	-38%	15%
Steam (kgCO <sub>2</sub> e)	133,847	6,535	95%	4,878	96%	25%
<b>Total Emissions (kgCO<sub>2</sub>e)</b>	<b>156,403</b>	<b>43,243</b>	<b>72%</b>	<b>36,033</b>	<b>77%</b>	<b>17%</b>
Electricity Utility Cost (2023\$)	\$-	\$-	-	\$-	-	-
Steam Utility Cost (2023\$)	\$-	\$-	-	\$-	-	-
<b>Total Utility Cost (2023\$)</b>	<b>\$-</b>	<b>\$-</b>	<b>-</b>	<b>\$-</b>	<b>-</b>	<b>-</b>
TEUI (ekWh/m <sup>2</sup> )	598.55	689.15	15%	582.90	28%	15%
TEDI (ekWh/m <sup>2</sup> )	N/A	332.61	-	274.90	-	17%
GHGI (kgCO <sub>2</sub> e/m <sup>2</sup> )	90.34	33.92	72%	28.26	77%	17%

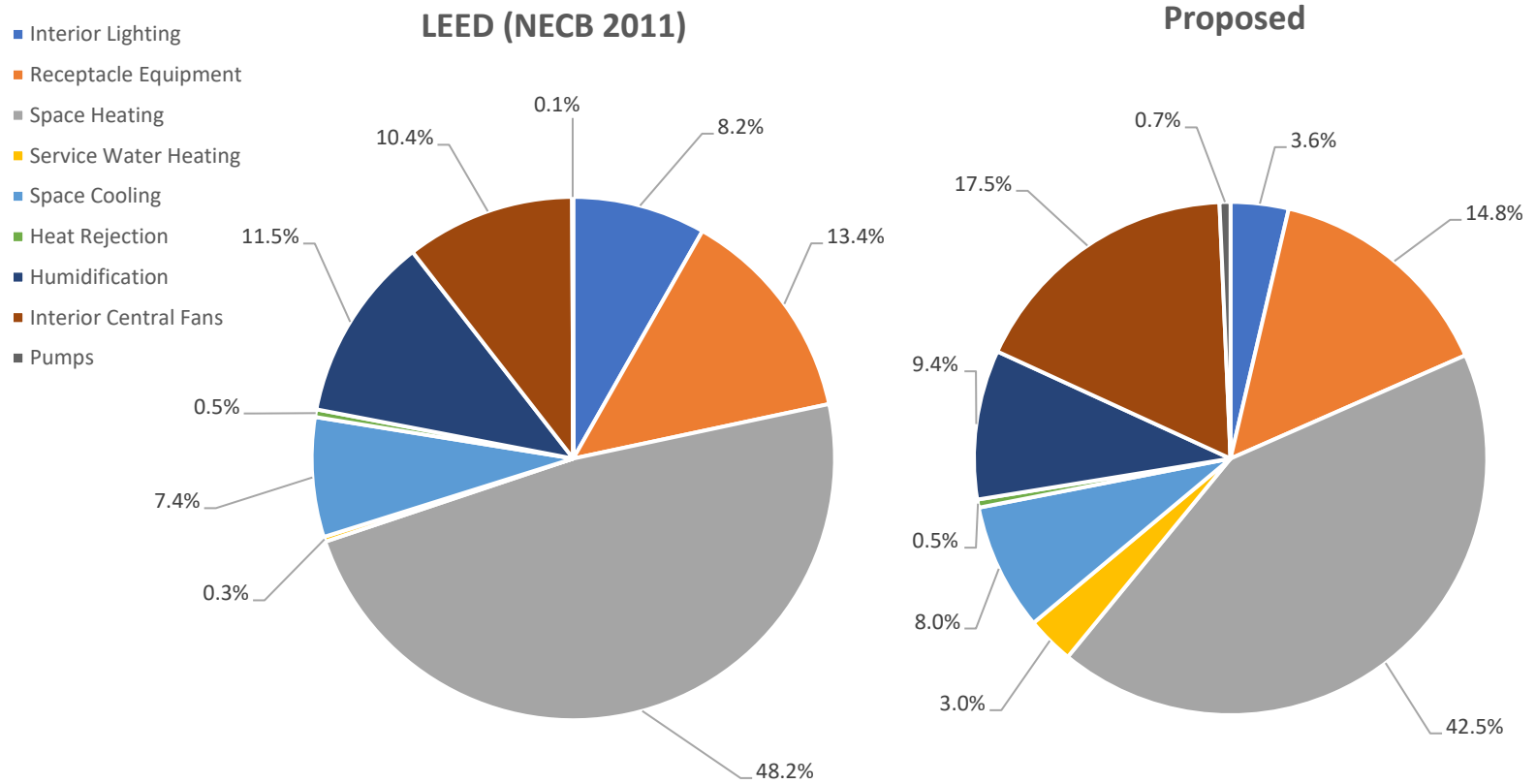


Figure 7: Energy End-Use for the LEED and Proposed Models



## 5. Appendices

### 5.1. Appendix A – IESVE Model Summaries

LEED (NECB 2011)																
	Total Energy (MWh)	Natural Gas (MWh)	Electricity (MWh)	Enwave - HW (MWh)	Interior Lighting (MWh)	Receptad Equipmen (MWh)	Other Process (MWh)	Space Heating (MWh)	Service Water Heating (MWh)	Space Cooling (MWh)	Heat Rejection (MWh)	Humidifica (MWh)	Interior Central Fans (MWh)	Interior Local Fans (MWh)	Exhaust Fans (MWh)	Pumps (MWh)
Date	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -
Jan	125.1857	0.0000	120.4504	4.7353	6.3125	3.2949	7.0537	80.2748	0.2319	0.5905	0.0377	19.1033	8.1565	0.0000	0.0000	0.1298
Feb	125.1483	0.0000	120.3864	4.7620	5.5348	2.8845	6.1645	80.7269	0.2029	0.2488	0.0159	20.4806	8.7583	0.0000	0.0000	0.1311
Mar	111.6081	0.0000	107.5919	4.0163	6.0979	3.1768	6.7869	68.0868	0.2241	0.4787	0.0306	17.9310	8.6894	0.0000	0.0000	0.1061
Apr	65.1921	0.0000	63.2464	1.9456	5.8369	3.0398	6.4906	32.9835	0.2131	1.4442	0.0922	8.6817	6.3632	0.0004	0.0000	0.0468
May	41.3562	0.0000	40.7429	0.6133	6.3125	3.2950	7.0537	10.3974	0.2319	5.5305	0.3530	1.5269	6.6336	0.0065	0.0000	0.0152
Jun	33.8267	0.0000	33.8163	0.0104	5.8387	3.0400	6.4906	0.1766	0.2144	10.5664	0.6744	0.0526	6.7266	0.0463	0.0000	0.0002
Jul 01-31	44.5505	0.0000	44.5410	0.0095	6.0961	3.1766	6.7869	0.1609	0.2227	18.0499	1.1521	0.0004	8.8134	0.0912	0.0000	0.0003
Aug	45.1742	0.0000	45.1681	0.0062	6.3125	3.2950	7.0537	0.1043	0.2319	17.6336	1.1255	0.0000	9.3164	0.1012	0.0000	0.0002
Sep	32.3171	0.0000	32.1932	0.1239	5.6224	2.9216	6.2238	2.0998	0.2052	7.7928	0.4974	0.2678	6.6338	0.0495	0.0000	0.0030
Oct	48.9994	0.0000	47.6426	1.3568	6.3125	3.2949	7.0537	23.0012	0.2319	1.2902	0.0824	1.3346	6.3655	0.0003	0.0000	0.0324
Nov	85.9374	0.0000	82.9723	2.9652	6.0532	3.1581	6.7573	50.2665	0.2222	0.8049	0.0514	12.1265	6.4245	0.0000	0.0000	0.0728
Dec	119.3555	0.0000	114.9191	4.4365	5.8816	3.0584	6.5202	75.2097	0.2149	0.4809	0.0307	19.2301	8.6130	0.0000	0.0000	0.1162
Summed	878.6513	0.0000	853.6705	24.9810	72.2114	37.6356	80.4355	423.4885	2.6471	64.9113	4.1433	100.7355	91.4942	0.2953	0.0000	0.6543
Proposed																
	Total Energy (MWh)	Natural Gas (MWh)	Electricity (MWh)	Enwave - HW (MWh)	Interior Lighting (MWh)	Receptad Equipmen (MWh)	Other Process (MWh)	Space Heating (MWh)	Service Water Heating (MWh)	Space Cooling (MWh)	Heat Rejection (MWh)	Humidifica (MWh)	Interior Central Fans (MWh)	Interior Local Fans (MWh)	Exhaust Fans (MWh)	Pumps (MWh)
Date	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -	Clinic 2 -
Jan	91.7403	0.0000	90.1531	1.5872	2.3648	3.0414	6.5708	50.2539	1.9612	0.3604	0.0230	15.2200	11.6747	0.0000	0.0000	0.2701
Feb	96.3673	0.0000	95.1505	1.2167	2.0770	2.6627	5.7447	55.8369	1.7071	0.0740	0.0047	16.5785	11.4583	0.0000	0.0000	0.2235
Mar	83.1786	0.0000	81.3146	1.8639	2.2888	2.9324	6.3251	43.9851	1.8785	0.5600	0.0357	13.2864	11.5871	0.0000	0.0000	0.2994
Apr	49.1302	0.0000	47.3804	1.7498	2.1926	2.8061	6.0497	19.5198	1.7931	1.6255	0.1038	4.9241	9.7817	0.0000	0.0000	0.3338
May	45.0033	0.0000	42.9976	2.0057	2.3648	3.0414	6.5708	14.4194	1.9612	5.3764	0.3432	0.3492	10.1426	0.0002	0.0000	0.4341
Jun	43.7856	0.0000	42.4196	1.3660	2.1929	2.8061	6.0497	10.2512	1.7938	9.2175	0.5884	0.0005	10.3431	0.0006	0.0000	0.5418
Jul 01-31	53.0554	0.0000	52.0990	0.9564	2.2886	2.9324	6.3251	9.1515	1.8778	16.9763	1.0836	0.0000	11.6032	0.0022	0.0000	0.8147
Aug	52.5283	0.0000	51.5141	1.0142	2.3648	3.0414	6.5708	9.6450	1.9612	15.7383	1.0046	0.0000	11.4045	0.0016	0.0000	0.7962
Sep	40.7595	0.0000	39.0001	1.7594	2.1167	2.6971	5.8040	11.3954	1.7104	6.3053	0.4025	0.0000	9.8736	0.0003	0.0000	0.4542
Oct	43.4256	0.0000	41.1607	2.2648	2.3648	3.0414	6.5708	16.6478	1.9612	2.0924	0.1336	0.2479	9.9940	0.0000	0.0000	0.3718
Nov	58.9406	0.0000	56.7707	2.1699	2.2689	2.9152	6.2954	27.7121	1.8765	0.9277	0.0592	6.2204	10.3140	0.0000	0.0000	0.3512
Dec	85.2725	0.0000	84.5809	0.6916	2.2126	2.8233	6.0793	47.2716	1.7951	0.1817	0.0116	13.0921	11.5740	0.0000	0.0000	0.2311
Summed	743.1872	0.0000	724.5413	18.6457	27.0973	34.7408	74.9563	316.0898	22.2771	59.4355	3.7938	69.9191	129.7507	0.0049	0.0000	5.1219

## **5.2. Appendix B – LEED V4: Indoor Water Use Reduction Calculator**

## Clinic 2

Group name	Clinic 2
------------	----------

### Table: Project Information

Enter project occupancy information. This information should be consistent with occupancy numbers used in other LEED credits.

☐ **Non-default gender mix**

The default gender mix is half male and half female. If necessary, modify the Male and Female occupant type columns for non-default gender mix if the project is specifically designed for an alternative gender ratio or the project is expected to have alternative gender usage rates for the life of the building.

☒ **The project includes ADA and/or gender-neutral bathrooms**

If the project includes separate gender neutral and/or ADA restrooms without urinals, the LEED default assumption is that 5% of male occupants and 5% of female occupants use these restrooms. Enter 95% into the percent of males expected to use restrooms with urinals below. Alternately, the project team can estimate this percentage based on the project's restroom layout/anticipated usage patterns or weighted fixture counts.

Occupancy Type	Employees (FTE)	Visitors	Retail Customers	Students (K-12)	Residential	Other (specify)	Gender Ratio (%)
Total	10	100					100%
Male	5	75	0	0	0	0	50%
Female	5	75	0	0	0	0	50%

Determine the percent of males expected to use urinals (enter 100% if all male restrooms have urinals, 0% if the project contains no urinals, etc)

Percent of males expected to use restrooms with urinals	0%
---	----

Enter the number of days the project is accessible to employees or FTE.

Annual days of operation	260
--------------------------	-----

### For projects with dual-flush toilets

Enter the resulting flush rate into the design case flush rate section below.

Low flush (lpf)	
Full flush (lpf)	
LEED weighted average flush rate (lpf)	

### Table: Flush Fixtures

1. Indicate the **Fixture ID** that matches the information provided in the plumbing schedule.
2. Select the **Fixture Family** and **Fixture Type** installed on the project.
3. Enter the **Design Flush Rate** identified by the manufacturer - for dual flush toilets, use the dual flush calculator to determine average flush rate.
4. Enter **Percent of Occupants** with access to the fixture. If the fixture is installed in all restrooms, use 100%.
5. If necessary, modify the **Total Uses per Day** column for non-default uses.


Fixture Information			Flush Rate			Uses per Day						Total Daily Uses		Total Daily Water Use	
Fixture ID	Fixture Family	Fixture Type	Baseline Flush Rate (lpf)	Design Flush Rate (lpf)	Percent of Occupants (%)	Employees (FTE)	Visitors	Retail Customers	Students (K-12)	Residential	Other	Default	Non-default (Optional)	Baseline (liters)	Design (liters)
WC-1	Toilet (male)	Dual-Flush Water Closet	6.00	4.2	100	3.0	0.5	0.00	0.0	0.0		52.5		315.00	220.5
WC-1	Toilet (female)	Dual-Flush Water Closet	6.00	4.2	100	3.0	0.5	0.00	0.0	0.0		52.5		315.00	220.5
						0.0	0.0	0.00	0.0	0.0		0.0		0.00	0
						0.0	0.0	0.00	0.0	0.0		0.0		0.00	0
						0.0	0.0	0.00	0.0	0.0		0.0		0.00	0
Baseline case annual flush volume (liters/year)					163,800.00										
Design case annual flush volume (liters/year)					114,660.00										

### Table: Flow Fixtures

1. Indicate the **Fixture ID** that matches the information provided in the plumbing schedule.
2. Select the **Fixture Type** installed on the project.
3. If necessary, modify the **Duration** column for non-default values.
4. Enter the **Design Flow Rate** identified by the manufacturer.
5. Enter **Percent of Occupants** with access to the fixture. If the fixture is installed in all restrooms, use 100%.
6. If necessary, modify the **Total Uses per Day** column for non-default uses.

Fixture Information		Duration		Flow Rate		Percent of Occupants (%)	Uses per Day						Total Daily Uses		Total Daily Water Use	
Fixture ID	Fixture Type	Default (sec)	Non-default (sec) (Optional)	Baseline Flow Rate (lpm)	Design Flow Rate (lpm)		Employees (FTE)	Visitors	Retail Customers	Students (K-12)	Residential	Other	Default	Non-default (Optional)	Baseline (liters)	Design (liters)
Lav-Pub	Public lavatory (restroom) faucet	30		1.90	1.9	100	3.0	0.5	0.0	0.0	0.0	105.0		99.75	99.75	
Lab-1	Kitchen faucet	15		8.30	5.7	100	1.0	0.0	0.0	0.0	0.0	10.0		20.75	14.25	
							0.0	0.0	0.0	0.0	0.0	0.0		0.00	0.00	
							0.0	0.0	0.0	0.0	0.0	0.0		0.00	0.00	
							0.0	0.0	0.0	0.0	0.0	0.0		0.00	0.00	
Baseline case annual flow volume (liters/year)						31,330.00										
Design case annual flow volume (liters/year)						29,640.00										

### **5.3. Appendix C – LEED ID+C V4 Checklist**

		<b>LEED ID+C v4 Checklist Worksheet</b>						Gross m²: 1,731.2 ~ 10 Employees & ~150 Students/Visitors	
		<b>U of T Clinic 2 Renovations</b>							
		<b>Target: Design to LEED Silver Standards</b>							
		2026-01-09							
		Current Points:						110	
		Pts Avail						46	
		Yes						22	
		Probable						21	
		May be						5	
		Not Probable						36	
		No						Primary Responsibility	
		Remarks/ Tasks							
		<b>Minimum Program Requirements</b>						<b>Summary Requirements</b>	
MPR1	Must be in a permanent location on existing land	All LEED projects must be constructed and operated on a permanent location on existing land. No project that is designed to move at any point in its lifetime may pursue LEED certification.							
MPR2	Must use reasonable LEED boundaries	Establish a LEED Boundary for the project - based on limits of construction or property line.							
MPR3	Must comply with project size requirements	LEED BD+C and LEED O+M: a minimum of 1,000 square feet of gross floor area LEED ID+C Rating Systems: a minimum of 250 square feet of gross floor area.							
		<b>Integrative Process</b>						<b>Max. 2 Point</b>	
IPc1 Design	Integrative Process	Beginning in pre-design and continuing throughout the design phases, identify and use opportunities to achieve synergies across disciplines and building systems. Use the analysis to inform the OPR, BOD, and DD's and CD's.						2021-12-14 EXP: worksheet to be completed by team	
		<b>Location &amp; Transportation</b>						<b>Max. 18 Points</b>	
LTc1 Design	LEED for Neighborhood Development Location	Locate the project within the boundary of a development certified under LEED for Neighborhood Development. Points are determined by Project Certification. Certified - 8 pts; Silver - 10 pts; Gold - 12 pts; Platinum - 18 pts						Not applicable	
LTc2 Design	Surrounding Density and Diverse Uses	Locate on a site whose surrounding density win a 1/4 mile radius of the project boundary meets the requirements of Table 1 in the reference guide. Locate building such that the main entrance is within a 1/2-mile walking distance of 4 to 7 (1 point) or 8 or more (2 points) diverse uses.						2022-01-16 EXP: combined densities will be used. With The Hospital for Sick Children and several other large buildings within the 400m radius, atleast 3 points will be achieved for this credit.  2021-12-14 EXP: project is within 800m walking distance to 8+ diverse uses.  Additional points for residential and non-residential densities will be confirmed in DDs.	
LTc3 Design	Access to Quality Transit (v4.1)	Project located within 1/2 mile of a commuter rail, light rail, subway station, bus rapid transit station, or commuter ferry terminal, or 1/4 mile of a public or campus bus line with minimum 72 of weekday and 30 weekend daily trips.						2022-01-05 EXP: Dundas Station Line 1 provides enough Weekday Trips and Weekend Trips to ear 5 points. Additional points may be earned for Bus Lines and Streetcar lines, pending confirmation on reverse routes.  2021-12-14 EXP: project is within 400m walking distance to tram stations, subway station and bus stops. EXP will refine calculations in DD's to confirm complete # of weekday and weekend trips.	
LTc4 Design	Bicycle Facilities	Provide bicycle storage -- for 5% of long-term regular occupants and 2.5% of short-term transients. Long-term racks must be covered (or inside). Provide 1 shower for first 100 regular occupants and one additional shower for each additional 150 regular occupants. Locate project within 200-yards from a bicycle network that connects to one of the following: 10 diverse uses; a school or employment center; a bus rapid transit stop, light or heavy rail station, commuter rail station or ferry terminal. All destinations must be within a 3-mile radius of project boundary.						2021-12-14 EXP: 16 existing bike racks are located on the south side of Elm Street. Showers are installed in the building. A bicycle network (trail) is 124m from the bike storage area. 10+ diverse uses and a transit stop are within 4.8 km of the project boundary.	
LTc5 Design	Reduced Parking Footprint (v4.1)	<b>Option 1: No Parking or Reduce Parking (1 pt)</b> - Do not exceed minimum local code requirements for parking capacity OR <b>Option 2: Car Share (1 pt)</b> - Car share vehicle parking space(s) for 1% total parking spaces or 1 space for minimum of 2 years OR <b>Option 3: Unbundling Parking (1 pt)</b> - sell parking separately from all property sales/leases. No free/subsidized parking						2021-12-14 EXP: there is no new parking for the project. Further investigation is required to confirm that parking does not exceed max limits for this space.	
		<b>Water Efficiency</b>						<b>Max. 12 Points</b>	
WEp1 Design	Indoor Water Use Reduction	Beat baseline water use by 20% for water closets, urinals, lavatory faucets, showers, kitchen sink faucets, pre-rinse spray valves. Fixtures must be WaterSense labeled, if eligible.							
WEc1 Design	Indoor Water Use Reduction 25% - 2 pts, 30% - 4 pts, 35% - 6 pts, 40% - 8 pts, 45% - 10 pts, 50% - 12 pts  EP Available	Beat baseline potable water use by: 25% (2 points), 30% (4 points), 35% (6 points), 40% (8 points), 45% (10 points), 50% (12 points).  - Reduce connected lighting power density by 5% below ASHRAE 90.1-2010 using the space-by-space method or by applying the whole-building lighting power allowance to the entire tenant space. - Install ENERGY STAR appliances, office equipment, electronics, and commercial food service equipment (HVAC, lighting, and building envelope products are excluded) for 50% (by rated-power) of the total ENERGY STAR eligible products in the project.						2022-02-01 EXP: no showers in scope for LEED assessment, to achieve 36% (6 points) savings, the following should be specified: • 3.8 lpf - WC's • 1.33 gpf - Lav's • 3.8 lpm - Breakroom Sinks  WEpct15 will still be used to maximize LEED points and consider any reductions in the clinic sinks.  To meet Project Charter 50% reduction, a separate calc will be reviewed to understand savings associated with no water piped to the dental chairs.  2025-02-27 EXP: The following fixtures were used in the LEED V4 Indoor Water Calculator • 3.8 lpf - WC's • 1.33 gpf - Lav's • 3.8 lpm - Breakroom Sinks This achieves a 38% reduction (6 points)  2025-05-01 EXP: The following fixtures were used in the LEED V4 Indoor Water Calculator • 4.2 lpf - WC's • 1.9 gpf - Lav's • 5.7 lpm - Laboratory Sinks This achieves a 26% reduction (2 points)	
		<b>Energy &amp; Atmosphere</b>						<b>Max. 38 Points</b>	
EAp1 Construction	Fundamental Commissioning and Verification	Complete the fundamental commissioning (Cx) process activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC&R Systems, as they relate to energy, water, indoor environmental quality, and durability.							
EAp2 Design	Minimum Energy Performance	<b>Option 1. Whole-building energy simulation</b> Beat ASHRAE 90.1-2010 Baseline by 3% for commercial interiors. OR <b>Option 2. Prescriptive compliance: ASHRAE 50% Advanced Energy Design Guide</b> - Comply with the mandatory and prescriptive provisions of ANSI/ASHRAE/IESNA Standard 90.1-2010, with errata (or a USGBC-approved equivalent standard for projects outside the United States). - Reduce connected lighting power density by 5% below ASHRAE 90.1-2010 using the space-by-space method or by applying the whole-building lighting power allowance to the entire tenant space. - Install ENERGY STAR appliances, office equipment, electronics, and commercial food service equipment (HVAC, lighting, and building envelope products are excluded) for 50% (by rated-power) of the total ENERGY STAR eligible products in the project.							
EAp3 Design	Fundamental Refrigerant Management	No CFC use in building equipment							

EA1 Con- struction	<b>Enhanced Commissioning</b>	<b>Option 1: Enhanced commissioning (4 points)</b> OR <b>Option 2. Monitoring-based commissioning (+1 point)</b> Achieve Option 1. Develop monitoring-based procedures and identify points to be measured and evaluated to assess performance of energy- and water-consuming systems. Include the procedures and measurement points in the commissioning plan.	5	4				1		2021-12-14 EXP: enhanced commissioning requirements met for the project. MBCx not included.
EA2 Design	<b>Optimize Energy Performance</b> OPTION 1: 4% = 4 pts, 5% = 6 pts, 6% = 8 pts, 7% = 10 pts, 8% = 11 pts, 9% = 12 pts; 10% = 13 pts, 11% = 14 pts, 12% = 15 pts, 13% = 16 pts, 14% = 17 pts, 15% = 18 pts, 16% = 19 pts, 17% = 20 pts, 18% = 21 pts, 20% = 22 pts, 22% = 23 pts, 24% = 24 pts, 26% = 25 pts  EP Available	<b>OPTION 1. TENANT-LEVEL ENERGY SIMULATION (1–25 POINTS)</b> Analyze efficiency measures during the design process and account for the results in design decision-making. Analysis can include energy simulation of efficiency opportunities, energy simulation analyses for similar projects, or published data from energy analyses performed for similar projects (such as AEDCs). Analyze efficiency measures focused on load reduction and HVAC-related strategies; passive measures are acceptable. Project the potential energy savings and cost implications for all affected systems. Follow the criteria in EA Prerequisite Minimum Energy Performance to demonstrate a percentage improvement in the proposed tenant project performance rating compared with the baseline.	25	18		7				2022-01-11 EXP: to meet the prereq, the following inputs were assumed: • Envelope: Walls = R28.8, Windows = U-0.38 / SHGC-0.39 • HVAC: DX AHUs with VAV Boxes. DOAS units (100% Eff), FCUs with Elec Htg, Heat Recovery (70% enthalpy recov) • Int. Lighting: 7.35 W/m² • Receptacle Load: 4.67 W/m² • Process Loads: 50 W/m²  2025-02-26 EXP: 17 points (14% Savings) • Ext. Wall: R-10 (IP) • Roof: R-15 (IP) • Exposed Floor: R-15 (IP) • Windows: U-0.20 (IP) / SHGC 0.4 • Mechanical System: HVAC - ASHP VAV + Heat Pipe • Heating: RTU ASHP COP 4.20 / Preheat Coils COP 1.0 • Cooling: RTU ASHP COP 4.41 • Humidification: Electric COP 1.0 • Heat Recovery: 50% eff.  2025-04-30 EXP: 25 points (28% Savings) • Ext. Wall: R-10 (IP) • Roof: R-15 (IP) • Exposed Floor: R-15 (IP) • Windows: U-0.20 (IP) / SHGC 0.4 • Mechanical System: HVAC (22,000 CFM) - ASHP VAV + Heat Pipe • Heating: RTU ASHP COP 4.20 (486.0 kBTU/h x3) / Preheat Coils COP 1.0 • Cooling: RTU ASHP COP 4.41 (430.5 kBTU/h x3) • Humidification: Electric COP 1.0 • Heat Recovery: 50% eff.  2025-05-30 EXP: 17 points (14% Savings) • Ext. Wall: R-10 (IP) • Roof: R-15 (IP) • Exposed Floor: R-15 (IP) • Windows: U-0.20 (IP) / SHGC 0.4 • Mechanical System: HVAC (9435 L/s) - ASHP VAV + Heat Pipe • Heating: RTU ASHP COP 4.20 (285 kW) / Preheat Coils COP 1.0 (146 kW) • Cooling: RTU ASHP COP 4.41 (339 kW) • Humidification: Electric COP 1.0 • Heat Recovery: 58.2% eff.
EA3 Design	<b>Advanced Energy Metering</b>	<b>Option 1. Metering (1 pt)</b> Install new or use existing tenant-level energy meters to provide tenant-level data representing total tenant energy consumption (electricity, natural gas, chilled water, steam, fuel oil, propane, biomass, etc.).  <b>Option 2. Advanced metering (2 pts)</b> Install advanced energy metering for the following: all energy sources used in the tenant space; and any individual energy end uses that represent 10% or more of the total annual consumption of the tenant space.	2			2				2021-12-14 EXP: can we separately meter the space energy usage through Adv. Metering Option 2? Would require a meter for CHW, HHW and fan energy. FCU energy would also need to be captured.
EA4 Design	<b>Renewable Energy Production</b> EP Available  (v4.1)	Use on- OR off-site renewable energy sources for all/a portion of annual energy use. Choose one or more strategies from Tier 1 (on-site renewable energy generation), Tier 2 (new off-site renewable energy), Tier 3 (off-site renewable energy) for up to 6 points. 1 pt: 2% Tier 1, 10% Tier 2, or 35% Tier 3 2 pts: 5% Tier 1, 20% Tier 2, or 70% Tier 3 3 pts: 10% Tier 1, 30% Tier 2, or 100% Tier 3 4 pts: 15% Tier 1 or 40% Tier 2 5 pts: 20% Tier 1 or 50% Tier 2	5					5		2021-12-14 EXP: no RE's planned for the project.
EA5 Design	<b>Enhanced Refrigerant Management</b>	Projects are required to select cooling equipment to minimize or eliminate the emission of compounds that contribute to ozone depletion.	1					1		2022-01-06 EXP: VRF is proposed which typically does not meet the Enh. Refrigerant Mgmt credit, due to large amount of refrigerant in the system. Credit moved to Not Probable.
EA6 Design	<b>Green Power and Carbon Offsets</b>	Engage in a contract for qualified resources that have come online since January 1, 2005, for a minimum of 5 years, to be delivered at least annually. The contract must specify the provision of at least 50% (1 point) or 100% (2 points) of the project's energy from green power, carbon offsets, or renewable energy certificates (RECs).  Green power and RECs must be Green-e Energy certified or the equivalent. RECs can only be used to mitigate the effects of Scope 2, electricity use.  Carbon offsets may be used to mitigate Scope 1 or Scope 2 emissions on a metric ton of carbon dioxide-equivalent basis and must be Green-e Climate certified, or the equivalent.  Use the project's annual energy consumption, calculated in EA Prerequisite Minimum Energy Performance, if Option 1 was pursued; otherwise use the U.S. DOE's CBECS database to estimate energy use.						2		2022-02-02 EXP: moved to no; if needed to achieve a higher threshold, can be considered at the end of the project.
	<b>Materials &amp; Resources</b>		Max. 13 Points							
MRp1 Design	<b>Storage and Collection of Recyclables</b>	Provide easily accessible recycling collection, sorting, and storage facilities for all of the building's occupants. Must include mixed paper, corrugated cardboard, glass, plastics and metals.		Req'd						
MRp2 Con- struction	<b>Construction and Demolition Waste Management Planning</b>	Develop and implement a construction and demolition waste management plan.		Req'd						
MRc1 Design	<b>Long-term Commitment</b>	The occupant or tenant must commit to remain in the same location for at least 10 years.	1	1						2021-12-14 EXP: space owned by U of T for U of T faculty and students.
MRc2 Con- struction	<b>Interior Life Cycle Impact Reduction</b>  EP Available (v4.1)	<b>v4</b> <b>Option 1. Interior Reuse (2 pts)</b> Reuse or salvage interior nonstructural elements for at least 50% of the surface area.  <b>Option 2. furniture reuse (1 point)</b> Reuse, salvage, or refurbish furniture and furnishings for at least 30% of the total furniture and furnishings cost.  <b>Option 3. design for flexibility (1 point)</b> Conduct an integrative planning process to increase the useful life of the project space by install accessible systems (floor or ceiling) for at least 50% of the project floor area/Design at least 50% of interior nonstructural walls, ceilings, and floors to be movable or demountable./ Include in at least one major component or systems purchase contract a clause specifying sub-contractor, vendor, or on site take back system./ Implement flexible power distribution (i.e., plug-and-play) systems for at least 50% of the project floor area so that lighting, data, voice, and other systems can be easily reconfigured and repurposed./ Implement a flexible lighting control system with plug and play components such as wall controls, sensors, and dimming ballasts for a minimum of 50% of the lighting load.  <b>v4.1</b> <b>Option 1. Interior Furniture and Nonstructural Elements Reuse (1-3 points)</b> Path 1: Furniture and Interior Nonstructural Elements Reuse: 1 pt - 10% 2 pts - 25%	4					4		2021-12-14 EXP: No nonstructural elements will be reused and no furniture will be reused.

MRC3 Con- struction	<b>Building Product Disclosure and Optimization - Environmental Product Declarations</b>  Achieve one or more, for a max. of 2 pts  EP Available (v4.1)	<b>Option 1. Environmental Product Declaration (EPD) (1 point)</b> Use at least 10 different permanently installed products sourced from at least three different manufacturers that meet the criteria. AND/OR <b>Option 2. Embodied Carbon/LCA Optimization (1 point)</b> Use products that have a compliant embodied carbon optimization report or action plan separate from the LCA or EPD. Use at least 5 permanently installed products sourced from at least three different manufacturers.	2		1		1			2021-12-14 EXP: require in specs.
MRC4 Con- struction	<b>Building Product Disclosure and Optimization - Sourcing of Raw Materials</b>  EP Available (v4.1)	Use products sourced from at least three different manufacturers that meet at least one of the responsible sourcing and extraction criteria. 1 pt: 15% of permanently installed products 2 pts: 30% of permanently installed products	2		1		1			2021-12-14 EXP: require at least 1 point in specs.
MRC5 Con- struction	<b>Building Product Disclosure and Optimization - Material Ingredients</b>  EP Available (v4.1)	<b>Option 1. Material Ingredient Reporting (1 point)</b> Use at least 10 different permanently installed products from 3 different manufacturers with MIDs AND/OR <b>Option 2: Material Ingredient Optimization (1 point)</b> Use products that have a compliant material ingredient optimization report or action plan. Use at least 5 permanently installed products sourced from at least three different manufacturers.	2		1		1			2021-12-14 EXP: require at least 1 point in specs.
MRC6 Con- struction	<b>Construction and Demolition Waste Management</b>  EP Available	Recycle and/or salvage nonhazardous construction and demolition materials. Calculations can be by weight or volume but must be consistent throughout. <b>Option 1. diversion (1-2 points)</b> <b>Path 1. divert 50% and three material streams (1 point)</b> Divert at least 50% of the total construction and demolition material; diverted materials must include at least three material streams. OR <b>Path 2. divert 75% and four material streams (2 points)</b> Divert at least 75% of the total construction and demolition material; diverted materials must include at least four material streams. OR <b>Option 2. reduction of total waste material (2 points).</b> Do not generate more than 2.5 lbs of construction waste per SF of the building's floor area.	2	2						2021-12-14 EXP: Waste Mgmt plan should target 75% diversion rate of at least 4 material streams.
<b>Indoor Environmental Quality</b>			<b>Max. 17 Points</b>							
EQp1 Design	<b>Minimum IAQ Performance</b>	For mechanically ventilated spaces (and for mixed-mode systems when the mechanical ventilation is activated), determine the minimum outdoor air intake flow for mechanical ventilation systems using the ventilation rate procedure from ASHRAE 62.1-2010 or a local equivalent, whichever is more stringent. Meet the minimum requirements of ASHRAE Standard 62.1-2010, Sections 4-7, Ventilation for Acceptable Indoor Air Quality (with errata), or a local equivalent, whichever is more stringent.	Req'd							
EQp2 Design	<b>Environmental Tobacco Smoke (ETS) Control</b>	Smoking is prohibited inside in building, and outdoor smoking area is prohibited except in designated smoking areas located at least 25 feet from all entries, outdoor air intakes, and operable windows. This includes the use of e-cigarettes/electronic smoking devices. Signage must be posted within 10 feet of all building entrances indicating the no-smoking policy.	Req'd							
EQc1 Design	<b>Enhanced IAQ Strategies</b>  EP Available	<b>Option 1. Enhanced IAQ strategies (1 point):</b> Mechanically ventilated spaces A. entryway systems: Install permanent entryway systems at least 10 feet (3 meters) long in the primary direction of travel to capture dirt and particulates entering the building at regularly used exterior entrances. B. interior cross-contamination prevention: Sufficiently exhaust each space where hazardous gases or chemicals may be present or used C. filtration: Each ventilation system that supplies outdoor air to occupied spaces must have particle filters or air-cleaning devices that meet minimum efficiency reporting value (MERV) of 13 or higher, in accordance with ASHRAE Standard 52.2-2007  <b>Option 2. Additional enhanced IAQ strategies (1 point)</b> Mechanically ventilated spaces (select one): A. exterior contamination prevention: Design the project to minimize and control the entry of pollutants into the building. B. increased ventilation: Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates as determined in EQ Prerequisite Minimum Indoor Air Quality Performance. C. carbon dioxide monitoring: Monitor CO2 concentrations within all densely occupied spaces. CO2 monitors must be between 3 and 6 feet (900 and 1 800 millimeters) above the floor. D. additional source control and monitoring: For spaces where air contaminants are likely, evaluate potential sources of additional air contaminants besides CO2.	2		1	1				2021-12-14 EXP: MERV 13 filters (min) on DOAS units. No direct exterior access; project is exempt from Requirement. Proper exhaust requirements are met.
EQc2 Con- struction	<b>Low Emitting Materials</b>  2 categories = 1 pt 3 categories = 2 pts 4 categories = 3 pts 5 categories = 3 pts + EP Exemplary Performance: reach 90% threshold in at least 3 product categories (for 90% option, award exemplary performance or 1 additional pt if only 2 pts are achieved)  (v4.1)	<b>Interior paints and coatings applied on site:</b> At least 75%, by volume, for emissions; 100% for VOC content <b>Interior adhesives and sealants applied on site</b> (including flooring adhesive): At least 75% by volume, for emissions; 100% for VOC content <b>Flooring:</b> 90%, by cost, for emissions <b>Wall panels:</b> 75%, by cost, for emissions <b>Ceilings:</b> 90%, by cost, for emissions <b>Insulations:</b> 75%, by cost, for emissions <b>Composite wood:</b> 75%, by cost, for emissions <b>Furniture</b> (include in calculations if part of scope of work): At least 75%, by cost meet furniture evaluation	3		1	1		1		2021-12-14 EXP: target 3 compliant categories (1 point); paints/coatings, adhesives/sealants, ceiling/walls/thermal/acoustic insulation.  Additional point can be achieved if 2 more categories are met (i.e. flooring, composite wood, furniture).  Depending on categories met, budget calc method may be preferred. 1 point earned for 50% compliance by cost; a 2nd point earned if over 70%.
EQc3 Con- struction	<b>Construction IAQ Management Plan</b>	Develop an IAQ Management Plan. Conform to SMACNA IAQ guidelines, protect onsite or installed absorptive materials, install MERV 8 filters, replace filtration media prior to occupancy if the system is used during construction, and prohibit the use of tobacco products inside the building and within 25 feet of the building entrance during construction.	1	1						2021-12-14 EXP: require IAQ Mgmt Plan in specs.
EQc4 Con- struction	<b>Indoor Air Quality Assessment</b>	<b>Option 1. Flush-Out (1 point):</b> Install filtration media and supply at least 14,000 cu. ft. per sf of floor area. Maintain internal temp. of at least 60 degrees F and no higher than 80 degrees F and relative humidity no higher than 60%. OR <b>Option 2. Air Testing (2 points):</b> After construction ends and before occupancy, conduct baseline IAQ testing using protocols consistent with methods in Table 1.	2		1		1			2021-12-14 EXP: calculate duration of flushout. May be more achievable because of DOAS unit. Pricing for Air Testing can be requested from contractor if 2 points needed.
EQc5 Design	<b>Thermal Comfort</b>	<b>Thermal Comfort Controls</b> Provide thermal comfort controls for at least 50% of individual occupant spaces. Design HVAC systems and the building envelope to meet the requirements of ASHRAE 55-2010 (1 point).	1					1		2021-12-14 EXP: not feasible with layout; each training area does not have direct individual control

EQc6 Design	<b>Interior Lighting</b> (v4.1)	Meet 1 strategy for 1 point. Meet 3 strategies for 2 Points *Applies to regularly occupied spaces <b>Option 1 - Glare Control:</b> Use light fixtures with luminance < 7000 candela/m2 between 45 and 90 deg from nadir OR achieve Unified Glare Rating (UGR) < 19 using model <b>Option 2 - Color Rendering:</b> Use light source with CRI >= 90 OR Color Fidelity Index >= 78 and a gamut index between 97 and 100. <b>Option 3 - Lighting Control:</b> Dimmable or multilevel lighting for 90% occupant spaces <b>Option 4 - Surface Reflectivity:</b> For 90% of reg. occupied spaces, use interior finishes with surface reflectance >= 80% for ceilings and >=55% for walls Of applicable, use furniture finishes with surface reflectance >= 45% for work surfaces and 50% for movable partitions.	2		1	1					2022-02-02 EXP: lights at dental chairs are tri-level. 90% will be achieved (Opt. 1). Lighting Quality (Opt. 2) will be analyzed by lighting designer.
EQc7 Design	<b>Daylight</b> (v4.1)	Provide manual or automatic (with manual override) glare-control devices for all regularly occupied spaces AND Select one of following 3 options Option 1: Simulation - Spatial Daylight Autonomy and Annual Sunlight Exposure Option 2: Simulation - Illuminance Calculations Option 3: Measurement	3						3		2021-12-14 EXP: no daylight model is planned for the space. Points moved to No. Credit may not be achievable because layout of training rooms
EQc8 Design	<b>Quality Views</b>	Achieve a direct line of sight to the outdoors via vision glazing for 75% of all regularly occupied floor area.  View glazing in the contributing area must provide a clear image of the exterior, not obstructed by frits, fibers, patterned glazing, or added tints that distort color balance.	1						1		2021-12-14 EXP: layout is not conducive to achieving this credit.
EQc9 Design	<b>Acoustic Performance</b> (v4.1)	1. Achieve max. background noise levels from HVAC per 2011 ASHRAE Handbook, Ch. 48, Table 1; AHRI Standard 885-2008, Table 15; or local equivalent. 2. Meet the composite sound transmission class (STCC) ratings or local building code, whichever is more stringent. 3. Meet the reverberation time requirements.	1		2						2021-12-14 EXP: is there an acoustical consultant on the project?
<b>Innovation</b>			<b>Max. 6 Points</b>								
INc1 D/C	<b>Innovation</b>	<b>Exemplary Performance:</b>	1	1							2021-12-14 EXP: WEpc147 All-Gender Restroom pilot credit  <a href="https://www.usgbc.org/credits/WEpc147-v4.1?return=/credits/New%20Construction/v4.1">https://www.usgbc.org/credits/WEpc147-v4.1?return=/credits/New%20Construction/v4.1</a>
INc2 D/C	<b>Innovation</b>	<b>Exemplary Performance:</b>	1	1							2022-01-06 EXP: Green Cleaning Policy  <a href="https://www.usgbc.org/credits/commercial-interiors-retail-commercial-interiors-hospitality-commercial-interiors/v4/om-v4-c?return=/credits/Commercial%20Interiors/v4">https://www.usgbc.org/credits/commercial-interiors-retail-commercial-interiors-hospitality-commercial-interiors/v4/om-v4-c?return=/credits/Commercial%20Interiors/v4</a>
INc3 D/C	<b>Innovation</b>	<b>Innovation:</b>	1	1							2022-01-06 EXP: Green Building Education  <a href="https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-healthca-57?return=/credits/Commercial%20Interiors/v4">https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-healthca-57?return=/credits/Commercial%20Interiors/v4</a>
INc4 D/C	<b>Innovation</b>	<b>Innovation:</b>	1	1							2022-01-06 EXP: Purchasing - Lamps  <a href="https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-data-32?return=/credits/Commercial%20Interiors/v4">https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-data-32?return=/credits/Commercial%20Interiors/v4</a>
INc5 D/C	<b>Innovation</b>	<b>Pilot:</b>	1	1							2022-01-06 EXP: Occupant comfort survey  <a href="https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-healthca-81?return=/credits/Commercial%20Interiors/v4">https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-healthca-81?return=/credits/Commercial%20Interiors/v4</a>
INc2 Construction	<b>LEED Accredited Professional</b>	At least one principal participant of the project team must be a LEED Accredited Professional (AP) with a specialty appropriate for the project.	1	1							2021-12-14 EXP: LEED AP on team
<b>Regional Priority</b>			<b>Max. 4 Points</b>								
RPc1 D/C	<b>Regional Priority</b>	Enh. CX (4 pt threshold)	1	1							2021-12-14 EXP: RP earned for Enh. CX (4 pt threshold)
RPc2 D/C	<b>Regional Priority</b>	Optimize Energy Performance (10 pt threshold)	1	1							2022-02-02 EXP: project exceeds threshold.  2021-12-14 EXP: 7% reduction (10 points) should be achieved with DOAS and FCUs, plus upgrades to façade
RPc3 D/C	<b>Regional Priority</b>	<b>Surrounding Density and Diverse Uses (5 pt threshold)</b> Interiors Life-Cycle Impact Reduction (3 pt threshold)	1	1							2022-02-02 EXP: Surr. Density and Diverse Uses threshold is met.  2021-12-14 EXP: MRc1 will depend on reuse (see notes above); Surrounding Density threshold may be met - EXP to confirm with calcs
RPc4 D/C	<b>Regional Priority</b>	<b>Indoor Water Use Reduction (6 pt threshold)</b> Thermal Comfort (1 pt)	1	1							2022-02-02 EXP: 6 points can be achieved with recommended fixtures under WE credit Indoor Water Use Reduction.  2021-12-14 EXP: Indoor Water Use reduction requires 50% per the RFP; All-gender restrooms may make this difficult. RP would be earned at 35% reduction.  Thermal Comfort not earned



#### **5.4. Appendix D – Renovation Project Charter**

# Project Charter

## Overview

### Introduction

The Project Charter has been developed to aid in the calculation of the project-specific performance targets and provide a central repository for the assumptions and design characteristics that drive the utility performance of buildings. It must be used in conjunction with the [University of Toronto Tri-Campus Energy Modelling & Utility Performance Standard](#). The Project Charter serves as a reference point throughout the design process to ensure the performance goals are clearly understood by all involved parties and ultimately achieved.

### Navigation

This workbook contains two versions of the Project Charter: for Renovation ("Reno") projects and for New Construction ("NC") projects, as categorized by U of T. For both of these versions, the Project Charter is comprised of three components: the PPR Form; the Design Form; and the Project Submissions Checklist. These components must be completed in accordance with the Standard, as summarized below:

#### Renovation Projects

##### Component

[PPR Form](#)

[Design Form](#)

[Project Submissions Checklist](#)

##### Worksheet

"Reno-PPR"

"Reno-Design"

"Reno-Submissions Checklist"

##### Instruction

Completed by U of T at PPR stage.

Completed by Project Consultant Team at Project Initiation.

Completed by Project Consultant Team at each project stage.

#### New Construction Projects

##### Component

[PPR Form](#)

[Design Form](#)

[Project Submissions Checklist](#)

##### Worksheet

"NC-PPR"

"NC-Design"

"NC-Submissions Checklist"

##### Instruction

Completed by U of T at PPR stage.

Completed by Project Consultant Team at Project Initiation.

Completed by Project Consultant Team at each project stage.

### Instructions For Use

The Project Charter is completed by providing the required inputs as indicated by the visual cues defined below.

#### Visual Cues

Input Cell
Input Cell
Sample Drop Down
Calculated Cell
Greyed Out Cell

#### Instruction

Cells that require input by U of T are identified in blue.

Cells that require input by Project Consultant Teams are identified in green.

Some input cells have drop down menus.

Calculated values are displayed in white cells with borders.

Cells that are not applicable to the current project are greyed out.

#### Possible Error Types

##### Missing a required input

This type of error is resolved by finding and completing the input that was missed.

##### Example

\*\* No Target Year

##### Calculation error

This error indicates the area inputs used to generate performance targets fall outside the expected bounds. It should be resolved in communication with U of T Facilities & Services.

\*\* Too Much Wet Lab

# Renovation Project Charter

PPR Form

Input Cells

## Project Characteristics

Project Name

FoD Clinic 2 Renewal

Proposed Occupancy Date

2026-2030

## Programming Breakdown

In the table below, categorize the project's programmed areas as net assignable floor area ("NASM") into the appropriate use-types, following the descriptions provided. Apply multipliers as appropriate to reach the total anticipated gross floor area ("GSM") of the project. When all space uses have been assigned, the total NASM and GSM should align with the PPR.

## Space Use Types

	NASM (m2)	Multiplier	GSM (m2)	Notes
<b>Residence Space</b> - including living quarters, amenity and common spaces, laundry rooms, etc.	0.0	0.0	0.0	
<b>Retail Space</b> - including sales area, kitchen, dining/seating area, server, etc.	0.0	0.0	0.0	
<b>Athletic Space</b> - including exercise rooms, gymnasiums, change rooms, lockers, multi-purpose rooms, etc.	0.0	0.00	0.0	
<b>Wet Laboratory Space</b> - laboratory and lab support/storage spaces that have high ventilation exhaust requirements and high equipment power density.	771.1	1.63	1,256.7	
<b>Dry Laboratory Space</b> - laboratory and lab support/storage spaces that have high equipment power density but no ventilation exhaust requirements.	0.0	0.00	0.0	
<b>Office Space</b> - including staff, faculty & grad offices, and associated areas	258.4	1.72	445.0	
<b>Academic Space</b> - including classroom and lecture, meeting rooms, multipurpose academic spaces, etc.	26.4	1.12	29.5	
<b>Library</b> - stack, reading rooms, meeting rooms, study areas	0.0		0.0	
<b>All Other Areas</b> - any space not attributed above	0.0	0.00	0.0	
<b>Total (m2)</b>	1,055.9		1,731.2	

## Baseline Energy Performance

The Table will fill in based on the EUI table beside the target table. If the actual utilities are known, calculate the building's baseline energy performance by inputting the total annual energy use by fuel type when known. Use the most recent and complete full year of utility data available, making sure that usage from all fuel types is recorded during the same 12-month period. For fuel types that are not applicable, input 0.

Fuel Type	Annual Usage		Notes
Electricity	524,563.0	kWh	
Natural Gas	0.0	ekWh	
District Heating	511,641.9	ekWh	must enable removal of steam
District Cooling	0.0	ekWh	
Low temperature heating	0.0	ekWh	
<b>Total Baseline Energy Usage</b>	1,036,204.9	ekWh	598.5 Existing TEUI, ekWh/GSM

## Performance Targets

The scope of the renovation project (major or minor) is assigned by Facilities & Services, and is based on the question: will the project meaningfully impact the energy use of the building?

Scope of Renovation

Major Renovation

## Performance Targets for Major Renovation

Renovation Category	Interior	HVAC	Envelope	
Select all that apply	Yes	Yes	No	
% Energy Use Reduction	47.9%			
Target Energy Usage	539,625.7	ekWh		
Indoor Water Use Reduction	50%	897.6 m3		
Outdoor Water Use Reduction	60%			
On-Site Renewable Requirements	0%			

heating must be designed for <60C  
25,425 m3 baseline

## Charter Agreement

Name	Role	Initials	Date
Scott Hendershot	Sustainability Office		

# Renovation Project Charter

Input Cells

Design Form

Project Name

FoD Clinic 2 Renewal

Proposed Occupancy Date

2026-2030

Renovation Scope

Major Renovation

Baseline Energy Usage

1,036,204.9

ekWh

## Performance Targets

### Performance Targets - Major Renovations

	Interior Systems	HVAC Systems	Envelope	Renovation GSM
Applicable Renovation Categories	Yes	Yes	No	1,731.2
Target % Energy Use Reduction	47.9%	ekWh	598.5	Existing TEUI, ekWh/GSM
Target Energy Use	539,625.7		311.7	New TEUI, ekWh/GSM
Indoor Water Use Reduction	50%			
Outdoor Water Use Reduction	60%			
On-Site Renewable Requirements	0%		-	Target solar, kWh/yr
Proposed Calculation Methodology				

## Charter Agreement

The project characteristics and performance targets recorded in this Project Charter are confirmed by the undersigned. Any changes to the project scope will require review and revision of this Charter.

### U of T Implementation Committee

	Name	Initials
Project Manager		
Facilities & Services		

### Design Consultants Team

	Name	Firm	Initials
Architect			
Energy Consultant			
Mechanical Engineer			
Electrical Engineer			
Landscape Consultant			

Date of Agreement

# Renovation Project Charter

Project Submissions Checklist

To be completed at each design stage.

Input Cells

Project Name

FoD Clinic 2 Renewal

	PPR	Project Initializaton	SD	DD	CD	Occupancy
Date						

Documentation Submitted (Y/N)

Project Charter						
Utilities Performance Report						
Water Efficiency Worksheets						
Summary of Changes						
Equipment Cut Sheets						

Performance

Unit

Target % Energy Use Reduction	%	0.5	0.5	50%	28%	28%	
Target Energy Usage	ekWh	539,625.7	539,625.7	518,109	748,748	743,187	
Indoor water reduction (%)	%	50%	50%	38%	26%	26%	
Outdoor water reduction (%)	%	60%	60%	0%	0%	0%	
Renewable Energy	%	0.0	0%	0%	0%	0%	

MONTGOMERY SISAM ARCHITECTS INC.

KAHLER SLATER

**UNIVERSITY OF TORONTO**  
**DENTISTRY BUILDING – CLINIC 2 RENOVATION**  
124 EDWARD ST  
TORONTO, ON M5G 1G6

**REF 04**

CODE REPORT

**LRI Engineering Inc., Fire Protection & Building Code Engineers**  
*170 University Ave., 3<sup>rd</sup> Floor, Toronto, ON M5H 3B3*

January 9, 2026



APPLICATION OF THE 2024 ONTARIO  
BUILDING CODE & 2026 ONTARIO FIRE CODE FOR:

## U OF T DENTISTRY CLINIC 2 RENOVATION TORONTO, ONTARIO

LRI File: 31671

**PREPARED BY:**

A handwritten signature in black ink, appearing to read 'A Gillies'.

**Adam Gillies, P.Eng.**  
Associate

**REVIEWED BY:**

A handwritten signature in black ink, appearing to read 'Paul Wagner'.

**Paul Wagner, P.Eng.**  
Senior Associate

and

A handwritten signature in black ink, appearing to read 'Steven Grant'.

**Steven Grant, M.A.Sc., P.Eng.**  
Vice President, Engineering

## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1
2.0	PROJECT DESCRIPTION .....	2
3.0	APPROACH TO THE APPLICATION OF THE CODE .....	3
3.1	GENERAL .....	3
3.2	STRUCTURAL FIRE PROTECTION .....	3
3.3	FIRE SEPARATIONS .....	4
3.4	FIRE SUPPRESSION SYSTEMS .....	6
3.5	FIRE ALARM & DETECTION SYSTEM .....	6
3.6	INTEGRATED SYSTEMS TESTING .....	7
3.7	EGRESS AND EXITING .....	7
3.8	INTERIOR FINISHES .....	10
3.9	LIGHTING .....	11
3.10	WASHROOM FACILITIES.....	11
3.11	BARRIER-FREE ACCESSIBILITY .....	12
4.0	APPLICATION OF THE OFC.....	14
4.1	GENERAL .....	14
4.2	FLAMMABLE AND COMBUSTIBLE LIQUIDS .....	14
4.3	AEROSOLS .....	15
4.4	COMBUSTIBLE DUST .....	15
4.5	LABORATORY .....	16

## APPENDIX A – U of T DENTISTRY CLINIC 2 CHEMICAL INVENTORY

REVISION HISTORY	
January 24, 2025	Draft issued.
February 28, 2025	Preliminary report issued.
June 17, 2025	Draft DD report issued.
September 26, 2025	Updated draft report issued.
January 9, 2026	Final report issued.

This report has been prepared for (Montgomery Sisam Architects Inc.) and their consultants; LRI is not responsible for unauthorized revisions of this document nor reliance by parties that are not the intended recipients.





## 1.0 INTRODUCTION

This report has been prepared for Montgomery Sisam Architects Inc. (Client) to summarize the application of Part 3 of the Ontario Building Code and Parts 3, 4 and 5 of the Ontario Fire Code on the proposed UofT Dentistry Clinic 2 Renovation project located in the existing building at 124 Edward Street in Toronto, Ontario.

This report provides a summary of the approach for application of Part 3 of the 2024 Ontario Building Code (OBC) in terms of the life safety and fire protection requirements that may have significant design and cost implications for the project. It is not intended that this report identify all applicable life safety and fire protection requirements of the Code.

This report also addresses the approach for the application of Section 5.5., “Laboratories”; Section 5.3., “Dust Producing Processes”; and Subsection 3.2.5., “Indoor Storage of Aerosol Products” of the 2026 Ontario Fire Code (OFC), in terms of the principal life safety and fire protection requirements that may have significant design and cost implications for the project. It is not intended that this report identify all applicable life safety and fire protection requirements of the OFC.

This report is intended to assist the design team and support the design drawings prepared by Montgomery Sisam Architects Inc. with the application of applicable OBC Part 3 requirements.

This report is based on a review of architectural floor plan drawings received May 30, 2025 and design discussions to date. The report is intended to be read in conjunction with the aforementioned drawings.

References (i.e. Article, Sentence, and Clause) note Division B, Part 3 OBC requirements unless otherwise stated.



## 2.0 PROJECT DESCRIPTION

The University of Toronto Faculty of Dentistry building is an existing 5-storey building containing teaching space, labs, and clinics related to dentistry. The building has a mechanical penthouse, one level below grade, and an approximate building area (footprint) of 6,420 m<sup>2</sup>. The original building, which was constructed in 1959, has undergone multiple renovations. A number of additions were constructed in the 1980's and 2 additional floor levels were constructed in 2018. The existing building is partially sprinklered, and the areas subject to renovation will be fully sprinklered as part of this project.

The project consists of renovations to Clinic 2 plus renovations to the building's main entrance, including providing a new convenience stair between the 'mezzanine' level and Level 2. The clinic renovations will involve the consolidation of its operations from locations throughout the building into the existing Clinic 2 space on the second level.



### 3.0 APPROACH TO THE APPLICATION OF THE CODE

#### 3.1 GENERAL

Part 11 of the OBC is applicable to the renovations of existing buildings that are at least 5 years old. In general, renovations to the UofT Dentistry Building will be considered extensive, in accordance with OBC Article 11.3.3.2., and therefore new construction will generally conform to the current Building Code. The performance level of the building after renovations is required to be at least equal to the performance level of the building prior to renovations.

The approach for life safety and fire protection for the project will be based on the requirements of Part 3 of the 2024 edition of the Ontario Building Code (OBC), as amended.

##### 3.1.1 Major Occupancy Classification

The major occupancy of the building is Group A, Division 2. The occupancy of Clinic 2 will be considered subsidiary to the Group A, Division 2 major occupancy.

Dentistry clinics would generally be considered a Group D personal services occupancy, however, as Clinic 2 will involve the use of flammable and combustible liquids and will be designed in accordance with the OFC's requirements for laboratories, to be conservative it will be considered a Group F, Division 2 occupancy, which is typical for laboratories.

##### 3.1.2 Hazardous Substances/Laboratory

As mentioned above, Clinic 2 will include the use of hazardous substances. These substances are regulated by OBC Subsection 3.3.6. and the OFC, as required by OBC Article 3.3.1.2.

It is the responsibility of the owner to comply with the requirements of the OFC as it pertains to the use, handling, storage, maintenance and operational procedures within the building.

#### 3.2 STRUCTURAL FIRE PROTECTION

The construction type and structural fire-resistance ratings for the renovations will be based on OBC Article 3.2.2.23., "Group A, Division 2, Any Height, Any Area, Sprinklered". The structural fire protection measures include:

- Noncombustible construction, combustible elements will be limited to those permitted by OBC Subsection 3.1.5.,
- Floor assemblies will be constructed, and maintained, as fire separations with a fire-resistance rating of at least 2 h,
- Loadbearing walls, columns and arches will have a fire-resistance rating not less than that required for the supported assembly.

##### 3.2.1 Interconnected Floor Space

The building contains an existing interconnected floor space between Level 1 and 2 at the north lobby. There is currently a large ramp connecting the Levels 1 and 2 with the lobby, which is at an intermediate elevation.



As part of renovations, the existing ramp will be removed, and rooms will be constructed in its place on Level 1. The space above the rooms will be used as a waiting area on Level 2. A new convenience stair will provide access between the lobby and Levels 1 and 2. It is considered reasonable to consider the lobby a sunken portion of Level 2 in consideration of its size and function. Level 1 will be fire separated from the lobby and Level 2 by a 2 h fire separation, in order to maintain floor-to-floor fire separations. Level 2 will not be fire separated from the lobby. This is an improvement of the existing condition in terms of fire and life safety, as the existing interconnected floor space does not comply with the OBC.

### 3.3 FIRE SEPARATIONS

#### 3.3.1 Interior Fire Separations

The following fire-resistance ratings are applicable to new construction:

- 2 h exit enclosures
- 1.5 h elevator shafts
- 1 h dumbwaiter shafts
- 1 h vertical service spaces, enclosed at the top and bottom of the shaft [OBC 3.6.3.1.(2) and (3)]
- 1 h laboratory
- 1 h service rooms containing service panel more than 600 A or air-cooled dry-type transformers more than 750 V
- 1 h fuel-fired equipment rooms
- 1 h between sprinklered and non-sprinklered areas
- 0 h janitor's closets

#### 3.3.2 Closures

The following are the required fire-protection ratings (FPR) for closures in fire separations, in accordance with OBC Article 3.1.8.4.

1 h fire separation.....	¾ h FPR
1.5 h fire separation.....	1 h FPR
2 h fire separation.....	1.5 h FPR

Doors operating as closures will be equipped with listed self-closing and self-latching hardware.

Closures equipped with power door operators will include a connection to the fire alarm system, designed to disengage the power door operator in the event of fire alarm activation in conformance with NPFA 80. Note this is only applicable to doors located in required fire separations.

Service penetrations through required fire separations will be cast-in-place or firestopped with listed firestop systems in accordance with OBC 3.1.9.



Note that some of the firestop requirements of the 2024 OBC are different than the requirements of the 2012 OBC:

- Firestops tested in accordance with CAN/ULC-S115 are required to have an F rating not less than the required fire-resistance rating of the fire separation. Previously, the F rating was required to be not less than the required rating of a closure from Table 3.1.8.4.
- Penetrations are only permitted to be cast-in-place, rather than firestopped, if they are steel, ferrous, copper, concrete or masonry.
- Penetrations for service equipment through horizontal service space fire separations described in OBC Sentence 3.6.4.2.(2) are permitted to be provided with a firestop that has an F rating, rather than an FT rating, not less than the fire-resistance rating required for the fire separation, provided the penetration is contained within the cavity of a wall above and below the horizontal fire separation. The above is also true where the penetration is:
  - Contained within the concealed space of a floor or ceiling assembly having a fire-resistance rating,
  - Located above a ceiling membrane that is a horizontal fire separation, or
  - Contained within a horizontal service space conforming to OBC Subsection 3.6.4. that is directly above or below the floor.

Note that existing unprotected penetrations of existing fire separations are required by the Ontario Fire Code to be provided with firestopping in order to maintain the integrity of the fire separation, regardless of whether or not they are part of the proposed scope of work. The application of the OFC is retroactive, and it is the responsibility of the owner to maintain compliance with the OFC.

### 3.3.3 Smoke Dampers

Smoke dampers or a combination of fire and smoke dampers will be installed in ducts or air-transfer openings that penetrate a required fire separation that separates a public corridor, contains an egress door, or serves an assembly occupancy in accordance with OBC Sentence 3.1.8.7.(2).

Smoke dampers are permitted to be waived for ducts where all inlet and outlet openings serve not more than one fire compartment.

In addition, smoke dampers are permitted to be waived for noncombustible branch ducts having a melting point above 760°C that penetrate a fire separation,

- Provided the ducts,
  - Have a cross sectional area not more than 130 cm<sup>2</sup> and serve only air-conditioning units or combined air-conditioning and heating units discharging air not more than 1.2 m above the floor,
  - Extend not less than 500 mm inside exhaust duct risers that are under negative pressure and in which the airflow is upward as required by Article 3.6.3.4., or
- Provided the fire separation separates a vertical service space from the remainder of the building and provided each individual duct exhausts directly to the outdoors at the top of the vertical service space.



Similar to the note above regarding firestopping, the Ontario Fire Code requires existing unprotected penetrations of fire separations by ductwork to be provided with fire and/or smoke dampers (as appropriate), regardless of whether or not they are part of the proposed scope of work.

#### **3.3.4 New Convenience Stair**

As part of renovations, an existing convenience stair will be reconstructed. The stair will provide access between Levels 1, 2, and 3.

In order to maintain continuity of floor-to-floor fire separations, the stair is required to be 2 h fire separated from the remainder of the building. Note that the 2024 OBC does not have an exception for stair openings in horizontal fire separations, unlike the 2012 OBC.

### **3.4 FIRE SUPPRESSION SYSTEMS**

#### **3.4.1 Standpipe and Hose System**

The building is equipped with an existing standpipe and hose system. The existing system will be modified and extended as necessary to maintain the required hose coverage for the areas subject to renovation. Any modifications, construction, installation and testing of the standpipe and hose system will conform to NFPA 14, “Installation of Standpipe and Hose Systems”.

It is understood that existing fire hose cabinets within the building are provided with 23 m lengths of fire hose, rather than 30 m lengths, which are permitted by the current OBC. Fire hose cabinets will be added or relocated as necessary in order to maintain coverage based on a 23 m fire hoses. If necessary for fire hose coverage, 30 m fire hoses may be provided.

#### **3.4.2 Sprinkler System**

The existing building is partially sprinklered. The sprinkler system will be expanded to ensure most areas subject to renovation are fully sprinklered in accordance with the OBC and NFPA 13, “Installation of Sprinkler Systems”.

The reception desk and waiting area, plus the universal washroom outside the lab, are currently not sprinklered and will not be provided with sprinklers as part of renovations. A 1 h fire separation will be provided between sprinklered and unsprinklered areas.

### **3.5 FIRE ALARM & DETECTION SYSTEM**

The building is equipped with an existing fire alarm and detection system.

Any installations will be in conformance with CAN/ULC-S524-M and verified in conformance with CAN/ULC-S537-M.

Refer to electrical documents prepared by others for further details.

### 3.6 INTEGRATED SYSTEMS TESTING

As the building has integrated fire protection and life safety systems that will be affected by renovations, the systems will be required to be tested as a whole in accordance with CAN/ULC-S1001, “Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems” to verify they have been properly integrated.

### 3.7 EGRESS AND EXITING

#### 3.7.1 Occupant Load

Based on information received from the Client, it is understood renovations will not result in an increase in occupant load, as the building has a program occupant load.

As the occupant load will not be increased by renovations, the performance level will not be decreased in accordance with OBC Subsection 11.4.2.

#### 3.7.2 Exit Capacity

Sufficient exit width will be provided for the occupant load. As the occupant load will not be increased by renovations, no additional exit capacity is required. The required width of exits and access to exits is based on the following factors:

Doorways .....	6.1 mm/person
Corridors .....	6.1 mm/person
Stairs (run $\geq$ 280 mm, rise $\leq$ 180 mm) .....	8.0 mm/person
Stairs (other than above) .....	9.2 mm/person

Note that all new stairs are required to have steps with a run of at least 280 mm and a rise not more than 180 mm. The exit capacity factor provided for other stairs above may be applicable to existing stairs.

An individual exit is not permitted to provide more than 50% of the required exit width for the floor area. Exit capacities are based on the most restrictive component of the exit facility (e.g. doors vs. stairs).

#### 3.7.3 Travel Distance

In general, exits will be provided such that the maximum travel distance within the areas subject to renovations will not exceed 45 m, as the renovated areas will be fully sprinklered.

45 m travel distance measurements are not permitted to lead from a sprinklered area through a nonsprinklered area. Where travel distance must be measured through a nonsprinklered area, the measurement will be limited to 30 m.

The building contains some existing travel distance deficiencies. The existing travel distance deficiencies are not addressed by the OBC’s Compliance Alternatives, as the floor areas are not sprinklered throughout.



There is an existing travel distance deficiency in the area subject to renovation on Level 1. The maximum travel distance in this area is approximately 46 m. The area will be sprinklered as part of renovations, however, the nearest exits serving Level 1 can only be accessed through unsprinklered portions of the building. As such, if this was new construction, travel distance would be limited to 30 m. It is considered reasonable to maintain the existing travel distance in consideration of the upgrades to this area: the area will be sprinklered as part of renovations and the area will be fire separated from the intermediate entrance level above by a 2 h fire separation, which does not currently exist. The renovations will not increase travel distance in this area such that the existing performance level of the building will be maintained. Adding or relocating exit stairs is not within the scope of the proposed renovations.

On Level 2 in the lobby there is a similar travel distance deficiency. The maximum travel distance in this area is approximately 48 m when measured to one of the exit stairs serving Level 2. Similar to Level 1, this travel distance must be measured through unsprinklered portions of the building and would therefore be limited to 30 m if it were new construction. In this case, it is considered reasonable to measure travel distance within the lobby using the convenience stair that provides access to the intermediate entrance level, which will be considered a sunken portion of Level 2 as addressed earlier in this report. The maximum travel distance in the lobby, when measured using the convenience stair down to the exterior doors, is approximately 29.5 m. This is considered reasonable, as a new 2 h fire separation will be provided between the lobby and Level 1, the space will be sprinklered as part of renovations, and the path of travel to the exterior doors will be intuitive to occupants of the lobby.

#### **3.7.4 Egress Doorways and Door swing**

Two egress doorways will be provided for rooms and areas where the travel distance from any point in the room or area exceeds 25 m to the egress door, where the occupant load of the room or area exceeds 60 persons, or where the area is greater than 200 m<sup>2</sup> (for Group A or Group F, Division 2 occupancies).

Where a room or space is required to be served by two means of egress, the egress doors will be located so that the distance between them is a minimum of 1/3 the maximum diagonal dimension of the room or space. The distance between the egress doors will be measured as the shortest distance smoke would have to travel.

Doors serving rooms or spaces with more than 60 persons will swing in the direction of egress travel.

#### **3.7.5 Dead-end Corridors**

Dead-end corridors serving the clinic are not permitted unless the space served by the dead-end corridor is provided with a second egress door not leading into a dead-end corridor, or if:

- The dead-end portion of the corridor is not more than 9 m long,
- It serves an occupant load not more than 30 persons, and
- The corridor doors are provided with self-closing devices.

Dead-end corridors serving Group A occupancies are only permitted if the space served by the dead-end corridor is provided with a second egress doorway not leading to a dead-end corridor.



### 3.7.6 Exit Width

The required width of access to exit and exit facilities will be designed to support the intended occupant loads, and will have minimum clear widths as follows:

- 850 mm doorways not located in a barrier-free path of travel,
- 850 mm clear doorways (typically requires a 915 mm wide door) located in a barrier-free path of travel,
- 1100 mm corridors and passageways,
- 900 mm stairs serving not more than 2 storeys above the lowest exit level, and
- 1100 mm stairs serving more than 2 storeys above lowest exit level.

### 3.7.7 Stair Design

New stairs, including convenience stairs, will be designed to comply with the requirements for exit stairs as follows:

- Minimum width of 1100 mm for stairs serving more than two storeys above the lowest exit level,
- Minimum width of 900 mm for stairs serving not more than two storeys above the lowest exit level,
- Minimum headroom of 2050 mm,
- Slip-resistant surfaces on treads and landings,
- Colour contrast or distinctive pattern to demarcate the leading edge of treads and landings,
- A tactile attention indicator conforming to Article 3.8.3.18. installed:
  - At the top of stairs, starting one tread depth back from the top edge of the top stair, and
  - at the leading edge of landings where a doorway opens onto stairs starting one tread depth back from the edge of the landing.
- No fewer than 3 risers.
- Maximum vertical rise of 3.7 m between floors or landings,
- Landings must be at least as long as the width of the stair,
- Continuous handrails provided on both sides designed to Article 3.4.6.5.,
- Intermediate handrails provided so that at least on handrail is reachable within 825 mm of all portions of the stair width,
- Guards provided in accordance with Article 3.4.6.6.,
- Treads and risers conforming to Article 3.4.6.8., including:
  - Treads with a run of 280 mm to 355 mm,
  - A rise of 125 mm to 180 mm,
  - No open risers,
  - A maximum slope on treads and landings of 1 in 50.

### 3.7.8 Exit Signs

Exit signs will be added or relocated as necessary based on changes to the layout, to maintain compliance with OBC Subsection 3.4.5.

Note that any exit door subject to renovation is required to be provided with a tactile exit sign conforming to OBC Article 3.8.3.1., mounted on the approach side of the exit door, in the direction of exit travel.

### 3.7.9 Safety Glazing

Note that the 2024 OBC contains new requirements for safety glazing in assembly occupancies. The requirements of OBC Article 3.3.2.17. are applicable to glazing in all fixed or operable panels of new doors or windows.

### 3.8 INTERIOR FINISHES

The flame spread rating and smoke developed classification of new interior finishes of walls and ceilings will be as follows when tested in accordance with CAN/ULC-S102 “Standard Method of Test for Surface Burning Materials and Assemblies” and for floors where tested in accordance with CAN/ULC-S102.2 “Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies”.

Location or Element	Maximum Flame Spread Rating			Maximum Smoke Developed classification		
	wall	ceiling	floor	wall	ceiling	floor
Exit stairs, exit corridors, exit vestibules and exit lobbies	25	25	--	--	--	--
Trim, millwork and doors located in an exit, exit lobby, vestibule to an exit, public corridor and corridors used by the public	150 <sup>1</sup>	150 <sup>1</sup>	--	300 <sup>1</sup>	300 <sup>1</sup>	--
Public corridors and corridors used by the public	150	25 <sup>3</sup>	--	--	--	--
Elevator cars	75	75	300	450	450	450
Non-exit doors (excluding within dwelling units)	200	--	--	--	--	--
Other locations	150 <sup>2</sup>	25 <sup>3</sup>	--	--	--	--
<sup>1</sup> Limited to an aggregate area of not more than 10% of the area of the wall or ceiling where they occur. <sup>2</sup> Combustible interior wall finishes, other than foamed plastic, not more than 25 mm thick provided the flame spread is on any exposed surface including cutting through the material in any direction (OBC 3.1.5.12.(2)). <sup>3</sup> Combustible interior ceiling finishes, other than foamed plastic, not more than 25 mm thick provided the flame spread is on any exposed surface including cutting through the material in any direction; except that up to 10% of the ceiling area within each fire compartment may have finishes with a flame spread not more than 150 (OBC 3.1.5.10.(3)).						

Light diffusers and lenses will have a maximum flame spread rating of 250 and a maximum smoke developed classification of 600.

### 3.9 LIGHTING

Illumination at an average level of at least 50 lx, and no less than 10 lx, is required to be provided at floor or tread level for the following areas:

- Exits
- Corridors providing access to exit for the public
- Corridors serving classrooms
- Electrical equipment rooms
- Hoistway pits

Rooms and spaces used by the public are required to be provided with illumination in accordance with OBC Article 9.34.2.7.

Controls that are required to be barrier-free, other than light switches or internally illuminated controls, are required to be provided with illumination not less than 100 lx. Where visual information is provided at those controls, the minimum level of illumination must not be less than 200 lx, unless the visual information is internally illuminated. The minimum level of illumination for the barrier-free entrance sign must not be less than 200 lx.

Elevator machine rooms are required to be provided with an average level of illumination of at least 100 lx at floor level.

#### 3.9.1 EMERGENCY LIGHTING

Emergency lighting at an average level of illumination not less than 10 lx at floor or tread level must be provided in the following locations:

- Exits,
- Corridors used by the public,
- Principal routes providing access to exit in open floor areas and service rooms,
- Corridors serving classrooms,
- Public corridors,
- Parts of floor areas where the public may congregate,
- Washrooms.

The minimum value of illumination for the spaces described above must not be less than 1 lx.

### 3.10 WASHROOM FACILITIES

The occupant load will not be affected by renovations. Therefore, the existing number of washroom fixtures will be maintained. The design of new washrooms is required to conform to the current OBC.

The number of barrier-free accessible washroom stalls provided in new washrooms is required to be in accordance with OBC Table 3.8.2.3.B.

One new universal washroom will be provided as part of renovations. The universal washroom is required to conform to OBC Article 3.8.3.12.

### **3.11 BARRIER-FREE ACCESSIBILITY**

New construction will conform to the OBC's barrier-free accessibility requirements. The following is a summary of significant design considerations. Specific design criteria for doors, ramps, washrooms, etc. are contained in OBC Section 3.8.

#### **3.11.1 Barrier-free Path of Travel**

A barrier-free path of travel will be provided throughout all areas subject to renovation. Barrier-free paths of travel will have a width of at least 1100 mm. Where the width of the barrier-free path of travel is less than 1600 mm, spaces that are minimum 1800 mm by 1800 mm will be provided at intervals not exceeding 30 m.

#### **3.11.2 Doors/Doorways**

Every new doorway located in the barrier-free path of travel will have a clear width of at least 850 mm.

Unless power door operator equipped, swing doors will be provided with a latch-side clearance of at least 600 mm on the pull side and at least 300 mm on the push side. Sliding doors will be provided with a latch-side clearance of 300 mm on both sides.

Doors will:

- Be equipped with opening devices that are operable by closed fist, mounted between 900 mm and 1100 mm above the finished floor,
- Open under a force of 22 N for interior doors and 38 N for exterior doors applied to the opening hardware (unless they are provided with a power door operator), if the door is self-closer equipped. Self-closers will also require at least 3 seconds to close from a 70° open position to within 75 mm of the closed position,
- If constructed of sheet glass, marked with a 50 mm wide, opaque, colour and brightness contrasted strip located continuously across the width at a height of 1350 mm to 1500 mm, and
- If provided with vision panels, have panels at least 75 mm wide and located with the panel having an edge within 250 mm of the latch-side door edge and bottom edge within 900 mm of the floor.

Note any new doors located in the barrier-free path of travel from the building entrance up to (but not including) rooms served by a public corridor or corridor used by the public, are required to be provided with power door operators. Potential examples include cross-corridor doors and elevator vestibule doors.

#### **3.11.3 Controls**

Controls for building services or safety devices intended to be operated by building occupants will be located so as to be adjacent to a clear floor space not less than 810 mm by 1370 mm and centered on either the length or width of the clear space. Controls will be operable using a closed fist, except for pull-stations.

Controls will be mounted:

- 1200 mm above finished floor for thermostats and pull-stations, and
- 900 mm to 1100 mm above finished floor for all other controls.

#### **3.11.4 Washrooms**

The number of barrier-free accessible washroom stalls provided in each new washroom is required to be in accordance with OBC Table 3.8.2.3.B.

One new universal washroom will be provided as part of the renovations.

Detailed design requirements for washroom facilities are provided in OBC 3.8.3.8. to 3.8.3.12.

#### **3.11.5 Other**

All amenities, including public telephones and drinking fountains, will have at least one such facility that is barrier-free accessible.

Regarding OBC Article 3.3.1.7. and the requirement to provide protection for floor areas with a barrier-free path of travel, upgrades to Level 2 for compliance with this Article are not required in consideration that the barrier-free path of travel on this Level is existing and that the renovations only involve a portion of the floor area. It is noted that the existing condition will be improved by renovations, as new sprinklers will be added to a portion of the floor area, and that portion will be provided with a 1 h fire separation from unsprinklered parts of the floor area.

Where a dissimilar floor elevation more than 250 mm exists or where the floor is sloped steeper than 1 in 3, and is not protected by a guard, a tactile attention indicator conforming to OBC Article 3.8.3.18. will be provided.

Where a service counter is provided, at least one section of the counter must be barrier-free accessible and comply with the following:

- Have a height not more than 865 mm,
- Have a knee space underneath that is
  - At least 800 mm wide,
  - At least 685 mm tall, and
  - At least 485 mm deep,
- Be at least 800 mm long, centred over the knee space described above.

## 4.0 APPLICATION OF THE OFC

### 4.1 GENERAL

Clinic 2 will involve the use and storage of flammable liquids and combustible powders plus the storage of aerosol products, all of which are regulated by the OFC.

Section 5.5 of the OFC is specifically applicable to laboratories. Section 5.3. of the OFC applies to processes that produce combustible dust.

Note that the Ontario Fire Code will be amended, and those amendments will come into effect on January 1, 2026. The requirements contained in this section of the report are based on the requirements of the 2026 Ontario Fire Code, as it will be applicable to the laboratory after completion.

The U of T Dentistry Building is not classified an office building, factory, arena, or shop. Hence, the Occupational Health and Safety Act does not deem the building to be an industrial establishment. This means that O.Reg. 851, "Industrial Establishments" does not regulate the building. On this basis, the room used for storage of the Class IA product known as GermXtra in closed containers is not required to be built of damage-limiting construction and equipped with explosion vents.

### 4.2 FLAMMABLE AND COMBUSTIBLE LIQUIDS

Flammable and combustible liquids are required to be classified in accordance with OFC Subsection 4.1.2. The detailed classification criteria for flammable and combustible liquids are as follows:

Classification	Flash Point	Boiling Point
<b>Flammable Liquids (Class I)</b>		
Class IA	< 22.8°C	< 37.8°C
Class IB	< 22.8°C	≥ 37.8°C
Class IC	≥ 22.8°C and < 37.8°C	N/A
<b>Combustible Liquids (Class II)</b>		
Class II	≥ 37.8°C and < 60°C	N/A
Class IIIA	≥ 60°C and < 93.3°C	N/A

The terms "flammable liquids" and "Class I liquids" in this report will refer to all Class IA, IB and IC liquids as defined above. The term "combustible liquids" in this report will refer to Class II and Class IIIA liquids as defined above.

Based on review of the chemical inventory provided, the following flammable/combustible liquids are anticipated within the lab (refer to Appendix A):

- 3M Polyether Adhesive
- Caulk Try Adhesive
- Ethyl Alcohol (95% ABV)
- Duralay Liquid
- Copal Varnish
- CoeSoft
- Kooliner



- Permasoft Liquid
- Pattern Resin
- Monobond
- Polyether Adhesive
- VPS Tray Adhesive
- Biotext Eurowipe
- GermXtra

These products are generally in very small containers ranging from 14 mL to 262 mL, with the exception of products used for cleaning. The cleaning products, such as ethyl alcohol, will be in containers up to 4 L in volume.

It is noted that other raw materials could also be classified as flammable or combustible liquids and may not be included in the list above. It is the responsibility of the owner to ensure that SDSs are available for all materials that and that classified liquids are appropriately stored and handled.

#### **4.3 AEROSOLS**

The indoor storage of aerosol products is regulated by Subsection 3.2.5. of the OFC. Clinic 2 will use and store an aerosol product that is classified as Level 3 in conformance with NFPA 30B, “Manufacture and Storage of Aerosol Products” (see Appendix A).

The product is IPS Contrast Spray Labside, of which a maximum of 10, 200 mL capacity cans will be stored. This quantity is below the storage limits specified in OFC Article 3.2.5.4., which would permit storage of up to 1000 kg of Level 3 aerosol products with no additional protection measures.

#### **4.4 COMBUSTIBLE DUST**

OFC Section 5.3. applies to buildings or equipment where combustible dusts are generated in quantities or concentrations that could create a fire or explosion hazard.

The clinic will use and store combustible powders with the trade names “Duralay Powder Shades”, “CoeSoft Powder”, and “Permasoft Powder”.

Based on the information provided by the Client, it is understood that all three products will be used in very small quantities:

- Duralay Powder Shades - the entire clinic is anticipated to have a maximum of 9 bottles of the product at 60 mL each.
- CoeSoft Powder – the entire clinic is anticipated to have a maximum of 4 bottles of the product at 180 mL each.
- Permasoft Powder – the entire clinic is anticipated to have a maximum of 6 bottles of the product at 60 g each.

The products will be measured and processed using hand tools, which is not anticipated to produce large suspensions of powders. Surfaces and equipment within the clinic will be cleaned regularly and as such, powders are not anticipated to accumulate on surfaces in any significant quantities.

In consideration of the above, the handling and cleaning procedures in the clinic will effectively minimize the amount of combustible powder released into the air and accumulated on surfaces. This will prevent an explosive concentration of combustible powder from being released into the air. On this basis, it is not considered to result in a fire or explosion hazard. As such, the clinic will not require any special fire or explosion protection measures related to combustible dust.

## **4.5 LABORATORY**

### **4.5.1 General**

OFC Section 5.5. regulates laboratories in which flammable and combustible liquids are used, handled or stored. While not defined in the OFC, laboratories are generally recognized as those spaces in which chemicals in portable containers are used for experiments, tests, reactions or other handling. On this basis, OFC Section 5.5., "Laboratories" will be applied to Clinic 2 in the U of T Dentistry Building, where flammable liquids will be used and handled in small quantities.

### **4.5.2 Fire Separations**

The clinic is required to be separated from the remainder of the building by a 1 h fire separation. Note that the OFC deems existing lath and plaster or gypsum board fire separations to comply with the 1 h fire separation requirement.

The laboratory fire compartment is permitted to include ancillary spaces such as offices, however, it should be noted that the requirements for laboratories, such as ventilation and electrical equipment classification, will apply to all spaces within the laboratory fire compartment.

### **4.5.3 Interior Finishes**

The interior finish materials in the laboratory, including floors, furniture, and equipment, are required to be chemically resistant to the dangerous goods used within the laboratory, in conformance with OFC Articles 3.2.7.7. and 3.2.7.8.

The laboratory is required to be clearly designated as an area where dangerous goods are used, by posted placards at the entrance conforming to the Transportation of Dangerous Goods Regulations, SOR/2001-286, made under the Transportation of Dangerous Goods Act (Canada). A placard is required to be posted for each individual class of dangerous good, or the "Danger" placard shown in the standard mentioned above may be used as an alternative.

### **4.5.4 Containers**

Containers for the storage of flammable liquids will have a maximum capacity of 5 L and will typically conform to the first of the following standards:

- The Transportation of Dangerous Goods Regulations (Canada),
- ULC/ORD-C30, "Safety Containers", or
- Section 6 of CSA-B620, "Highway Tanks and Portable Tanks for the Transportation of Dangerous Goods".





Flammable liquids are permitted to be stored in containers other than those in OFC Article 4.2.3.1. (listed above) provided their capacity does not exceed 1 L.

Where container capacity exceeds 5 L, safety containers conforming to ULC/ORD-C30, “Safety Containers” will be provided and their capacity will not exceed 25 L.

Products that are classified as dangerous goods under the OFC are required to have appropriate identifying labels and are to be separated in accordance with OFC Table 3.2.7.6, “**Separation Chart for Storage of Dangerous Goods**”.

#### **4.5.5 Maximum Quantity Limits**

Not more than 300 L of flammable or combustible liquids are permitted to be stored in the open area of the clinic, of which not more than 50 L are permitted to be flammable liquids. Quantities in excess of these limits are required to be stored in the cabinets described below.

#### **4.5.6 Cabinets**

Flammable liquids in excess of 50 L are required to be stored in listed flammable and combustible liquids cabinets conforming to OFC Subsection 4.2.10., “Cabinets for Container Storage”.

Cabinets for flammable and combustible liquids storage will conform to one of the following:

- ULC/ORD-C1275, “Storage Cabinets for Flammable Liquid Containers”,
- ULI 1275, “Flammable Liquid Storage Cabinets”,
- Be FM Approved by FM Global, or
- Be listed as meeting NFPA 30, “Flammable and Combustible Liquids Code”.

Only closed containers are permitted to be used for the storage of flammable or combustible liquids in cabinets.

The maximum quantity of flammable and combustible liquids stored in a single cabinet in a laboratory fire compartment is not permitted to exceed 500 L. A maximum of three cabinets may be stored in each fire compartment.

Storage cabinets that are provided with ventilation openings will be sealed with materials providing a fire protection rating at least equivalent to the construction of the cabinet or be ventilated to the outdoors using vent piping that provides an equivalent fire protection rating.

#### **4.5.7 Refrigerated Storage**

If refrigerators are used to store Class I liquids, they will be identified as containing flammable liquids and will have electrical classifications in accordance with OFC Sentence 4.1.4.1.(2). Class I liquids stored in refrigerators will be in closed containers.

Flammable and/or combustible liquids stored in refrigerators or freezers will be included in the maximum quantities of flammable and combustible liquids permitted in the laboratory fire compartment, as specified previously.

#### 4.5.8 General Laboratory Ventilation

The laboratory is required to be provided with a continuous mechanical ventilation system that is exhausted to the outdoors and designed to ensure that dangerous goods vapours and particles:

- Do not accumulate within the laboratory,
- Do not migrate to other parts of the building,
- Do not accumulate within the ventilation system, and
- Are not returned to the building.

The ventilation system will be interlocked with the Clinic's ceiling lights, for example, such that activities generating flammable vapours cannot be performed when the ventilation system is not in operation. Monitoring devices will be provided to indicate that the system is in operation and to sound an alarm if the system malfunctions. Additionally, an alarm will sound in an attended area if the system is shut down.

The ventilation system is required to be inspected and cleaned at least every 12 months.

#### 4.5.9 Power-Ventilated Enclosures (Fume Hoods)

The OFC requires that where flammable liquids are used in a manner that releases flammable vapours within a laboratory, their use be confined inside a power-ventilated enclosure (i.e. fume hood). It is proposed that Clinic 2 waive the OFC Section 5.5 requirement for fume hoods due to the way in which the Clinic's flammable liquids must be used, the limited volume of the containers, and the large volume of the Clinic.

The flammable liquids that will be used in Clinic 2 are all intended to be used either chairside in an operatory or for cleaning purposes. In both cases, it would not be practical from an operational standpoint to confine the use of these liquids to the inside of a fume hood. The cleaning of surfaces (e.g. countertops, chairs) cannot be confined to the inside of a fume hood, nor can dental work on patients.

As mentioned previously in this report, the flammable liquids in Clinic 2 are generally contained in very small containers ranging from 14 mL to 262 mL, with the exception of products used for cleaning. The cleaning products, such as ethyl alcohol, will be in containers up to 4 L in volume. Based on these container sizes, the maximum credible spill scenario of flammable liquid in Clinic 2 would be 4 L. The main portion of Clinic 2 has a floor area of approximately 1000 m<sup>2</sup> and will have ceiling height of approximately 6.4 m. It is not possible that a spill of 4 L of flammable liquid can produce an explosive concentration of flammable vapours throughout a space of this volume, especially in consideration of the continuous general exhaust ventilation provided.

Based on the above, it is considered reasonable to waive the OFC Section 5.5 requirement for fume hoods within Clinic 2 and that the flammable liquids listed in this report are used outside of fume hoods. This approach is subject to AHJ approval.



#### **4.5.10 Spill Control**

In accordance with OFC Article 4.1.6.4., a written spill control procedure will be approved and implemented for any occupancy where flammable and combustible liquids are stored, handled, processed or used.

The spill control procedure will include the following:

- Suitable operating procedures to prevent leaks and spills from piping, pumps, storage tanks or process vessels,
- Ventilation,
- Control of ignition sources,
- Spill containment and clean up,
- Personal protective clothing or equipment that should be used (such as rubber gloves, rubber boots and self-contained breathing apparatus),
- Chain of command, including notification of affected agencies and management,
- A preventive maintenance program, and
- Training for new staff within three months of being hired, and for experienced staff every six months.

The laboratory is required to be provided with absorbent and neutralizing materials in conformance with OFC Sentence 3.2.7.11.(2).

#### **4.5.11 Separation of Dangerous Goods**

Incompatible dangerous goods are not permitted to be stored together in the same fire compartment. It is required that the storage and use of dangerous goods in laboratories be conducted in consideration of the Workplace Hazardous Material Information System (WHMIS) and good engineering practice.

#### **4.5.12 Supervision and Training**

At least one person is required to provide supervision of the laboratory during operating hours and be available to respond to an emergency day or night. That person is required to be trained in the correct procedures for the handling, storing and transport of dangerous goods. Any person involved in the storage and handling of dangerous goods is required to be trained in safe handling procedures and correct responses to an emergency.

#### **4.5.13 Waste and Combustible Materials**

The quantity of combustible materials, such as packaging, in the laboratory is not permitted to exceed the amount necessary for one day of normal operation.

Waste dangerous goods are required to be identified, in order to prevent the mixing of incompatible chemicals. Additionally, the waste dangerous goods are required to be included in the maximum quantity limits described earlier in this report.



#### **4.5.14 Ignition Sources**

Smoking is not permitted in the laboratory and signs are required to be posted in accordance with OFC Article 2.4.3.2.

Ignition sources that are a part of an operation involving flammable vapours are only permitted if:

- The quantity of flammable or combustible liquids used for the operation is controlled and kept to a minimum,
- Flammable vapours and combustion fumes are exhausted via fume hood,
- There are no other sources of ignition capable of igniting flammable vapours, and
- There is no combustible material in the vicinity of the operation.

The Clinic will include the use of small ethanol-fueled hand torches, which will be used chairside. It is understood that the hand torches are small. As discussed previously in this report, flammable liquids will be used in the Clinic and their use will not be confined to fume hoods. Given the volume of the Clinic, the small containers sizes, and the general ventilation provided, a spill of ethyl alcohol will be incapable of forming an explosive concentration of flammable vapours throughout the Clinic. As such, the use of small ethanol-fueled hand torches will not be performed in fume hoods as required by OFC Clause 5.5.3.5.(3)(b). This approach is subject to AHJ approval.

**APPENDIX A**

**U OF T DENTISTRY – CLINIC 2  
CHEMICAL INVENTORY**

**Flammable and combustible liquids:**

<b>Product</b>	<b>Operations/Used for</b>	<b>Flash Point [C]</b>	<b>Boiling Point [C]</b>	<b>Relative Vapour Density [Air = 1]</b>	<b>OFC Class</b>
3M Polyether Adhesive	Prosthodontics	-3.8	76.11	>1	Class 1B
Caulk Try Adhesive 59ml x 10	Restorative	-5	63	3.04	Class 1B
Ethyl Alcohol (95% ABV) 4L	Cleaning/Disinfection	25	78	1.6	Class 1C
Duralay Liquid	Restorative	10	100	3.5	Class 1B
Copal Varnish 14ml x 5	Restorative	14	78	Unknown	Class 1B
CoeSoft liquid 6oz x2 ea	Prosthodontics	16	173	Unknown	Class 1B
Kooliner liquid 55ml	Prosthodontics	42	151	Unknown	Class II
PermaSoft liquid 120g	Prosthodontics	23	77	2.5	Class 1C
Pattern Resin 262ml	Prosthodontics	10	100	Unknown	Class 1B
Monobond 5g x 5	Restorative/Prosthodontics	13	78	Unknown	Class 1B
Polyether adhesive 17ml x5	Prosthodontics	-3.9	76.11	>1	Class 1B
VPS Tray Adhesive 59ml	Restorative/Prosthodontics	-3.9	76.11	>1	Class 1B
Biotext Eurowipe 4L x 2	Cleaning/Disinfection	36	90	Unknown	Class 1C
Ethyl Alcohol 95%	Ethyl alcohol will be used for hand held torches	25	78	1.6	Class 1C
GermXtra	GermXtra is a disinfectant used to disinfect impressions	16	N/A	Unknown	Class 1A or 1B*
*Boiling point is unavailable. To be conservative, it is assumed that GermXtra is a Class 1A liquid.					

**Aerosols:**

Product	Operations/Used for	NFPA 30B Class
IPS Contrast Spray	Restorative	Level 3

**Combustible powder:**

Name
Duralay Powder Shades
Permasoft Powder
CoeSoft Powder