

FOR RECOMMENDATION

PUBLIC

OPEN SESSION

TO: Academic Board

SPONSOR: Scott Mabury, Vice-President Operations and Real Estate Partnerships

CONTACT INFO: 416-978-2031, scott.mabury@utoronto.ca

PRESENTER:

CONTACT INFO: See Sponsor

DATE: March 3, 2022 for March 10, 2022

AGENDA ITEM: 5

ITEM IDENTIFICATION:

Capital Project: *Report of the Project Planning Committee for the University of Toronto Emerging and Pandemic Infections Centre (EPIC) Facility – Project Scope and Sources of Funding*

JURISDICTIONAL INFORMATION:

Pursuant to section 4.2.3. of the Committee’s terms of Reference, “...the Committee considers reports of project planning committees and recommends to the Academic Board approval in principle of projects (i.e. space plan, site, overall cost and sources of funds) with a capital cost as specified in the *Policy on Capital Planning and Capital Projects*.”

The *Policy on Capital Planning and Capital Projects* provides that capital projects with costs in excess of \$50 million (Approval Level 3) on the St. George campus, will first be considered by the Planning & Budget Committee, which shall recommend approval to Academic Board. Following consideration and approval by the Academic Board and Business Board, such proposals are then brought forward to the Executive Committee, and then forwarded to the Governing Council.

GOVERNANCE PATH:

A. Project Planning Report

1. Planning and Budget [for recommendation] (February 28, 2022)
2. **Academic Board [for recommendation] (March 10, 2022)**
3. Executive Committee [for endorsement and forwarding] (March 22, 2022)
4. Governing Council [for approval] (March 31, 2022)

B. Execution of the Project:

1. Business Board [for approval] (March 15, 2022)

PREVIOUS ACTION TAKEN:

At the October 2, 2020 meeting of the Capital Project and Space Allocation (CaPS) Executive Committee, the project [formerly identified as Combined Containment Level 3 (C-CL3) Facility] was brought forward to approve the Terms of Reference, and to formally strike the Project Planning Committee.

On January 4, 2021, following a between meeting approvals request, consultant fees were approved to engage consultants to initiate design services.

At the June 29, 2021 CaPS Executive Committee meeting, an increase in consultant fees was approved to procure other sub-consultants and bring the design to the next phase and expedite the demolition and abatement package ahead of construction.

At its meeting held on October 1, 2021, the CaPS Executive Committee approved the request for an increase in project expenditure to be made available for expenditure of early works to initiate abatement and demolition services for the U of T Emerging and Pandemic Infections Centre (EPIC) Facility.

HIGHLIGHTS:

The University of Toronto's (U of T) Emerging and Pandemic Infections Centre (EPIC) facility is currently split across three units within the Medical Sciences Building (MSB) and the Terrence Donnelly Centre for Biomedical Research (CCBR). The EPIC3 *in vitro* facility and the EPIC2 Core Virology and BioBank units, a complementary EPIC2 Risk Group 3 (RG3) pathogens secure laboratory, are in the West Wing (Block B) of MSB. The third EPIC3 unit is the *in vivo* facility in the Terrence Donnelly Centre for Cellular & Biomolecular Research (CCBR). The Temerty Faculty of Medicine (TFoM) proposes to consolidate the EPIC facility within MSB, co-locating the EPIC3 unit (*in vitro* and *in vivo*) and the complementary EPIC2 unit.

The EPIC Unit manages these facilities and the regulatory program for research with infectious biological agents that require high containment infrastructure and operational approaches. At present, the EPIC Unit supports the activities of: approximately 45 Principal Investigators across multiple divisions at the University of Toronto, Toronto Academic Health Science Network (TAHSN), other Canadian universities, and other government partners [Public Health Agency of Canada (PHAC) and Health Canada]. The EPIC Unit at the University of Toronto is the only research-dedicated high-containment level 3 facility in the Greater Toronto Area that has the regulatory license to conduct RG3 research, including manipulation *in vitro* and use of *in vivo* infection models.

To address the infrastructural challenges facing the Risk Group 3 (RG3) program at the University, the new EPIC3 and EPIC2 facilities will be located within MSB, given specific benefits and impacts on the academic program for the EPIC Unit to build in the future. The space program for the proposed facilities were developed to respond to the projected future steady-state research

demand in a Risk Group 3 pathogens secure environment to support the Temerty Faculty of Medicine's academic program, and broader institutional research initiatives at the University. Within the new facilities, research operations will be enhanced by state-of-the-art analytical and diagnostic equipment.

The space program for the combined EPIC3 was initially developed by Perkins Eastman Architects as per the *U of T Faculty of Medicine CL3 Lab Relocation Feasibility Study* — Refer to the *Report of the Project Planning Committee for the University of Toronto Emerging and Pandemic Infections Centre (EPIC) Facility*. The space program was further refined in Implementation Phase with the External Consultant team of DIALOG and Merrick along with TFoM and U of T. The facility simulates a box-in-a-box design to allow the facility's infrastructure and systems to be mostly independent from MSB infrastructure, as much as possible.

The current space program includes the EPIC3 facility consisting of six *in vitro* lab suites, and three *in vivo* procedure suites within the CL3 containment perimeter. Additionally, the layout incorporates required support spaces including an effluent decontamination management system to enable a wider scope of pathogenic research as well as a new imaging facility. The EPIC2 laboratory consists of a molecular lab, an infection room, and the BioBank within the CL2+ containment perimeter. CL2+ containment is physically akin to a Containment Level 2 laboratory, but with the operational requirements akin to the EPIC3 lab. Many of the features incorporated in the proposed facilities will allow the EPIC Unit to expand research. The EPIC facility must be designed to meet all required regulatory body licensing requirements and ensure high level of containment to ensure lab security and safety.

The total space program consists of 1,124 nasm of research and office space within a 2,138 gsm interior renovation (nasm-to-gross ratio of 1.9). This gsm includes the 750 gsm enclosed condition rooftop mechanical penthouse but excludes the 600 gsm screened nonconditioned enclosure.

The project submitted to the Committee of Adjustment (COA) for minor height variance September 28, 2021. The COA committee approved the minor variance as per the Final and Binding letter issued December 22, 2021. Heritage Preservations Services will administratively review/approve through the Building Permit submitted December 23, 2021, as the Medical Sciences Building is earmarked for future designation. An Alternative Solution package will be submitted to the City January 12, 2022, to get approval for use of flammables below grade. The proposed EPIC mechanical penthouse height is contextually appropriate, being only 5.1m above MSB's existing roof and the associated exhaust stack will be aligned to the existing MSB exhaust stack. The proposed mechanical penthouse is set back and positioned on the south end of MSB's existing roofs away from Front Campus. Although the 2011 Master Plan did not contemplate new development at the Medical Sciences Building, the Secondary Plan Application and Draft Urban Design Guidelines identify the West Wing location appropriate for additional mid-scale height with a step down northward to transition sensitively to Front Campus as well as help reinforce the existing frontage along King's College Road, an important view corridor to University College from College Street. The proposed EPIC project's Mechanical Penthouse massing and location is not anticipated to have any impact on future redevelopment.

There are no Secondary Effects associated with this project.

SCHEDULE:

The proposed target schedule for the project is as follows.

- | | |
|---|-----------------------|
| • Schematic Design | Mar – Jul 2021 |
| • Design Development | Aug – Dec 2021 |
| • Construction Documents Phase | Jan 2021 – Mar 2022 |
| • Full Governance Approval Cycle 4 | Jan 21 - Mar 31, 2021 |
| • Demolition and Abatement Tender/award | Oct - Dec 2021 |
| • Demolition and Abatement | Jan-Mar 2022 |
| • Construction tender/award | Apr – Jun 2022 |
| • Construction start | Jul 2022 – Feb 2024 |
| • Commissioning and Licensure | Feb 2024 – Aug 2024* |
| • Client Move-in | Jun - Aug 2024 |
| • Schedule Contingency | Jun - Dec 2024** |

*Commissioning, Performance Verification Testing, Licensure by Public Health Agency of Canada (PHAC), CCAC and CFIA

**Schedule assumptions include: City of Toronto accepts Alternative solution

FINANCIAL IMPLICATIONS:

Discussion of overall costs and sources of funds can be found in the *in camera* document for this project.

RECOMMENDATIONS:

Be It Recommended:

THAT the project scope of the Emerging and Pandemic Infections Centre (EPIC) Facility as identified in the *Report of the Project Planning Committee for the University of Toronto Emerging and Pandemic Infections Centre (EPIC) Facility*, dated February 10, 2022, be approved in principle; and,

THAT the project totaling 1,124 net assignable square metres (nasm) 2,138 gross square metres (gsm), be approved in principle, to be funded by Temerty Faculty of Medicine (TFoM) Operating Funds, TFoM Dean's Covid Priority Fund, Canadian Foundation for Innovation (CFI) / Ontario Research Fund (ORF) and Fundraising.

DOCUMENTATION PROVIDED:

- *Report of the Project Planning Committee for University of Toronto Emerging and Pandemic Infections Centre (EPIC) Facility*, dated February 10, 2022

**Report of the Project Planning Committee for
University of Toronto
Emerging and Pandemic Infections Centre (EPIC) Facility**

February 10, 2022

University Planning - University Planning, Design and Construction
Facilities Management and Space Planning, Temerty Faculty of Medicine

I. Executive Summary

The Medical Sciences Building's (MSB) West Wing is prominently situated at the corner of King's College Road and King's College Circle and houses two of the three units of the Emerging and Pandemic Infections Centre (EPIC) facility. The EPIC facility supports research activities on established and emerging infectious diseases. The EPIC facility is currently split across three units. Two of the three EPIC units are in the West Wing of MSB, the EPIC3 *in vitro* facility and the EPIC2 Core Virology and BioBank. The third EPIC3 unit is the *in vivo* facility, which resides in the Terrence Donnelly Centre for Cellular & Biomolecular Research (CCBR). The Temerty Faculty of Medicine (TFoM) proposes to consolidate the EPIC facility, co-locating the EPIC3 facility (*in vitro* and *in vivo*) and the complementary EPIC2 Risk Group 3 (RG3) pathogens secure laboratory.

The EPIC Unit manages these facilities and the regulatory program for research with infectious biological agents that require high containment infrastructure and operational approaches. At present, the EPIC Unit supports the activities of approximately 45 Principal Investigators across multiple divisions at the University of Toronto, Toronto Academic Health Science Network (TAHSN), other Canadian universities, and other government partners [Public Health Agency of Canada (PHAC) and Health Canada]. The EPIC Unit at the University of Toronto is the only research-dedicated high-containment level 3 facility in the Greater Toronto Area that has the regulatory license to conduct RG3 research, including manipulation *in vitro* and use of *in vivo* infection models.

To address the infrastructural challenges facing the Risk Group 3 (RG3) program at the University, the new EPIC3 and EPIC2 facilities will be located within MSB, given specific benefits and impacts on the academic program for the Unit to build in the future. The space program for the proposed facilities were developed to respond to the projected future steady-state research demand in a Risk Group 3 pathogens secure environment to support the Temerty Faculty of Medicine's academic program, and broader institutional research initiatives at the University. Within the new facilities, research operations will be enhanced by state of the art analytical and diagnostic equipment.

In addition to replacing and consolidating the EPIC3 *in vivo* and *in vitro* research facilities, it will also include imaging with CL3 containment security protocols for periodic shared use with the Division of Comparative Medicine (DCM). The proposal also co-locates the existing EPIC2 Core Virology and BioBank, and the modest administrative areas of the EPIC Unit. The space program for the combined EPIC3 was initially developed by Perkins Eastman Architects as per the *U of T Faculty of Medicine CL3 Lab Relocation Feasibility Study* (refer to Appendix). The space program was further refined in Implementation Phase by the external consultant team of DIALOG and Merrick along with TFoM and U of T. The facility simulates a box-in-a-box design to allow the facility's infrastructure and systems to be mostly independent from MSB infrastructure, as much as possible.

The current space program includes the EPIC3 facility consisting of six *in vitro* lab suites, three *in vivo* Procedure suites, as well as dedicated equipment and analytic instrumentation areas within the containment perimeter. Additionally, the layout incorporates required support spaces: donning and doffing, showers, autoclaves, and non-assignable areas to house the dedicated infrastructure including an effluent decontamination management system to enable a wider scope of pathogenic research. The EPIC2 laboratory consists of a molecular lab, an infection room, and the BioBank. It is physically akin to a Containment Level 2 laboratory with the operational requirements akin to the EPIC3 lab. Many of the features incorporated in the proposed facilities will allow the EPIC Unit to expand the kind of research they can

support. The EPIC facility must be designed to meet all required regulatory body licensing requirements and ensure high level of containment to ensure lab security and safety.

The total space program consists of 1,124 nasm of research and office space within a 2,138 gsm interior renovation (nasm-to-gross ratio of 1.9). The gsm includes the 750 gsm enclosed condition rooftop mechanical penthouse but excludes the 600 gsm screened nonconditioned enclosure.

The project submitted to the Committee of Adjustment (COA) for minor height variance September 28, 2021. The COA committee approved the minor variance as per the Final and Binding letter issued December 22, 2021. Heritage Preservations Services will administratively review/approve through the Building Permit submitted December 23, 2021, as the Medical Sciences Building is earmarked for future designation. An Alternative Solution package will be submitted to the City January 12, 2022, to approve use of flammables below grade. The proposed EPIC mechanical penthouse height is contextually appropriate, being only 5.1m above MSB's existing roof and the associated exhaust stack will be aligned to the existing MSB exhaust stack. The proposed mechanical penthouse is set back and positioned on the south end of MSB's existing roofs away from Front Campus. Although the 2011 Master Plan did not contemplate new development at the Medical Sciences Building, the Secondary Plan Application and Draft Urban Design Guidelines identify the West Wing location appropriate for additional mid-scale height with a step down northward to transition sensitively to Front Campus as well as help reinforce the existing frontage along King's College Road, an important view corridor to University College from College Street.

There are no Secondary Effects associated with this project.

Table of Contents

I.	Executive Summary	1
II.	Project Background	5
	a) Background Information	5
	b) Existing space	5
	Occupant profile	7
III.	Project Description	13
	a) Vision Statement	13
	b) Statement of Academic Plan	13
	c) Space Requirements, Program and Functional Plan	15
	Space Requirements	15
	Space Program	21
	d) Functional Plan	22
	Non-assignable space	23
	e) Building Considerations and Sustainability	23
	Standards of Construction	23
	Building Characteristics and Massing	23
	Sustainability Design and Energy Conservation	24
	Personal safety and security	27
	Accessibility	27
	Elevators	28
	Signage, Donor Recognition	28
	Key building systems serving the EPIC facilities	28
	f) Site Considerations	33
	Site Context	33
	Master Plan	33
	Zoning regulations	33

Heritage Status	33
Environmental Issues, Regional Conservation, Ministry of Environment, Conservation and Parks (MECP).....	34
Soil Conditions.....	34
Site Access	34
Site Access – During Construction.....	35
Site Servicing; Existing and Proposed	35
Hazardous Waste Disposal.....	35
g) Campus Infrastructure Considerations.....	36
Utilities	36
Sewer and Storm Water Management.....	36
h) Secondary Effects	36
a) Schedule.....	38
I. Resource Implications.....	39
a) Total Project Cost Estimate	39
b) Operating Costs.....	39
c) Other Related Costs	39
d) Funding Sources	39
APPENDIX.....	40

II. Project Background

a) Background Information

The Temerty Faculty of Medicine maintains secure facilities for work with Risk Group 3 (RG3) pathogens such that crucial research on established and emerging infectious diseases can be conducted while ensuring researchers and the larger community are protected from risk. Paramount in the support of these facilities is the regulatory group within the Temerty Faculty of Medicine that oversees and facilitates the work that is undertaken in the EPIC Unit. This team provides expert risk assessment for research projects, standardized protocol development, and essential training and certification for all EPIC research personnel. The approach meets and often exceeds all federal regulatory requirements and has been acknowledged as sector-leading by national regulatory bodies.

The EPIC Unit manages the EPIC facilities and the regulatory program for research with infectious biological agents that require high containment infrastructure and operational approaches. It is currently active in supporting researchers from University of Toronto (multiple Divisions), University Health Network (UHN), and other partners, including governmental agencies such as the Public Health Agency of Canada (PHAC) and Health Canada. The EPIC Unit at the University manages the only research-dedicated high-containment level 3 facility in the Greater Toronto Area that has the regulatory license to conduct RG3 research, including manipulation *in vitro* and use of *in vivo* infection models.

The Medical Sciences Building's (MSB) West Wing is prominently situated at the corner of King's College Road and King's College Circle and houses two of the three units of the Emerging and Pandemic Infections Centre (EPIC) facility. The EPIC facility supports research activities on established and emerging infectious diseases. The EPIC facility is currently split into three units. Two of the three EPIC units are in the West Wing of MSB, the EPIC3 *in vitro* facility and the EPIC2 Core Virology and BioBank. The third EPIC3 unit is the *in vivo* facility, which resides in the Terrence Donnelly Centre for Cellular & Biomolecular Research (CCBR). The Temerty Faculty of Medicine (TFoM) proposes to consolidate the EPIC facility, co-locating the EPIC3 facility (*in vitro* and *in vivo*) and the complementary EPIC2 Risk Group 3 (RG3) pathogens secure laboratory.

b) Existing space

The facilities of the EPIC Unit consist of the MSB EPIC3 *in vitro* lab, the CCBR EPIC3 *in vivo* lab, and the MSB EPIC2 Core Virology and BioBank, with associated support areas/storage rooms and administrative offices in MSB and CCBR.

Table 1.0 - EPIC Unit Existing Space Allocation

COU Category	MSB EPIC3 <i>in vitro</i>		CCBR EPIC3 <i>in vivo</i>		MSB Core Virology and BioBank (EPIC2)	
	NASM	GSM	NASM	GSM	NASM	GSM
3.1	146.99	-	-	-	151.72	-
3.2	56.7	-	92.18	-	58.66	-
Cat. 3. Subtotal	203.69	228.13	92.18	104.16	210.38	237.72
4.1	-	-	-	-	19.43	-
4.2	-	-	-	-	-	-
4.3	-	-	-	-	-	-
4.4	9.4	-	-	-	-	-
4.5	-	-	-	-	-	-
Cat. 4. Subtotal	9.4	10.52	-	-	19.43	21.95
18.1	-	-	131.11	-	-	-
Cat. 18. Subtotal	-	-	131.11	146.84	-	-
Non-Assign Space within facility perimeter	(4.89)	5.47	(45.90)	51.40	-	-
Facility Subtotal	213.09	244.12	223.29	302.40	229.81	259.67
EPIC Unit Grand Total					666.19	806.19

The MSB *in vitro* lab accommodates five bays, each with a biosafety cabinet (BSC), and one within a separated aerosol containment area. A total of 5 research staff can work at the 5 biosafety cabinets in the *in vitro* facility at a time. However, the maximum number of occupants in the lab is presently 13 due to a limited number of specialized PPE. Typical occupancy during day-time hours is between 4-6 researchers. However, recently it has not been uncommon for up to 8 researchers to be working at a time in the facility during the day.

The facility includes an autoclave for decontamination of waste and clothing and two donning/ doffing/ shower-out facilities for personnel and has a sealed containment perimeter of 244 sm. A shared administrative office is in MSB down the hall from the EPIC3 laboratory areas.

The CCBR *in vivo* lab has one procedure room with a large biosafety cabinet (BSC), two core research rooms, dirty and clean change rooms, a decontamination area, and an autoclave staging area. The EPIC3 sealed containment perimeter is 146 sm.

The MSB EPIC2 Core Virology and BioBank is a core facility available for researchers from UofT, UHN and other academic institutions, as well as industrial sector partners. It consists of a molecular lab and an infection room. A total of 5 staff can work in the infection room Biosafety Cabinets at a time. The Core Virology and BioBank requires equipment such as ultra-low temperature freezers, humidified cell culture incubators, microscopes, multimode analytic equipment, standard freezers and fridges and centrifuges. The administrative offices are also located in MSB in two rooms that open from within the lab areas. Refer to Appendix for existing EPIC space inventory.

Occupant profile

Administrative oversight, managerial and laboratory staff complement

The Combined Containment Level 3 (EPIC) Unit is supported through an integrated approach to facility management. A dedicated manager and technician oversee daily operations and the extensive administrative requirements of the EPIC program. They are further supported in regulatory operations and strategic planning by the Research Operations Officer (Temerty Faculty of Medicine) and the EPIC Scientific Director (faculty member, term-appointed). The aspects of the EPIC program incorporating *in vivo* research are supported by the Division of Comparative Medicine (DCM) Director, DCM Manager and DCM technicians to provide operational and regulatory supports (permit approvals, personnel training, inventory control, cleaning, maintenance), as well as technical services for core research. All the individuals listed above participate in a collaborative EPIC Management Team to provide consistency and harmonization of all aspects of the RG3 program (e.g., standardized operating protocols, training approaches etc.). This team also oversees the operations of the Core Virology Laboratory and BioBank, as non-aerosol transmitted RG3 pathogens are stored and manipulated in this facility and it is therefore governed by the RG3 regulatory/administrative program at UofT. This interconnectedness of personnel and administrative structures between the EPIC Unit and the Core Virology Lab underscores the necessity of their close physical adjacency.

Due to the in-facility requirements of the jobs related to the EPIC3 Manager, EPIC3 Technician and DCM technicians, office space outside of the containment perimeter but directly proximal to the facilities is required. Further, the bio-risk and bio-security implications of the documentation held by the members of the EPIC Management Team, in particular the EPIC Manager, necessitates secure and private office space such that regulatory requirements can be met.

Research Staff Complement – Pre-Pandemic

Two dedicated research staff positions support the EPIC and Core Virology and BioBank programs in so far as coordinating and carrying out research that is central to the program intent including establishment and standardization of pathogen models, validation of pathogen inactivation technologies and biobanking efforts. These individuals are located full time in the EPIC3 and EPIC2 facilities and require adjacent office space.

As core facilities serving the entire Toronto research community, the EPIC3 and EPIC2 facilities support a user base where most researchers are located primarily at other lab spaces and transit to the facilities for specific activities. To work with RG3 pathogens, researchers are obligated to use a high-containment compliant laboratory space by the regulatory framework laid out in the federal Human Pathogens and Toxins Act. As the only such laboratory space available in downtown Toronto to researchers, Temerty Medicine's EPIC3 and EPIC2 labs are essential for any TAHSN-affiliated researcher (and beyond) working with RG3 pathogens. Over the course of the past 15 years, the RG3 program has supported the research programs of 13 principal investigators, with over 110 research personnel (graduate students, technicians, post-doctoral researchers, and research assistants) working in the facilities and developing high-containment expertise. As with many core facilities, the existing EPIC3 *in vivo* and *in vitro* facilities are financially built on a cost-recovery model and available for a fee for researchers from UofT, UHN and other academic institutions, as well as industrial sector partners.

Pre-pandemic, there were 16 researchers utilizing the EPIC3 facilities. Note that the EPIC2 Core Virology and BioBank was not in existence prior to the 2020 COVID-19 pandemic.

Research Staff Complement – Pandemic

During the 2020 COVID-19 pandemic, the facilities have become the center of intense research operations. Immediately, it was recognized by both the University and Temerty Faculty of Medicine that expanded space and infrastructure was required to accommodate additional scientific capacity. The University through its Institutional Strategic Initiatives (ISI) program and the Faculty through a Temerty Foundation gift contributed to purchase equipment, PPE's, support staff, and renovation that has now become the EPIC 2 Core Virology and BioBank.

From February – October 2020 (February 2020 – June 2021), 11 additional principal investigators expanded to incorporate RG3 research, adding 24 research personnel to the active roster in the EPIC3 and EPIC 2 facilities. These join 13 pre-established EPIC3 researchers who were actively working at the beginning of the pandemic. The EPIC3 and EPIC2 facilities are operating on a 24/7 basis to ensure continuity of all research with the average week of operating exceeding 10 entries into containment/day with use reaching 250 hrs/week, representing 25% over full-time capacity (full time = 40 hrs/workbay/week). Of the 16 researchers that utilized the EPIC3 facilities pre-pandemic, 7 are active in the EPIC2 at present (4 of them are active in both EPIC2 and EPIC3).

To support this greatly enhanced user demand and the need for rapid, impactful COVID-19 research discoveries, the EPIC3 and EPIC2 facilities added 5 supplemental part-time research assistants, working anywhere between 10-30 hours/week.

Update: In Spring 2021, numbers grew to 16 additional PIs doing RG3 research, adding 37 research personnel to the EPIC3 and EPIC 2 facilities. Usage of the EPIC3 and EPIC2 facilities are reaching 275 hrs/week, representing 37% over full-time capacity.

Future Projections

As need continues to rise for space in full EPIC3 space for research with aerosol pathogens such as pandemic viruses, the work of the HIV research program has been relocated to the new EPIC2 Core Virology Lab. This shift will allow for a more productive profile for the research groups working on HIV and likely lead to higher usage of the EPIC2 infrastructure by groups that were restricted by EPIC3 operational protocols until now. The diversification of the RG3 program alongside a new UofT Institutional Strategic Initiative structured around emerging pathogens with pandemic potential will see the demand on the EPIC3 and EPIC2 spaces rise. Occupancy of these facilities is projected to increase 30-40% over the next 5-7 years with the refocusing of infectious disease research onto SARS-CoV-2 and other emerging pathogens, and the recruitment of new principal investigators focused in these areas.

Indirect Support Staff

Engineers and technical staff attend to the alarms and perform the maintenance of the systems for the EPIC3 lab. On an as needed basis, building trades may also need to enter the facility. If they enter when the facility is not decontaminated, they must do so while accompanied by a trained EPIC3 DCM staff member to ensure compliance with SOPs.

Table 2.1 – Existing: Dedicated Occupants (dedicated managerial and research staff complement) of EPIC

Relevant COU Category	Occupant Type EPIC Unit Personnel	Head count (HC)	FTE 2020 pandemic	Hours / Week (actual, Fall 2020)	
				In Lab EPIC3, EPIC2	Admin
3.0, 4.1	EPIC Scientific Director (faculty member, term-appointed) *	1	0.8	*	32
3.0, 4.2	EPIC Research Operation Officer (EPIC Manager) *	1	0.9	*	20
3.0, 4.2	EPIC3 <i>in vitro</i> Manager*	1	1		10
3.0, 4.2	EPIC Technician	1	1		5
3.0, 4.2, 4.3	EPIC Research Assistant/Graduate Student (Casual Support for past 4 years) - Present: 2 RAs & 2 Grads	1 - 4	2.5	*	20
4.2	DCM Director*	1	0.2	-	5
3.0, 4.2	DCM Manager (EPIC3 <i>in vivo</i> Manager) *	1	0.4		11
3.0, 4.2	DCM Technician	1	0.5		-
Total EPIC Unit Personnel		8 - 11	7.3		103

Table 2.2 – Future Projection (steady state): Dedicated Occupants (managerial and research staff complement) of EPIC

Relevant COU Category	Occupant Type EPIC Unit Personnel	Head count (HC)	FTE Future/ steady state projection	Hours / Week	
				In Lab EPIC3, EPIC2	Admin
3.0, 4.1	EPIC Scientific Director (faculty member, term-appointed) *	1	0.1	-	4
3.0, 4.1	EPIC Strategy and Partnerships Director	1	1	-	20
3.0, 4.2	EPIC3 <i>in vitro</i> Manager*	1	1	20	20
3.0, 4.2	EPIC Research Operation Officer (EPIC Manager) *	1	0.2	-	8
3.0, 4.2	EPIC Technician	1	1	35	5
3.0, 4.2, 4.3	EPIC Research Assistant/Graduate Student (Casual Support for past 4 years)	1 - 4	0.2	8	-
3.0, 4.2	DCM Technician	1	0.5	20	-
4.2	DCM Director*	1	0.1	-	4
3.0, 4.2	DCM Manager (EPIC3 <i>in vivo</i> Manager) *	1	0.2	2	6
Total EPIC Unit Personnel		8 - 11	3.3	85	47

Notes:

- 1.) * Denotes EPIC Management Team as per regulatory documents.
- 2.) ** Denotes FTE estimate based on actual percentage of staff member's time dedicated to the EPIC Unit. Number of hours per week are reflective of a conservative estimate.
- 3.) Relevant COU Category reflects direct relationship between the number of faculty, researchers and graduate students associated with the EPIC Unit and the amount of research and admin functions being done by the unit personnel. Per COU, staff who are hired to assist in the research of "research appointed staff" are accommodated within the space generated by the "research appointed staff" and are also counted separately under Total Non-Academic Staff (paid through research fund). The research supported by the EPIC Unit is unique in that many of the EPIC Unit Personnel participate and contribute to the research of PIs in a larger capacity than what the COU categorizes as research assistance. Details are provided below.
- 4.) The EPIC Scientific Director is both an administrative and an academic research position. As he is the co-investigator to all PIs whose research is supported by the EPIC facilities but who do not dedicate personnel to the lab, one additional PI is allocated in the Supported and Direct Users Occupant Complement Headcount. In addition, in his capacity as a U of T TFoM PI he conducts his own research using the facilities and dedicating personnel to the labs.
- 5.) The EPIC Strategy and Partnerships Director leads the management of research, training and partnership projects anchored out of the EPIC labs. They assess research proposals for implementation in the EPIC lab facilities by the research and technical staff, coordinate development of research plans pertinent to partner institutions throughout TASHN and develop strategic funding and partnership opportunities for the EPIC ISI program.
- 6.) EPIC ROO (EPIC Manager) fulfills both administrative and academic research positions, as a research collaborator to PIs (for COU purposes this is akin to the role of a Research Associate), and manager of the entire EPIC Unit (administrative function).
- 7.) Non-academic research and technical staff positions, such as the EPIC3 *in vitro* Manager, EPIC Technician, DCM Manager (EPIC3 *in vivo* Manager), and DCM Technician, provide both technical and academic research support to the PIs who do not dedicate personnel to the lab, based on a 50% technical support and 50% co-creation apportionment of their lab time (for COU purposes this is akin to the role of a Research Associate or Graduate Student).
- 8.) The four Research Assistant/Graduate Student casual support positions are dedicated PI support, and reflected as 50% technical support, 25% Research Assistant support, and 25% Graduate Student support in the Supported and Direct Users Occupant Complement Headcount.

Table 2.3 – Existing Occupant Complement of EPIC: Supported and Direct Users, Headcount (Fall 2020 data)

	Supported without dedicating personnel to the lab			Direct Use - PIs who dedicate personnel to the lab			Direct Use Personnel who are physically present in the labs								
	Principal Investigators (PI)			Principal Investigators (PI)			PDF / RA			Graduate Students			Lab Technicians		
	only EPIC3	both	only EPIC2	only EPIC3	both	only EPIC2	only EPIC3	both	only EPIC2	only EPIC3	both	only EPIC2	only EPIC3	both	only EPIC2
EPIC Unit															
Lab Personnel*	1						3			2			4		
UofT:															
T FoMed.	7	1	2	2	2		3		2	8		4	1		
FASE	1		1												
IBBME					1		1		1	1		1			
LD FoPharm.	1														
UTSC	1		1												
UofT Other				1			1								
TAHSN:															
SickKids	1	1		1	1		1		1				1		
Sunnybrook	1				2		6		2			1	3		2
UHN	1	1		3	1		5		1	2		1	2		1
UHN - Krembil															
Unity Health					1		1			1		1	1		1
Outside of TAHSN:															
McGill	1														
McMaster	1														
Ryerson			1												
UCalgary	1														
UBC	2														
UMontreal	1														
Western	1														
Total	21	4	5	7	8	-	18	3	7	12	-	8	8	4	4
	25 EPIC3			15 EPIC3			21 EPIC3			12 EPIC3			12 EPIC3		
	9			8			10			8			8		

EPIC2

EPIC2

EPIC2

EPIC2

EPIC2

Notes:

- 1.) * denotes EPIC Unit Personnel supporting those PIs who do not have personnel in labs.
- 2.) Table does not account for collaborative work with government agencies including the Public Health Agency of Canada, Health Canada, The Bank of Canada, the Royal Canadian Mint, or interest in industrial research from Canadian and international companies.
- 3.) EPIC Scientific Director is both an administrative and an academic research position. As he is the co-investigator to all PIs whose research is supported by the EPIC facilities but who do not dedicate personnel to the lab, one additional PI is allocated in the Supported and Direct Users Occupant Complement Headcount (under EPIC Unit Dedicated Lab Personnel line). In addition, in his capacity as a UofT TFoM PI he conducts his own research using the facilities and dedicating personnel to the labs. This is included in the total Temerty Faculty of Medicine PI count.
- 4.) Per COU, staff who are hired to assist in the research of "research appointed staff" are accommodated within the space generated by the "research appointed staff" and are also counted separately under Total Non-Academic Staff (paid through research fund). The research supported by the EPIC Unit is unique in that many of the EPIC Unit Personnel participate and contribute to the research of PIs in a larger capacity than what the COU categorizes as research assistants. This activity is reflected in the counts in this table under EPIC Unit Personnel.

III. Project Description

a) Vision Statement

The proposed new EPIC research laboratory is envisioned as a critical core facility - and the only one of its kind in Toronto - in fully renovated space within the Medical Science Building. The new location will offer more modern facilities than what currently exists and allow for efficiencies through co-location of the three units: the EPIC3 *in vitro* unit, the EPIC3 *in vivo* unit, and the EPIC2 Core Virology and BioBank unit.

b) Statement of Academic Plan

The University of Toronto is established as a global leader in high containment research with high-impact pathogens. The EPIC Unit supports all University of Toronto-based research with Risk Group 3 (RG3) pathogens. Due to the unique and highly complex requirements of maintaining the necessary facilities, the EPIC Unit also serves the broader Toronto research community as the only high-containment research facility in Toronto.

From 2005 – 2019, the EPIC Unit has supported the work of 13 different research groups and provided the unique opportunity for over 110 trainees and other research professionals to train and work on innovative research in a high-containment infectious disease research environment.

The EPIC3 *in vitro* facility has reached 20 years since design and implementation, and its sophisticated infrastructure has now reached the end of its expected lifespan. Further, during those years, federal biosafety and biosecurity regulations have changed with the enactment of an entirely new federal legislative framework governing the handling of pathogenic microbes, making the original design elements outmoded and eclipsed by modern containment facility design.

Space constraints in the existing *in vitro* EPIC3 laboratory and other logistical considerations led to the *in vivo* EPIC3 facility's construction within the CCBR 10 years ago, providing the opportunity for the RG3 program to expand. While transformative, the distance between the two containment laboratories poses technical, financial, and administrative challenges because samples must be 'shipped' between two facilities (as they would between institutions), and the separation restricts the analyses that can be performed.

Pandemic Response: The COVID-19 pandemic has highlighted the importance of a robust and responsive high containment program. The established RG3 program has led to a close relationship with regulators, allowing fast-track approval for use of SARS-CoV-2 and rapid response to the pandemic. The EPIC team's experience working with RG3 pathogens in a high containment environment allowed them to develop safe and effective protocols to handle SARS-CoV-2. In Toronto, academic work rapidly expanded, with 11 research groups starting EPIC3 operations throughout 2020, with EPIC staff training 24 researchers and trainees to work with the virus and, ultimately, combat this public health crisis. This SARS-CoV-2 research leadership also led to intense levels of interest in the use of the EPIC3 facilities for collaborative work with government agencies including the Public Health Agency of Canada, Health Canada, The Bank of Canada, the Royal Canadian Mint, and the Ontario Human Milk Bank. The Unit has also been approached by a wide variety of Canadian and international companies who need help with development and/or validation of their products; unfortunately, most of these industry requests have not been accommodated because the increase in academic research efforts have had the EPIC Unit running beyond full capacity over the last 7 months.

Prior to the COVID-19 pandemic, the *in vitro* EPIC3 laboratory had functioned as two distinct containment zones: for pathogens not transmitted by aerosol and a smaller physically segregated room for work. To accommodate the unprecedented surge in SARS-CoV-2 research, a strategic decision was made to convert the entire *in vitro* EPIC3 facility. This was accomplished by obtaining regulatory approval to move select research programs out of the *in vitro* EPIC3 facility and into the new EPIC2 Core Virology Laboratory and BioBank. This EPIC2 laboratory and BioBank are physically adjacent to and operationally linked with the EPIC Unit, allowing effective oversight, staffing and management of both high containment facilities.

A Forward-Looking Vision: The high containment facilities are critical for research to understand and develop interventions that can combat infection caused by existing and emergent pathogens, including the COVID-19 pandemic and others that will certainly follow. The complex infrastructural requirements of these facilities necessitate planning now for its renewal, which will allow ongoing work and increased capacity to deal with these future emerging pathogen challenges. To address the infrastructural challenges facing the Risk Group 3 (RG3) program at the University, the new EPIC unit will be renovated within MSB, given specific benefits and impacts on the academic program the EPIC Unit can build in the future.

The space program for the proposed facilities was developed to respond to the projected future steady-state research demand in a RG3 pathogens secure environment, support the Temerty Faculty of Medicine's academic program, and broader institutional research initiatives at the University. The *in vitro* portion of the EPIC3 lab will have internal lockdown capabilities conforming to the federal regulatory requirements for manipulation of specific bioagents while the remainder of the facility remains operational for handling of other RG3 pathogens. The plans also expand the EPIC Unit's existing infectious disease modeling capacity in the EPIC3 *in vivo* facility by incorporating imaging and analytic modalities within containment, allowing pre-clinical testing of innovative new interventions before implementation in the clinic. Each of these facilities will be supported by expert investigators who will assist the EPIC Unit's academic, clinical, government agency and industrial partners in experimental development, perform work on a fee-for-service basis and will train their students and staff so that they can apply these approaches for their own research goals.

Locating the facilities within the MSB allows the EPIC Unit to envision a fully integrated new high containment facility with the *in vitro* (pathogen manipulation) and *in vivo* (pathogen modelling) EPIC3 laboratories, the EPIC2 Core Virology Laboratory and the BioBank in contiguous space. This would allow a more effective workflow for experimental procedures, more effective technical support, and increased biosafety and biosecurity by avoiding movement of researchers and biological samples between areas of the high containment labs. The co-location of the *in vitro* and *in vivo* EPIC3 areas, allows for compartmentalization of the new EPIC3 research space permitting manipulation of specific biological agents without disrupting ongoing work by other research groups. To allow for improved biosafety containment within the facility, and to provide increased capacity and diversity in pathogens and model systems, the *in vivo* EPIC3 space will be subdivided into separate isolation rooms with shared procedure rooms for handling and technical support. Notably, the plan incorporates high-technology imaging facility available to EPIC3 research. Access to imaging modalities for RG3 pathogen research would be a major advancement for researchers to define and characterize disease progress and pathogenesis that has been inaccessible to UofT researchers up to this point.

The University of Toronto's established RG3 pathogen program allowed the EPIC Unit to rapidly mobilize and lead the national research response to the COVID-19 pandemic. The EPIC lab renewal plans being considered both support the EPIC Unit's vision to maintain its position as a global resource in the study of high impact pathogens and development of medical interventions to rapidly diagnose them, prevent their transmission and effectively cure the diseases that they cause. The development of the new high containment unit dovetails with the University's firm commitment to broaden their infectious disease

focus through the recruitment of new infectious disease-focused faculty. The University of Toronto's breadth of expertise has been key to the EPIC Unit's success in confronting the COVID-19 pandemic because a successful infectious disease program must holistically consider environmental, societal, clinical, and microbial aspects of disease. The new high containment facility will provide the physical hub for campus and hospital research institute-based investigators to bring their varied perspectives and expertise together so that researchers can tip the scale against these deadly pathogens.

c) Space Requirements, Program and Functional Plan

Space Requirements

A COU analysis of the EPIC Unit to deliver its academic vision to the space generated by the Council of Ontario Universities (COU) formula for Category 3 Research Laboratory Space, Category 4 Office Space, and Category 18 core research is not wholly appropriate for the following reasons:

1. There is no direct relationship between the number of PIs, researchers, and graduate students of the EPIC unit, and the amount of research being done by the EPIC Unit, as most of the PIs, researchers, and graduate students whose research is supported by the EPIC unit are within different academic groupings of the University or are coming from outside institutions.
2. PIs whose research is supported by the EPIC Unit often do not need to physically enter the facility but either dedicate personnel to the labs who work on site, or the EPIC Unit's staff runs the experiments for them. In fact, only researchers and staff with the appropriate training and certification can enter and conduct work within the containment zone.
3. Most of the PIs from within the University, researchers, graduate students, and research staff, who actively use and enter the facilities are assigned to a dedicated lab elsewhere, thus technically their FTEs generate space need in relation to lab space, lab support space, and office space within a different academic grouping. Outside PIs and research personnel don't have FTEs.
4. The COU formula for generating *Category 3.0 Research Laboratory* space (including laboratory support space) does not account for centralized core research facilities in overall support of teaching or research. COU does not provide a formula for generating *core research* requirements, thus benchmarking becomes difficult.
5. The formula assumptions do not consider the necessary duplication of infrastructure required as researchers within the containment zone cannot bring RG3 samples out of containment to access research equipment resident in CL2 or CL1 laboratory space.

While maintaining the spirit of COU, the emphasis in determining the EPIC Unit's space requirements has been done by analysing lab-specific spatial and infrastructure demands, as well as logged hours in the facility to pro-rate each PI team's approximate presence in the labs to generate fractional FTEs in proportion, which then can be used as input measure in the COU "Building Blocks" Space Standards formulas. The tables on the following pages build on the data provided under the Occupant profile section and outline the analysis for generated theoretical space need.

Table 3.1 – Existing Supported & Direct Users: Hours of lab usage per week (Fall 2020 data)

	Head count (HC)	plus EPIC personnel HC	Combined HC	Total Weekly Logged Lab Hours	Average Hours per Person per Week	Rounded to nearest ½ workday (Average per person)
EPIC3 lab users						
PI supported only	24	1	25	-	-	-
PI who dedicates personnel	15	-	15	-	-	-
Total - PIs - EPIC3	39	1	40			
PDF / RA	19	3	22	147.90	7.8	1.0
Graduate Students	12	2	14	54.40	4.5	0.6
Lab Technicians	10	4	14	93.13	9.3	1.2
Total lab personnel - EPIC3	41	9	50	295.43	5.9	1
EPIC2 lab users						
PI supported only	8	1	9	-	-	-
PI who dedicates personnel	8	-	8	-	-	-
Total PIs - EPIC2	16	1	17			
PDF / RA	10	3	13	58.48	5.0	0.6
Graduate Students	8	2	10	11.00	1.4	0.2
Lab Technicians	8	4	12	37.48	4.7	0.6
Total lab personnel - EPIC2	26	9	35	98.95	3.8	1/2

Notes:

- 1.) No hours can be logged in the EPIC3 and EPIC2 laboratories without receiving ~50 hr training prior. PIs themselves don't enter the labs, as a result there are no logged hours reported.
- 2.) Each PI benefits from logistical and regulatory support not reflected in the laboratory hours logged by lab personnel.
- 3.) The central element of the workbay that limits usage is the Biosafety Cabinet (capacity is 1 person at a BSC at a time). Experiments are maintained in incubators and other equipment even when lab personnel are not logging hours, or while the next occupant has logged in and is using the BSC at the workbay. As a result, workbays are in constant use and multiple experiments are always ongoing. Turn-over time required between users at a workbay is ~10 minutes.
- 4.) The existing EPIC3 *in vitro* facility has 5 workbays, each available for 40 hrs per week. Therefore, based on a regular 40 hr week, there are 200 hrs of work using the BSC that the existing facility can support. During the current pandemic, the facility is run 24/7 to accommodate usage well above the 200 hrs.

Table 3.2 – Future Projection (steady state): Supported and Direct Users: Hours of lab usage per week

	Head count (HC)	plus EPIC personnel HC	Combined HC	Total Weekly Logged Lab Hours	Average Hours per Person per Week	Rounde d to nearest ½ workday (Average per person)
EPIC3 lab users						
PI supported only	10	1	11	-	-	-
PI who dedicates personnel	21	-	21	-	-	-
Total - PIs - EPIC3	31	1	32			
PDF / RA	24	3	27	175	7.3	0.9
Graduate Students	16	-	16	73	4.6	0.6
Lab Technicians	14	4	18	122	8.7	1.1
Total lab personnel - EPIC3	54	7	61	370	6.1	1
EPIC2 lab users						
PI supported only	4	1	5	-	-	-
PI who dedicates personnel	14	-	14	-	-	-
Total PIs - EPIC2	18	1	19			
PDF / RA	15	3	18	53	3.5	0.4
Graduate Students	17	-	17	40	2.4	0.3
Lab Technicians	11	4	15	42	3.8	0.5
Total lab personnel - EPIC2	43	7	50	135	3.1	1/2

Table 3.3 – Future Projection (steady state): Supported & Direct Users - COU Generated Space Need

COU Cat.	Category Name		Total Count	Days in Lab	% of Full-Time	Approx. FTE	Space Factor	Generated Space (nasm)
Based on users and utilization of EPIC3 lab								
3.0	Research Lab	PI + 50% PDF & RA + 50% Grad Student =	53.5	1	20 %	10.70	(A) 45	481.50
	Core Research Space							N/A
4.1	Academic Office	PI	32	-	-	-	-	-
4.2	Research Office	PDFs / Research Associates	0	1	20 %	0.00	12	0.00
4.2	Research Office	Non-Acad. Research Staff: Lab Technicians	16	1	20 %	3.20	3	9.60
4.3	Graduate Office	Graduate Students	27	1	20 %	5.40	12	64.80
4.5	Office Support						25%	18.6
4.0	Office Space							93.00
Subtotal EPIC3 Lab =								574.50
Based on users and utilization of EPIC2 lab								
3.0	Research Lab	PI + 50% PDF & RA + 50% Grad Student =	36.5	1/2	10%	3.65	(A) 45	164.25
4.1	Academic Office	PI	14	-	-	-	-	-
4.2	Research Office	PDFs / Research Associates	18	1/2	10%	1.80	12	21.60
4.2	Research Office	Non-Acad. Research Staff: Lab Technicians	15	1/2	10%	1.50	3	4.50
4.3	Graduate Office	Graduate Students	17	1/2	10%	1.70	12	20.40
4.5	Office Support						25%	11.63
4.0	Office Space							58.13
Subtotal EPIC2 Lab =								222.38
3.0	Research Lab							645.75
	Core Research Space							N/A
4.0	Office Space							151.13
EPIC FACILITIES - TOTAL Generated Space Requirement =								796.88

Notes:

- 1.) The COU recognizes that there is a difference in space requirements between disciplines. Station area (i.e., space factor) for academic program grouping denoted with the letter A accounts for the space requirements associated with Molecular Medicine. In consultation with the EPIC Unit, it was determined that applying this space standard is the closest match within the COU guidelines to their laboratory station size requirements.
- 2.) The COU formula for generating *Category 3.0* research laboratory space facilities (including service space) does not account for centralized core research facilities (including long-term holding) in overall support of teaching or research. COU does not provide a formula for generating *Core Research Space* requirements.
- 3.) Lab Technicians do not generate Research Space, as COU assumes that they are accommodated in the space generated based on the PI, PDF/RA, and Graduate Student FTEs.
- 4.) Office space need (i.e., shared hoteling workstations and access to meeting room) is assumed only for those personnel who are on site and using the facilities. Therefore, the theoretical generated space derived based on PI counts has been omitted from the calculations.

Table 3.4 – Future Projection (steady state): COU Generated Space Need, Existing and Provided Space

COU Cat.	Sub. Cat.	Category Name	Generated Space (nasm)	Existing (nasm)	% E/G	Provided (nasm)	% P/G
EPIC3 lab							
3.0	3.1	Research Lab	481.50	295.87	61%	581.88	121%
	3.2						
		Core Research Space	N/A	131.11		228.91	
4.0		Office Space	93.00	9.40	10%	64.51	69%
		Subtotal =	574.50	436.38	76%	875.30	152%
EPIC2 lab							
3.0	3.1	Research Lab	164.25	210.38	128%	216.87	132%
	3.2						
4.0		Office Space	58.13	19.43	33%	32.25	55%
		Subtotal =	222.38	229.81	103%	249.12	112%
3.0		Research Lab	645.75	506.25	78%	798.75	124%
4.0		Office Space	151.13	28.83	19%	96.76	65%
TOTAL EPIC FACILITIES =			796.88	666.19	84%	1,124.42	141%

Notes:

1. As the COU standards do not provide a formula for generating *Core Research* requirements, the 141% looks overprovided.
2. The proposed office space program has been prorated, to allocate 66% to the EPIC3 lab users generated space requirements, and 33% to the EPIC2 lab users generated space requirements. This distribution aims to reflect that both the users and the management team of the EPIC 3 and EPIC2 lab will be sharing the hoteling workstations and meeting room. Most of the proposed office space in the space program will serve the EPIC Unit Personnel as well as the users of the EPIC3 and EPIC 2 labs.

Examining the aggregate results of the space needs analysis, the overall proposed space program appears to be oversized at approximately 141% of the generated space need. However, upon closer look at the COU categories where existing and proposed space is compared (cat. 3.0, 18.0, and 4.0), the results yield a more nuanced picture:

- This space is driven by the academic plan: the co-location of the *in vivo* and *in vitro* laboratories as well as the imaging suite, and the configuration of isolation cubicles and multiple procedure rooms, will allow for multiple research projects to run simultaneously. This will drastically broaden the research possibilities the new facility will be able to support. The proposed is efficient with shared housing rooms instead of individual iso cubicles, which will increase capacity in the allotted footprint. It also co-locates the procedure room with an *in vitro* lab module to accomplish the pathogen RG3 "zone" which was not accounted for in the Feasibility Study.
- The EPIC3 lab's space requirements in Category 3.0 Research Laboratory space is currently underserved at 61% of the generated need. The proposed combined facility at the MSB will be right-sized to meet the demands of the future projected steady-state use to keep up with surge demands if a similar scenario were to occur as the current pandemic. Also, worth noting that following consultation with the EPIC Unit, it was discovered that the proposed MSB EPIC3 *in vitro* facility equipment rooms are slightly undersized based on the proposed equipment dimensions required to be accommodated in the facility to support the research activities of the proposed Academic Plan.
- The existing Core Virology and BioBank EPIC2 facility will maintain the same functionality as the existing lab. However, the footprint proposed will be better suited to meet surge demands if a pandemic situation arose again, which is not the projected utilization rate that was used in the analysis to generate the theoretical space need.
- *Category 4.0 Office Space* is efficient as the administration space serves both EPIC 3 and EPIC2+ staff and is at 64% COU generated. In general, the Cat. 4.0 support areas outside of the containment zone are required to provide appropriate accommodation to the EPIC Unit's dedicated personnel, provide hoteling workstations and a meeting/training room for PIs and lab personnel who come from beyond MSB to consult with the EPIC Unit and conduct research work in the labs.
- RG3 lab work may not be common in Ontario Universities, and so the COU space factor, which is generic, may not reflect the specialized requirements for equipment, circulation, and core research and support areas needed to support and maintain the CL3 containment barrier.

Space Program

The space program for the new combined EPIC3 lab was developed first by external consultants led by Perkins Eastman in the Summer/Fall 2020, in consultation with UofT users, stakeholders, EHS, facilities and planning staff. As the EPIC Management Team oversees the operations of both the EPIC3 *in vivo* and *in vitro* facilities, as well as the EPIC2 Core Virology and BioBank operations, the space program developed by the external consultants was expanded to include the EPIC2 facility requirements as well. The space program was further refined in Implementation Phase by the External Consultant team of DIALOG and Merrick along with TFoM and U of T.

For Detailed Space Program, refer to Appendix

Space Program – Descriptions:

EPIC3

Research Lab within the Containment Barrier

Acting as secondary physical containment are six individually enclosed *in vitro* lab suites, each equipped with lab benching, appropriate equipment and two Bio Safety Cabinets acting as primary containment protection barrier for manipulations. Additional dedicated instrumentation and equipment rooms provide space for larger analytic equipment and ultra-low storage as the nature of the research determines samples cannot leave the containment perimeter for these purposes. One of the *in vitro* labs is paired with and directly connected to an *in vivo* procedure room. The additional two *in vivo* procedure rooms have contiguous access to isolation rooms with controlled ventilation equipment and controlled temperature and humidity following applicable Canadian regulatory requirements, arranged in separate suites to accommodate pathogen and model-specific needs. One of the procedure rooms will house an analytic intensive care unit.

Research Lab Support Spaces within the Containment Barrier

Entrance to the lab suites is achieved with operational protocols and restricted access control through multiple airlocked donning/ doffing, dirty change and shower out support spaces located inside the containment barrier. Also, within the containment barrier there are service corridors that provides staging and access to decontamination equipment /autoclave in both the *in vitro* and *in vivo* zones, pass through boxes and a dunk tank on the perimeter to manage passage of samples out of containment, a materials airlock to manage ingress of large items and decontamination of large items for egress and housekeeping spaces.

Research Lab Support Spaces Outside of Containment Barrier

Consist of clean shower-in spaces, donning anterooms, prep spaces, and storage. Lab-specific infrastructure including but not limited to effluent collection and treatment facilities, gas decontamination room, lab gas cylinder room, mechanical and electrical rooms, etc.

Imaging

The imaging facility is within the CL3 containment barrier and consists of two small imaging suites incorporating both *in vivo* and *in vitro* imaging modularity.

EPIC2

Core Virology Laboratory and the BioBank Space Program

The EPIC2 Core Virology and Biobank consists of three spaces: an Infection Room, a BioBank complete with Anteroom and a Molecular Lab. The entirety of this space is a CL2 laboratory enhanced with CL3 requirements including Inward Directional Airflow (IDA). While CL2+ is not a defined term in the Canadian Biosafety Standard, it refers to a lab designed to the CL2 standard of the Canadian Biosafety Standard in compliance with ASHRAE 62.1, 2010, Ventilation for Acceptable Indoor Quality, and operationally managed as a CL3 lab.

One hundred percent of outside air will be supplied to the Infection room containment zone. Critical containment HVAC systems is designed to maintain the containment zones under negative differential air pressure, establishing a physical containment barrier of air. To ensure IDA and a physical containment barrier between the common hallway space and where pathogens are manipulated, entry into the Infection Room, the Molecular Lab, or the BioBank proceeds from an anteroom where PPE can be donned and doffed. The airflow gradient relative to the hallway will increase to the maximum negative pressure in the infection room, which then exhausts directly from the infection room.

The Infection Room is an EPIC 2 Lab housing 6 BSCs for containment of manipulations of specific RG3 and RG2 pathogens. It also contains a variety of research equipment (humidified CO2 incubators, ultracentrifuge, tabletop centrifuge, fluorescence microscope, etc.) two working sinks and a hand wash sink. The six biosafety cabinets and key supporting equipment will be connected to Emergency Power.

The BioBank/Anteroom houses ultra-low temperature freezers (connected to Emergency Power), as well as PPE storage and change facilities, and acts as anteroom to control the entry of staff, materials and equipment to the Infection Room and Molecular Lab via enhanced ventilation and Inward Directional Airflow.

The Molecular lab contains a fume hood and four lab workbenches. This space will be fully equipped with equipment for molecular analysis (qPCR, PCR, gel apparatus, microcentrifuges, spectrophotometer, tabletop centrifuge, etc.). There will be extensive cold storage in this area in the form of a bank of 4C fridges to accommodate storage of reagents for the research groups. Key features of this part of the lab space includes lab sink units, dedicated handwash sinks, emergency shower, eyewash station, lab (mobile/flex preferably) base cabinets including Mixing Faucet and RO Water Faucet. A small in-lab writeup area for technicians and research personnel is also to be provided within the Molecular Lab.

Administrative areas of the EPIC facilities

Administrative areas will consist of two private dedicated office for the EPIC Strategy and Partnerships Director and the EPIC3 *in vitro* Manager, a shared office for the EPIC ROO and EPIC Technician, another shared office for EPIC support casual staff, a Meeting/Project room that will be also used for training purposes. Hoteling space with four workstations will be provided for research personnel who come from off-site.

d) Functional Plan

The functional relationships and preferred adjacencies have been described under the Space Program section.

Non-assignable space

Included in the renovation project are non-assignable elements that are not specifically described in the Space Program. Most non-assignable areas are not described with room data sheets, and instead rely on best design and engineering practices, and UofT's design standards and specifications.

Only EPIC related non-assignable areas are included in the EPIC gross-up factor. Approximately 101 nasm for EPIC related non-assignable spaces like Electrical Room, IT and Reverse Osmosis water were included in the alteration. Non-assignable spaces not included in the gross-up factor are: Corridors outside the CL3 and CL2 containment, new washrooms, a new vestibule needed for the alternative solution and the new stair to provide access to the relocated west pit.

Non-assignable spaces, including but not limited to the following:

- Vestibule added at existing stair to allow for fire fighting personnel to enter for staging
 - Note: The alternative solution is under review by City of Toronto.
- Mechanical and Electrical rooms and closets serving the proposed laboratories near the laboratories
- EPIC mechanical penthouse - see Secondary Effects
- IT/Data & communication closet.
- Washrooms - see Secondary Effects
- West Pit – See Secondary Effects

e) Building Considerations and Sustainability

Standards of Construction

The laboratories should feel airy, light and welcoming to both faculty, researchers, and staff. Equally important, the laboratories will be functional and robust with durable materials and details that meet or exceed the regulatory and legislated requirements, as well as the University and TFoM standards and can be easily maintained.

Surfaces and finishes will be made of sealed, non-absorbent materials. Surfaces will be cleanable, resistant to scratches, stain moisture, chemical, heat, impact, repeated decontamination, and high pressure washing. Edges and joints are to be continuous and overlapping. Benches, millwork, and shelving will have smooth finishes, edges, and corners where protection suits are worn. All joints will be sealed. Floor finish will be slip resistant. Refer to all requirements listed in the Canadian Biosafety Standards and Guidelines, specific for use and level of containment.

Building Characteristics and Massing

The MSB building was completed in 1969 and is a 7-storey (plus 2 penthouse levels) teaching and laboratory building for the Temerty Faculty of Medicine. The building consists of a specialized teaching lab, research labs and core research support spaces. The existing floor-to-floor height will be maintained.

- Dedicated new EPIC Mechanical Penthouse:
 - ±5m height for the enclosed mechanical penthouse

- ± 12 height of the screened areas for the exhaust stacks are not to exceed the height of the existing MSB high plume exhaust stack and will be positioned behind the existing stack as much as possible to minimize massing
- ± 5 m height for the screened area for the generator and chiller

As the proposed project is an interior renovation with limited exterior scope on the roof to accommodate the EPIC mechanical penthouse. During the early design of the EPIC mechanical penthouse, the following considerations were reviewed by University, Design and Construction:

- Front Campus Panorama considerations: The proposed penthouse addition and all exterior equipment are located on the south roof of MSB to minimize visibility the Front Campus, and shadowing on the Front Campus.
- The proposed rooftop penthouse and associated exterior equipment and stacks shall be positioned on Block C and D, which are the two blocks east of West Wing.
- Cladding for the penthouse and screening of equipment and fume stacks to be selected to complement with the local context and colour palette. In addition, the cladding of the penthouse is to allow for easy adaptability for any future changes; and
- Location of the EPIC exhaust stacks to match the existing MSB exhaust stack height and be located behind it (south).

Sustainability Design and Energy Conservation

The University of Toronto is committed to reducing its scope 1 and 2 greenhouse gas (GHG) emissions by at least 37% below its 1990 level of 116,959 tonnes eCO₂ by 2030, targeting a net-zero GHG institution by 2050. To accomplish this, the University has retired the previous Energy Performance and Modelling Standard (April 1, 2019) and introduced this now-governing Tri-Campus Energy Modelling & Utility Performances Standard. This new standard provides project-specific energy and water efficiency goals, used to calculate energy and GHG project budgets, as necessary to achieve our 2030 goal, while also introducing a streamlined modelling and documentation submission approach.

This standard is meant to inspire innovative designs based on absolute energy and GHG targets that are used to calculate energy and GHG performance budgets according to when the building is going to be constructed and the program use. The targets become more stringent over time as cost-effective technologies and delivery methods improve in conjunction with compliance paths with authority approvals.

The tool used to define the goals and budgets is called the “Project Charter” as completed by U of T staff before the call for design tenders is issued. The energy and GHG budgets for new construction are defined for the year that occupancy is scheduled in the project planning reports. The approved energy modelling procedures will be used to calculate the energy and GHG performance for the designs and will be compared to the Project Charter targets throughout the design stages.

These Standards and resulting models are not post-occupancy energy or GHG predictions – they are to be used as a comparative tool for building baseline and performance evaluation. Post-occupancy, the model will be updated (12 – 14 months post-occupancy) by the consulting team and compared to the final design model results.

All applicable Codes, Guidelines or Standards referenced in the standard are to be applicable to the current regulations within the project timeframe defined in the Project Charter. Estimates of the impact of any foreseeable future standards, codes and guidelines may be required and shall be presented to the U of T Implementation Team for consideration. In all cases, higher performance targets shall be the preferred targets.

Utility Performance Requirements for Renovation Projects - Energy

The renovation and renewal of existing buildings plays a critical part in U of T's plan to achieve the established 2030 GHG emission reduction target. U of T's Standard also identifies utility performance requirements and targets for renovation projects of varying scopes and complexities through a prescriptive pathway for minor renovations and performance pathway for major renovation projects.

The Project Consultant Team must complete and submit to U of T an energy simulation, key performance indicators (TEUI, TEDI, GHGI) with associated documentation at each stage of the design process to demonstrate ongoing compliance with these performance targets. An energy baseline model will be created through mirroring and extrapolating the existing MSB EPIC3 lab and existing MSB EPIC2 Core Virology Lab through a consultant produced simulation. The baseline simulation model will be reviewed by the U of T Project Committee. The project energy budget will be determined in consultation between U of T and the consulting engineers to maximize the efficiency of the facility. A new energy simulation model will be created by the consultant to track efficiency against the baseline model. This model will be updated by the consultant at each stage of the project in accordance with the University Sustainability Standards for Energy Modelling. At the completion of commissioning, the energy model simulation must be updated to reflect the as-constructed building characteristics. This will form the basis of the project's baseline performance.

Depending on the project timeframe, the targets will be revisited and adjusted regularly to ensure U of T remains in a leadership position. The progression of targets depends on numerous factors, many of which are outside U of T's direct control (e.g., the rate at which new technologies come to market). However, projects should anticipate the adjustments to the targets for 2022-2026 and 2026-2030 for all the key performance indicators included in the standard to account for increased capabilities of designers, technologies, and the industry practices to meet net zero targets by 2030 in many jurisdictions, including the City of Toronto.

This project will be able to achieve 40% better than ASHRAE 90.1 2013.

Beyond energy, additional performance levels include:

- reduction in indoor water use (strive to achieve close to 50% reduction. LEED™ version 4 baseline)

The above targets are combined with project-specific information to establish unique energy and water efficiency targets for every building based on floor area and different space use types. The project-specific goals are established as part of the Project Planning Report (PPR) using the separately enclosed Project Charter. The Project Charter will serve as a guide for the renovation project and outlines key project information, performance targets, and serves as a reference point throughout the project to ensure the performance goals are clearly understood by all involved parties and ultimately achieved. The project charter will be updated by the consultants at each stage of the project.

To further ensure projects are developing in accordance with these performance requirements, documentation must be completed by the Project Consultant Team and/or the U of T Implementation

Committee at each project stage. For each documentation item, the expectations and responsible parties are outlined in the standard.

In addition to the energy performance, utilities performance and water efficiency targets mandated by the University through this standard other regulatory authorities and certification process will be included within the planning, design, and implementation of all projects. The intent of these additional regulatory processes is to ensure that the high-performance building required by the energy and water performance targets of this standard is part of a holistic approach to sustainable building practice. The following certifications and regulations will be mandatory for all renovation projects: LEED™ Silver minimum (non-certified); Minimum required Toronto Green Standard Tier. The minimum requirements for these certifications and regulations are not to supersede the energy, utilities, and water efficiency performance targets of this standard. The decision to pursue full certification or a higher level of LEED™, and TGS will be at the discretion of the Project Planning Committee in consultation with University of Toronto Facilities and Services.

Project Planning, Implementation and Consultant teams are to address the embodied energy, embodied carbon and other GHG emissions associated with building materials. Building and renovation projects will be required to report the embodied emissions of the building's structural and envelope materials using life-cycle assessment (LCA) software in compliance with the Canadian Green Building Council's recommended methodology. (CAGBC Zero Carbon Building Standard, May 2017: Pg. 7) The University of Toronto Facilities and Services will provide utility costs to the consultant team for the purposes of life cycle costing.

Other Considerations

Renovations may include multiple uses and occupancies resulting in “mixed use buildings”. As indicated, the energy performance targets and resulting budgets will be based on the area weighted aggregate as calculated by the project charter and energy modelling process. Care is required when assigning the use areas when completing the project charter, including consultation with University Planning.

District energy includes energy supplied from a central steam or other gas fired network. For networks supplied from low temperature heating sources (heat pumps, heat reclaim energy) the non-district system targets and emissions factors will be used.

Sustainable strategies to be considered during the design phase include:

- Optimal energy efficiency for reduced operating cost and emissions
 - Energy efficient lighting and controls, coordinated with natural light where appropriate
 - Energy efficient equipment and fixtures
 - Flexible building automation systems (with occupancy/occupant load sensors to moderate HVAC and lighting levels)
 - Zoned HVAC control wherever beneficial and desirable
 - Study use of the low temperature hot water (< 135F) to provide heating as a primary source of heat. Assume that the low temperature hot water source will not be available at the time of EPIC labs construction at the CCBR location.
 - Heat recovery options
 - Minimizing the amount of outside air required.
 - High-efficiency fume hoods and biosafety cabinets in laboratories

- If it can meet lab requirements, consider low face velocity fume hoods, and integrate with VAV controls. Success of fume hood operation is very dependent on diffuser arrangement. EHS will certify fume hoods.
- Durable, local materials with renewable and/or recycled content
- Provision of recycling depots for source-separation of waste throughout the building to meet the needs of the University's recycling and waste reduction programs and vehicular access to these sites

U of T Tri-Campus Energy Modelling & Utility Performance Standard:

https://www.fs.utoronto.ca/wp-content/uploads/2020/08/U-of-T_Energy-Performance-and-Modelling-Standards_July1_2020_vs842020_w_CHARTER.pdf

U of T Overall Building Commissioning Standard:

<https://www.fs.utoronto.ca/wp-content/uploads/standards/commissioning/BuildingCommissioningProcess.pdf>

Personal safety and security

The EPIC facility will be compatible with the Medical Science Building's existing security system. Likewise, access to EPIC facility will be restricted to authorized personnel. Access through the public corridor between CL3 and CL2 will be monitored by security devices. Consultants to ensure restricted access complies with Building Code and Fire Code. Proposed security doors on east and west end of the Corridor separating CL2 and CL3 units must be available for approved users which include, but are not limited to: MedStore staff, TFoM researchers, DCM staff and researchers and approved F&S persons such as caretaking, building engineers, Property Managers, and other potential users still to be identified.

Accessibility

Although the University is committed to equitable access to all facilities by the whole campus community a EPIC3 Lab cannot be designed for universal accessibility. All occupants and materials that enter and exit the lab must undergo a thorough disinfection process through the autoclave, thus presenting challenges in the disinfection of wheelchairs and other assistance mobility devices. In addition, the personnel working in the EPIC3 Lab must respond to stringent emergency and evacuation procedures, also presenting a challenge for people with disabilities. AODA accommodation therefore presents a risk in evacuation and decontamination protocols for the EPIC3 lab.

The following applies to the EPIC2 facility, administrative offices, and all other areas within the project scope, except for the EPIC3 Lab:

The University is committed to equitable access to all the building's facilities by the whole campus community. A Universal Design Consultant typically will be retained early in the design process to ensure that the consultant's recommendations will be incorporated into the built project.

To address the broad diversity of people who will use the facilities, the signage system will be designed to assist individuals with disabilities in identifying spaces (e.g., high contrast) and wayfinding. Attention will be given to the layout of the space and the materials used and the Manager of the Accessibility Resource Centre will be consulted throughout the design process.

An amendment to the Ontario Building Code (2012) related to Accessibility was filed on December 27, 2013 (Ontario Regulation 368/13). Effective for applications submitted after January 1, 2015, the requirements are more stringent and impact the following areas relevant to this project: barrier-free path of travel, visual fire safety devices, washrooms, and seating in assembly spaces.

New or redeveloped exterior, and some interior (i.e. service counters, fixed queuing guides, and waiting areas), public space, must comply with Part IV.1, Design of Public Spaces Standards (Accessibility Standards for the Built Environment, Integrated Accessibility Standards of the Integrated Accessibility Standards, Ontario Regulation 191/11, <http://aoda.hrandequity.utoronto.ca/buildings/>). This would include approaches to new buildings. Maintenance, environmental mitigation, or environmental restoration excluded from this requirement.

Public space projects affecting exterior paths of travel, recreational trails, outdoor play spaces, or accessible on-street parking must include consultation with the public and persons with disabilities pursuant to aforementioned standards.

For additional information contact the University of Toronto's AODA Office.
<http://aoda.hrandequity.utoronto.ca/>

Equity Diversity and Inclusion

Following the University of Toronto's statement on Equity, Diversity and Excellence, EDI principles will be considered during the development of the design of the EPIC facility.

Ergonomics

Ergonomic design of lab benching will be taken into consideration.

Elevators

Existing elevators are near the proposed laboratory fit out. These will be available to faculty, staff, and students who need to access the proposed laboratories and EPIC offices. Elevator upgrades and modifications are not part of the scope of this project. Refer to Non-Assignable Section regarding potential Secondary Effect to service elevator 7.

Signage, Donor Recognition

This project will provide all necessary signage, and wayfinding associated with the laboratory. Signage will be installed throughout the EPIC facility identifying biohazards present, entry requirements, and precautions, in compliance with Environmental Health and Safety biosafety guidelines standards. Interior signage includes not only those signs mandated by the Ontario Building Code but also departmental identifications, room names and numbers, room schedules (as required) and interior wayfinding.

Key building systems serving the EPIC facilities

The following sections provide an overview in general terms of the proposed infrastructure and key system requirements for the EPIC labs, and the operational criteria and assumptions.

The External Consultants in Implementation were tasked with evaluating and recommending systems and equipment to serve not only the EPIC3 lab but the entire EPIC facility. A critical assessment summary showing summary of the key user requirements and/or code requirements, against proposed equipment and or services redundancy, reliability, power failure, constructability was provided. Currently, the project is at the end of 100% Construction Drawings. The final selection of the preferred mechanical and electrical equipment and services, including redundancies, shall be done to accommodate mechanical and electrical operational and maintenance requirements resulting from the user operational requirements and / or code requirements.

MSB will require separation of building systems as a “Box in the Box” concept as much as possible and the creation of new Lab Specific infrastructure which is currently not present in the existing facilities.

All systems will be provided new to the EPIC facilities and separate from the rest of the Medical Sciences Building including but not limited to dedicated electrical supply, backup power, ventilation, fibre connection, and drainage systems (after passing through a new dedicated effluent treatment system). Medical Sciences Building is an aging building with infrastructure that is beyond the end of its service life where all systems and utilities will require full replacement in the near term according to the most recent Building Condition Assessment completed for MSB in 2020. Steam will come from Central, and potable water source and normal power source from MSB and water/drainage to/from City.

U of T F&S has developed detailed specifications and standards for mechanical and electrical design and building automation systems. In most instances, U of T F&S will not specifically prescribe the mechanical and electrical systems that must be used in the design and construction of the new facility. However, the design team will be required to meet the users’ and stakeholder’s specific operational needs, U of T’s sustainability design requirements, U of T F&S’s design standards, and the requirements of all associated municipal, regional, provincial, and federal regulatory agencies. Special considerations will need to be given to any systems that require redundancy. Although U of T has extensive design standards and specifications, U of T is willing to consider innovative approaches to achieve or exceed the criteria that have been imbedded in its policies, standards, and specifications.

Electrical Utilities

Normal Power

Electrical service for Normal Power will be provided by a new 13.8kV substation with redundancy. The new substation to carry the loads of the EPIC facilities for all systems & equipment. Redundancy will be met with feeds from two substations on two different loops. Provided transformers will be capable of carrying the entire load. Switchgear will include two main breakers, one from each substation 9C and 9D along with double tie switches on the busing of the switchgear for the safety of the maintenance staff.

Life Safety Emergency Power

Life Safety Emergency Power will be provided by a new, separate natural gas-fed generator system, a new UPS system and new solid-state transfer switch. All Power systems will comply with the Ontario Electrical Safety Code.

Lab Backup Emergency Power (Non- Life Safety)

Lab Backup Emergency Power (Non-Life Safety) will be provided by a new emergency generator which will have the capability of carrying indefinitely the entire load of the EPIC3 lab (primary biocontainment)

and its mechanical equipment, including mechanical, electrical, and imaging equipment in the event of a power outage.

Emergency power and UPS system to consider the following:

- Steam systems (autoclaves: Process and Clean Steam is to be electric), vacuum air system and equipment decontamination system on a back-up generator
- new solid state transfer switch for continuous back-up and extended duration.
- Research equipment needs to run longer than standard life safety.
- All EPIC3 Lab and the EPIC2 Infection Room to operate during emergency conditions including benchtop equipment including, but not limited to:
 - o Mechanical and Ventilation system, controls- BAS,
 - o Bio Safety Cabinets, fume hoods, and associated mechanical ventilation
 - o control sensors and alarms,
 - o IT Racks
 - o IT network connectivity,
 - o Personal safety / Security, CCTV,
 - o Selected lighting
 - o Processing rooms
 - o ultralow temperature freezers,
 - o fridges
 - o incubators and
 - o sensitive/ expensive large or benchtop lab equipment

UPS (Uninterrupted Power Supply)

UPS will be sized for critical loads in the lab, including sensitive equipment protection as well as security and safety systems. See considerations under Emergency Power.

Ventilation, Heating and Cooling

Ventilation system to be dedicated, and independent from the existing services. One hundred percent of outside air will be supplied in containment zones to prevent recirculation of air from containment zones. The Air Handling supply fans will be fully redundant (AHU factory connected with separate controls) and will remain in operation 24/7 should one fan fail and need to be repaired.

Current design is exploring a new dedicated heating and cooling plant with two new dedicated air-cooled units with heat recovery system for full redundancy. Similarly, new dedicated heat exchangers and condensing boilers with low temperature heat recovery in compliance with the University's Utility Master Plan will be provided. Electrical back up heating will be provided as well as electrical humidifier. Maintenance/access/ergonomic considerations to be factored in the design of mechanical rooms and spaces.

Critical containment HVAC systems will be designed to maintain the containment zones under negative differential air pressure so that air flows into the containment zone from areas of lower containment to areas of higher containment, establishing a physical containment barrier of air against airborne or aerosolized infectious materials or toxins. Anterooms and airlocks are provided to accommodate the entry of staff, materials, and equipment through the containment barrier. Separate redundant High Plume exhaust fans with heat recovery will be provided. Acoustic mitigation will be provided for the ventilation equipment and fans to avoid environmental noise contamination.

Plumbing and Water Supply/Drainage

A dedicated and exclusive domestic lab water supply for laboratory fixtures and equipment will need to be provided from existing services, with redundancy through a secondary feed. Domestic low temperature hot water (from heat recovery chiller boosted by electrical will be provided). In addition, the EPIC Lab will be provided with a RO water room. Backflow preventers shall be installed on all water coming into the lab and all drainage will be captured by the effluent decontamination system prior to evacuation in the city water system.

Pressure requirements for lab equipment shall be reviewed on an individual equipment basis. Pressure reducing valves shall be required for any equipment with maximum pressure ratings lower than the floor supply pressure.

All drains from within EPIC3 and EPIC2 infection room will be connected to the effluent decontamination system.

Laboratory Gases

Laboratory gases to be supplied through a centralized compressed cylinder room with piping extending to the EPIC 2 Infection Room and into the EPIC 3 *in vitro* lab modules. Compressed air will also be required for the sterilizer doors.

Fire Prevention Systems & Fire Alarm System

Fire alarm system and fire prevention system will need to be provided throughout the EPIC3 facility, EPIC2, and for all spaces within the total project scope where required per OBC and OFC. The subsequent design phase to include the assessment of the appropriate type fire prevention system suitable for EPIC3 environment, preventing incidental activation with structural consideration to ensure containment as required by Codes and best industry practices.

Sprinkler systems will be installed. Floor drains connected to the effluent decontamination holding & treatment system will be provided for the EPIC3 lab, and sized to accommodate water flow, including water from sprinkler system, and “shower-out” facilities where non-indigenous pathogens are being handled. In the event the sprinkler system activates, the design of the EPIC3 facility must ensure that water from inside the containment area will not leak out.

Class I flammable liquids will be in use in both the EPIC3 facility and the EPIC2 facility. The Fire Code restricts the presence (in use and in storage) of Class I flammable liquids which will need to be factored into the design of the laboratory. A comprehensive code analysis has been undertaken during Schematic Design. Application of an Alternative Solution for OBC compliance was provided to the AHJ for review mid-July 2021.

A new DGP dedicated to the EPIC3 Labs will be added to the fire alarm system. The proposed approach will be compatible with proposed modernization and upgrades to the fire alarm system to ensure that no interruptions are experienced during wiring upgrades proposed for MSB.

Flood Mitigation Strategy

Due to the risk of floods within aging MSB structure, a floor mitigation strategy will be developed by the Consultants.

Physical Security and Facility Safety Features, Access Control

Entry and exit access control and intrusion detection systems will be provided to all rooms with access card entry or access card + PIN (except keyed storage rooms). There will be a zoned access for further control. Physical key access will be provided to storage rooms and holding doors, PPE storage, general storage. Physical key access will be provided to the emergency autoclave access door.

Security features include CCTV Cameras, IP cameras, Fire Alarm/ Heat/ Smoke Detectors, Coloured status room light alarm Indicators and EPIC3 Airlock Door Interlock, panic alarm and phones and Announcement System. Security systems will connect to the Campus Police F&S network.

Communication Systems

Uninterrupted internet connectivity is crucial for the functionality of the biosafety systems. A direct primary and a direct redundant connection to Central IT to be provided. The primary new direct fiber line via new conduit is to connect to the central IT hub in CCBR. The scope for the second direct connection includes pulling new direct fiber between the EPIC3 lab and the Central IT hub at McLennan Physics. The possibility for infrastructure to support a second direct connection to Central IT (at the McLennan location) was studied in Schematic Design. Two direct redundant connections are proposed: primary from MacLennan building via CCBR and secondary from the main router in CCBR via the utilities tunnel.

Wi-Fi, wireless network within the lab will be provided by Central IT. Wired network will be provided along with a dedicated IT closet and switch. Copper lines (Bell) for telephones must be provided as telephone lines have to remain operational when power or data connection goes out.

Building Automation System & System Alarms

Systems will be connected to the F&S BAS system independent from the base building and will contain all functionality including recording on all the parameters and stored for analysis on hard drives. Status Alarm Systems and monitoring devices will be put in place on site that visually demonstrate inward directional airflow is working properly will be installed in all rooms (except storage rooms). Controls will be installed to prevent and notify of sustained pressurizations of the Laboratory during fan failures and transfer air devices will be designed to maintain directional airflow and backdraft protection.

Include for provision of all new DDC BAS system and connect to the EMRS system.

Laboratory Biosafety Equipment

A combination of hard ducted and HEPA filtered Type B2, and A2 Biosafety Cabinets (BSCs) are proposed as primary containment for work with infectious material or toxins. An effluent decontamination system, large bulk sterilizers, a Hydrogen Peroxide Vapor (VHP) walk in decontamination chamber, chemical storage cabinets, pass through boxes, among others, are proposed equipment elements to ensure optimum environmental health and safety standards within the Lab.

f) Site Considerations

Site Context

MSB is situated in the south-east sector of the campus at the corner of King's College Road and King's College Circle and is bounded on its southern edge by Discovery Lane. Immediately to the north of MSB is the Front Campus Lawn. CCBR and the Mechanical Engineering building are located directly south, McMurrich to the east, and Convocation Hall is directly across King's College Road to the west. The precinct of campus within which MSB resides is described as the South Campus Character Area, where it interfaces with the Historic Campus Character Area, as identified in the proposed Secondary Plan application, under review by the City.

Master Plan

In September 2016 the University applied to the City of Toronto to amend the Official Plan, to adopt a new Secondary Plan for the St George Campus Area. The Secondary Plan application, (including reports and supporting studies, draft Urban Design Guidelines (UDG) and a draft Zoning Bylaw) was resubmitted in February 2018 and is in review by the City. The Secondary Plan application is anticipated to go to City Council by Q2 2022. The Secondary Plan will replace the existing 1997 University of Toronto Secondary Plan. The Secondary Plan and Urban Design Guidelines reflect and build upon the objectives and vision of the 2011 Master Plan. Although the 2011 Master Plan did not contemplate new development at the Medical Sciences Building, the Urban Design Guidelines identify the West Wing location appropriate for additional mid-scale height, with a step down northward to transition sensitively to Front Campus as well as help reinforce the existing frontage along King's College Road, an important View Corridor to University College from College Street.

Zoning regulations

EPIC scope impacting the building envelope will be limited to a new mechanical penthouse addition on the roof of MSB to house dedicated infrastructure exclusively serving the proposed facility.

The height permitted by the in-effect zoning by-law 438-86 for the site where MSB is located is 18m. The existing height of MSB is considered legal non-confirming. The anticipated height of the new penthouse on the roof of MSB will exceed the by-law permitted limit of 5m for space exclusively used to accommodate M&E equipment.

The project submitted to the Committee of Adjustment (COA) for minor height variance September 28, 2021. The COA committee approved the minor variance as per the Final and Binding letter issued December 22, 2021. Heritage Preservations Services will administratively review/approve through the Building Permit submitted December 23, 2021.

Heritage Status

1 King's College Circle (MSB) is currently not on the City of Toronto Heritage Register. As part of the application to amend the Official Plan for the purposes of adopting a new Secondary Plan for the University of Toronto (replacing the existing University of Toronto Secondary Plan of 1997), the University of Toronto Cultural Heritage Resource Assessment (CHRA) was prepared by ERA Architects

in February 2018. The cultural heritage value of the built resources of the St. George Campus are being assessed through the Secondary Plan process, to ensure the conservation of significant cultural heritage resources as the campus evolves to meet current and future institutional requirements. The CHRA identifies the Medical Sciences Building property as a Character-Defining resource. In addition, based on the research and analysis outlined in the CHRA report, MSB was found to meet the Ontario Regulation 9/06 criteria for cultural heritage value based on design, historical, and contextual value.

No impact on the exterior façade is anticipated except for the new penthouse on MSB's roof, as the Medical Sciences Building is earmarked for future designation.

Environmental Issues, Regional Conservation, Ministry of Environment, Conservation and Parks (MECP)

Environmental emissions (MECP submission requirements)

Consultant to perform associated ASHRAE and AERMOD modelling (air) and acoustic assessment related to the project and built upon existing models in the current Emissions Summary and Dispersion Modeling (ESDM) report and Acoustic Assessment Report (AAR), to ensure continued regulatory compliance as required per the U of T's current Environmental Activity and Sector Registration (EASR) for the site. All noise emitting sources to comply with acoustic emission regulations and standards. All significant air emission sources to comply with air emission regulations and standards. If the design indicates any non-compliance for air and/or noise emissions, then the consultant shall provide modelled mitigation or design alteration options which will achieve compliant outcomes. The consultants will coordinate Noise, Air and Emission modelling information with the U of T Office of Environmental Health and Safety (EHS) and will provide EHS with both Acoustic and Emission Dispersion modeling information to be reviewed. The final deliverable to this regulatory requirement will be updated model outcomes, model files and acoustic and emission summary tables, signed and stamped by a third-party Licensed Engineering Practitioner (LEP). EHS will update the ESDM, AAR and EASR via the final deliverable, as required by MECP.

The EPIC Lab will be designed to meet all operational and physical safety and security requirements identified in the current Canadian Biosafety Guidelines and Standards issued by the Public Health Agency of Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs.

Soil Conditions

Comprehensive soil conditions assessment and testing was conducted at the MSB location during the early design stage of the West Service Pit relocation, and Exit Stair replacement components of the project, prior to any work on site. (See: Secondary Effects).

Site Access

Pedestrian access to MSB is provided through numerous entrances, the main entrance located at King's College Circle off MSB Plaza.

Site Access – During Construction

Construction will require access from King’s College Road via Discovery Lane to the south of MSB. While the proposed EPIC3 lab is located on the south exterior wall of MSB off the Discovery Lane, an off-site staging area will be required for construction staging.

Depending on vehicle size and/or frequency of trips to site, timing of construction activities, construction related deliveries, and occasional partial or full laneway closures will need to be carefully planned, disruption mitigated and coordinated with Facilities & Services Property Management, Campus Police, Fire Prevention Services, and the Temerty Faculty of Medicine’s Facility Management & Space Planning. Site Access during construction will be managed by Campus Police.

Any work within the lane that necessitates the closure of the lane to be performed after working hours. Every attempt shall be made to maintain the full activity of the loading dock during working hours.

Considerations related to Discovery Lane are:

- The lane provides two-way traffic access to loading dock facilities serving MSB, CCBR, Pharmacy Building, FitzGerald Building, and Sir David Naylor Building. Trucks measuring no higher than 12’6” and no longer than 25’ can be accommodated into the master loading dock. These trucks can complete a three-point turn inside the dock and head out of Discovery lane without the need to drive in reverse to get out.
- An exterior stair from the main level of CCBR just outside of the MSB food court exits to the lane at the south side towards the east end of the lane and is well used to enter CCBR.
- Exits opens onto the lane on the north from MSB.
- Other exists open onto the lane on the south from the Mechanical Engineering Building.
- There is a generator serving MSB. Further assessment is required to determine which areas of MSB it serves, and where it can be relocated if necessary.
- There is bicycle parking within the lane.
- There is cylinder storage for Engineering
- There is flammable storage within the lane

Site Servicing; Existing and Proposed

Service (garbage, recycling) and loading access is currently along Discovery Lane and this arrangement is expected to be maintained during and after the completion of the project.

Hazardous Waste Disposal

The University of Toronto will investigate and identify designated substances and other site-specific hazardous materials present within the project area as per appropriate regulations and the Ontario Occupational Health and Safety Act.

g) Campus Infrastructure Considerations

Utilities

Utilities and infrastructure existing conditions line drawings can be made available upon request.

Addition of new gas line under Discover Lane is contingent on coordination with AHJ and timeframe of EPIC construction.

Sewer and Storm Water Management

Sewer

The EPIC labs will have a dedicated and contained effluent decontamination system. Pipe shafts will also be within containment. Main Backflow preventers will be provided as well as connections and for eye- and emergency-shower stations as required.

The effluent decontamination will to be in a pit below the lab.

Stormwater

As the project scope is largely an internal lab fit-out with potential alterations at the penthouse/rooftop level, it is not anticipated that the existing stormwater management system of the base building will need to be altered significantly. Alterations of rooftop/penthouse conditions will tie into existing stormwater run-off lines.

h) Secondary Effects

Decanting & Demolition & Construction – Impact on MSB and other buildings

Areas within MSB will be vacated to allow for the interior demolition of $\pm 1,845$ gsm of existing space. Of this space 961.69 nasm is occupied by the Division of Comparative Medicine (DCM).

MSB must remain operational, with adjacent spaces to EPIC remaining fully occupied throughout construction. Noise, dust, and vibrations should be minimised in the approach to construction. Due to operational complexities, phasing may be required. Adjacent buildings will be fully occupied during construction. Noise, dust, and vibrations should be minimised in the approach to construction. See: Site Access - laneway considerations. Due to West Pit relocation, construction work in Discovery Lane is required. Refer to West Pit below.

New Washrooms

New additional Washrooms has been added near EPIC to serve the users of the EPIC facility and adjacent TFoM facilities. The new washroom facilities will add 4 female and 4 male washroom fixtures.

Mechanical penthouse and screened mechanical enclosure

To ready the existing roof structure for the EPIC mechanical penthouse, some structural reinforcing of the existing slab is required to accommodate snow loads. Note that full roof membrane & associated build-up replacement is anticipated, as it has been identified as per the BCA prepared in 2020 that the existing roof membrane on Block C and D is beyond its expected service life and it has broken down to the point that there is no viable roof membrane to tie into. The structural work will not have an impact on building users as below is the existing mechanical penthouse Level 9.

Vertical and horizontal access to the EPIC mechanical penthouse and screened mechanical enclosure has been added to the scope of the project as currently the only access is via a ship's ladder. A stair will be added within Block C, Level 9 to access the enclosed mechanical penthouse above. On Block D, there will be an exterior elevated walkway to access the screened enclosure in winter. Access via an elevator to facilitate transportation of heavy equipment for mechanical/electrical equipment will not be added to EPIC but will be added in the future as a separate project.

West Service Pit relocation

- MSB services come from an ± 70 gsm service pit below the West Wing footprint. Services include steam, domestic cold water, sprinkler line and condensate piping.
- The new West Pit will be excavated within Discovery Lane south of Block C of MSB. The footprint of the west pit is long dimensionally in east west direction and narrow in the north south direction to allow for single lane access within Discovery Lane to continue during construction as loading and servicing for MSB and CCBR must be operational as much as possible. All new equipment to support existing services to MSB will be provided. Gross area of the new West Pit is ± 90 gsm (including the access stair).

MSB South Exist Stair #2 New Vestibule:

The Ontario Fire Code (OFC) Sentence 4.1.5.9.(1) restricts the storage, handling and use of flammable liquids in laboratories. Through a review of existing conditions, OBC and OFC review, and approach to minimize impact to the façade/building fabric, the Consultants have proposed a suite of alternative solutions to address fire safety, exiting and access requirement due concerns of flammables to improve safety.

The suite of solutions ranges from fire compartmentation, ventilation requirements, volume control limits, cabinets for flammable liquid container storage and Fire fighter access. Access will be modified through the existing Stair where a mechanically pressurized vestibule will be added within the public corridor. The vestibule to be able to protect the exit stair and provide an area for staging to facilitate firefighter response such that fire fighters will have a protected space for staging firefighting at the same level as the flammable liquid laboratory.

The alternative solution will meet and exceed fire safety requirements and ultimately must satisfy Authorities Having Jurisdictions (AHJ). The Consultants met with AHJ in June to review the approach. Acceptance of an alternative solution will not be determined until after AHJ review the Building Permit, which was submitted December 2021. The alternative solution may be a potential project risk.

Vertical Shaft and Service Elevator 7

A large vertical shaft is required for EPIC project to run the intake and exhaust up to the new EPIC Mechanical Penthouse. This shaft was enlarged as services from the old west pit needed to be relocated to a new west pit and the services run through Block B/West Wing. Removal of a service elevator is

required to accommodate these services. To accommodate the large vertical shaft, many options were explored by the External Consultants both interior and exterior to the building. The recommended option to use service elevator 7 shaft was earmarked by the Consultants as it allowed for: a direct line up to the EPIC mechanical penthouse, all the infrastructures could fit, reduced designated substances, no Heritage impact, or no impact to occupants in the building. The recommended option was approved by U of T October 2021. Since MSB has 4 existing passenger elevators and two service elevators and one freight elevator.

Decommission of Existing Laboratories

After the completion, commissioning, and successful licensure of the new facilities, and after research work has been relocated there, the existing EPIC facilities that are no longer going to be used for manipulation of RG3 biomaterials will be decommissioned.

Decommissioned equipment that will be reused will be moved and installed in the new labs.

Reallocation of Vacated Space

The EPIC3 *in vivo* rooms in CCBR will be reallocated to the Division of Comparative Medicine.

a) Schedule

The proposed project schedule for the project is as follows.

- Schematic Design Mar – Jul 2021
- Design Development Aug – Dec 2021
- Construction Documents Phase Jan 2021 – Mar 2022
- Full Governance Approval Cycle 4 Jan 21 - Mar 31, 2021
- Demolition and Abatement Tender/award Oct - Dec 2021
- Demolition and Abatement Jan-Mar 2022
- Construction tender/award Apr – Jun 2022
- Construction start Jul 2022 – Feb 2024
- Commissioning and Licensure Feb 2024 – Aug 2024*
- Client Move-in Jun - Aug 2024
- Schedule Contingency Jun - Dec 2024**

* Commissioning, Performance Verification Testing, Licensure by Public Health Agency of

Canada (PHAC), CCAC and CFIA

**Schedule assumptions include: City of Toronto accepts Alternative solution.

I. Resource Implications

a) Total Project Cost Estimate

The total estimated cost for the project includes estimates or allowances for:

- construction costs (assuming a lump sum type of tender to qualified general contractors. Refer to Schedule)
- contingencies
- taxes
- hazardous waste removal (decommission of hazardous substances, disposal costs for hazardous materials, release of area (hazardous materials) for unrestricted re-use)
- site service relocates (West Pit relocation)
- secondary effects
- demolition
- landscaping
- permits and insurance
- Professional fees, architect, engineer, misc. consultants, project management.
- computer and telephone terminations
- moving and staging, decommission of labs being vacated
- furniture and equipment
- miscellaneous costs [signage, security, other]
- commissioning
- donor recognition
- escalation

b) Operating Costs

The estimated operating cost is \$190 per gsm. Operating costs will be paid for by the Temerty Faculty of Medicine

c) Other Related Costs

Market Factors, that have implications on labour shortages and supply chain

d) Funding Sources

- TFoM Operating Funds
- TFoM Dean's Covid Priority Fund
- Canada Foundation for Innovation (CFI)/Ontario Research Fund (ORF)
- Fundraising

APPENDIX

1. Existing Space Inventory (on request to limited distribution)
2. Background reports/studies (on request to limited distribution)
 - 2.1 MSB Building Conditions Assessment, dated June 2020, by Perkins Eastman and WSP
 - 2.2 Programming and Feasibility Study Report, dated Dec 9, 2020, by Perkins Eastman
3. UofT Design Standards and Policies
<https://www.fs.utoronto.ca/projects/design-standards-and-project-forms/>
4. Proposed Detailed Space Program (on request to limited distribution)