UNIVERSITY OF TORONTO

OFFICE OF THE ASSISTANT VICE-PRESIDENT
CAMPUS & FACILITIES PLANNING

APPENDIX "C" TO REPORT NUMBER 165 OF THE ACADEMIC BOARD – January 28, 2010

TO: Planning and Budget Committee

SPONSOR: Elizabeth Sisam, Assistant Vice-President, Campus and Facilities Planning

CONTACT INFORMATION: 416-978-5515; avp.space@utoronto.ca

DATE: Dec 14, 2009 for January 18, 2010

AGENDA ITEM: 3

ITEM IDENTIFICATION:

Project Planning Report for the Renovation of Chemistry Undergraduate Teaching Laboratories at the University of Toronto Mississauga (Phase 2).

JURISDICTIONAL INFORMATION:

Under the Policy on Capital Planning and Capital Projects, the Planning & Budget Committee reviews Project Planning Reports prepared for a capital project and recommends to the Academic Board approval in principle of the project.

BACKGROUND:

The existing chemistry laboratories at UTM have been in service since 1970 and have undergone essentially no renovation or modernization since that time. Each room was designed to accommodate 24 students at a time for a total of ~600 students per 5-day week. Today the laboratories must accommodate more than twice that number of students. As a result, laboratory classes have been scheduled on a number of evenings, on Saturdays and laboratory instructional hours for students, particularly first-year students, have been reduced. Upper year laboratory sessions and the type of experiments performed have been restricted by the number and location of fume hoods.

HIGHLIGHTS

In 2008, the UTM Chemistry programs were assessed for renewal of accreditation by the Canadian Society for Chemistry. Recommendation 1 of the accreditation report focused on the undergraduate teaching laboratories. It cautioned that failure to renovate these laboratories and increase the space available for instruction "may jeopardize the accreditation of the programs" and will "ultimately affect the UTM graduate student population". In 2009, the Department of Chemical and Physical Sciences underwent an external review. The resulting report stated that it was essential that renovations to UTM's crowded and inadequately vented undergraduate laboratories be "given the highest priority" and "completed as soon as possible." Thus, two independent assessments identified undergraduate chemistry laboratories as being substandard and in need of immediate attention.

Our vision is to accomplish these renovations and secure the competitiveness of UTM's Chemistry programs with those of the St. George campus and of other universities across Canada. We also see this as an opportunity to pursue one of the goals of the initial departmental plan and advance a more constructivist pedagogy in our courses defined by integrated laboratory work and problem–based learning.

Design of the new laboratory space will allow for the elimination of Saturday and most evening classes and for the restoration of 3 hour laboratory sessions in first–year Chemistry required for CSC accreditation. The improved and increased number of fume hoods will expand the nature of the experiments that can safely be performed (in particular, for the inclusion of more organic chemistry in the first–year curriculum). Together with the Phase 1 renovations, Phase 2 will allow for strict adherence to best practices in chemical health and safety standards for students and staff and will thereby allow for improved training in this area, training that is compatible with the needs of chemists in modern commercial and government laboratories.

Space for the proposed renovation, is limited to the area of the existing laboratories and their support space and dedicates an entire 900nasm in the main laboratory block for teaching. The 1st and 2nd Year Chemistry teaching laboratory in 600 sq.m.; the Upper Year Chemistry Teaching Laboratory in 300 sq.m. and 60 nasm of laboratory technician workstations and offices.

FINANCIAL AND PLANNING IMPLICATIONS

The estimated total project cost is $4.24 million dollars.

In terms of operating cost the cost of electrical power to operate the large number of additional fume hoods will be offset by incorporation of a variety of "green" initiatives. The two most significant once are 1) the ability to turn off the fume hood fans when not in use instead of the current 24/7 operation, and 2) utilization of re-circulating chilled water for cooling of all chemistry experiments rather than utilizing domestic cold water.

FUNDING SOURCES

The project will be fully funded from the UTM Operating budget.

SCHEDULE

The Renovation of the Chemistry teaching laboratories – Phase 2 will be undertaken in the spring and summer of 2010 with occupancy September 2010.

AFD Approval to hire consultants	December 11, 2009
Consultant Selection and Design	December-January 2010
Planning and Budget Meeting	January 18, 2010
Business Board Meeting	February 8, 2010
Laboratory Bench/Fume Hood Tender	February 2010
Permit Application	February-March 2010
General Tender	March 2010
Construction	April-August 2010
Occupancy	September 2010

The proposed schedule is based on advanced planning to allow for construction to commence in April immediately after classes finish. It is essential for construction to be completed by the end of August because UTM does not have an alternate location to accommodate Chemistry practical courses.

RECOMMENDATIONS

It is recommended that the Planning and Budget Committee recommend to the Academic Board:

1. That the Project Planning Report for the University of Toronto Mississauga Renovation of Chemistry Undergraduate Teaching Laboratories be approved in principle.

2. That the project scope, comprising renovation of 958 nasm in the South Building at a total project cost of $4.24 million be approved with the full funding from the University of Toronto Mississauga operating budget.

PROJECT PLANNING REPORT FOR THE RENOVATION OF CHEMISTRY UNDERGRADUATE TEACHING LABORATORIES AT UTM - PHASE 2

REPORT

December, 2009

UTM Project 2009-10-46

Facilities Management & Planning, University of Toronto Mississauga

printed on January 12, 2010

I. EXECUTIVE SUMMARY

The existing chemistry laboratories at UTM have been in service since 1970 and have undergone essentially no renovation or modernization in the ensuing 39 years. Rooms were designed to accommodate a total of ~600 students per 5-day week. But the actual number has grown to the current 1182 laboratory FCEs, nearly twice that originally intended. As a result, laboratory classes have been scheduled on a number of evenings and on Saturdays and laboratory instructional hours for students, particularly first-year students, have been severely cut back. As well, in light of our increased knowledge of chemical toxicity and changing health and safety regulations, the lack of sufficient fumehood capability has restricted the nature of the experiments that can safely be performed.

In the spring of 2008, the UTM chemistry programs were assessed for renewal of accreditation by the Canadian Society for Chemistry. In their report, the site visit team made the following **Recommendation 1**.

> "The University's plan to complete the renovations to the first year labs, and just as important to expand the lab space for undergraduate instruction, is crucial and failure to do this in the announced time frame may jeopardize the accreditation of the programs. In view of the expanding enrollment and the potential for shifting undergraduate students from the St. George campus to the suburban ones, increased space is an absolute necessity. The expansion/renovations must allow a minimum of three hour laboratories for first year students at least on a biweekly basis and preferably on a weekly basis. A failure to do so in a timely fashion will leave UTM's programs uncompetitive with others at the other UT campuses and across Canada. It will inhibit recruitment into higher years of the programs, and ultimately affect the UTM graduate student population."

In the Spring of 2009, the project was submitted under the Knowledge Infrastructure Program: UTM Instructional and Laboratory Project. Funding for the Instructional Centre was awarded under the program and the laboratory renovations were proposed to be funded by the UTM operating budget.

The proposed renovation of the chemistry teaching laboratories will take place in three independent phases:

Phase 1	Preparation Room (Summer 2009)
Phase 2	Laboratory for 1st and 2nd year (Summer 2010) Laboratory for 3rd year (Summer 2010)
Phase 3	Expansion of Upper Year lab, Expansion of Preparation room (this phase of the project will be done once space currently occupied by Biology and Psychology research becomes available)

Phase 1 of this project was approved in May 2009 by AFD, and it was implemented in the summer of 2009. This first step was essential as it will ease the transition from several small labs with distributed laboratory support space into one large open concept laboratory with centralized laboratory support space.

Phases 2, the renovation of the two main teaching laboratories, must be completed in the summer months and be ready for September 2010 classes. Since UTM has no space to provide alternate accommodation for the practical sessions of the chemistry courses, the planning and design have to be completed in advance to allow construction to start by April 2010 fully utilizing the short construction window from April to August 2010.

This report includes project background, detailed description and resource implications for Phase 2 of the Chemistry Undergraduate Teaching Laboratories. The total project cost was estimated at $4.24M and will be funded from UTM Operating budget.

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II. PROJECT BACKGROUND

a) Membership

Gage Averill, Vice-Principal Academic and Dean, UTM (Chair)
Peter Macdonald, Professor and Chair of CPS, UTM
Judith Poe, Senior Lecturer CPS, UTM
Ulrich Fekl, Associate Professor CPS, UTM
Rubina Lewis, Chemistry Lab Coordinator CPS, UTM
Lin Milne, Chemistry Technician CPS, UTM
Mylene Vincent, Departmental Manager CPS, UTM
Andrew Chan, Graduate Student CPS, UTM
Mitchell Kerr, Undergraduate Student, UTM
Wei-Ting Shek, Environmental Health and Safety Manger, UTM
Stepanka Elias, Facilities Planner, Facilities Management and Planning, UTM
Anil Vyas, Director Technology Resource Center, UTM
Paull Goldsmith, Director, Facilities Management & Planning, UTM
Sarah Birtles, Planner, Office of the Assistant Vice-President Campus and Facilities Planning
Julian Binks, Manager, Capital Projects Planning, Real Estate Operations

b) Terms of Reference

1. Review the space utilization of the chemistry undergraduate teaching laboratories and related support space and demonstrate that the proposed space program will be consistent with the Council of Ontario Universities' and the University's own space standard.
2. Make recommendation describing other models for undergraduate teaching laboratory layout and operation.
3. Review environmental and occupational health and safety processes and procedures, propose improvements to laboratory operation and implement new chemical and chemical waste management processes (i.e. purchasing and inventory management and control) for the undergraduate laboratories.
4. Identify equipment and moveable furnishings necessary to the project and their estimated costs.
5. Identify all data, networking, communication, and A/V requirements and their related costs.
6. Identify all environmental, occupational health and safety, life safety, security and accessibility requirements and their related costs.
7. Determine a total project cost estimate (TPC) for the capital project, operating costs including the cost of implementation in phases and indentify all other resource costs to the University.
8. Identify all sources of funding for capital and operating costs.
9. Report in September 2009.

c) Background Information

The existing chemistry laboratories at UTM have been in service since 1970 and have undergone essentially no renovation or modernization in the ensuing 39 years. Rooms were designed to accommodate a total of ~600 students per 5-day week. But the actual number has grown to the current 1182 laboratory FCE's, nearly twice that originally intended. As a result, laboratory classes have been scheduled on a number of evenings and on Saturdays and laboratory instructional hours for students, particularly first-year students, have been severely cut back. As well, in light of our increased knowledge of chemical toxicity and changing health and safety regulations, the lack of sufficient fume hood capability has restricted the nature of the experiments that can safely be performed.

In the spring of 2008, the UTM chemistry programs were assessed for renewal of accreditation by the Canadian Society for Chemistry. In their report, the site visit team wrote the following.

> "In common with many universities who are struggling to cope with increasing numbers of students, the *(first year)* laboratory is offered only on every second week… However, unlike other schools, the labs are only two hours in length. Both students and technical staff feel that the first year lab experience is too rushed. Furthermore, the laboratory space is not used for first year in the intervening weeks, but is actually used for other courses. This is due to a severe lack of laboratory space and contributes nothing to decreasing the first year crowding in the labs….The laboratory facilities are typical for a building of this age. It has adequate ventilation for first year experiments, but not for more advanced classes. Much of the laboratory space in the department is in real need of renovation to bring it to modern standards….In the case of the technical staff who are responsible for administering the laboratory program to a large degree, the combination of lack of space and small numbers appears to be leading to a situation which is, at least, not student-friendly and at worst, a real health and safety issue. While we were assured by the CAO *(UTM)* that new facilities would be in place by 2010, some skepticism was expressed by many. If this does not come to pass as suggested, we feel the situation may be unmanageable. At present, as noted above, laboratory hours in the first year are restricted to two hours every second week. Chemistry is an experimental science and this limited exposure is damaging to the student experience of the science and also to the recruitment of good students into the program."

As a result of the above assessment, the site visit team made the following their **Recommendation 1**.

> "The University's plan to complete the renovations to the first year labs, and just as important to expand the lab space for undergraduate instruction, is crucial and failure to do this in the announced time frame may jeopardize the accreditation of the programs. In view of the expanding enrollment and the potential for shifting undergraduate students from the St. George campus to the suburban ones, increased space is an absolute necessity. The expansion/renovations must allow a minimum of three hours laboratories for first year students at least on a biweekly basis and preferably on a weekly basis. A failure to do so in a timely fashion will leave UTM's programs uncompetitive with others at the other UT campuses and across Canada. It will inhibit recruitment into higher years of the programs, and ultimately affect the UTM graduate student population."

In February of 2009, the Department of Chemical and Physical Sciences underwent an external review. One of the reviewers, the Dean of Physical Sciences at the University of California Irvine, offered the opinion that under California health and safety regulation the chemistry laboratories at UTM would probably not be allowed to operate. Thus, two groups of independent assessors over the past year have concluded that the facilities required to comply with our changing local health and safety legislation are urgently needed.

Phase 1, completed in Summer 2009, addressed this matter with regard to technical employee involvement in inventory management and control, storage of chemicals, chemical and hazardous waste disposal and energy consumption. Furthermore, by relocation and consolidation of the preparation space, the teaching laboratories can be made larger and better suited for teaching of large classes.

Phase 2 will consist of two large labs: one large laboratory for first and second year Chemistry courses (600nasm) and one smaller lab for upper year courses (300nasm). The proposed configuration will allow scheduling of large classes (CHM140Y) and eliminate the need for evening and Saturday classes (although some evening sessions will be retained to accommodate the scheduling needs of part-time students). The upper year chemistry laboratory will benefit greatly from having sufficiently serviced space to safely accommodate their experiments while providing access to sophisticated instrumentation and computers. Both labs will benefit from having fume hoods integrated with the bench space, with one 4-ft fume hood being shared by two students. This will allow for the inclusion of more organic chemistry in the first year curriculum, a growing trend at Canadian universities. As well, it will allow for strict adherence to best practices in chemical health and safety standards.

While the existing Chemistry laboratories are decidedly uninspiring as a teaching and learning environment, the proposed new laboratories will transform the student laboratory experience. The Laboratory for 1st and 2nd year will be arranged in 5 pods of 24 students each. Each pod will be overseen by a teaching assistant and it will include an instructional zone with white board and LCD monitor. This will allow for demonstrations and instruction specific to the work of that pod, and for teaching content and methods of the discipline in an integrated format (refer to the TEAL project at MIT). Centralized electronic capabilities will make it possible to simultaneously project to all or a selected number of pods when common instruction is desirable. The entire facility could be used by a single course or to accommodate more than one course at a time; thus providing great flexibility in scheduling the laboratory use. The Laboratory for 3rd year will be arranged in two sections: fume hood intensive and instrumentation sections. This setup will allow for teaching courses that require not only extensive access to fume hoods but also utilize sophisticated laboratory equipment.

On the St. George campus, Phase 1 of the undergraduate Chemistry laboratory renovations was completed in 2003; Phase 2 in 2007. When surveyed, students enrolled in one or more Chemistry course on average rated their laboratory experience in Chemistry as better than that in other disciplines. As well, in his Self-Study of the Department, the Chair of the Department of Chemistry credited Phase I of those renovations as being one key factor responsible for the significant increase in Chemistry program enrollments over the period 2001-02 through 2005-06 (a growth that cannot be accounted for simply by the double cohort of 2003-04).

d) Statement of Academic Plan

Enrollment expansion continues at the UTM campus. In Chemistry courses, enrollment has increased from 949 FCE in 03–04 (the year in which the Department of Chemical and Physical Sciences was formed) to 1669 FCE in 08–09, a 76% increase. In Chemistry programs over that period, enrollments rose 301%, from 85 to 341 students. In order to sustain this dramatic increase in interest, it is essential that we provide safe and modern laboratory facilities; facilities that will prepare students for a relatively seamless transition into chemical, pharmaceutical and government laboratories upon graduation.

To advance the constructivist pedagogy of our discipline, the Department intends to place a greater emphasis on active learning, which will integrate experimental work with problem–based learning. These new laboratories, which are divided into fully functional, independent pods (albeit linked through technology) are fashioned so as to support both individual and group work and to support a range of learning experiences within the laboratory environment. Ultimately, the goal of this project is to develop an integrated, platform course in chemical and physical sciences that takes full advantage of the studio–based environment. Such innovations in the student experience have been pioneered at Rensselaer (where, based on its clear superiority over traditional teaching methods, now use it for most of their science and engineering courses) and have been adopted by leading U.S. science and engineering universities, in both research intensive (M.I.T.) and undergraduate–only (California Polytechnic) categories.

III. PROJECT DESCRIPTION

a) Vision Statement

In 2008, the UTM Chemistry programs were assessed for renewal of accreditation by the Canadian Society for Chemistry. Recommendation 1 of the accreditation report focused on the undergraduate teaching laboratories. It cautioned that failure to renovate these laboratories and increase the space available for instruction "may jeopardize the accreditation of the programs" and will "ultimately affect the UTM graduate student population". In 2009, the Department of Chemical and Physical Sciences underwent an external review. The resulting report stated that it was essential that renovations to UTM's crowded and inadequately vented undergraduate laboratories be "given the highest priority" and "completed as soon as possible." Thus, two independent assessments identified undergraduate chemistry laboratories as being substandard and in need of immediate attention.

Our vision is to accomplish these renovations and secure the competitiveness of UTM's Chemistry programs with those of the St. George campus and of other universities across Canada. We also see this as an opportunity to pursue one of the goals of the initial departmental plan and advance a more constructivist pedagogy in our courses defined by integrated laboratory work and problem–based learning.

Design of the new laboratory space will allow for the elimination of Saturday and most evening classes and for the restoration of 3–hour laboratory sessions in first–year Chemistry required for CSC accreditation. The improved and increased number of fume hoods will expand the nature of the experiments that can safely be performed (in particular, for the inclusion of more organic chemistry in the first–year curriculum). Together with the Phase 1 renovations, Phase 2 will allow for strict adherence to best practices in chemical health and safety standards for students and staff and will thereby allow for improved training in this area, training that is compatible with the needs of chemists in modern commercial and government laboratories.

b) Space Program & Functional Plan

Ideally, the laboratories will consist of a dedicated laboratory for lower year courses. This space would be large, open, and flexible accommodating large number of students and relatively simple large scale experiments. The upper year laboratories could be dedicated or shared and fitted with additional services, sophisticated laboratory and computer equipment. The laboratory used to teach Biochemistry could be separate to prevent contamination of surfaces and equipment.

Space for the proposed renovation, however, is limited to the area of the existing laboratories and their support space. In the first phase of this project, a central preparation room was created freeing up 115nasm. This step made it possible to dedicate the entire 900nasm in the main laboratory block for teaching.

Space Program

Room Description	**Area [nasm]**
1st and 2nd Year Chemistry Teaching Laboratory	600
Upper Year Chemistry Teaching Laboratory	300
Laboratory technician station	19
Laboratory Technician Offices	40
TOTAL	958

The split between the two laboratories and allocation of the 900nasm was based on existing geometry of the available floor plate. A larger part of the floor will be renovated into the 1st and 2nd year laboratory, and the remaining portion will be renovated into the Upper year laboratory. A Laboratory technician station will be in the middle allowing access and support to both laboratories.

Space Program and Lab Layout Summary

Laboratory for 1st and 2nd year

Main Laboratory	
Area [nasm]	600
Lab Capacity	120
No of Fume Hoods	63

No of Student Benches	15
No of Students per Bench	8
No of Sinks per Bench	1
No of Balances per Bench	2
No of Fume hoods per Bench	4

Laboratory for 3rd year

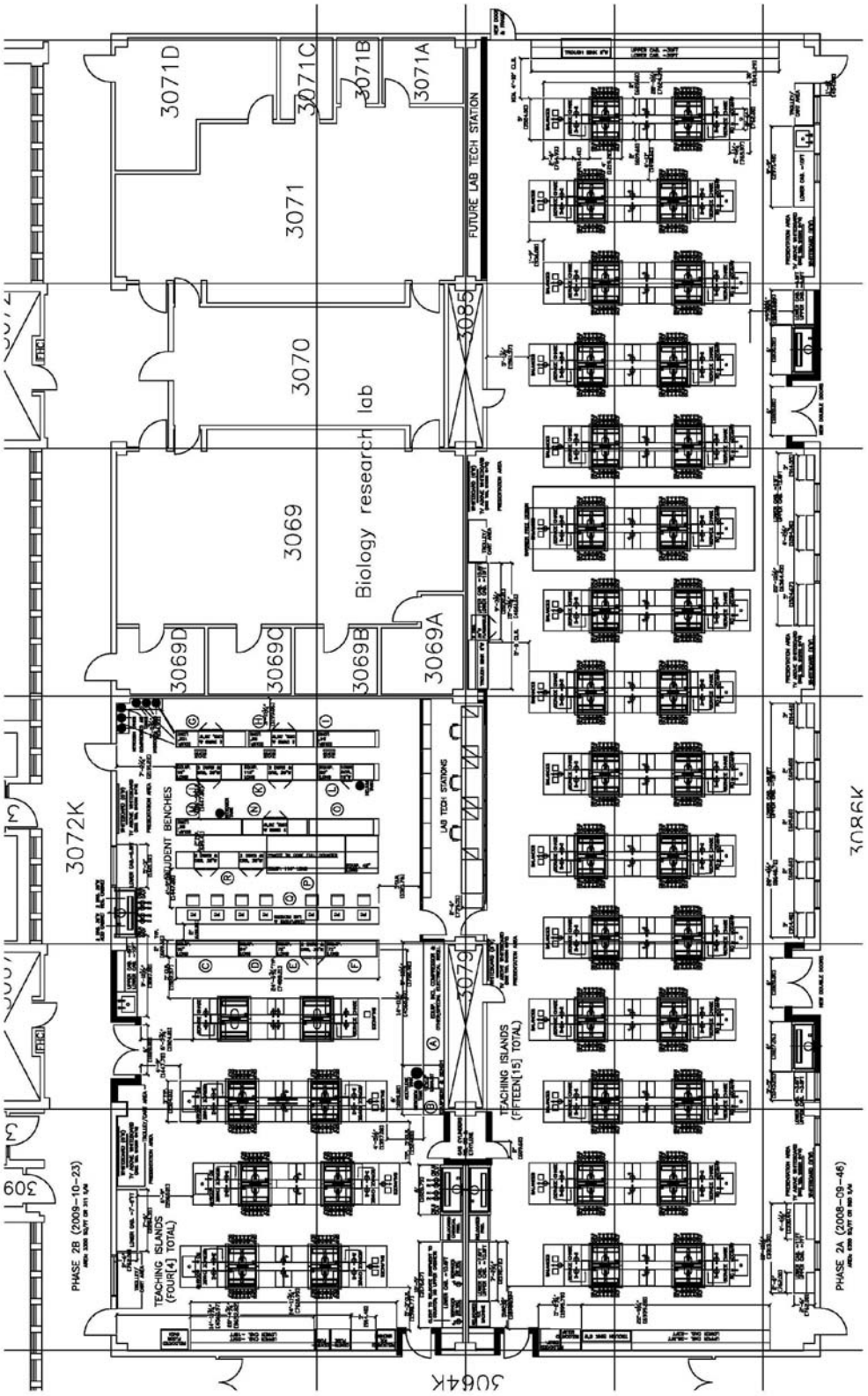
Main Laboratory	
Area [nasm]	300
Lab Capacity	68
No of Fume Hoods	18

Fume Hood intensive section	
No of Student Benches with Fume Hoods	4
No of Students per Bench	8
No of Sinks per Bench (typical)	1
No of Balances per Bench	2
No of Fume hoods per Bench	4

Instrumentation section	
No of Student Benches with no Fume Hoods	3
No of Students per Bench	12
No of Sinks per Bench (typical)	0
No of Balances per Bench	0
No of Fume hoods per Bench	0

The largest improvement from a teaching and safety point of view is the increased number of fume hoods, allowing all students to work in fume hoods or on a lab bench as required. One four-foot fume hood is proposed for every two students. Low velocity teaching style fume hoods with shared ducting were selected to provide safe teaching environment, while minimizing the impact on construction and operating costs.

Each three-student bench will form a pod for instructional purposes. Each pod will have its own presentation area including LCD monitors. Central control of A/V transmission will be located in the Laboratory Technician Station, allowing individual and/or central control for different pods.



Proposed layout:

c) Building Considerations

Accessibility
The University of Toronto is committed to ensuring that its buildings and services are accessible to persons with disabilities and requires all consultants to adhere to University's Barrier Free Design Standards.

Safety and Security
Doors to the larger 1st and 2nd year teaching laboratory should be locked manually, with a standard lock set. The current practice of laboratory technicians opening the lab, being present during laboratory sessions, and closing the lab (including safety checks) should continue as the best approach to both safety and security of the laboratory and students.

Access to the upper year teaching laboratory should controlled by electronic card access and CCTV camera. This will ensure not only safe access but also provide security to the expensive laboratory equipment.

Computing
Computing and communications will utilize the network already available in the South Building. The laboratory will have several data ports for presentation areas in addition to wireless environment throughout the laboratories.

d) Site Considerations

Campus Planning
UTM accommodates its academic activities in several buildings across campus. The South Building provides space required for all teaching and research activities of all physical and life sciences. Future campus expansion includes a proposed Science Complex and an Instructional Center currently under construction. Both buildings will provide urgently needed space for academic activities. The proposed Science Complex, connected to the South Building, is envisioned as a new home for research facilities. This will allow existing space in the South Building to be renovated for teaching laboratories. The proposed renovation will therefore work well with the proposed plans.

e) Campus Infrastructure Considerations

All services required by the operation of the renovated laboratories are available within the existing South Building. No modifications to the systems supplying the building are required.

f) Environmental Impact – Construction/Renovation

Design and construction will be in accordance with all applicable environmental, health and safety legislation and University of Toronto policies and standards.

The current lighting, fluorescent lighting ballasts may contain PCB's which are substances that are heavily regulated under the Canadian Environmental Protection Act. The benefits of the lighting retrofit to new T-8 lighting ballasts include removal of PCB's and replacing them with ballasts that do not include PCB's or other highly regulated materials. In addition, through the lighting retrofit, the laboratory will reduce of energy consumption, reduce and the generation of waste from lamp replacement, due to the much longer lifetime of the proposed lighting retrofits.

The increased number in fume hoods would result in higher emissions and consequently require appropriate Certificates of Approvals (Air and Noise). In this regard, UTM will obtain a comprehensive Certificate of Approval (Air and Noise) that includes the fume hoods and other new equipment (if applicable) to allow for operational flexibility in future. That is, any changes in equipment and materials which are not outside the scope of the processes described in the CofA are simply tabulated and submitted to the MOE once per year as an Annual Report without having to go through the approvals amendments process (i.e., operational flexibility, move labs, fume hoods, etc.). This can reduce, if not eliminate, approval process (currently average 6-8 months with MOE) and reduce consulting fees associated with application process

g) Environmental Impact – Laboratory Operation

In the Canadian Society for Chemistry report respecting the renewal of accreditation, the site visit team (SVT) wrote the following: "The University has no stockroom facilities and the SVT was left with the impression that inventory control of chemicals and chemical waste was fragmented. Chemicals may be routinely used in departments other that those commonly associated with them (e.g., Art). These factors may lead to unacceptable risks in the health and safety area. Implementation of a more rigorous central control of chemicals at UTM should be a priority item. Such control should extend to all departments using hazardous materials. It seems clear that increasing societal demands will require this in the future." As a result of the above assessment, the site visit team made the following **Recommendation 6.**

> "The University and the department should implement together a program to provide central control and management of chemicals and chemical waste."

The proposed renovation addresses this recommendation and the following specific objectives as outlined in the University of Toronto Environmental Protection Policy:

- Meet and where possible exceed environmental standards, regulation, and guidelines.
- Minimize and where possible eliminate use of chemicals,
- Minimize polluting effluent and emissions into air, land and water
- Minimize noise and odour pollution
- Minimize waste generation through reduction, reuse and recycling
- Minimize energy use, through efficient management and practices

h) Environmental Impact – Waste Management

The renovation (i.e., increased fumehoods) will allow for changes in the nature, type, and scope of laboratory operations (e.g., inclusion of more organic chemistry in first year curriculum). As well, the renovation combined with refined chemical management systems will enable the University to meet the requirements of applicable environmental, health and safety regulations and standards.

The University is committed to being a positive and creative force in the protection of the local and global environment through its teaching, research, and administrative environments, it also recognizes that it and all members of the University community have the responsibility to act in ways consistent with its fundamental principles of minimizing negative impacts on the environment and the conservation and wise use of natural resources.

To this end, the renovations, in particular the space program and functional layout as outlined in Section 5 of this report, combined with refined chemical management systems offer opportunities to explore various waste minimization techniques, such as the following:

1. Process Modification

To the extent that it does not affect vital teaching, modifying experiments to decrease the quantity of chemicals used and waste generated (i.e., micro analysis techniques or small scale chemistry) has become a presence on the educational scene. The renovation will accommodate such process modifications made in the future. The benefits of small-scale chemistry include:

- o Reduces the amount of chemicals being purchased
- o Promotes waste reduction at the sources
- o Improves laboratory safety and risk to fire and explosion
- o Minimizes storage space
- o Reduces preparation and clean up time
- o Sharply reduces laboratory costs, associated with purchasing and disposal costs.
- o Teaches excellent laboratory techniques without sacrificing content, sound pedagogy, or student interest.

2. Segregation and Characterization

Segregation and characterization allows waste to be redistributed for reuse if someone else in the University system can use the chemicals; if the waste cannot be redistributed, segregation simplifies chemical recycling, such as distillation or reclamation, and minimizes costs.

3. Reclamation

The University reclaims some precious metals and valuable chemicals to reduce waste treatment costs.

4. Purchasing and Inventory Management and Control

The Office of Environmental Health and Safety has recently (February 2009) purchased software that has the capability to provide a client server data management program designed for users of Controlled Substances and hazardous chemicals. The software program allows for documentation of purchasing, receipt, use, waste disposal, real time inventory, and instrument inventory. The Department of Chemical and Physical Science has agreed and is eager to pilot the implementation and use of this software as a tool to assist in the management of chemicals and chemical waste.

5. Chemical Exchange Programs

Through the use of the client server data management program described above in item D, the opportunity to develop a chemical exchange program within the Department exists.

i) Secondary Effects

Phase 1 of the project implemented in summer 2009, provided space for all laboratory preparation functions previously accommodated in rooms SE3075/3078, SE3081/3084, and SE3065.

Administrative space for the laboratory technicians will be provided in room SE3001. This room is in an ideal location for laboratory technician offices because it is adjacent to both the newly renovated preparation area as well as the teaching laboratories.

SE3068 and 3068A (combined area=10.87nasm) are used for Biology research. These functions will be relocated within the South Building as part of SPMC projects 2009-10.

j) Staging

Temporary storage for the laboratory renovations will be accommodated within the space allocation of Chemical Physical Sciences.

The need for staging space was minimized by completing Phase 1 in the summer of 2009.

- All of preparation room equipment and materials will be relocated to SE3007 before February 2010.
- All administrative functions will be relocated to room SE3001 by the end of March 2010.
- All equipment and materials that will be reused in the renovated space will remain in the laboratory till the last laboratory session and then relocated to a temporary space in SE2056 (ERS teaching lab) or SE2052 (PHY teaching lab).
- Chemistry will not offer any laboratory courses in the summer of 2010 since UTM does not have alternate space to hold any chemistry laboratory sessions.

k) Schedule

The Renovation of the Chemistry teaching laboratories – Phase 2 will be done in the Spring and Summer of 2010.

AFD Approval to hire consultants	December 11, 2009
Consultant Selection and Design	December-January 2010
Planning and Budget Meeting	January 18, 2010
Business Board Meeting	February 8, 2010
Laboratory Bench/Fume Hood Tender	February 2010
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General Tender	March 2010
Construction	April-August 2010
Occupancy	September 2010

The proposed schedule is based on advanced planning to allow for construction to commence in April immediately after classes finish. It is essential for construction to be completed by the end of August because UTM does not have an alternate location to accommodate Chemistry practical courses and the whole Chemistry curriculum would be in disrupted.

IV. RESOURCE IMPLICATIONS

a) Total Project Cost Estimate

The estimated total project cost is $4.24 million dollars which include estimates or allowances for the following items:

- construction cost (assuming lump sum type of tender to a qualified general contractor)
- contingencies
- taxes
- hazardous waste removal
- secondary effects
- demolition
- permits and insurance
- professional fees
- moving & staging or laboratory equipment & furniture
- furniture and equipment
- computer and telephone terminations
- security and access system
- commissioning

Equipment and Furniture Cost

The proposed renovation will include replacement of all existing fume hoods and a small portion of the existing equipment because some is nearly 40-years old, outdated and no longer repairable. Appendix B, Room Specification Sheets, include a full list of existing and new equipment and furniture.

The details of the cost estimate are included in Appendix C.

b) Operating Costs

Cost of electrical power to operate the large number of additional fume hoods will be offset by incorporation of a variety of “green” initiatives. The two most significant once are 1) the ability to turn off the fume hood fans when not in use instead of the current 24/7 operation, and 2) utilization of re-circulating chilled water for cooling of all chemistry experiments rather than utilizing domestic cold water.

The cost of maintenance, caretaking, and security is likely to remain unchanged.

c) Funding Sources

Phase 2 was estimated to cost $4.24 million dollars and it will be funded from UTM Operating budget.

V. RECOMMENDATIONS

It is recommended that the Planning and Budget Committee recommend to the Academic Board:

1. That the Project Planning Report for the University of Toronto Mississauga Renovation of Chemistry Undergraduate Teaching Laboratories be approved in principle.

2. That the project scope, comprising renovation of 958 nasm in the South Building at a total project cost of $4.24 million be approved with the full funding from the University of Toronto Mississauga operating budget.

APPENDICES

Appendix A: Existing Space Inventory
Appendix B: Space Utilization and Requirements Analysis
Appendix C: Equipment and Furnishings Schedule
Appendix D: Room Specification Sheets
Appendix E: Total Project Cost
Appendix F: Environmental Checklist

APPENDIX A:

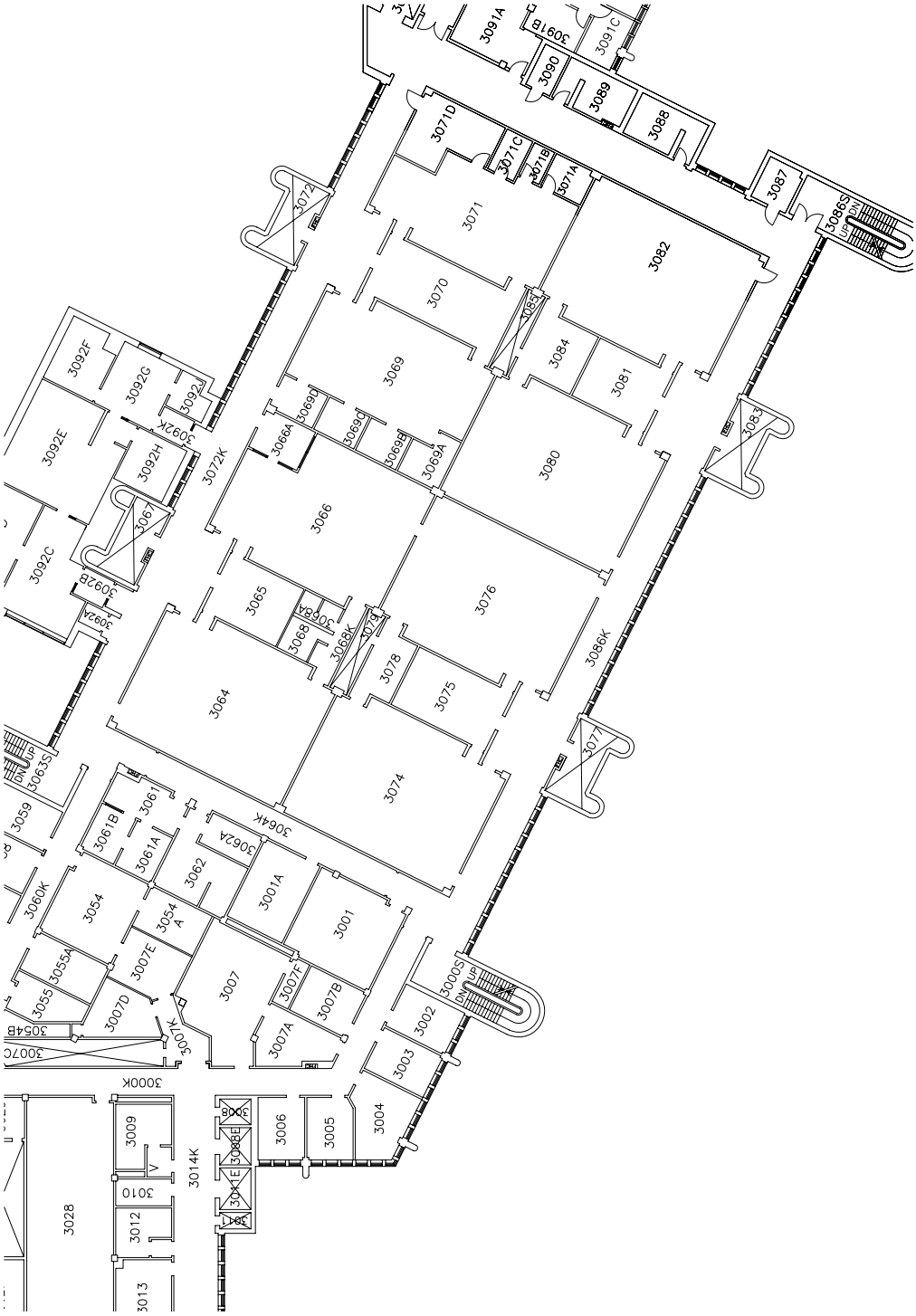
EXISTING SPACE INVENTORY

The following table summarizes the space inventory affected by the proposed renovation.

Space Inventory

Building Name	Room No.	Sfx.	Department Name	COU Category Code	Proration Type	%	Room Stns	Details Room Alloc Comments	Area	Renovation Phase
South Bldg	3007	B	UTM-ChemPhysSci	2.3			0	Lab Apparatus Cleaning	14.07	Phase 1
South Bldg	3007	B	UTM-ChemPhysSci	2.3			0	Lab Apparatus Cleaning	14.07	Phase 1
South Bldg	3007	D	UTM-ChemPhysSci	4.1			1	Stipend Office	15.07	Phase 1
South Bldg	3007	E	UTM-ChemPhysSci	4.1			1	Stipend Office	16.64	Phase 1
South Bldg	3007		UTM-Registrar	1.2			30	Non-Tiered Clas	45.82	Phase 1
South Bldg	3054	A	UTM-ChemPhysSci	3.2			0	Lab Storage and Supply	13.82	Phase 1
South Bldg	3054		UTM-ChemPhysSci	3.2			0	Lab Storage and Supply	25.28	Phase 1
South Bldg	3074		UTM-ChemPhysSci	2.1			24	Wet Lab	122.92	Phase 2
South Bldg	3075		UTM-ChemPhysSci	2.3	Space	50	0	Technician's Office Single	12.04	Phase 2
South Bldg	3075		UTM-ChemPhysSci	2.3	Space	50	0	Lab Prep	12.04	Phase 2
South Bldg	3076		UTM-ChemPhysSci	2.1			24	Wet Lab	120.42	Phase 2
South Bldg	3078		UTM-ChemPhysSci	2.3			0	Balances	21.15	Phase 2
South Bldg	3080		UTM-ChemPhysSci	2.1			24	Wet Lab	120.42	Phase 2
South Bldg	3081		UTM-ChemPhysSci	2.3	Space	50	0	Lab Prep	12.04	Phase 2
South Bldg	3081		UTM-ChemPhysSci	2.3	Space	50	1	Technician's Office	12.04	Phase 2
South Bldg	3082		UTM-ChemPhysSci	2.1			24	Wet Lab	120.42	Phase 2
South Bldg	3084		UTM-ChemPhysSci	2.3			0	Balances	21.15	Phase 2
South Bldg	3064		UTM-ChemPhysSci	2.1			24	Wet Lab	120.42	Phase 2
South Bldg	3065		UTM-ChemPhysSci	2.3			0	Lab Prep	24.08	Phase 2
South Bldg	3066		UTM-ChemPhysSci	2.1	Space	25	6	Wet Lab (Instrumentation)	27.57	Phase 2
South Bldg	3087		UTM-ChemPhysSci	2.3			0	Lab Storage and Supply	7.80	-
South Bldg	3007	A	UTM-ChemPhysSci	4.4			1	Technician's Off Single	17.05	Phase 1

Building Name	Room No.	Sfx.	Department Name	COU Category Code	Proration Type	%	Room Stns	Details Room Alloc Comments	Area	Renovation Phase
South Bldg	3068	A	UTM-Biology	3.1			0	Research space	4.85	Phase 2
South Bldg	3068		UTM-Biology	3.1			0	Research space	6.02	Phase 2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APPENDIX B:

SPACE UTILIZATION AND REQUIREMENTS ANALYSIS

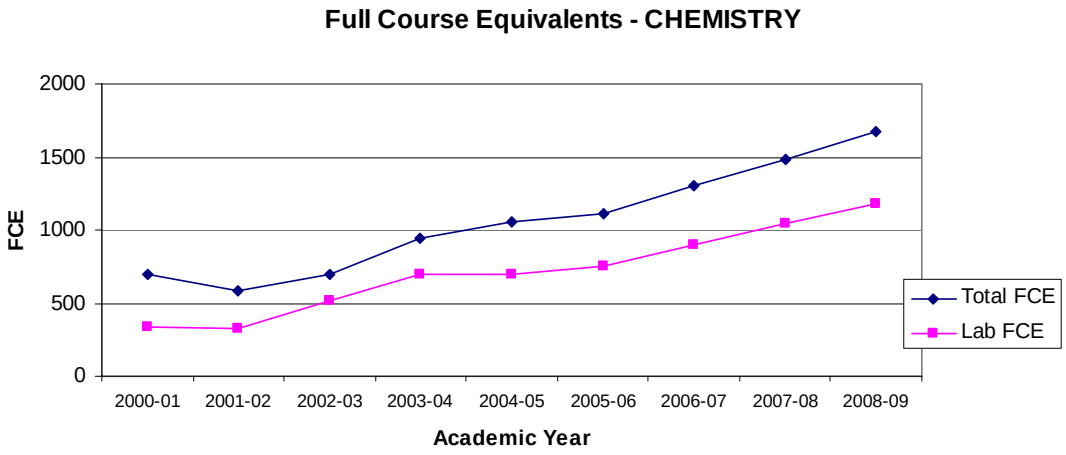
The utilization level of the chemistry teaching laboratories was evaluated using three indicators:

- Full course equivalents
- Weekly student contact hours
- Laboratory schedules

Full Course Equivalents

Full Course Equivalents (FCEs) are calculated as the sums of all course weights multiplied by the number of enrolled students. The FCE calculation differentiates between full and half courses: a full Y course has a weight of 1.0 and a half course H has a weight of 0.5.

The following chart shows the increase in the Total FCE and Laboratory FCEs for Chemistry over the last few years.



In 2000-01, chemistry had 342 laboratory FCEs which increased to 1182 in 2008-09. Such large increase in laboratory use resulted in significant changes in teaching and laboratory operations:
1) The number of laboratory hours per 1st year student was reduced to one hour per week in order to accommodate the required enrollment expansion.
2) Laboratory scheduling necessitated multiple laboratory sessions each day, so that labs start at 10:00am (with early morning preparation) and some do not end untill 10:00pm. Some lab sessions are scheduled also on weekends.
3) The heavy utilization of teaching laboratories necessitated long working hours for laboratory technicians.

Weekly Student Contact Hours

The Council of Ontario Universities (COU) space guidelines provide a quantitative guide to the space required to accommodate undergraduate teaching laboratories and their support space (COU category 2). The amount of space is based on the number of Weekly Student Laboratory Contact Hours (WSCH) and the nature of the discipline.

The table below shows that the generated (theoretically required) space 1334nasm greatly exceeds the existing space of 792nasm.

UTM Chemistry Course Information (Fall 2008-09)

COURSE	Practical Lab hrs per week	Course Enrollment	Contact Hours per course	COU space factor	Generated NASM
CHM140Y	1	816	816	0.6	489.6
CHM211H	4	150	600	0.6	360
CHM221H	1.5	-	0	0.6	0
CHM231H	2	120	240	0.6	144
CHM243H	4	-	0	0.6	0
CHM371H	4	36	144	0.6	86.4
CHM391H	4	32	128	0.6	76.8
CHM393H	4	24	96	0.6	57.6
CHM489Y	10	20	200	0.6	120

TOTAL	contact hours	2224
	generated NASM	1334
	existing NASM	792

Note, CHM221H has 97 students, and CHM243H has 217 students. Both of these courses are offered in the Spring term, so they have been exluded from the table above.

Note, CHM140, the main first year course, has only 1hr lab per week. According to the recommendation of the accreditation report this number has to be increased to minimum of 3 hours per 2 weeks. This change will increase the laboratory contact hours to 2632 and generate 1579nasm of “theoretically required” laboratory teaching space, nearly double the existing available space.

Laboratory Schedules

Chemistry uses 792nasm of laboratory teaching and support space located in the South Building (Appendix C). Each lab is approximately 120nasm and all six labs have similar layout. Each laboratory has a wall of fume hoods, wall for displays, and a wall with blackboard for instructions:
Four laboratories on the third floor (SE3074, SE3076, SE3080, SE3082) are furnished with three banks of taller laboratory benches with gas, water, air and vacuum connections for each laboratory station.
One laboratory on the third floor (SE3066) is dedicated to teaching instrumentation and analytical chemistry. This space is shared with research; teaching utilizes the space approximately 25% of the time.
One laboratory on the third floor (SE3064) is equipped to teach advanced organic chemistry and inorganic synthesis. The laboratory is furnished with three banks of taller laboratory benches with gas, water, air and vacuum connections for each laboratory station.

Rooms SE3080 and SE3082 (120nasm each), used mainly for first and second year courses, are booked throughout the day. These bookings reach 34hours per week when CHM140 runs their labs, exceeding the COU suggested laboratory booking of 18 hours per week. The strange lab schedule was necessitated by the large number of lab sessions.

SE3074 and SE3076 (120nasm each) are used to teach second and third year courses. These two labs are booked 8-20 hours per week in the Fall term and 24 hours per week in the spring term, exceeding the COU suggested booking of 18 scheduled laboratory hours per week except SE3076 in the Fall term.

Room SE3066 (110nasm) is dedicated to teaching instrumentation and analytical chemistry. This space is shared with research. Since teaching utilizes the space approximately 25% of the time it translates to 0.25*18=4.5 of COU recommended scheduled teaching hours. This room is booked typically 8 hours per week exceeding the COU recommended utilization.

Room SE3064 is booked only 8hours per week. However, it is used additional 8 hours per week to accommodate "fume hood" experiments in CHM391 increasing the actual booked time in SE3064 to 16hours per week. Note, the 3rd year experiments require follow up work approximately 3hrs per week for each lab. This activity occupies the laboratory time, but it is not reflected in the booking schedule.

Chemistry - Laboratory schedule (Spring 2005-06)

Room Number		Lab Capacity theoretical	actual	Spring 2005-06 Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Average weekly use
SE3064	3rd year	24	12		CHM393 4	CHM393 4	CHM393 4			12 hours
SE3066	4th year instrumentation	24	15	CHM391 4				CHM391 4		8 hours
SE3074	wet lab 2nd year	24	24	CHM243 4	CHM243 4	CHM243 4	CHM243 4		CHM243 4	20 hours
SE3076	2nd and 3rd year	24	24 2nd year 18 3rd year	CHM243 4	CHM243 4	CHM243 4	CHM371 4	CHM371 4	CHM243 4	24 hours
SE3080	wet lab 1st year (alternate week booking)	24		CHM140 6	CHM140 8	CHM140 6	CHM140 6	CHM140 4		15 hours
SE3082	wet 2nd and 3rd year (courses booked in alternate weeks)	24		CHM221 3 CHM140 6	CHM221 3 CHM140 8	CHM221 3 CHM140 6	CHM221 3 CHM140 6	CHM140 4		21 hours

Chemistry - Laboratory schedule (Spring 2008-09)

Room Number		Lab Capacity theoretical	actual	Spring 2008-09 Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Average weekly use
SE3064	3rd year	24	12			CHM393 4	CHM393 4			8 hours
SE3066	4th year instrumentation	24	15	CHM391 4				CHM391 4		8 hours
SE3074	wet lab 2nd year	24	24	CHM243 4	CHM243 4	CHM243 4	CHM243 4	CHM243 4	CHM243 4	24 hours
SE3076	2nd and 3rd year	24	24 2nd year 18 3rd year	CHM243 4	CHM243 4	CHM243 4	CHM371 4	CHM371 4	CHM243 4	24 hours
SE3080	wet lab 1st year (alternate week booking)	24		CHM140 6	CHM140 8	CHM140 6	CHM140 8	CHM140 4	CHM140 2	17 hours
SE3082	wet 2nd and 3rd year (courses booked in alternate weeks)	24		CHM221 4 CHM140 6	CHM221 4 CHM140 8	CHM221 4 CHM140 6	CHM221 4 CHM140 8	CHM221 4 CHM140 4	CHM140 2	27 hours

NOTE: CHM140 has large number of labs schedulled on bi-weekly basis.
CHM221has labs every two weeks, this allows the lab space to be shared between CHM221 and CHM140.

The TOTAL weekly booked hours is based on the average booking if booking varies on bi-weekly basis.

The capacity of some laboratories is reduced by the number of available fume hoods.

Space restrictions

The above analysis clearly indicate that the chemistry undergraduate teaching laboratories are heavily utilized and under accommodated for current student enrollment according to the COU space guidelines and University's own space standards.

The space available for the proposed renovation of the teaching laboratories is limited to the existing teaching and support areas. The space therefore needs to be not only renovated and modernized, but the layout also has to be changed to maximize the flexibility in scheduling of both large and small classes.

The only possible increase in space was achieved by relocating all laboratory preparation functions into a separate Preparation Room (SE3007). This work was completed in the Summer of 2009 as part of Phase 1 of this project. This relocation freed up rooms SE3075, SE3078, SE3081, SE3084, and SE3065 thus increasing the area available for teaching by approximately 115nasm.

Additional space for the teaching laboratories is needed to support future enrollment growth. Additional space was identified and in the future will be converted into to chemistry teaching laboratory space when the current occupants (Biology research) accommodated in SE 3069, SE3070, SE3071 can be relocated (approximately 300nasm).

APPENDIX C:

EQUIPMENT AND FURNISHINGS SCHEDULE

Available on request.

APPENDIX D:

ROOM SPECIFICATION SHEETS

ROOM SPECIFICATION SHEET
UTM Teaching Laboratories

SECTION A:

ROOM NAME: **1st and 2nd Year Chemistry Teaching Laboratory**

Room Area (NASM): **600.0** **No. Rooms:** **1**
Total NASM: **600.0**

SECTION B:

A. Space Purpose and Type of Activity:
This is the teaching laboratory for first and second year UTM chemistry courses.

B. Number of Occupants, Resident:

None

C. Number of Occupants, Transient:

Up to 120 students plus teaching staff and TAs.
Fifteen lab benches with eight students each. Each three benches will form a pod for teaching purposes.

D. Space Relationships: as exist

E. Visual Relationships: as exist

F. Communications:

Voice: Standard connection (1 line, two phones, located one on each end of the room).

Data: Five network connections conveniently located in the presentation area for each pod. Wireless environment to be provided for the entire laboratory.

Audio Video: The laboratory is to have five presentation areas each with the following equipment: PC, wireless microphone, document camera, and a white board. Visual for each pod or group of students to be provided using series of LCD screens strategically located throughout the laboratory. Wiring is to be provided from each presentation area to the Laboratory Technician Station to allow local and/or central control of the presented material. Additional small speakers are to be located throughout the laboratory to optimize sound transmission.

Communication line to UTM Police for emergency will be provided via a phone line. Two phones are to be located in the laboratory. An emergency number to contact UTM Police is to be clearly indicated on each phone set.

G. Furniture and Equipment, Fixed:

Island Benches:
Laboratory to have fifteen (15) identical double-sided island benches. Each island bench will accommodate eight students and will be fitted with the following items:

- four low velocity teaching fume hoods (48" wide)
- eight (8) student spaces each with two separate compartments for storage of small student dedicated course items, and one larger open compartment with a hook for storage of personal belongings
- one sink at the end each island (30" wide located in the center of the island), storage cabinets below (14 in total)
- space for two balances at the end of each island; under the counter space to accommodate knee holes at the two ends and lower storage cupboards in the center
- accessible station(s), including bench, fume hood and balance area, to be integrated into the laboratory

Perimeter benching:

- min 40m of counter space with storage cupboards below and above
- one stainless steel
- three (3) 72-inch wide fume cabinets with ventilated storage below for solvents and/or acids
- one (additional) under the counter vented storage cabinet for flammables

Other:

- two tack boards and/or white board (36" wide by 48" high)
- five presentation white boards (one in each presentation area)
- wall/counter mounted LCD screens
- wall/counter mounted paper towel dispensers (one per sink unit)

Hallway:

- 5 assignment drop-off boxes

H. Furniture and Equipment, Moveable:

Existing:
4 – carts (size)
2 – small ovens (specs)
Detailed list of small equipment and its future location will be provided on request

New:
2 – ice machines (specs)
2 – ovens (specs)
2 – fridges (specs)
120 - laboratory stools (one for each student)

Each room will need to accommodate waste and recycling bins. Containers for chemical waste and for broken glass (and other sharp waste) will be accommodated on bench tops.

SECTION C:

I. Lighting Requirements:

- o energy efficient overhead fixtures to be located in such a way to minimize casting of shadows on work surfaces
- o additional dimmable lights in each of the presentation area
- o light fixtures to be arranged in sections to accommodate independent control for each pod (two lab benches – 16 students) and for each of the presentation area
- o innovating approach to provide some natural light and a view to the hallway (minimum 10 - 36" wide tall glass panels 1.2m above floor)

J. Power Requirements:

- o each student fume hood (60 in total) to be equipped with four standard (110V/15A) duplex outlets
- o each lat tech fume hood (3 in total) to be equipped with three standard (110V/15A) duplex outlets
- o each benching runs (15 in total) to have ten (10) standard (110v/15A) duplex outlets (one duplex outlet for every student station, plus two duplex outlets for each balance area)
- o five standard (110V/15A) duplex outlets conveniently located in wall by each presentation area (one for each pod) for presentation purposes
- o two duplex receptacles to be located along the perimeter of the laboratory every 2ft; note, the electrical outlets to accommodate power requirements of all the large and small equipment listed in Appendix C
- o two standard (110V/15A) duplex outlets conveniently located in wall by entry doors for housekeeping purposes

K. Building Services Requirements:

See section N. Plumbing.

L. Special Systems:

- o none specified

M. HVAC:

- o thermostat for the laboratory (centrally located)
- o HVAC system should not produce any annoying background noise or vibration
- o system should ensure that odors do not migrate outside the room (especially into corridor)
- o air diffusers to ensure uniform air flow throughout the lab (avoid large air movement in the balances area, avoid main air supply directly in front of fume hoods)

N. Plumbing:

General:

- o eyewash stations to be supplied with properly tempered water (if available)
- o deluge shower to be supplied with properly tempered water (if available); pull station should accommodate users in wheelchairs

Fume Hoods (63 in total):

- o each lab tech fume cabinet to be 6ft wide (3 in total)
- o each student fume cabinet to be 4ft wide (60 in total) with glass walls

- each fume hood to have a “retort stand grid” to support experiments
- cold water and drainage (cup sink)
- vacuum
- compressed air
- nitrogen (distributed from “gas room” located within the lab area)
- chilled water for use in condensers

Each Sink (16 in total):

- 15 stainless steel sink with drainer on both sides
- 1 trough sink
- domestic hot & cold water and drainage (sinks should be deep enough to vertically clean 30” long burettes)
- sinks to have tall faucets (24” clear from counter top) with houses to prevent spash/spill
- distilled water

O. Special Finishes:

- bench tops must be stain & corrosion resistant – epoxy is preferred
- flooring must be stain & corrosion resistant, durable, non-slip, and readily maintained – flooring to extend under benching and other floor mounted furnishings/equipment (VCT tile preferred)
- floor and ceiling must be sealed prior to flooring installation to prevent leakage into the new lab and into the area bellow
- wall, ceiling & cabinet finishes must be stain resistant, durable and readily maintained

P. Special Requirements & Other Considerations:

- entry door opening should be suitable dimensioned to permit entry and exist of students
- additional convenient entry door should be provided in the wall near the freight elevator and another near the preparation area to permit convenient movement of equipment and materials
- accessible stations should be provided at convenient location at each end of the lab (accessible bench, sink, balances)

Q. Safety & Security Considerations:

- areas below and path to safety deluge shower station must be kept clear; target on floor is required below shower
- eye wash station at seven (7) sink units (ever second island bench)
- proper containers for broken glass (and other sharps) to be conveniently located throughout the laboratory
- wall-mounted first aid kits located at the two main room entrances
- wall-mounted fire extinguishers to be conveniently located throughout the laboratory
- chemical dispensing containers & chemical waste containers appropriately located in room; provision of spill kits conveniently located throughout the laboratory
- air monitoring alarm located in each fume hood to monitor performance of the fume hood (“Ventalert”)
- emergency shutoffs for electrical power and laboratory services located for ready access by room occupants and emergency personnel
- no electric locks on any doors to the lab. The access and security of this lab will be maintained using mechanical locks.

- all doors to have an "intrusion detection" alarm integrated into the door access system. The selected system must have an "autodial" feature to call the Campus Police emergency telephone number 905-569-4333

ROOM SPECIFICATION SHEET
UTM Teaching Laboratories

SECTION A:

ROOM NAME: Upper Year Chemistry Teaching Laboratory

Room Area (NASM): 300.0 **No. Rooms: 1**
Total NASM: 300.0

SECTION B:

A. Space Purpose and Type of Activity:
This is the teaching laboratory for upper year chemistry courses.

B. Number of Occupants, Resident:

None

C. Number of Occupants, Transient:

Up to 68 students plus teaching staff and TAs.

Two lab bench configuration:
Island Benches with fume hoods - four (4) lab benches with fume hoods and eight student stations will be used for teaching of upper year high intensity chemistry courses.

Island Benches without fume hoods - three (3) benches with no fume hoods, large number of electrical outlets, and space between benches for service will be used to accommodate various instrumentation intense chemistry courses.

D. Space Relationships: as exist

E. Visual Relationships: as exist

F. Communications:

Voice: Standard connection (1 line, two phones, located one on each end of the room).

Data: Two network connections conveniently located in the presentation area for each pod. Wireless environment to be provided for the entire laboratory.

Audio Video: Two presentation areas. Each presentation area to have a PC, wireless microphone, document camera, and a white board. Visual for each pod or group of students to be provided using series of LCD screens strategically located throughout the

laboratory. Wiring to be provided from each presentation area to the Laboratory Technician Station to allow local and/or central control of the presented material.

Communication line to UTM Police for emergency will be provided via a phone line. Two phones are to be located in the laboratory. An emergency number to contact UTM Police is to be clearly indicated on each phone set.

G. Furniture and Equipment, Fixed:

Island Benches with fume hoods:
Laboratory is to have four (4) double-sided island benches. Each island bench will accommodate eight students and will be fitted with the following items:

- four low velocity teaching fume hoods (48" wide)
- eight (8) student spaces each with two separate compartments for storage of small student dedicated course items, and one larger open compartment with a hook for storage of personal belongings
- one sink at the end each island (30" wide located in the center of the island), lower cabinets below
- space for two balances at the end of each island; under the counter space to accommodate knee holes at the two ends and lower storage cupboards in the center

Island Benches without fume hoods:
Laboratory is to have three double-sided island benches. Each island bench will accommodate several students and various instruments:

- each side of the bench to have six student stations
- each student station to have two separate compartments: one for storage of small student dedicated course items, and another larger open compartment with a hook for storage of personal belongings

Perimeter benching:

- min 21m of counter space storage space (maximize the space use in the laboratory)
- one stainless steel single sink units (2'6" deep by min 2'6" wide; cupboard below, draining surface, and drying rack)
- two 72-inch wide fume cabinet with ventilated storage below for solvents and/or acids
- four under-the-counter vented storage cabinets

Other:

- o one tack board and/or white board (36" wide by 48" high)
- o two presentation white boards (one in each presentation area)
- o wall/counter mounted paper towel dispensers (one per each sink unit)
- o wall/counter mounted LCD screens

Hallway:

- o 3 assignment drop-off boxes

H. Furniture and Equipment, Moveable:

Existing:
4 – carts (size)
2 – small ovens (specs)
Detailed list of small equipment and its future location will be provided on request

New:
1 – ice machines (specs)
2 – ovens (specs)
2 – fridges (specs)
68 - laboratory stools (one for each student)

Each room will need to accommodate waste and recycling bins. Containers for chemical waste and for broken glass (and other sharp waste) will be accommodated on bench tops.

SECTION C:

I. Lighting Requirements:

- o energy efficient overhead fixtures to be located in such a way to minimize casting of shadows on work surfaces
- o additional dimmable lights in each of the presentation areas
- o light fixtures to be arranged in sections to accommodate independent control for each pod and for each of the presentation area
- o innovating approach to provide some natural light and a view to the hallway (minimum 4 - 36" wide tall glass panels 1.2m above floor)

J. Power Requirements:

- o each student fume hood (16 in total) to be equipped with four standard (110V/15A) duplex outlets
- o each large fume hood (2o in total) to be equipped with three standard (110V/15A) duplex outlets
- o each benching runs with fume hoods (4 in total) to have ten (10) standard (110v/15A) duplex outlets (one duplex outlet for every student station, plus two duplex outlets for each balance area)
- o each benching run without fume hoods to have a power bar along the length of the bench
- o two standard (110V/15A) duplex outlets conveniently located in wall by each presentation area (one for each pod) for presentation purposes
- o two duplex receptacles to be located along the perimeter of the laboratory every 2ft; note, the electrical outlets to accommodate power requirements of all the large and small equipment listed in Appendix C

- o one standard (110V/15A) duplex outlets conveniently located in wall by entry doors for housekeeping purposes

K. Building Services Requirements:

See section N. Plumbing.

L. Special Systems:

- o none specified

M. HVAC:

- o thermostat for the laboratory (centrally located)
- o HVAC system should not produce any annoying background noise or vibration
- o system should ensure that odors do not migrate outside the room (especially into corridor)
- o air diffusers to ensure uniform air flow throughout the lab (avoid large air movement in the balances area, avoid main air supply directly in front of fume hoods)

N. Plumbing:

General:

- o eyewash stations to be supplied with properly tempered water (if available)
- o deluge shower to be supplied with properly tempered water (if available); pull station should accommodate users in wheelchairs

Fume Hoods (18 in total):

- o each lab tech fume cabinet to be 6ft wide (2 in total)
- o each student fume cabinet to be 4ft wide (16 in total) with glass walls
- o each fume hood to have a “retort stand grid” to support experiments
- o cold water and drainage (cup sink)
- o vacuum
- o compressed air
- o nitrogen (distributed from “gas room” located within the lab area)
- o gas from storage tanks stored in an enclosed area within the laboratory
- o chilled water for use in condensers

Each Sink (4 in total):

- o 4 stainless steel sink with drainer on both sides
- o domestic hot & cold water and drainage (sinks should be deep enough to vertically clean 30” long burettes)
- o sinks to have tall faucets (24” clear from counter top) with houses to prevent spash/spill
- o distilled water

O. Special Finishes:

- bench tops must be stain & corrosion resistant – epoxy is preferred
- flooring must be stain & corrosion resistant, durable, non-slip, and readily maintained – flooring to extend under benching and other floor mounted furnishings/equipment (VCT tile preferred)
- floor and ceiling must be sealed to prevent leakage into the new lab and into the area bellow
- wall, ceiling & cabinet finishes must be stain resistant, durable and readily maintained

P. Special Requirements & Other Considerations:

- entry door opening should be suitable dimensioned to permit entry and exist of students
- additional convenient entry door should be provided in the wall near the freight elevator and another near the preparation area to permit convenient movement of equipment and materials
- one accessible stations should be provided at convenient location at each end of the lab (accessible bench, sink, balances)

Q. Safety & Security Considerations:

- areas below and path to safety deluge shower station must be kept clear; target on floor is required below shower
- eye wash station at four (4) sink units
- proper containers for broken glass (and other sharps) to be conveniently located throughout the laboratory
- wall-mounted first aid kits located at the two main room entrances
- wall-mounted fire extinguishers to be conveniently located throughout the laboratory
- chemical dispensing containers & chemical waste containers appropriately located in room; provision of spill kits conveniently located throughout the laboratory
- air monitoring alarm located in each fume hood to monitor performance of the fume hood (“Ventalert”)
- emergency shutoffs for electrical power and laboratory services located for ready access by room occupants and emergency personnel
- electric lock with a swipe card access to be installed on the main door, side entry door (for deliveries from the Preparation Room), and door from the Lab Tech Station. All other doors will be for emergencies only. Three card access points in total.
- all doors to have an "intrusion detection" alarm integrated into the door access system. The selected system must have an "autodial" feature to call the Campus Police emergency telephone number 905-569-4333.

ROOM SPECIFICATION SHEET
UTM Teaching Laboratories

SECTION A:

ROOM NAME: **Laboratory Technician Station**

Room Area (NASM): **18.7** **No. Rooms:** **1**
Total NASM: **18.7**

SECTION B:

A. Space Purpose and Type of Activity:
Space for laboratory technicians to sit while monitoring ongoing laboratories. Space to store and access lab manuals, student lists, print lab updates, etc.

B. Number of Occupants, Resident:

None

C. Number of Occupants, Transient:

Up to 3 teaching staff.

G. Furniture and Equipment, Fixed:
- o laboratory grade work surface
- o 3 stations min 6ft per person
- o 2 pedestal storage units per station (6 in total)
- o 4ft wide tall cabinet to store electrical equipment

H. Furniture and Equipment, Moveable:
Existing: none

New: 8 – 48” tall and 36” wide bookshelves 12” deep
3 task chairs

SECTION C:

I. Lighting Requirements:

- o energy efficient overhead fixtures
- o large windows along both sides of the room (minimum 5m of tall glass panels 1.2m above floor)

J. Power & Data Requirements:

- o four standard (110V/15A) duplex outlets
- o four data outlets
- o one phone outlet
- o connection to all and control of all presentation areas

K. Building Services Requirements:

See section N. Plumbing.

L. Special Systems:

- o none specified

M. HVAC:

- o thermostat for the laboratory technician station
- o HVAC system should not produce any annoying background noise or vibration
- o system should ensure that odors do not migrate outside the room (especially into corridor)

N. Plumbing:

- o none specified

O. Special Finishes:

- o wall, ceiling & cabinet finishes must be stain resistant, durable and readily maintained

P. Special Requirements & Other Considerations:

- o none specified

Q. Safety & Security Considerations:

- o lockable entry doors

ROOM SPECIFICATION SHEET
UTM Teaching Laboratories

SECTION A:

ROOM NAME: Laboratory Technician Offices

Room Area (NASM): 39.52nasm **No. Rooms: 1**
Total NASM: 39.52nasm

SECTION B:

A. Space Purpose and Type of Activity:
Office space for laboratory technicians to perform their administrative duties.

B. Number of Occupants, Resident:

Five.

C. Number of Occupants, Transient:

Up to three.

G. Furniture and Equipment, Fixed:
o 5 coat hooks

H. Furniture and Equipment, Moveable:
Existing: 2 Bookshelves

New: 5 task chairs
5 workstations
Moveable partitions to provide privacy between desks

SECTION C:

I. Lighting Requirements:
- o energy efficient overhead fixtures

J. Power & Data Requirements:
- o five standard (110V/15A) duplex outlets
- o five data outlets
- o five phone outlets

K. Building Services Requirements:
- o as exist

L. Special Systems:
- o none specified

M. HVAC:
- o thermostat for the room
- o HVAC system should not produce any annoying background noise or vibration

N. Plumbing:
- o as exist

O. Special Finishes:
- o none

P. Special Requirements & Other Considerations:
- o none specified

Q. Safety & Security Considerations:
- o lockable entry doors

APPENDIX E:

TOTAL PROJECT COST

University of Toronto Mississauga		PROJ NUMBER: 2009-10-23 (Incl 2008-09-46 $)	PROJECT MANAGER: Del Taylor		
Draft #1	Gross Floor Area 10,160 sq ft	PROJ NAME: Undergrad Teaching Labs	FUNDING SOURCE:		
	Net Floor Area 9,900 sq ft				
Number	**Item**	**Remarks**	**Base Cost**	**GST (1.65%)**	**Cost**
CONSTRUCTION					
835730	Construction: Main Contract	UTM Pre Tender Budget 020509	$2,695,000	$44,468	$2,739,468
835752	Construction: Other Contract		$0	$0	$0
835754	Secondary Effects	**Lunch Rm Reno 6.5K & Tec Relocate 1K Allow**	**$7,500**	$124	$7,624
835757	Construction Contingency	**15.0%**	**$404,250**	$6,670	$410,920
835762	Hazardous Waste Removal	Incl	$0	$0	$0
835765	Demolition Services	Incl	$0	$0	$0
835768	Site Preparation		$0	$0	$0
				Total Construction	*$3,158,011*
LANDSCAPING					
835755	Landscaping Services		$0	$0	$0
				Total Landscaping	*$0*
PERMITS, INSURANCE					
835400	Licences / Permits	Bldg Permit	$7,000	$116	$7,116
836700	Insurance		$0	$0	$0
				Total Permits, Insurance	*$7,116*
PROFESSIONAL FEES					
835200	Consulting	Arch/Mech/Elec (12% x $2,695,000)	$323,400	$5,336	$328,736
835201	Consultants: Disbursements		$4,200	$69	$4,269
835204	Construction Management Fees	**Arch/Mech/Elec 1% Total Construction**	**$30,134**	$497	$30,631
835206	Other Consultants	Report-Asbestos $13,000+ **Siemen HVAC$50000**	**$63,000**	$1,040	$64,040
835210	Legal Services		$0	$0	$0
835721	External Project Manager		$0	$0	$0
895720	Design Fees: In House		$0	$0	$0
895721	Design: Disbursements	e.g. Meals, parking, mileage, printing	$0	$0	$0
835723	Project Disbursements	e.g. Meals, parking, mileage, printing	$0	$0	$0
895725	Project Management: Fees	3.5%	$121,263	$0	$121,263
				Total Professional Fees	*$548,939*
SERVICES TO SITE					
835700	Site Services and Infrastructure	e.g. City charges	$0	$0	$0
				Total Site Services	*$0*
COMPUTER WIRING AND TELEPHONES					
821110	Equipment: Computing: Purchase	Computing & Network Services	$10,000	$965	$10,965
835010	Telephone Line Service	Tel /Data	$26,500	$2,557	$29,057
				Total Computer Wiring & Telephones	*$40,022*
MOVING AND STAGING					
837100	Moving	**Furniture$10K & Lab 3066 Equip Re & Re10K**	**$20,000**	$330	$20,330
837101	Staging		$0	$0	$0
				Total Moving and Staging	*$20,330*
FURNISHINGS AND EQUIPMENT					
820010	Furniture: Purchase	**188 Lab Stools & 3 chairs,@$320 + 8 Bookcase**	**$66,000**	$6,369	$72,369
821010	Equipment: Purchase	**4 Oven, 4 Ice Mach,4 Fridge Allow**	$40,000	$3,860	$43,860
821510	Equipment: Audio / Visual: Purchase	Teaching AV System Allow	$150,000	$14,475	$164,475
821610	Equipment: Research: Purchase	PST is not applicable & **Ventalert Alarm 43x450**	**$19,400**	$1,872	$21,272
				Total Furnishings and Equipment	*$301,976*
OTHERS					
820011	Interior Signage: Purchase / Design		$0	$0	$0
821325	Security and Access Systems	**Key 5K & Card Access Systems 21K Allow**	**$26,000**	$429	$26,429
835070	Courier		$0	$0	$0
835756	Exterior Signage: Purchase / Design		$0	$0	$0
835764	Client Construction Expenses		$0	$0	$0
835766	Ceremonies	e.g. Ground breaking, top off, grand opening	$0	$0	$0
835900	Advertising / Marketing		$0	$0	$0
836430	Donor Recognition	e.g. Plaques	$0	$0	$0
890670	UTM Trades	Alarm Shutdowns Allow	$9,000	$0	$9,000
				Total Others	*$35,429*
				SUB TOTAL:	$4,111,823
PROJECT CONTINGENCY					
835758	Project Contingency	3.0%	$123,355	$2,035	$125,390
				Total Project Contingency	*$125,390*
FINANCE COSTS					
835305	Interest Charges		$0	$0	$0
				Total Finance Costs	*$0*
				TOTAL PROJECT COST:	**$4,237,213**

Project Management Fees		Recommended by: Del Taylor	Approved by:	Paull Goldsmith	$428.00/sq ftNet
$121,263		11/26/2009 16:52	Date:		

APPENDIX F:

ENVIRONMENTAL CHECKLIST

University of Toronto Environmental Protection Policy

PREAMBLE
The University of Toronto is committed to being a positive and creative force in the protection and enhancement of the local and global environment, through its teaching, research and administrative operations. Recognizing that some of its activities, because of their scale and scope, have significant effects on the environment, the University as an institution, and all members of the university community, have the responsibility to society to act in ways consistent with the following principles and objectives:

FUNDAMENTAL PRINCIPLES
• Minimization of negative impacts on the environment
• Conservation and wise use of natural resources
• Respect for bio-diversity **SPECIFIC OBJECTIVES**
In adopting these fundamental principles, the University will be guided by ethical attitudes towards natural spaces, and will take all reasonable steps to meet the following objectives:
• Minimize energy use, through efficient management and practice
• Minimize water use, through efficient management and practice
• Minimize waste generation through reduction, reuse and recycling
• Minimize polluting effluent and emissions into air, land and water
• Minimize noise and odour pollution• Minimize and where possible eliminate use of chemicals, including outdoor salt, pesticides herbicides and cleaning agents
• Include bio-diversity and environmental concerns in planning and landscape decisions
• Meet and where possible exceed environmental standards, regulations and guidelines

IMPLEMENTATION
To implement this Environmental Protection Policy:
• An Environmental Protection Advisory Committee (EPAC) will be established consisting of administrative staff, academic staff and student groups, to be chaired by a member of the University's academic staff. The Committee will provide advice to the Assistant Vice-President, Operations and Services, on programs to meet the environmental protection objectives. Membership of the committee will be made known to the community to ensure that new and existing initiatives are brought forward for consideration. The meetings of EPAC will be open.
• Facilities and Services, through the Waste Management Department will facilitate the development, implementation and evaluation of environmental protection programs, and will liaise with the EPAC and all three campuses on the programs.
• In this role Facilities and Services will:
  • Regularly review university policies to ensure consistency with this policy;
  • Carry out appropriate environmental audits and pilot projects;
  • Undertake education and training programs to inform the University Community about this and how its members, both personally and collectively, can best meet the objectives set forth in it;
  • Inform all contractors, service operations and users of University facilities that they must comply with the requirements of the policy;
  • Annually issue a report concerning the University's impact on the environment, summarizing initiatives undertaken and identifying matters which require particular attention.

Approved by Business Board of the Governing Council on March 7, 1994.

Environmental Checklist for Users Committees (5/99)

1. General planning principles: Consideration of alternatives, Life cycle approach

2. Minimize Energy Use
   a) Thermal Energy: Heating, Cooling
   b) Lighting/Use of Natural Light
   c) Ventilation/Windows
   d) Machinery/Equipment
   e) Orientation of Building - effect on building energy needs
   f) Roof Design

3. Minimize Water Use (Maximize Reuse)
   a) Flushing
   b) Washing - hands and body
   c) Building Cleaning
   d) Drinking
   e) Experimental/Labs
   f) Equipment Cooling
   g) Outdoor Vegetation - choice and watering (see #4)

4. Utilization and Diversion of Rainwater
   a) Use of Roof Water
   b) Porous Pavements

5. Waste Management (offices, classrooms, food outlets, outdoors, construction/demolition)
   a) Reduction
   b) Reuse
   c) Recycling
   d) Treatment and Disposal - possible on campus

6. Effluent and Emmissions (reduce, reuse, recycle, dispose)
   a) Indoor (Air Toxicity, Noise, Odours, Ventilation)
   b) Outdoor Air - laboratory emissions
   c) Water - Hazardous Wastes
   d) Land

7. Reduce Harmful Chemicals
   a) Outdoor Salts
   b) Pesticides/Herbicides
   c) Cleaning Agents

8. Outdoor Environment
   a) Encourage Bio-diversity (encourage and protection of species)
   b) Landscaping/Shading - effect on building energy needs in summer and winter
   c) Use of outdoor space (e.g. rest areas, roof gardens)

9. Monitoring and Metering of Use of Resources and Wastes
   a) Water
   b) Electricity
   c) Heat
   d) Wastes

10. Visibility of Environmental Concerns
   a) Pilot Projects
   b) Posters/Displays

11. Material Choice (Use of endangered/exotic materials, off-gassing)
   a) Building Fabric
   b) Fixtures and Furnishings