



McGill



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Sustainability
Projects Fund

Laboratory sustainability initiative: recycling glass and plastic wastes from research and teaching laboratories

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Pilot-scale studies

- **To quantify** the amount of recyclable plastic and glass waste produced by labs.
- To promote a discussion on **recycling impacts** among McGill community.
- To **motivate students** to pursue sustainability initiatives on campus and appreciate their extent of impact.

Overview



Initial data collection to estimate generation rate of glass and plastic wastes

- Existing EHS chemical inventory data base
- Questionnaires from major labs
- Cost analysis and detailed design of bin number, volume and collection frequency
- Selection of places to install bins (16 labs, 5 departments)

Coordinating between different departments and people involved

- Waste management department, building managers, Department chairs, PIs, lab managers

Training of members of the labs covered by pilot project

Data acquisition (8 weeks)

Sharing the results with the faculties and stakeholder's.

Moving forward?

What could be recycled ?



- **Empty Glass and Plastic**
- containers of following chemicals:
 - Acids,
 - Alcohols - ethanol, methanol, isopropanol
 - Benzene, hexane, toluene, xylene
 - Ethers - Petroleum ether, diethyl ether
 - Aldehyde - Formaldehyde, glutaraldehyde
- **Falcon tubes** 15-50ml centrifuge tubes
- Plastic containers for solid chemicals
- **Pipette tip boxes and inserts**
- **Non-contaminated bottles** for cell-culture media
- Plastic bottles/tubes

How ?

- **Clear labels for waste collection** bins for plastic and glass wastes made and each bins were distinctively colored for better identification.
- Free of chemical, biological and radioactive contamination.
- **Triple rinsed**, dry (no liquid drips out when the container is inverted), and uncapped are dropped in their respective bins.



“No item in the box should be Bio-hazardous, Radioactive, or Toxic”

Sample posters from the project

Recycling Plastic and Glassware in research laboratory

"Non-hazardous Glass Disposal"



Clean and Triple rinsed containers only
NO BROKEN GLASS NO GARBAGE

Recycling Plastic and Glassware in research laboratory

"Non-hazardous Plastic Disposal"

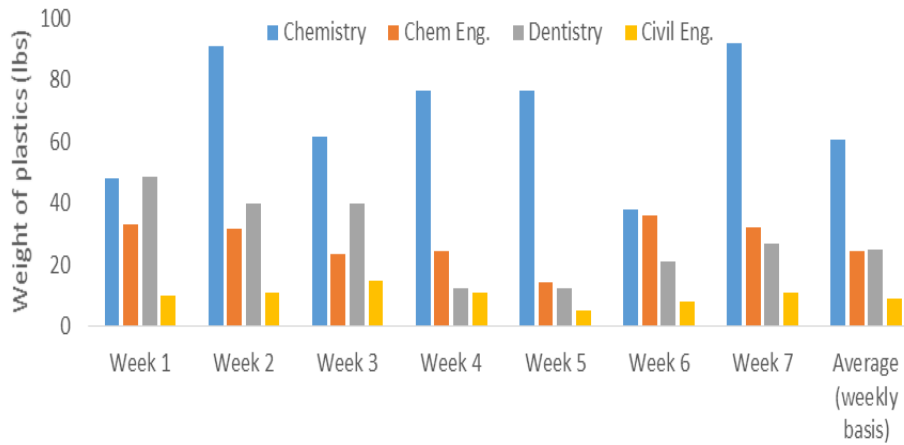


Clean and Triple rinsed containers only
NO GARBAGE NO GLOVE

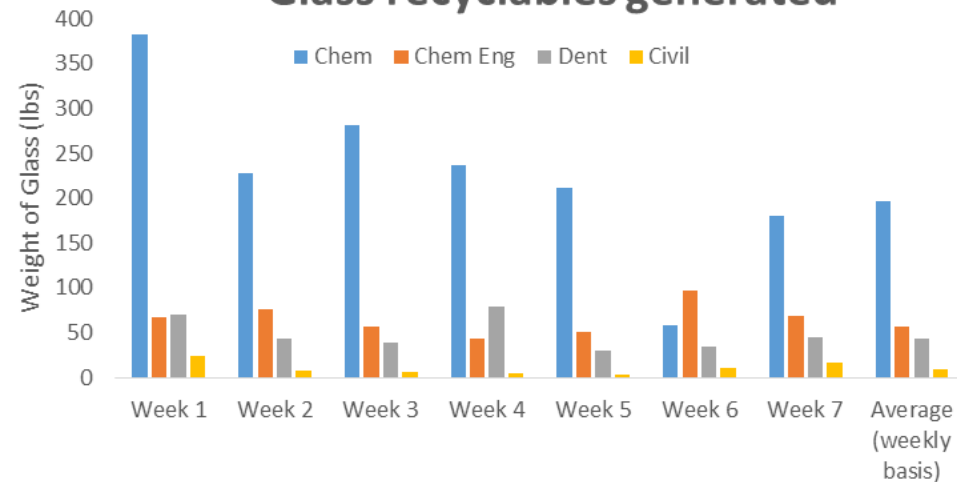
Recyclables generated



Plastic recyclables generated



Glass recyclables generated



- A weekly average of nearly **118 lbs. of plastic** and **305 lbs. of glass** in 16 monitored labs
- Depending on the location of bins few locations had more waste generated compared to the others.

Results from pilot-scale studies



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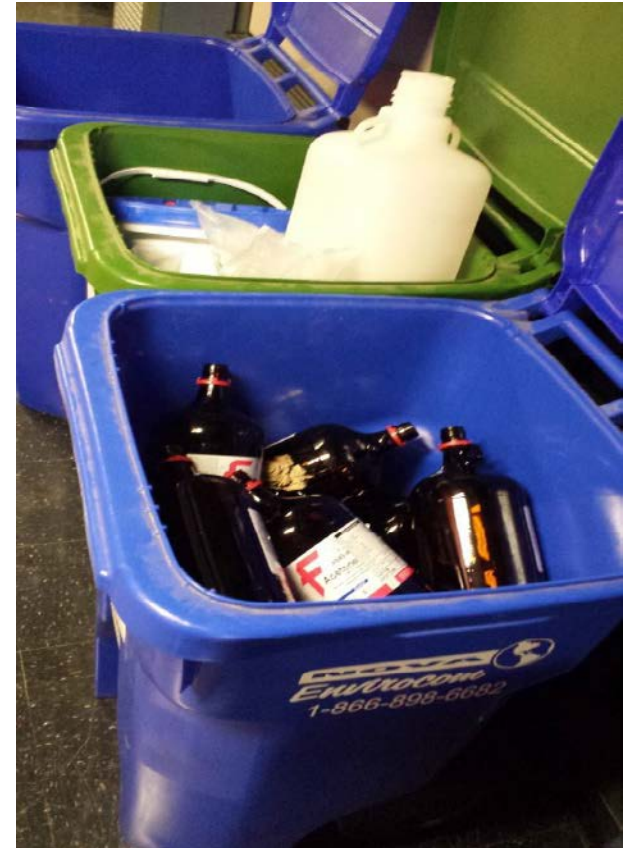
A rough estimate based on the total number of wet labs (~800) across campus would be

more than:

130 tons of plastic

360 tons of glass waste

could be recycled annually

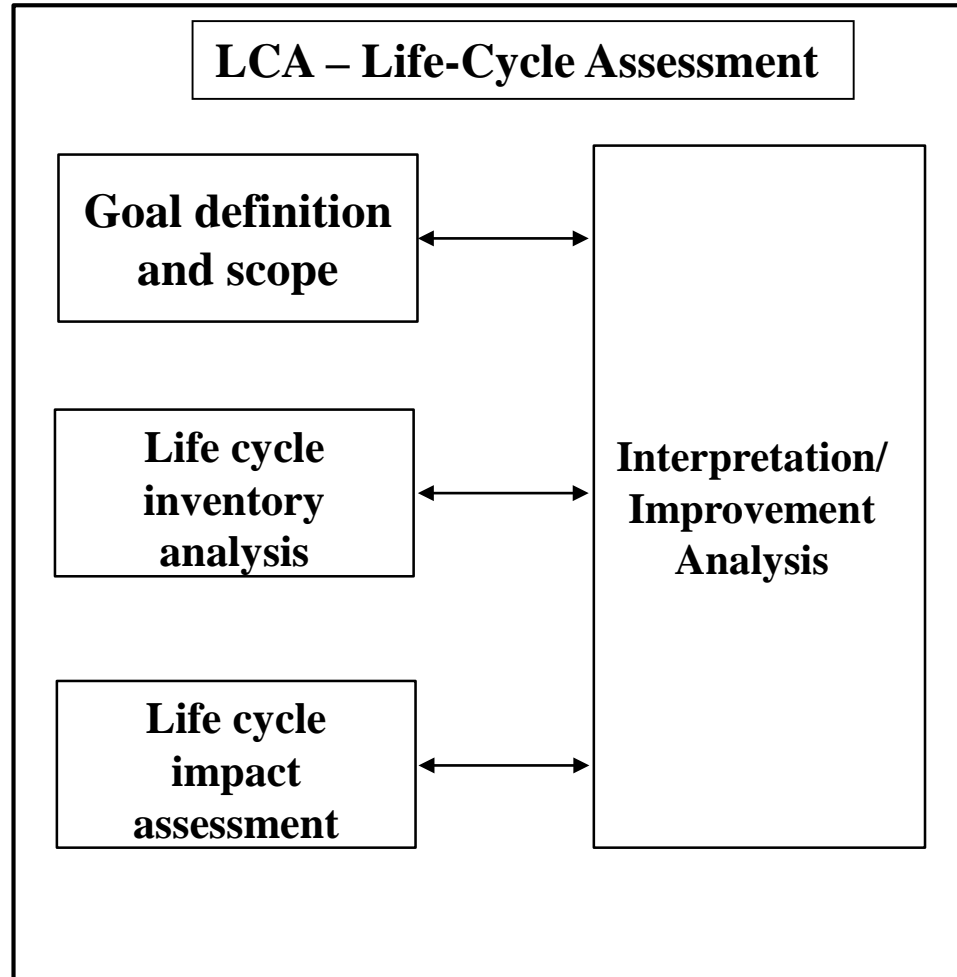


**McGill,
Chemical Engineering Department,
7th floor**

Future plans

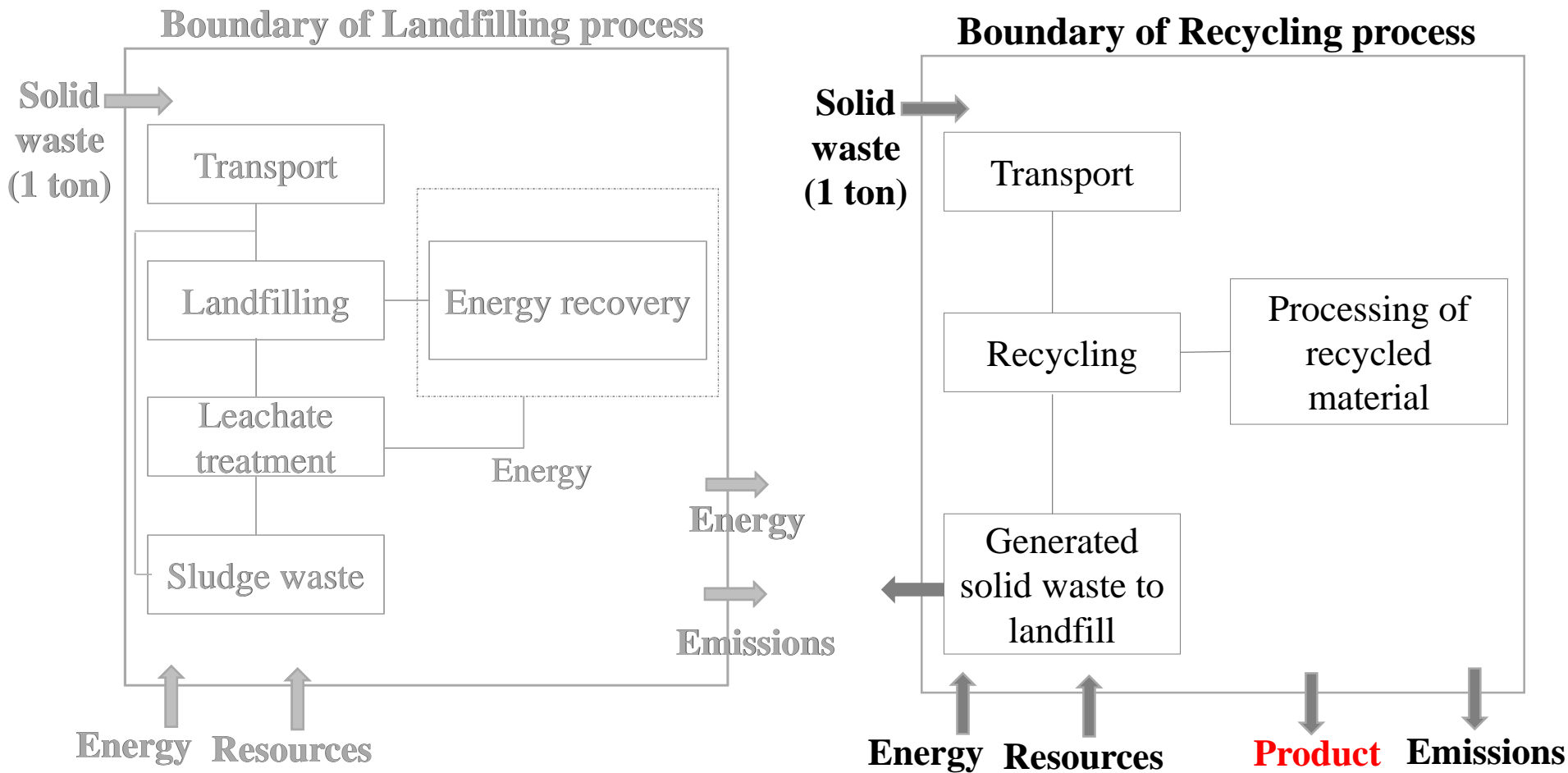
1. Presenting and **publicizing the results** from pilot scale study among, students and PI's (main lab users) and stake holders to increase the awareness, brainstorm and motivate for recycling glass and plastics.
2. Perform a **Life cycle assessment** and Life cycle impact assessment for assess the environmental benefit/burden, saving in carbon footprint associated with recycling process compared to alternate options.
3. **Marketing the collected materials** to a potential customer or original vendors (Fisher Scientific, Sigma etc.) to obtain a sustainable solution for plastic and glass recycling.
4. A through **campus wide implementation** for collection of plastic and glass recyclables across campus.

Life Cycle Assessment



Following the ISO 14040 Guidelines

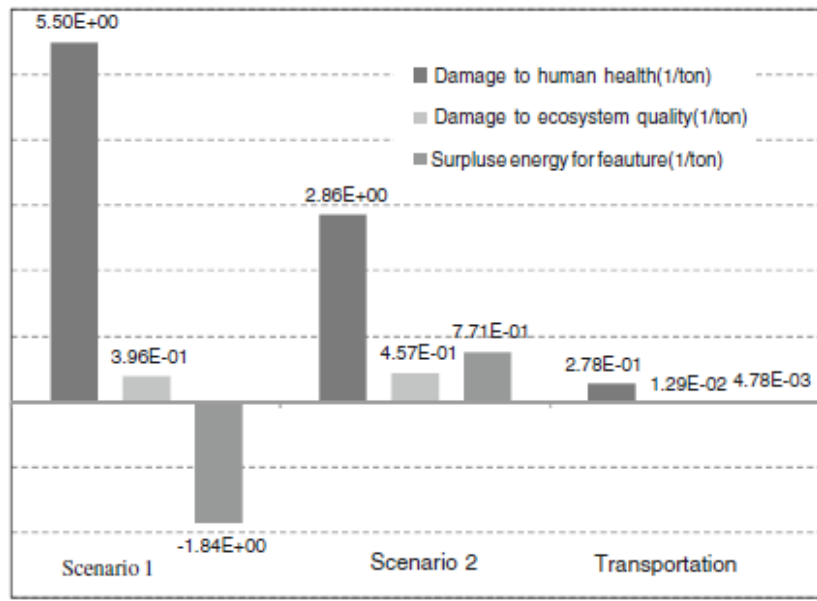
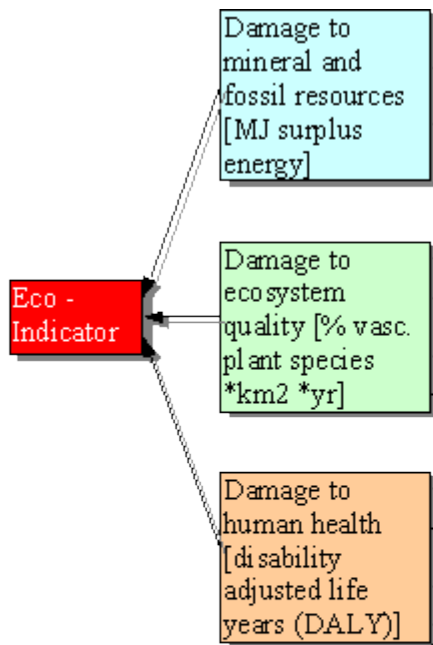
Process boundaries for Life Cycle Analysis



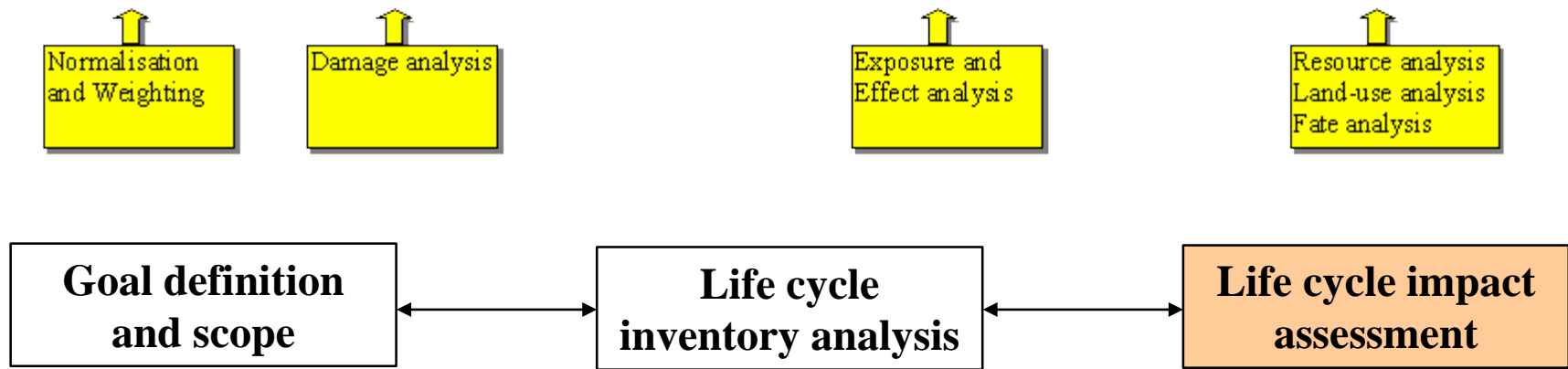
Akbari *et al.* (2011) *Environ. Monit. Assess.*



Eco- Indicator



Akbari *et al.* (2011) *Environ. Monit. Assess.*



Acknowledgments:



- The McGill Office of Sustainability and the Sustainability Projects Fund (SPF) personnel
- The members of the SPF Working Group
- Heena Kumra, Marx Ruiz-Wilson and Mohan Basnet graduate volunteers during the course of the project.

Stakeholders

- Waste Management Program
- Trottier Institute for Sustainability in Engineering and Design
- Environmental Health & Safety
- Facilities Development and Operations

Funding: Sustainability Projects Fund (SPF) – SPF 0131
McGill University

Challenges in waste collection:



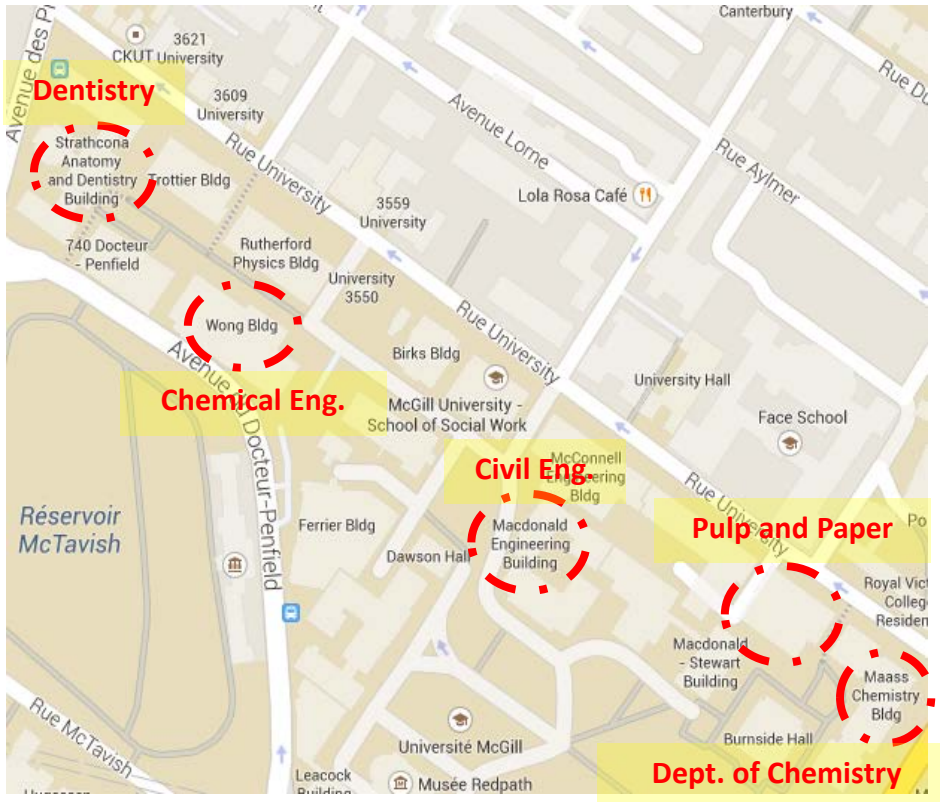
There were several challenges that we faced in different stages of the pilot scale projects.

- **Educate** students and advice facilities, lab managers & faculties.
- Behavioral change resistance
- **Ensuring the separation of hazardous and non-hazardous** waste from collection bins
- Sometimes **labeled recycle bins** were misplaced by custodial staffs. Therefore, permanent labels on the locations (i.e., walls) was necessary to keep bins in place.
- In the labs without paper and cartons recycling bins, cardboard and other recyclable paper was end up in plastic and glassware bins

Criterion

- According EHS, here at McGill with more than **800 wet labs** (labs that are using wet chemicals) accounting for thousands of individual chemical items in each lab annually (EHS, 2013).
- Labs were chosen to be **representative among each of the faculties** of Engineering, Science and Medicine.
 - **Active labs** were chosen based on the preliminary visits and information.
 - **Accessibility** was also another key selection criteria.
 - A **graduate representative** for the each departments were selected as a point of contact and to monitor the recycling facilities.

Locations for Pilot-scale studies



- 5 major departments at different labs (Science, Engineering and Medicine)
- 16 different locations for sampling and data acquisition

Map of Buildings participating in pilot recycling program

Weekly monitoring

PILOT PROJECT DATA COLLECTION			
Volunteer		DATE & TIME:	
Laboratory			
P.I (s)			
	Plastic		
Location	Weight (kg)	Total weight (kg)	Observations
Wang 1st floor			
Wang 4th floor			
Wang 5th floor			
Wang 6th floor			
Wang 7th floor			
Wang 1st floor			
Ground			
1st floor			
2nd floor			
Ottavness basement (1-4)			
Ottavness 2nd floor			
Ottavness 3rd floor (east)			
Ottavness 3rd floor (west)			
Ottavness 4th floor			
Pulp and paper basement			
Pulp and paper 2nd floor			
Pulp and paper 3rd floor			

Plastic waste generated

Location of the bins

Weight of each bins

Observations if any

	Glass Bin		
Item	Weight (kg)	Total weight (kg)	Observations
Wang 1st floor			
Wang 4th floor			
Wang 5th floor			
Wang 6th floor			
Wang 7th floor			
Wang 1st floor			
Ground			
1st floor			
2nd floor			
Ottavness basement (1-4)			
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Ottavness 3rd floor (east)			
Ottavness 3rd floor (west)			
Ottavness 4th floor			
Pulp and paper basement			
Pulp and paper 2nd floor			
Pulp and paper 3rd floor			

Glass waste generated



A projected value based on a conservative estimate from the total number of wet labs (~400) across campus would give us a whooping *~2000 lbs of plastic* and *~5300 lbs of glass* every week.

“This would be an enormous with over 100 tons of plastic and 275 tons of glass waste that could be recycled annually from these projects”

Recycling practices

- Implementing **recycling** of glass and plastic wastes generated from laboratories.
- **Non-contaminated** glass and plastic wastes are to be **placed in appropriate disposal containers**. But, not limited to test tubes, petri dishes, pipettes and pipette racks, boxes, trays, bottles and jars.
- Currently, these items are not accepted for recycling, partly out of concern that these materials may be hazardous.

Increase recycling practices and sustainability among McGill Community

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