

## Laboratory Sustainability Initiative: Recycling Glass and Plastic Wastes from Research and Teaching Laboratories

### Executive Summary:

McGill is one of the leading research-intensive universities in the world, with tons of plastic and glass waste discarded each year in research or teaching labs. Many of these items are singly-used prior to disposal (e.g. packaging, media bottles, solvent containers) and could readily be recycled if the proper infrastructure was in place. To estimate how much waste from labs could be recycled and the environmental and financial benefits that McGill would gain by implementing a non-hazardous laboratory plastic and glass waste recycling program, a month-long pilot recycling project was executed in several departments.

We monitored 16 of labs for plastic and glass waste (recyclables) for over a period of 8 weeks which were predominantly representing research labs. **A weekly average of nearly 118 lbs. of plastic and 305 lbs. of glass** recyclables was collected across 16 different locations for over a period of 8 weeks. The detailed results are for total plastic and glass waste collected for each week and weekly averages are reported in Table 2 and Table 3 respectively. Depending on the location of bins few locations have more waste generated compared to the other depending on various factors but not limited to (i) type of research, (ii) active research groups and (iii) research group size.

A projected value based on a conservative estimate from the total number of wet labs (~400) across campus would give us a whopping ~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.

### Pilot project:

As mentioned in the initial SPF proposal we picked several collection locations across 3 faculties and 5 different departments across McGill. After, prior assessment we decided on the list of locations for the pilot project (Table 1). The bins were provided to all labs before the start of the pilot project and recycling instructions were separately labelled and clearly marked for both plastic and glass recycle bins (Fig. 1 and 2).

A large sign with “Recycling Plastic and Glassware in research laboratory” was placed on the bins and adjacent to the bin location along with identified contact details of the departmental volunteer which has already been trained about project (Figure 1). Labs were instructed to put clean

glass and plastics e.g., pipette tips, 1.5 mL centrifuge tubes, and all the chemical bottles are triple rinsed and left uncapped. The custodial staff were given instructions to empty the bins once a week on a specific day of the week. This was to ensure that the amount of recycling wastes are measured prior to emptying of the bins. A picture of full bins are presented in Fig. 3. Items were weighed the day prior to pick up using a laboratory floor scale. Labs were also visited every week into the pilot project to ensure proper recycling procedures were being followed, and to get feedback from the users.

### **Challenges in waste collection:**

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

- Educate facilities, faculties, lab managers and students
- Behavioral resistance to change in some labs
- Ensuring the separation of hazardous and non-hazardous waste
- Sometimes labeled recycle bins were misplaced by custodial staffs. Therefore, permanent labels on the locations (i.e., walls) was necessary
- In the labs without paper and cartons recycling bins, cardboard and other recyclable paper was end up in plastic and glassware bins
- Allocated space for the bins were not readily accessible and portrayed in the labs

### **Future plans and recommendations:**

Based on the pilot scale studies and projected values of amount of plastic and glass wastes generated across several laboratories, we recommend the following steps toward campus-wide full implementation of the non-hazardous lab and glass waste collection in campus as below:

1. Perform a Life cycle assessment and Life cycle impact assessment for the amount of plastic and glass waste generated across the laboratories.
2. Marketing the collected materials to a potential customer to obtain a sustainable solution for plastic and glass recycling
3. A through campus wide implementation for collection of plastic and glass recyclables across campus.

**What would you have done differently?**

- Provide clearer instructions with respect to the recycling of glass and plastics.
  - Increase knowledge about proper disposal of glass and plastic wastes.
  - Instructions for bundling sharps and discarding them in small sealed boxes.
- Arrange for a larger brightly colored bins to distinguish between the traditional blue or green bins used for paper or recyclables.
- Provide more bins proximity to each lab, thus further encouraging them to use the recycling facility.
- Estimating a more realistic budget for the balance, so we could've provided one balance for each building. Having balance in each department would have helped us to cover more departments in our study.
- Consider hiring an undergraduate student to do literature survey and data mining for performing life cycle analysis for the proposed waste management practices.

**Continuing the project and recommendations towards next steps in moving forward:**

From the information gathered from our pilot scale project there are several key tasks that needs to be addressed a priori to a full-scale implementation including,

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 and motivate for recycling glass and plastics.
2. Brain storm among stake holders particularly lab manages, lab technician and PI's for developing specific instructions on identifying non-hazardous wastes.
3. In general, people are uncomfortable with change. A marketing strategy will also likely be necessary when a new program like this is rolled out, to educate users. So there needs to be a stronger emphasis and awareness among users for disposing the glass and plastic wastes for recycling. This could be achieved by integrating these practices as a part of WHIMS Training for Laboratory Personnel (Mandatory) –offered here in McGill.



4. Economic aspect for the recyclables generated, we need to identify a suitable local vendor for the glass and plastic recyclables collected thereby creating a new opportunity for revenue generation from recycling. This would further incentivise recycling practices.
5. A detailed projection of glass and plastic waste diverted from landfill upon implementing recycling program would further facilitate policy makers.
6. Lastly, planning and budgeting for the full-scale implementation of program based on the number of wet lab and accessibility of the bins in the proper location.

We believe that a supervision between SPF along with McGill facilities and key stakeholders including Environmental Health & Safety and Hazardous Waste Management.

#### **Team's experience with the SPF:**

With this project our team had an excellent opportunity to collaborate and learn waste management practices currently employed in one of the large institute such as McGill. During the course of our project several key stake holder's mainly SPF team members Krista Houser, Jameson Jones Doyle and Kim McGrath and offered their continuous mentorship, review and support through the entire process which facilitated for our success in a timely manner. The lessons learned tell us that we need to remember that people are the central part of any process and the ability continually learn and adapt for new challenges are key to success. Finally, we would like to thank SPF and McGill University for supporting this sustainability initiative in campus.

**Table 1: List of lab locations for pilot project**

Department	Building	Location*
Chemistry	Ottomass	1. Basement 2. Second floor 3. Third floor 4. Fourth floor
Pulp and paper	Pulp and paper	5. Basement 6. Second floor 7. Third floor
Civil Engineering	Macdonald Engineering Building	8. Fifth floor
Chemical Engineering	Wong Building	9. First floor 10. Fourth floor 11. Fifth floor 12. Sixth floor 13. Seventh floor
Dentistry	Strathcona Building	14. Second floor 15. Third floor 16. Fourth floor

\*each location had one bin for plastic and one bin for glass waste

**Table 2: weight of plastic waste generated each week (lb)**

Department	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Average (weekly basis) LBS
Chemistry	48	91	61.5	76.6	76.6	38	92	60.5
Chem. Eng.	33	31.5	23.5	24.5	14.5	36	32	24.4
Dentistry	48.5	40	40	12.5	12.2	21.2	27	25.2
Civil Engineering	10	11	15	11	5	8	11	8.8
<b>Total</b>	139.5	173.5	140	124.6	108.3	103.2	162	118.8

**Table 3: weight of glass waste generated each week (lb)**

Department	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Average (weekly basis) LBS
Chemistry	383	227.5	281	236.1	211	58.5	180	197.2
Chem. Eng.	66.5	75.5	56	43	50	96.5	69	57.1
Dentistry	70	44	38.5	78.5	30.5	34.7	44.5	42.5
Civil Eng.	24	7	6	5	3.5	10	17	9.1
<b>Total</b>	543.5	354	381.5	362.6	295	199.7	310.5	305.8

**Figure 1: SPF poster, with instructions and contact person information**



## Laboratory sustainable Initiative



### Recycling Plastic and Glassware in research laboratory

#### "Non-hazardous Glass Disposal"



**Clean and Triple rinsed containers only**  
**NO BROKEN GLASS NO GARBAGE**

Fragile glassware pack them in small cardboard boxes or discard in broken glass

#### "Non-hazardous Plastic Disposal"



**Clean and Triple rinsed containers only**  
**NO GARBAGE NO GLOVE**

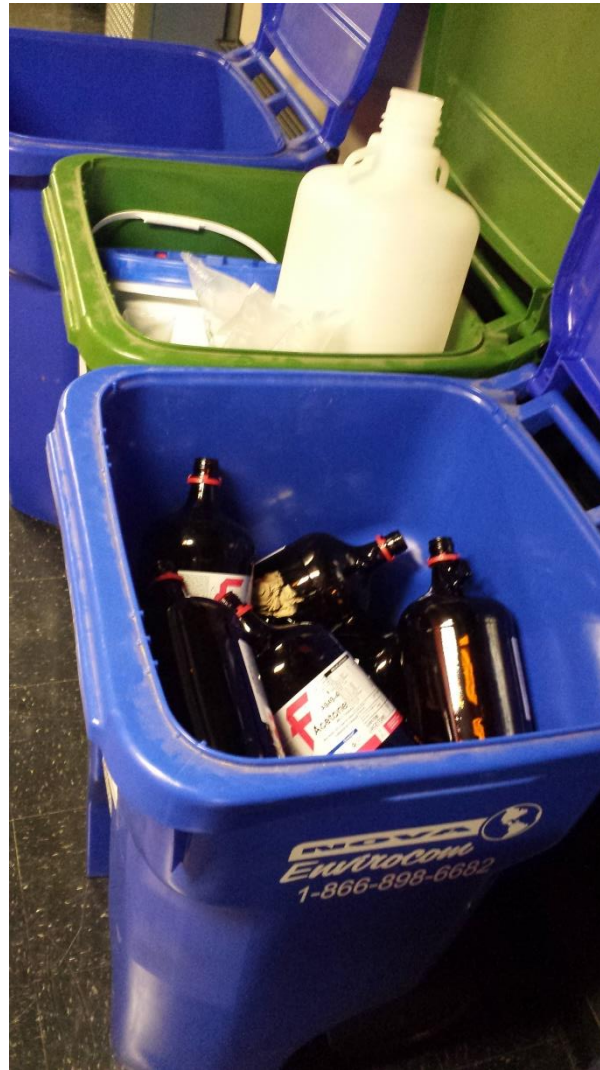
Summer & Fall - 2014  
Project information: Sai Chandrasekar  
sai.chandrasekar@mail.mcgill.ca

<http://www.mcgill.ca/sustainability/laboratory-sustainability-initiative-sp0131>

**Figure 2: Bin installation for plastic and glass bins**



**Figure 3: Plastic and glass recycle bins in use.**



Location: Chemical Engineering Department 7th floor



**What would you have done differently?**

- Provide clearer instructions with respect to the recycling of glass and plastics.
  - Increase knowledge about proper disposal of glass and plastic wastes.
  - Instructions for bundling sharps and discarding them in small sealed boxes.
- Arrange for a larger brightly colored bins to distinguish between the traditional blue or green bins used for paper or recyclables.
- Provide more bins proximity to each lab, thus further encouraging them to use the recycling facility.
- Estimating a more realistic budget for the balance, so we could've provided one balance for each building. Having balance in each department would have helped us to cover more departments in our study.
- Consider hiring an undergraduate student to do literature survey and data mining for performing life cycle analysis for the proposed waste management practices.

**Continuing the project and recommendations towards next steps in moving forward:**

From the information gathered from our pilot scale project there are several key tasks that needs to be addressed a priori to a full-scale implementation including,

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 and motivate for recycling glass and plastics.
2. Brain storm among stake holders particularly lab manages, lab technician and PI's for developing specific instructions on identifying non-hazardous wastes.
3. In general, people are uncomfortable with change. A marketing strategy will also likely be necessary when a new program like this is rolled out, to educate users. So there needs to be a stronger emphasis and awareness among users for disposing the glass and plastic wastes for recycling. This could be achieved by integrating these practices as a part of WHIMS Training for Laboratory Personnel (Mandatory) –offered here in McGill.



4. Economic aspect for the recyclables generated, we need to identify a suitable local vendor for the glass and plastic recyclables collected thereby creating a new opportunity for revenue generation from recycling. This would further incentivise recycling practices.
5. A detailed projection of glass and plastic waste diverted from landfill upon implementing recycling program would further facilitate policy makers.
6. Lastly, planning and budgeting for the full-scale implementation of program based on the number of wet lab and accessibility of the bins in the proper location.

We believe that a supervision between SPF along with McGill facilities and key stakeholders including Environmental Health & Safety and Hazardous Waste Management.

**Team's experience with the SPF:**

With this project our team had an excellent opportunity to collaborate and learn waste management practices currently employed in one of the large institute such as McGill. During the course of our project several key stake holder's mainly SPF team members Krista Houser, Jameson Jones Doyle and Kim McGrath and offered their continuous mentorship, review and support through the entire process which facilitated for our success in a timely manner. The lessons learned tell us that we need to remember that people are the central part of any process and the ability continually learn and adapt for new challenges are key to success. Finally, we would like to thank SPF and McGill University for supporting this sustainability initiative in campus.