

**An Investigation Into Cigarette Butt Disposal**  
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**APSC 262**  
**May 04, 2015**

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# An Investigation Into Cigarette Butt Disposal

Submitted to Dr. Naoko Ellis  
By Kevan Côté, Kai Hsieh, Graeme Rennie, and Alex Tang



Discarded cigarette butts are an environmental hazard  
Source: <http://mixstuff.ru/wp-content/uploads/2015/01/recycle-green-bird-cigarette-02.jpg>

University of British Columbia  
APSC 262: Technology and Society II  
April 9, 2015

**ABSTRACT**

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By Kevan Côté, Kai Hsieh, Graeme Rennie, and Alex Tang

Cigarette butts\* are the most commonly littered item worldwide and the University of British Columbia’s Vancouver campus is no exception. Through a survey of the campus, it was found that there are far more smoking “hot spots”\* where cigarette litter is concentrated, than there are available smoking receptacles for proper disposal. In addition to the lack of receptacles, many smokers don’t believe cigarette butts to be litter, which also attributes to the littering problem. This led to the investigation of three alternatives for mitigating the problem: recycling, incineration\* and status quo. A triple bottom line\* analysis was used to compare the positive and negative impacts of each alternative, and it was found that none of them really outperformed the others. The end result was to recommend the status quo option with some minor changes to target the smoker’s behavior. Introducing more effective receptacles and signs to communicate to smokers that cigarette butts are litter, will be a good, cost efficient, start towards a cigarette litter free campus.

\*Terms located in glossary

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**GLOSSARY**

<i>Cigarette Butt</i>	The portion of the cigarette left unburned after a smoker has used it
<i>CO<sub>2</sub></i>	Carbon Dioxide
<i>Incineration</i>	Burning of material to dispose of waste and in some cases create energy
<i>Hot Spots</i>	Areas where cigarette litter has piled up and become very visible
<i>NO<sub>x</sub></i>	Oxides of Nitrogen that are considered pollutants
<i>TerraCycle</i>	A recycling company based out of New Jersey that is capable of recycling cigarette butts and turning the product into plastics and compost
<i>TBL</i>	Triple Bottom Line
<i>VOC</i>	Volatile Organic Chemical

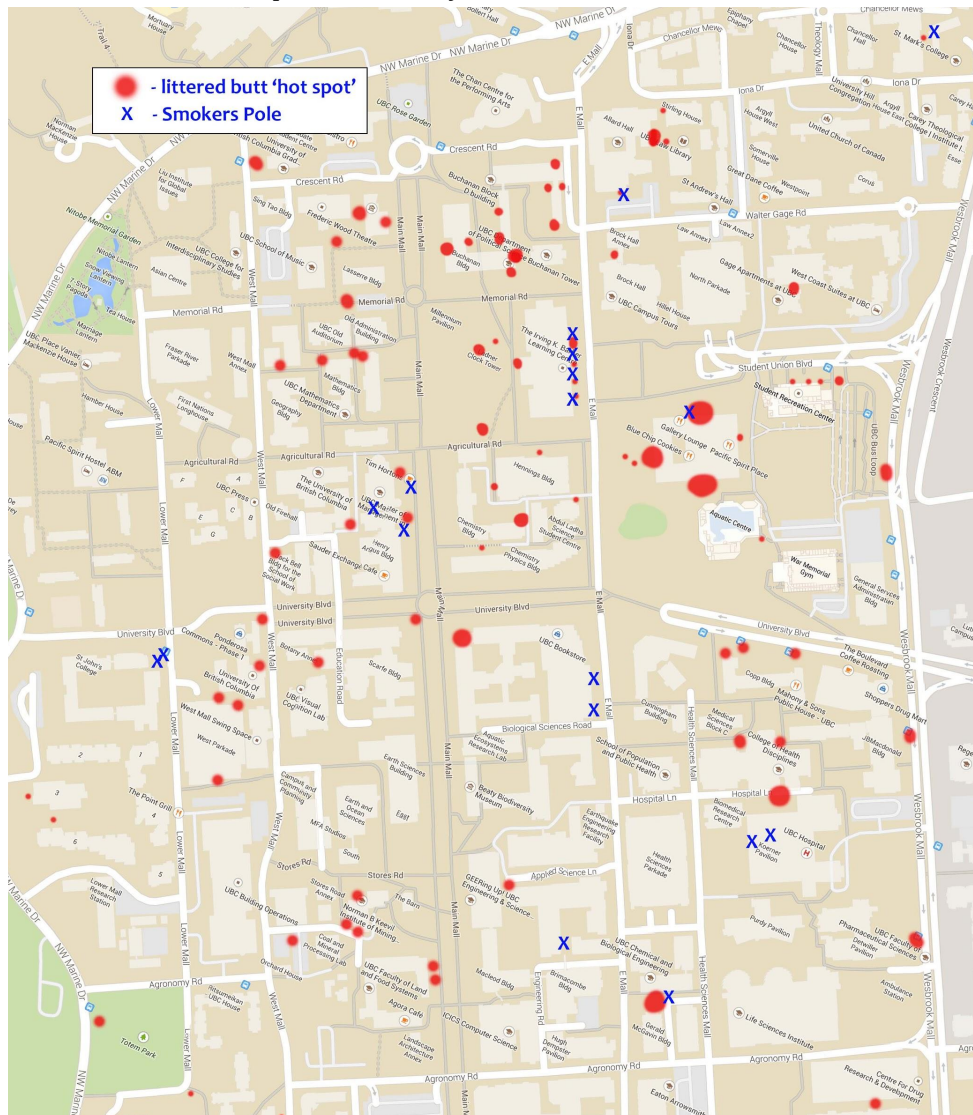
## **1.0 INTRODUCTION**

We were approached by the UBC SEEDS program in hopes of finding a solution to reducing cigarette litter on the UBC campus. In this report we investigate the effects of cigarette butt litter on the environment through investigative research. Our research begins with an analysis of the problem and a survey of the campus specifically looking for hot spots, or areas where large amounts of cigarette litter were found, as well as cigarette disposal posts or ashtrays. These results were mapped and patterns were observed to obtain a correlation between butt litter and location. We next take a triple bottom line approach in looking at the environmental, social, as well as economic impacts of alternatives to the current campus system for dealing with the litter, such as the disposing or recycling of cigarette butts. The alternatives being compared are the do nothing approach where the situation is left as is, the recycling approach through a company such as Terracycle\* and the incineration approach. Finally we will make recommendations based on our triple bottom line analysis.

\*Terms located in glossary

## 2.0 IMPACTS ON CAMPUS

Cigarette butts are by far the most commonly littered item in the world, with approximately 4.5 trillion littered every year, and an estimated 845,000 tons of butts end up as litter worldwide each year (Novotny, 2009). University of British Columbia's Vancouver Campus is no exception. There is a large amount of cigarette butts littered around campus as well as many areas where there are large amounts of cigarette butts. Areas with between fifteen and several hundred littered butts are classified here as "hot spots"\*. The following map, Figure 1, shows the hot spots and smoking poles we found on campus on Monday, March 23, 2015.



**Figure 1: Hot Spots and Smoking Poles on Campus**

These butts left on the ground cause negative impacts on the campus such as being visually unpleasant and leaching toxins into the ground. The locations of hotspots are often within one to six meters of a doorway and commonly under an overhang or other rain protection. Although the number of butts littered on UBC's campus is small in comparison to the worldwide 845,000 tons, the negative impacts still build up (Novotny, 2009). The negative impacts are categorized here into three major categories: ecological, social, and environmental.

\*Terms located in glossary



## 2.1 ECOLOGICAL

Cigarette butts generally consist of three parts: remaining unsmoked or partially smoked tobacco, the paper wrap, and if it was a filtered cigarette, as about 99% of manufactured cigarettes are, the filter (Barnes, 2011).

The filter, being the most visually obvious concern of a littered cigarette butt, presents an ecological challenge because it does not biodegrade. Cigarette filters are made out of cellulose acetate, a thermoplastic polymer that never completely decomposes. Given ideal exposure to ultraviolet rays the acetate will eventually photodegrade into smaller pieces that will become diluted into the water or soil but never completely disappear (Novotny, 2009). This slow decomposition causes plastic residue and other toxic substances to leach from the filter and tobacco residue into soil and waterways (Barnes, 2011).

Used cigarette butts also provide health concerns for all manner of living species. There has been reports showing the adverse health effects for birds, who occasionally use cigarette butts in nest building (Montserrat, 2012), fish, who must live with all the cigarette butts that are washed into rivers and oceans from streets (Slaughter, 2015), and dogs that ingest cigarette butts (Hackendahl, 2004). A report by the Rhode Island Department of Health even found 146 cases of children under the age of six ingesting cigarette butts, approximately 30% then showing signs of nicotine toxicity (Center for Disease Control and Prevention, 1997).

Leaching chemicals into the ground, potentially harming our plants, animals, and even children are serious environmental concerns that must not be overlooked. A common attitude is the one that a single cigarette butt won't make a difference but it is quite clear that the effects add up and the number that is currently littered is unacceptable.

## 2.2 SOCIAL

The social impacts of cigarette butts on campus are largely aesthetic. Butts accumulate in the hot spots identified above as well as being scattered all around campus. The scattering of butts in planters, as shown in Figure 2, and on paths degrades the natural beauty of campus while the accumulation of large amounts of cigarette butts in certain areas makes them unpleasant to spend time in, Figure 3.



**Figure 2: Butts in Planters**



**Figure 3: Butts in a Hot Spot**

The littering of cigarette butts on campus is also likely a source of contention between the non-smoking and smoking populations. Because most non-smokers dislike the appearance of the butts as litter and believe that smokers are the cause, there is a bias against all smokers even if some do not litter at all.

### **2.3 ECONOMIC**

The city of San Francisco estimates it spends more than \$7 million annually on cigarette butt litter cleanup (Cigarette Butt Pollution Project, 2013). Though the number of cigarette butts on campus is considerably less than that of an entire city of over 800,000 people, the cost will still be relevant. UBC spends money on sweeping and cleaning campus that could certainly be cut down if there was less cigarette butt litter or the litter was distributed into receptacles for easier collection.

### 3.0 EFFECTIVENESS OF STRATEGIES ON CAMPUS

Presented here, in order to best understand what steps to take next in overcoming the issue of cigarette butt litter on campus, is an overview of what has been done in that past and how campus currently deals with this issue. The current strategy for dealing with cigarette butt litter on campus consists of two main parts: provided smoking poles and sweeping up discarded butts.

#### 3.1 PROVIDED SMOKING POLES

Currently there are approximately 18 smoking poles and ashtrays on campus. Though this may seem like a reasonable number, the current smoking poles face several challenges.

Firstly the poles are too few in number and not placed in ideal locations. We identified over 60 litter hot spots that were not within a reasonable walking distance, 15 to 20 meters, of a smoker's pole or ashtray. The poles that were identified were on average in areas that needed them. However there were some areas, outside the U.B.C. bookstore for example, that have more smoking poles than are necessary.

Secondly they aren't emptied frequently enough. Figure 4 shows the only smokers pole at the perimeter of the student union building, the area with the most littered butts we identified on campus. The pole is clearly too full to be used and has likely not been emptied in a long time. Also when we returned several weeks later it was in the exact same state.



**Figure 4: Overflowing Smokers Pole**

Lastly the poles that are provided simply are not used enough. Outside of the Irving K. Barber Learning center there are four smoking poles near benches that commonly see a lot of smoking. However the areas around these poles are still an issue as there is a minimum of ten littered cigarette butts within a three-meter radius of each pole. Possible reasons for this littering when proper disposal is so close by could include the smokers not thinking of their butts as dangerous litter or an apathetic or rebellious outlook. For example a study from four large cities across the United States found that 13.8% of smokers did not consider cigarette butts to be litter and 21.1% thought that the butts were biodegradable (Rath, 2012).

### **3.2 SWEEPING UP DISCARDED BUTTS**

UBC Building Operations Custodians sweep up cigarette butts within 8 meters of the front door of a building, and dispose of them with regular garbage. Cigarette bins and ashtrays outside of those areas are emptied by the Waste Management Crew, which is a different division of Building Operations (Wasylyshen, 2015). See Appendix A for details on our correspondence with UBC Building Operations. Though this is a partial solution to many of the aesthetic issues that littered cigarette butts present on campus it is not an adequate solution as it is nearly impossible to collect all of the littered butts and disposing of butts in the garbage is not perfectly sustainable.

Along with the hot spot areas of littered cigarette butts there is also a large amount of individual butts discarded across campus. This comes from smokers' tendencies to have a smoke while walking or driving and simply throw the butt wherever they are when they finish the cigarette. Some areas, like East Mall between Buchanan and the bookstore, often have as more than two or three littered cigarette butts every couple of meters. Efforts to sweep up cigarette butts are never completely successful because of this speckling of litter around the entire campus.

The disposal of swept up cigarette butts with regular garbage gets them off of the ground, such that they do not have direct negative environmental effects, however it ensures that the butts are not recycled or disposed of in a sustainable way.

### 4.0 POTENTIAL ALTERNATIVES

Based on our research, we compared and contrasted three alternatives and the impacts they will have on the environment, economy, and society. The three alternatives are recycling, incineration and status quo.

The recycling option would be using the TerraCycle program, where cigarette butts are converted into plastic products and cigarette compost. Terracycle does not explicitly outline their recycling process for cigarette butts. Further research also did not provide insight into their process as peer-reviewed articles and patents do not show their process. However, reports from cities that have looked into possibly implementing TerraCycle’s program allowed some insight into their processes and its pros and cons.

The incineration alternative would combine collected cigarette butts with typical municipal solid waste that would be combusted to generate electricity. This alternative could involve installing more cigarette receptacles, but the butts would not be taken to a recycling facility.

Lastly, the ‘do nothing’ alternative would be leaving the littering problem as is and evaluating the consequences of doing so.

These comparisons are relative and we found that there is a significant lack of research regarding cigarette butt toxicity and recycling processes.

### 4.1 ENVIRONMENTAL

To start with the Environmental aspects of the three options are described here in Table 1. Overall we found recycling to be the best option from an environmental perspective.

**Table 1: Comparing the Environmental Pros and Cons of Recycling, Doing Nothing and Incineration**

	POSITIVES	NEGATIVES
RECYCLING	<ul style="list-style-type: none"> <li>› Recycled cigarette butts are separated into tobacco, paper, and plastics. The tobacco and paper can be composted</li> <li>› The plastics from cigarette butts are recycled and made into plastic pellets</li> <li>› Increased use of recycled plastics</li> </ul>	<ul style="list-style-type: none"> <li>› Cigarette butts are collected, shipped to Toronto, and then shipped to New Jersey or Pennsylvania. According to Google Maps (2015), this trip is 3215 miles. According to the EPA (Office of Transportation and Air Quality, 2008) this is a carbon output of 7.7kg per journey, 29.5kg of NO<sub>x</sub>*, 1.5kg of HydroCarbons and 1.5kg of VOC’s*</li> <li>› Recycled plastics may be disposed in landfills</li> </ul>
DO NOTHING	<ul style="list-style-type: none"> <li>› No additional infrastructure setup</li> </ul>	<ul style="list-style-type: none"> <li>› Current pollution will build up</li> <li>› Overflowing cigarette receptacles are leaching toxins into the ground</li> <li>› Cigarettes will continue to get mixed with regular garbage</li> </ul>

\*Terms located in glossary

INCINERATION	<ul style="list-style-type: none"> <li>› Can reduce landfill volumes dramatically (Wastes - Waste Management for Homeland Security Incidents, 2014)</li> <li>› Incineration can be used to generate heat, producing waste-to-energy (WTE)</li> </ul>	<ul style="list-style-type: none"> <li>› Combustion produces large amounts of CO<sub>2</sub>* emissions (Hussain)</li> <li>› Waste needs to be transported to incinerators resulting in transportation emissions (Wastes - Waste Management for Homeland Security Incidents, 2014)</li> <li>› Requires many resources to operate (fuel, water, and limestone)</li> <li>› Different Incinerators accept different types of waste</li> <li>› Products of incineration waste can be extremely toxic (Duff, 2006)</li> </ul>
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## 4.2 SOCIAL

Next, in Table 2, we examine the social pros and cons of the three options. We found that socially both recycling and incinerating would be more beneficial than doing nothing.

**Table 2: Comparing the Social Pros and Cons of the Three Alternatives**

	POSITIVES	NEGATIVES
RECYCLING	<ul style="list-style-type: none"> <li>› Less cigarette litter due to more recycling pods</li> <li>› Seeing smokers recycling cigarettes could convince others to recycle as well</li> </ul>	<ul style="list-style-type: none"> <li>› Unintentional exposure to gamma radiation used in radiating plastic from butts (Meiszner, 2013)</li> <li>› Increased chance of driving accident when transporting cigarette butts</li> <li>› TerraCycle obtains a large portion of their funding from a major Canadian tobacco manufacturer (Imperial Tobacco Canada, 2013)</li> <li>› Recycling pods for cigarettes create smoking areas and an increased chance of passerby's encountering second-hand smoke (Bycraft, 2014)</li> </ul>
DO NOTHING	<ul style="list-style-type: none"> <li>› Will not change the image of "its okay to smoke on campus" (currently not seen as a large issue)</li> </ul>	<ul style="list-style-type: none"> <li>› Cigarette garbage is not currently recognized as a large problem (Rath, 2012)</li> <li>› Will not create recognition of the issue</li> </ul>
INCINERATION	<ul style="list-style-type: none"> <li>› Creates more jobs because cigarette butts would need to be sorted before being incinerated</li> </ul>	<ul style="list-style-type: none"> <li>› Incinerators can create smoke stacks which create concern in the public eye</li> <li>› Children residing near incinerators</li> </ul>

\*Terms located in glossary

	› Less cigarettes butts being littered on the ground	are more likely to be diagnosed with asthma (Hussain) › Noise pollution from the incineration process (Hussain)
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**4.3 ECONOMIC**

Lastly we examine the economic factors of the three options in Table 3. From the university's perspective the do nothing option is likely the most economical as none of the benefits from other options will be felt on campus.

**Table 3: Comparing the Economic Pros and Cons of the Three Alternatives**

	POSITIVES	NEGATIVES
RECYCLING	› Increases number of jobs	› TerraCycle is increasingly losing money (Yi, 2014)
DO NOTHING	› Will not take more money out of funds to continue the current clean up	› Costs to clean up cigarettes will not decrease over time
INCINERATION	› Can create more land space with less garbage volume (Wastes - Waste Management for Homeland Security Incidents, 2014) › Cigarette butts could be incinerated with most municipal solid waste (MSW)	› More expensive to operate than landfilling (Ecocycle, 2011) › WTE is very small relative to the needs of an average city (Ecocycle, 2011) › Selling of WTE would not recover the cost of investment in an incinerator (Ecocycle, 2011)

**4.4 COMPARISON**

After generating the pros and cons of each alternative, they were ranked together on the following charts, Figures 5, 6, and 7, to see how they performed relative to each other.

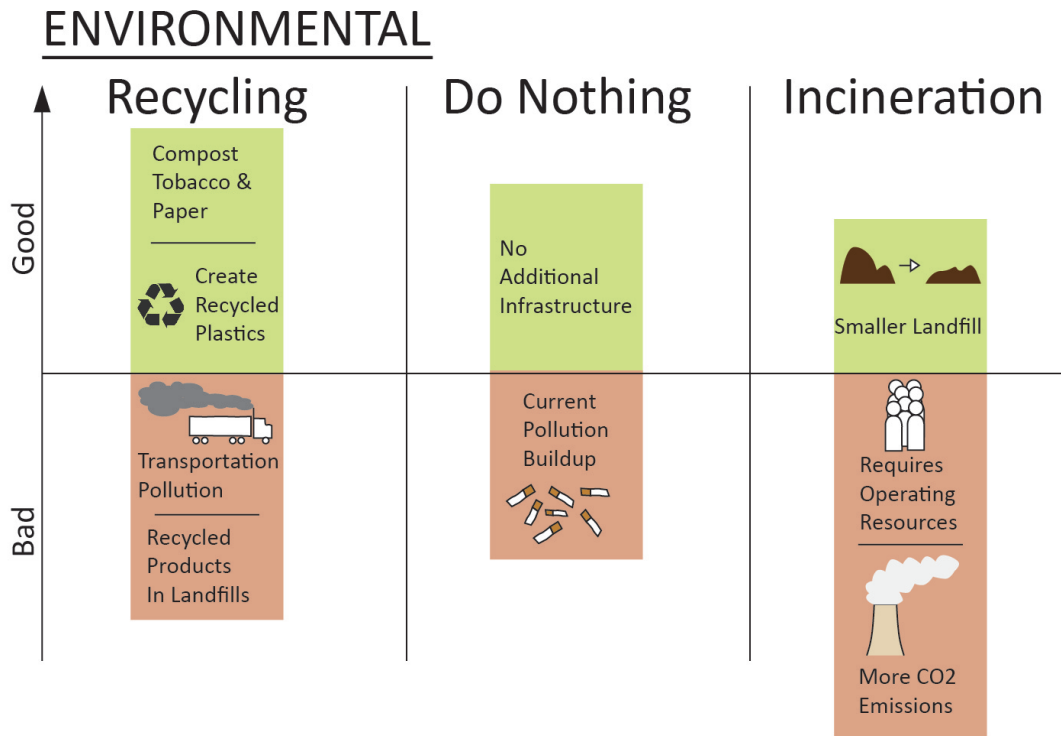


Figure 5: Environmental Analysis of Alternatives

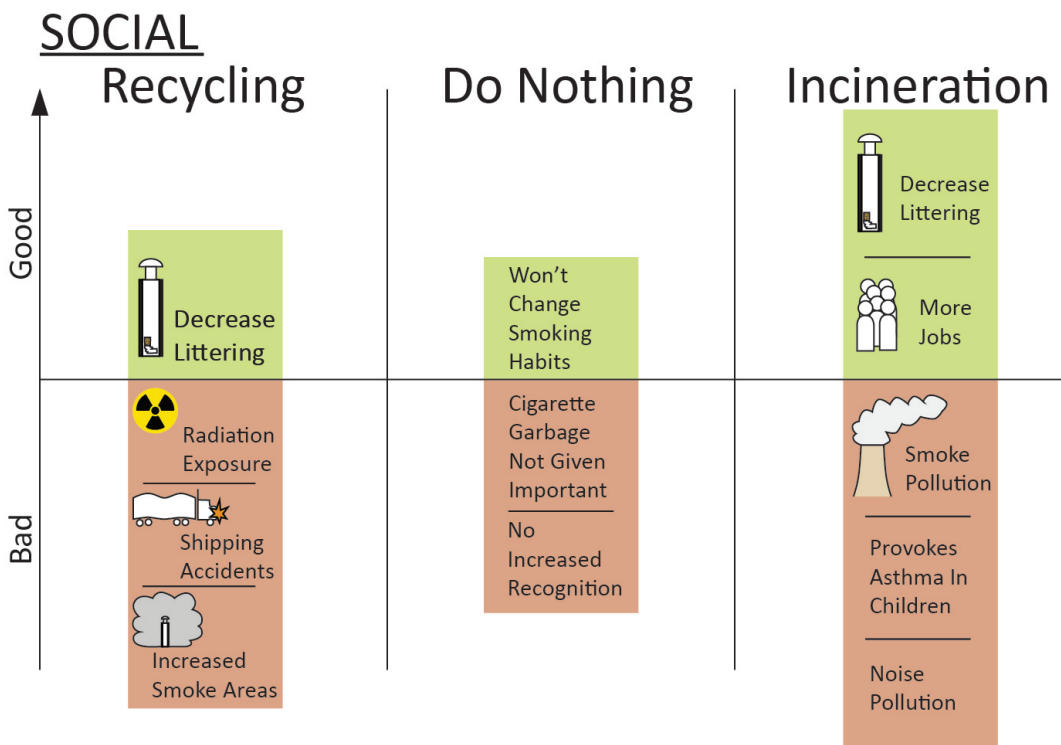


Figure 6: Social Analysis of Alternatives



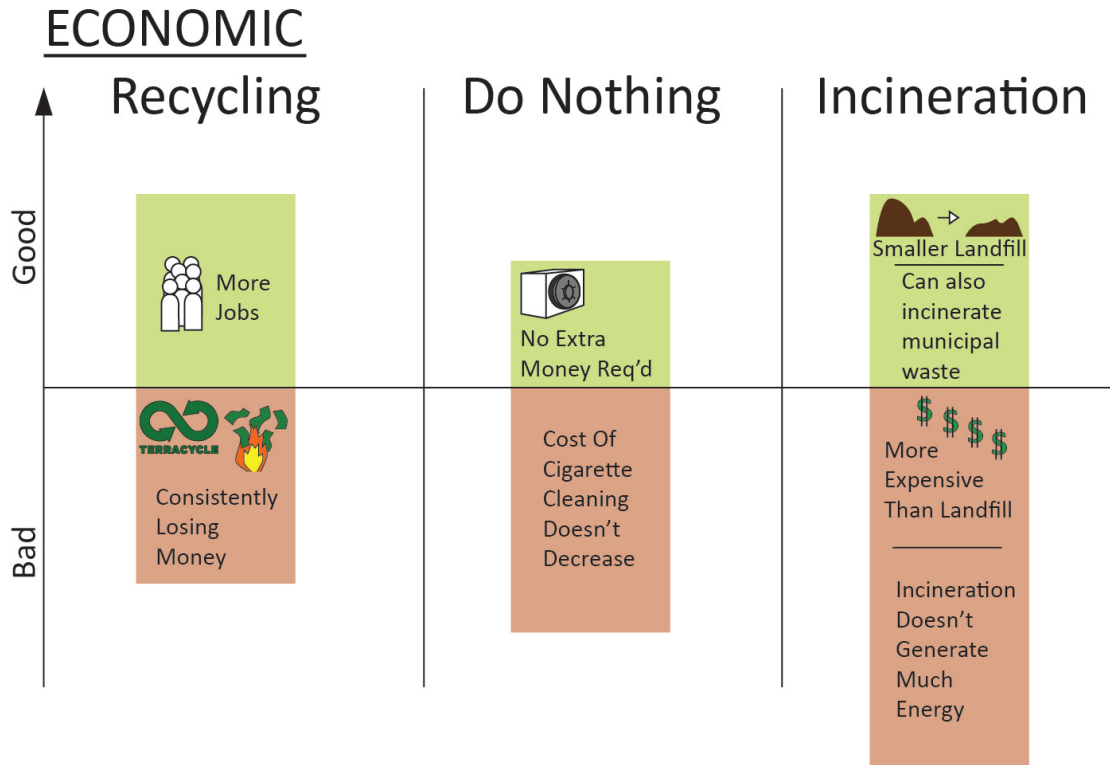


Figure 7: Economic Analysis of Alternatives

## **5.0 RECOMMENDATIONS AND CONCLUSIONS**

After examining the problem on campus, the current strategy of dealing with the issues, and the pros and cons of different options to solve the problem we present here our recommendations and conclusions.

### **5.1 RECOMMENDATIONS**

Upon review of our triple bottom line assessment we recommend better education for smokers on campus and better receptacles.

#### **5.1.1 Results from the TBL Analysis**

Using the triple bottom line method, it was concluded that there was no winning alternative. Incineration, while reducing the volume of cigarette butts in the trash system, had too many negatives regarding health and pollution. It would provoke asthma in children's respiratory systems and generate CO<sub>2</sub> as a result from the burning of plastics. TerraCycle, though well intentioned, is funded from a major tobacco manufacturer. TerraCycle also loses more money every quarter, and it has been rejected from the City of North Vancouver and the City of Richmond. The City of Richmond's report cited a letter from Vancouver Coastal Health, which stated that the organization did not approve of the TerraCycle program in Vancouver. Vancouver Coastal Health also stated that by increasing the number of smoking receptacles, it encouraged smoking and created larger areas where people would walk through clouds of cigarette smoke. The program also did not target the root of the problem: smoking. Instead of creating more infrastructure, Vancouver should push towards discouraging smoking. As of April 2015, the TerraCycle program has been drastically scaled down. Considering the state of TerraCycle in the lower mainland, we concluded that it was not worth pursuing. With the recycling and incineration of the table we are left with one option, however instead of "doing nothing" as our solution, we suggest "doing something."

We suggest modifying the infrastructure at UBC to target the social aspect of cigarette disposal. One study on littering of cigarette butts showed that people don't consider cigarette butts to be litter and think cigarette butts are biodegradable (Rath, 2012). We aim to reduce littering by first targeting these two ideas. Our second recommendation is to alter the design and location of the smoking poles to make them more visible to people and pleasant to the public. With our two recommendations we hope to impact cigarette butt littering on campus.

#### **5.1.2 Social Experiment**

In our research we found a social correlation between cigarette butt litter amount and location. The large hot spots of cigarette litter appeared to gather more cigarettes because there was already litter present. We believe that the image of cigarette litter creates a mental allowance for smokers to litter their butts in this area since there is already litter present. This concept creates very badly littered areas and does not easily allow for an elimination of the litter.

We recommend that two social experiments be conducted to see the effect of litter due to social changes. The first experiment we would like to conduct would be to put up signage such as the one proposed in Figure 8 around hot spots of litter and see if we notice a reduction in the cigarette litter. The signage would focus on the fact that cigarette butts are not biodegradable, as

this seems to be a very common misconception. The signage would also promote proper use of the cigarette disposal containers, which would help to keep the area clean.

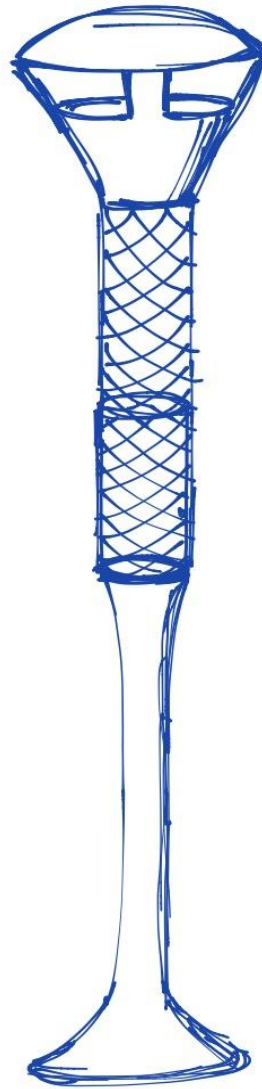
The second experiment we propose is a clean up of the hot spot areas. In order to test the social behaviour of piling up the cigarette butts we would clean up one or a few hot spots completely of cigarette butts and observe the litter build up over the following month.



Figure 8: Proposed Anti-Cigarette Littering Poster

### 5.1.3 Disposal Implementation

From the on campus research on the cigarette litter and disposal places shown in Section 2.0 above, it is evident that there is a large need for more smoking poles in order for people to properly dispose of their cigarette butts. We would recommend that poles be implemented where the larger hotspots are in order to reduce the majority of the litter. Another main issue is the design of the current smoker poles. We found many of the disposal stations were overfilled with cigarettes, filled with water or had other garbage stuffed inside that did not belong in them. Our proposed solution is to design a new disposal station to address some of these issues. A design is shown in Figure 9 for a smoking pole that addresses the main issues.



**Figure 9: Concept of Revised Pole**

A main feature of this pole is a covered top to prevent water from building up inside the pole. Examination of current smoking poles showed that water had infiltrated some poles, and chemicals had leached out and formed a ring around the smoking pole. This new design will keep the pole looking good during its life and stop chemicals from leaching into the surrounding environment. Another feature is an easily accessible container to collect the cigarette butts. This will make the collection much easier for the workers. One observation we made was that when there was a hotspot, the surrounding areas were not as littered with cigarette butts. Thus, a concentration of litter may provide a visual cue to throw cigarette butts in that location. With the new design the mesh provides a similar visual cue, allowing smokers to see a small pile of cigarettes within the pole. The final feature is that the exterior would have an attractive appearance to complement with the current architecture without blending into the background.

## 5.2 CONCLUSIONS

First impressions of the task led us to believe that implementing the TerraCycle program at UBC would be the most reasonable solution to the cigarette butt littering problem on campus. Under more scrutiny however, we concluded that TerraCycle should not be implemented. We also examined two more alternatives: the “Do Nothing” option and incineration. By running all options through a Triple Bottom Line analysis, it was found that there was no clear winner. Thus, we propose a “Do Something” option that targets the behaviour of smokers.

“Do Something” is still not a perfect option because more infrastructure may lead to larger smoking zones and increased chances of exposure to secondhand smoke. Also, it perpetuates the idea that smoking is okay, when there should be fewer people smoking. However, in an absence of the ability to end smoking this is the best option. To target smokers’ behaviour, we suggest a social experiment that has visual cues that tell smokers to not litter their cigarette butts. The other part of the “Do Something” option is to implement redesigned receptacles that prevent toxins from leaching and promotes proper disposal of cigarette butts through visual cues. Ultimately, infrastructure can only do so much; proper cigarette butt disposal will only occur when there is a social and behavioural shift.

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## Appendix A

Correspondence with Pamela Wasylyshen of the UBC Building Operations Custodial Services:



Alex Tang <alex.tang28@gmail.com>

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**RE: Cigarette Butt disposal**

1 message

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Wasylyshen, Pamela <pamela.wasylyshen@ubc.ca>  
To: "alex.tang28@gmail.com" <alex.tang28@gmail.com>  
Cc: Building Ops-Service Centre <servicecentre.buildingops@ubc.ca>

Thu, Mar 26, 2015 at 9:58 AM

Hi Alex,

Our custodial employees will empty the cigarette poles/ashtrays if they are within 8 meters of the front door of a building.

If they are outside of that area, say, in an open area or if it's a litter bin (big round bins with a slant for putting out ashtrays), then they are cleaned by the Waste Management Crew which is also a division of Building Operations.

Any other details I can provide you with, please let me know.

Thanks!

**Pamela Wasylyshen**

**Assistant Supervisor**

**Custodial Services - Building Operations**

The University of British Columbia, Vancouver Campus

2329 West Mall, Vancouver, BC V6T 1Z4

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