

**An Investigation into Green Laundry Products**  
**Dean Grimm, Jennifer Goodale, Lindsay Pistner**  
**University of British Columbia**  
**APSC 261**  
**November 28, 2013**

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# **An Investigation into Green Laundry Products**

Lindsay Pistner, Dean Grimm, Jennifer Goodale

**APSC 261: Technology and Society I**

Paul Winkelman

*Thursday, November 28<sup>th</sup>*

## **ABSTRACT**

Using laundry detergents that are not environmentally friendly can cause a buildup of toxic chemicals in wastewater. By using a local green brand of detergent, these chemicals can be avoided to improve UBC's water while providing income to a local Vancouver business. This investigation looks into a sustainable laundry solution for UBC residences. Various laundry detergents were researched considering specific aspects to identify the most suitable options. These were then compared with Tide Original Liquid Laundry Detergent, a benchmark product found through a survey of first year residents. As a result of the investigation, Nellie's All-Natural Laundry Soda fulfilled all requirements without sacrificing cleaning capabilities. It is recommended to install dispensing machines in residence laundry rooms to provide a green laundry detergent convenient to all students.

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## **LIST OF ABBREVIATIONS**

**UBC:** University of British Columbia

**BC:** British Columbia

**SHHS:** Student Housing and Hospitality Services

**Nellie's:** Nellie's All-Natural Laundry Soda

**Tide:** Tide Original Liquid Laundry Detergent

## **REPORT BODY**

### ***SECTION 1.0: Introduction***

UBC Residences are the home of almost 8000 students throughout the school year. Operating as its own city, it is essential to be conscience of the environmental impacts from everyday actions. This report will contribute to the investigation of a more sustainable campus by targeting laundry detergent, as it affects all residents. To meet UBC's sustainability goal, students' current laundry habits will be replaced with a local and environmentally friendly laundry detergent which is also easily accessible. By conducting a triple bottom line assessment comparing a benchmark product with green laundry detergents, the best option to implement on campus will be determined.

### ***SECTION 1.1: Environmental, Social, and Economic Impacts***

The triple bottom line analysis consists of three areas of focus: environmental, social, and economic impacts. The environmental investigation includes sections on toxicity, third party certification, compliance with UBC's Water Action and Sustainability plans, as well as performance in cold water. The social impacts considered consist of consumer performance, local sourcing, labour standards, availability, and potential to raise awareness of sustainability. Finally the total cost of the product and shipping will reflect the economic impact.

### ***SECTION 1.2: Benchmark Product***

A survey was conducted to determine a benchmark product to base green laundry detergent comparisons from. The first year residents of Place Vanier were asked what type and kind of laundry products they were currently using. It was concluded that 68% of students currently use Tide laundry detergent and an overwhelming 75% use a liquid detergent. This result suggested that Tide Original Liquid Laundry Detergent is the most accurate benchmark product (See Figure 1). The exact survey results are displayed in tables 1 and 2 below.



**Figure 1 Tide Original Liquid Laundry Detergent**

What type of Laundry detergent do you use?

Table 1 Survey of Place Vanier residents

Tide	51
Arm&Hammer	2
Gain	4
Purex	3
Seventh Generation	2
Other	13

What kind of detergent do you use?

Table 2 Survey of Place Vanier residents

Liquid	56
Powder	9
Pods	9
Other	1

### **SECTION 1.3: Nellie's All-Natural Laundry Soda**

After a total of nine potential green laundry products were reviewed, those which had obvious negative environmental impacts or poor reviews were eliminated from the investigation.

The remaining products were then evaluated based on key requirements: location of manufacturing, price, composition, packaging, and user reviews. Nellie's All-Natural Laundry Soda proved to be the most suitable detergent, satisfying all the parameters. Nellie's believes in honesty and simplicity, developing a collection of non-toxic hypoallergenic cleaning products.

For optimal cleaning only one tablespoon of laundry detergent is required, eliminating waste of product and energy, as no extra rinsing is necessary. Although the survey results suggested that liquid is preferred over powder, through research it was determined that powder would be a better cleaning agent. More cleaning power can be packed into a smaller space, as opposed to liquid detergents which can be made with up to 50% water. Also, powders are especially effective at lifting out clay and ground-in dirt. (Nellies All Natural, 2008)



## ***SECTION 2: Environmental Impacts***

### ***SECTION 2.0: Introduction***

Environmental impacts are a crucial component of the investigation because they determine whether or not the product is a suitable fit for the green label. Toxicity of the product will be considered, examining the chemicals and their effects on the environment. In addition, third party certifications will be evaluated for extra accreditation. The detergent must comply with the Water Action Plan and the Sustainability Plan to improve UBC's vision towards a green campus. Performance in cold water will also be an important factor.

### ***SECTION 2.1: Toxicity***

The main consideration in environmental impacts when investigating laundry detergents is their chemical compositions. After investigating Tide Original Liquid Laundry Detergent, it was found that some of the twenty seven ingredients are surfactants, which could be relatively toxic (See Appendix C). Surfactants are a concern because they do not degrade significantly, can accumulate in the environment through wastewaters, and cause problems for biodegradation. For example, Linear alkylbenzene sulfonate is a chemical that will not completely degrade for a very long time, resulting in accumulation. Another example is Disodium diaminostilbene disulfonate, a brightener which also degrades slowly, accumulates, and increases toxicity in the marine environment. Aside from surfactants, toxicity in Tide also comes from the fragrances, and 1,4-dioxane. 1,4-dioxane, an unlabeled carcinogen linked to lung cancer found in Tide, is a by-product from the process of manufacturing the detergent.

In contrast with Tide, Nellie's only contains five ingredients, all of which are earth friendly. One of the ingredients in Nellie's is Soda Ash, a substance naturally found in drinking water. Soda ash is not harmful unless at high concentrations and at direct contact with the body, in the amount used in the water it is harmless (Oregon Department of Human Services, 1998). Sodium Metasilicate is a chemical in the detergent, which is only toxic in direct contact, and not in the concentration used in the product. Not only is this chemical earth friendly, it also prevents corrosion in the washing machine. Another ingredient is sodium chloride, a common table salt that is well biodegradable in water. The final two ingredients used in Nellie's are citric acid and coconut based ethoxylated fatty alcohol, both of which are highly biodegradable. (Bajpaj, 2007)

### ***SECTION 2.2: Third Party Certification***

Neither Tide nor Nellie's are Third Party Certified. Although this could raise concerns about accountability, it was found that Third Party Certified products are not always as environmentally friendly as they claim to be.

### ***SECTION 2.3: Compliance with UBC's Water Action Plan and Sustainability Plan***

The introduction of Nellie's Natural Laundry Soda will be in compliance with UBC's Water Action Plan with its water smart target, which is to use 33% of the water used at UBC more efficiently by 2020. By using Nellie's in residence laundry rooms, it will eliminate the amount of surfactants which would be left in the water from other detergents. In doing so, the water will be used more efficiently, leaving the water cleaner and requiring less treatment. In addition to the current action plan, it would be recommended to implement a more strict policy regarding the chemicals and surfactants left in the water after use. This would encompass not only the laundry rooms, but also the kitchens (soaps, dish detergents) and housekeeping products (cleaners, disinfectants). (UBC Sustainability, 2011).

The Sustainability Plan requests a "cost neutral way to include sustainability." The prices of Nellie's and Tide are within the same range, which encourages students to purchase a cost efficient and earth friendly brand instead of their standard detergent. (University of British Columbia, 2012).

### ***SECTION 2.4: Performance in Cold Water***

It is important for laundry detergents to perform well in cold water because it is more energy efficient. According to Energy Star, 90% of the energy of washing clothes goes into heating the water. (Alliance to Save Energy, 2011). In addition, all washing machines in residence have a cold water setting. After testing, it was found that both Tide and Nellie's perform well in cold water.

**SECTION 3: Social Impacts**

**SECTION 3.0: Introduction**

Social impacts also play a large role in the investigation since the product must be accepted and perform to student standards in order to be successful. Consumer satisfaction provides the best indication of an effective product because it means that not only does the detergent work but it also satisfies the needs of the consumer.



Figure 2 Customer satisfaction

**SECTION 3.1: Consumer Performance**

To evaluate the performances of the detergents, the experiences from many different people who have used the benchmark detergent and Nellie’s were taken into consideration. Through secondary sources, such as blogs and product reviews, Nellie’s had overall good reviews with no reoccurring complaints (See table 3). By having no scent in Nellie’s, it will not cause problems with allergies or smell preference, and was said to leave clothes with only a “clean smell.” The “clean smell” left on the clothes was confirmed through direct testing. When using Nellie’s, less volume of detergent per wash is needed because the powder is concentrated more so than the Tide liquid, which reduces the overall packaging necessary for a certain amount of loads. (Some consumers liked the satisfaction of helping the environment.)

	Clean clothes?	Like the scent?	Rinses clean?	Easy to use?	Would you buy it?	Diaper Rating	Comments
Mom # 1 Jess	8.5	no scent	9	9.5	Yes	9	Works great, and amazing with diapers. Only downside is that HE machines use same amount as reg. machines.
Mom # 2 Katy	8	8	7	8	Yes	8	No comments (so I assume she was just content with it!)
Mom # 3 Shannon	9	8	9	9	Yes	n/a	My product of choice. Packaging fun/convenient, works well, and locally made. Worth mildly higher cost.
Mom # 4 Diane	7.5	7	10	8	Yes	10	A+ for packaging! Diapers smell good. Might have exacerbated a diaper rash? (Not sure) Loved the nuggets!
Mom # 5 Steph	9	8	9	9	Yes	8	Smells fresh, but not scented. Clothes clean and soft. Got musty smell from stored clothes.

Table 3 Mom’s Reviews of Nellie’s (Langford, Stephanie, 2010)

From direct testing of Nellie's and Tide detergent products, it was determined that they performed about equally. White T-shirts were dirtied with six types of common stains: grass (top left), dirt (top right), juice (middle left), coffee (middle right), oil (bottom left), and balsamic vinegar (bottom right). They were then washed separately in cold water, each with a different detergent, to compare the cleanliness. The results are shown in the before (figure 3) and after pictures (figure 4) below.



Figure 3 Before washing: Nellie's (left) and Tide (right)



Figure 4 After washing: Nellie's (left) and Tide (right)

Nellie's detergent removed the grass, juice, and oil stains better than the Tide. Although neither detergent was able to completely remove the dirt, coffee, and balsamic vinegar stains, they performed about equally. This testing suggests that Nellie's is at least as good as the benchmark product, if not better.

### **SECTION 3.2: Local Sourcing**

The information regarding the location of manufacturing for Tide products is unavailable. This is likely because it is a sensitive topic and is therefore hidden to protect the company's reputation. Nellie's advertises that their product is made locally in Mission, BC (Wendy, email, November 13, 2013). This satisfies the 150 mile radius for a local product from BC, being only 43.6 miles away (See figure 5).

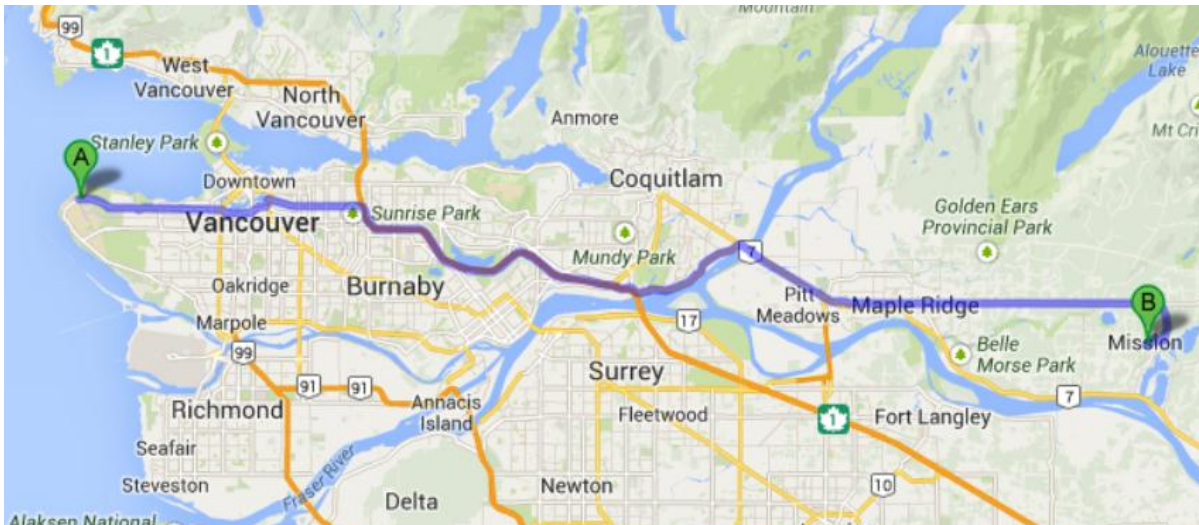


Figure 5 Map from UBC campus to Mission, BC

### ***SECTION 3.3: Labour Standards***

Similarly to the manufacturing location, Tide does not release information on their labour standards. This raises suspicions regarding workers and production methods.

On the other hand, an associate of Nellie's, Wendy, openly shared that the detergent is made in a factory located in Mission, BC (Wendy, email, November 25, 2013). This certifies that Nellie's follows BC's labour standards.

### ***SECTION 3.4: Availability***

Tide can be found almost anywhere, from large supermarkets to small convenient stores. (Procter&Gamble, 2012). It can also be bought online, and is available to purchase in large amounts (Procter&Gamble, 2012).

Nellie's has confirmed that it can be bought in large quantities from the manufacturer (Wendy, email, November 13, 2013). They have guaranteed that they can supply UBC's laundry needs (Wendy, email, November 13, 2013). Nellie's can also be found in certain stores such as Costco and London Drugs (L. Pistner, personal communication, November 13, 2013).

### ***SECTION 3.5: Potential to Raise Awareness of Sustainability***

By implementing a green detergent in the laundry rooms, students are being encouraged to become more sustainable. To increase this awareness, facts about laundry detergents could be posted on dispensers in the laundry rooms, similar to the water dispensers over campus. This could also be done through graphs, diagrams or charts. This investigation is the perfect opportunity to prove to people that earth friendly detergent can work.

## **SECTION 4: Economic Impacts**

### **SECTION 4.0: Introduction**

Economic impacts play a big role in the investigation because the product must not only be available, but affordable to UBC residents. The survey of first year students asked how much extra they would pay for a more sustainable product? The results are displayed in table 4 below.

Would you pay extra for a more sustainable product?

**Table 4 Survey of Place Vanier residents**

2x more	6
1.5x more	19
1.25x more	33
Would not pay more	17

From these results most students are only willing to pay a small amount extra, if any. This could be attributed to a leading question on the survey. The survey prompts participants to pay extra as there is only one alternative option. Although the cost results may not be completely accurate, it is clear that students are concerned with sustainability as 77.3% would pay more for a sustainable product. (See table 5)

Is using a sustainable detergent important to you?

**Table 5 Survey of Place Vanier residents**

Very important	20
Somewhat important	43
Not important	12

These results suggest that residents would prefer a sustainable product within their current price range.

### **SECTION 4.1: Total Cost of Product**

A rough calculation gave an estimate of the total cost of Nellie's per month. This calculation was based on the idea of laundry detergent dispensing machines inside residence laundry rooms, which would only dispense the amount of detergent required for a single load with each purchase. Of the 8000 UBC residents, only about 5000 would have access to laundry detergent

dispensing machines. The survey results from a secondary source suggested that most students do laundry twice a month (See table 6).

How often do you do your laundry?

Table 6 Survey of Gage residents

More than once a week	5%
Once a week	40%
Every couple weeks	50%
Once a month	5%

Therefore every month, about 10000 loads of laundry are done in residence laundry rooms. Since each 36.7-pound tub of Nellie’s contains the detergent necessary for 1101 loads, approximately 9 tubs are required per month (Nellie’s All-Natural, 2008). To order 9909 loads every month, the cost per load is just under \$0.14. The exact cost calculation is done in figures 6 and 7.

<b>YOUR TOTAL</b>	
<b>SUB-TOTAL</b>	\$1,124.55
<b>SHIPPING</b>	\$15.90
<b>TAX</b>	\$136.86
<b>ORDER TOTAL</b>	<b>\$1,277.31</b>

Figure 6 Total monthly cost for Nellie's detergent

Handwritten calculations on a chalkboard:

$$\frac{10000 \text{ loads}}{\text{month}} \cdot \frac{\text{bin}}{1101 \text{ loads}} = 9.08 \text{ bins/month}$$

$$\frac{9 \text{ bins}}{\text{month}} \cdot \frac{\$1,277.31}{9 \text{ bins}} = \$1,277.31/\text{month}$$

Figure 7 Calculation of total monthly cost for Nellie's detergent

If this amount is accurate, every month \$1277.31 will be spent on detergent, including the cost of shipping and taxes (Nellie's All-Natural, 2008). After further investigation, Nellie's does offer discounts when being sold in bulk, therefore UBC SHHS could negotiate an even better deal if Nellie's got implemented (Wendy, email, November 25, 2013).

In contrast, every load of Tide costs about \$0.26 (Walmart, 2013). This estimate is generated from a 96-load bottle of Tide Original Liquid Laundry Detergent from Walmart, including the costs of shipping and taxes (Walmart, 2013). This is significantly more expensive, confirming that Nellie's is a student friendly solution.

## ***SECTION 5: Conclusion***

### ***SECTION 5.0: Conclusion and Recommendations***

To help achieve UBC's sustainability goals Nellie's All-Natural Laundry Soda should be available within residences. Nellie's is only made with five ingredients that are environmentally friendly, effectively reducing the risk for accumulation of chemicals and toxins that are not biodegradable or filtered out of UBC's wastewater. It satisfies the Water Action Plan and performs well in cold water. Through customer reviews and direct testing, it is clear that Nellie's is a reliable product. Not only is it made locally in Mission BC, it also follows the BC labour standards and has the capability to supply all of UBC residences. Buying Nellie's directly from the manufacturer is already cost efficient being 50% less than the benchmark product, Tide. For Nellie's to be most successful, it is recommended that detergent dispensing machines be installed within residence laundry rooms (See Figure 7). These machines would dispense a single load of detergent per purchase. For student convenience, they would be able to make purchases with their Smart City laundry cards, as opposed to with coins. This is the best option for students since it is available in laundry rooms, eliminating the need for students to purchase their own detergents. Another benefit is the controlled amount of detergent dispensed, reducing the amount of detergent wasted by using excess. The transport bins would be recycled directly by UBC SHHS, reducing waste from individual students. The dispensing machines also provide the opportunity to promote sustainability facts directly on them. This will help raise awareness of actions towards a more environmentally friendly community.





Figure 8 Model of dispensing machines

One final recommendation is to consider Nellie's All-Natural Dryer Balls and Scent Sticks (See figure 9). This would be a viable solution if students are concerned about scented clothes or sustainable dryer products. This option still requires further research to determine if it is a long term alternative. After future considerations and testing, these products could also be sold within laundry dispensing machines.

In closing, Nellie's is the ideal green laundry detergent

because it will satisfy residents and help the environment, all while being local and affordable.

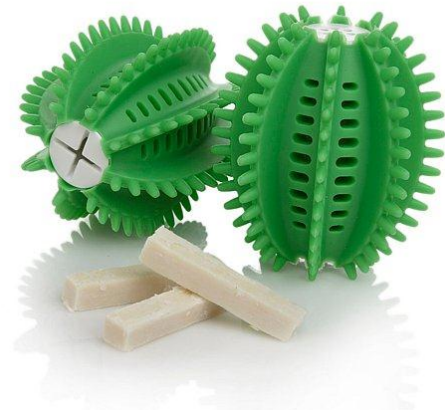


Figure 9 Nellie's All-Natural dryer balls and scent sticks

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## APPENDIX A: Place Vanier Residence Laundry Survey

What laundry detergent do you currently use?

- Tide
- Arm & Hammer
- Gain
- Purex
- Seventh Generation
- Other \_\_\_\_\_

Your detergent is...

- Liquid
- Powder
- Pods
- Other \_\_\_\_\_

Where do you buy your laundry detergent?

- Superstore/Costco
- Grocery Store
- Drug Store
- Hubbard's
- Other \_\_\_\_\_

How important is it to you that your detergent is a sustainable product?

- Very important
- Somewhat important
- Not important

How much extra would you pay for a more sustainable product?

- 2x more
- 1.5x more
- 1.25x more
- Would not pay extra

Would you prefer to buy your detergent in bulk or with many loads?

- Bulk
- Many loads

Would you consider using a detergent in the form of a reusable wash ball?

- Yes
- No

## APPENDIX B: Comparison of nine green laundry products

Product	Local	Price per load	Composition	Packaging	Bulk	Scented	Reviews
Smart Klean Ball	No	\$0.13	The inner beads are completely biodegradable. The ball itself is made of thermoplastic elastomer, an eco-friendly and recyclable material.	Cardboard box	NA	Unscented	Good in soft water
Vancouver Only	Yes	\$0.13 - \$0.20		Recyclable bag			Good, Cheap
Rockin' Green	No	\$0.17 - \$0.35	phosphate free, biodegradable ingredients	Recyclable bag	Possibly	Unscented	Good
Biokleen	Northern US	\$0.19/fl oz	Surfactants+conditioning agents, alkylbenzene sulfonates, orange peel powder, grapefruit seed&fruit extract, coconut, corn, grapefruit pulp, enzymes, water	Plastic	32oz, 64oz	Sometimes	Mixed reviews, mostly good, complaints about scent
Greenworks		\$0.19/fl oz	(colours, preservatives, boric acid, fragrance)bad, then a bunch of good stuff	Plastic	32oz, 64oz	Yes	3.5/5, mostly great, some concerned with scent/ingredients
Nature Clean	Ontario	\$0.34/load	Aqua/Water/Eau, Decyl Glucoside (mild plant derived cleanser), Sodium Citrate (natural water softener), Cellulose Gum(natural anti redeposition agent), Magnesium Nitrate (natural mineral), Magnesium Chloride (natural mineral), Sodium Chloride (table salt-viscosity enhancer), Methylisothiazolinone and Methylchloroisothiazolinone + fragrance (preservative-maintain product freshness and prevents bacteria growth)	Plastic	1.8L, 3L	Sometimes	Excellent reviews
Seventh Generation	Berlington, Vermont		Aqua (water), sodium lauryl sulfate (plant-derived cleaning agent), laureth-6 (plant-based cleaning agent), sodium citrate (plant-derived water softener), oleic acid (plant-derived anti-foaming agent), sodium hydroxide (mineral-derived pH adjuster), boric acid (mineral-derived enzyme stabilizer), protease and amylase (plant-derived enzyme soil removers), glycerin (plant-derived enzyme stabilizer), calcium chloride (mineral enzyme stabilizer), sodium chloride (mineral viscosity modifier), citric acid (plant-derived processing aid and pH adjuster), essential oils and botanical extracts* for scented varieties only (see below for details), methylisothiazolinone and benzisothiazolinone (synthetic preservatives).	Cardboard, plastic	150oz bottle	Yes	Excellent reviews
Arm + Hammer	Princeton, New Jersey		Trade secret or proprietary formula (2-6%), Sodium Carbonate (70-85%), Sulfuric acid (2-4%)	Plastic	2.03L bottle	None	Bad, does not clean clothes well
Nellie's Natural	Mission, BC	\$0.14	Sodium carbonate, sodium metasilicate, sodium chlorise, citric acid, ethocylated fatty alcohol	Plastic, cardboard, tin	1101 loads	None	Fantastic Reviews

## APPENDIX C: List of Tide Ingredients

### Tide Liquid Original

#### Ingredients

water  
alcoholethoxy sulfate  
linear alkylbenzene sulfonate  
propylene glycol  
citric acid  
sodium hydroxide  
borax  
ethanolamine  
ethanol  
alcohol sulfate  
polyethyleneimine ethoxylate  
sodium fatty acids  
diquaternium ethoxysulfate  
protease  
diethylene glycol  
laureth-9  
alkyldimethylamine oxide  
fragrance  
amylase  
disodium diaminostilbene disulfonate  
DTPA  
sodium formate  
calcium formate  
polyethylene glycol 4000  
mannanase  
Liquitint™ Blue  
dimethicone

#### Cleaning Technology

process aid  
surfactant  
surfactant  
process aid  
captures soil  
pH neutralizer  
captures soil  
process aid  
process aid  
surfactant  
polymer  
surfactant  
polymer  
enzyme  
process aid  
surfactant  
surfactant  
fragrance  
enzyme  
brightener  
captures soil  
process aid  
process aid  
process aid  
enzyme  
colorant  
process aid