UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Framework for the UBC-Relevant Red List of Materials

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CIVL 492C

Themes: Materials, Buildings, Health

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FRAMEWORK FOR THE UBC-RELEVANT RED LIST OF MATERIALS

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List of Abbreviations

CO2	Carbon Dioxide
C2C	Cradle to Cradle
CIRS	Center for Interactive Research on Sustainability
EPD	Environmental Product Declaration
HBN	Healthy Building Network
HPD	Health Product Declaration
ILFI	International Living Future Institute
LBC	Living Building Challenge
LEED	Leadership in Energy and Environmental Design
MSDS	Material Safety Data Sheet
PPE	Personal Protective Equipment
SBS	Styrene Butadiene Styrene
UBC	University of British Columbia

Table of Contents

Table of Figures

Table of Tables

Executive Summary

The University of British Columbia is renowned as a leader in sustainability and is committed to constructing sustainable buildings. To continue innovating, UBC is introducing a Green Building Plan that focuses on actionable items that promote human and ecological wellbeing in building design. A part of the plan focuses on creating a UBC-relevant Red List of Materials, which compiles all the worst-in-class building material ingredients. These ingredients or chemicals are harmful because they damage the environment, off-gas chemicals in the atmosphere and bio-accumulate in humans and the eco system. Since humans spend most of their time indoors, it is important to construct healthy buildings that will not have a negative impact on human health.

There are many firms and organizations that are studying the effects of material health, such as the International Living Future Institute, who came up with the original Red List, Transparency @ Perkins + Will, Healthy Building Network, LEED and much more. The challenge is to synthesize the information across these organizations to create a UBC-relevant Red List of Materials that the university can use to inform its decision making process.

The proposed tool is a framework for consultant audiences that assembles and categorizes building material information. While the industry standard is to identify harmful ingredients, the framework looks at specific building products throughout different life cycles. The specifications of Center for Interactive Research on Sustainability (CIRS) are used to compile a list of common products, which are researched and analyzed to determine if they contain suspect chemicals and at what level of concern. This gives a clearer idea of how healthy a product is which can inform users to determine if the product should be used or an alternative option is better. Building materials that are potentially harmful to occupants when installed should have a higher priority compared to those that are harmful in their manufacturing phase.

There are different ways to use the framework to understand building products. One way is to find information on a specific product and see if there are any health and environmental concerns. Another way is to compare and contrast different product categories (for example vinyl vs. aluminum vs. fiberglass windows). This method could be helpful in the design phase of the project as it gives the designer an idea of the health risks associated with certain products, if there are any. Consultants can

also compare and contrast different brands for a certain product type and by doing this they can select the best option.

Research challenges included being unable to find product ingredients or forms that were incomplete, inaccurate and out of date. Encouraging manufacturers to declare their product ingredients is important in the future of material health. It is recommended that industry facilitates material declaration for manufacturers and makes this information accessible.

UBC-specific recommendations include continuing to expand the framework by researching other UBC building specifications and incorporating both institutional and residential buildings. A UBC-relevant list of ingredients should be created based on the research. The most harmful chemicals should be eliminated first along with products that are most harmful in the occupancy phase.

1. Introduction

The University of British Columbia (UBC) is focused on sustainability as it relates to the economic, social and environmental impact of the diverse projects it is involved in. UBC aims to achieve “a place of mind” by constructing sustainable buildings that meet the needs of its students and faculty. Many new constructions at UBC are at minimum LEED Gold certified to evaluate the buildings environmental performance through the selection of building materials, energy conservation and sustainable design, among other criteria.

UBC is also in the process of creating their own Green Building Plan, which aims to develop a strategy for achieving buildings that promote human and ecological wellbeing. Part of that initiative is developing policies that target identifying and reducing the use of harmful building materials on campus. Harmful chemicals found in building materials affect the health and productivity of its users and can be detrimental to the ecosystem. These chemicals can be otherwise created at any point during the extraction, production, use and disposal of the materials and can affect manufacturers, construction workers, building inhabitants, wildlife, and ecosystems.

Notable organizations already conduct research and bring attention to harmful materials that are banned or to be avoided in buildings because they are potentially hazardous to the environment or human and animal health. To summarize their findings, these organizations have developed lists or recommendations for hazardous materials. This project aims to build upon existing research and propose a UBC-relevant Red List of harmful construction materials which can be continually updated in order to provide valuable current information to consultants working on UBC building projects. The goal is to use this information to incrementally reduce the use of these materials over time through policy.

2. Overview of Red List of Materials across Industry and UBC

Within the construction industry the term Red List typically consists materials considered worst-in class. These materials are dangerous because:

- They are harmful to the environment at some stage at in their life cycle due to their basic composition (i.e during processing or their eventual disposal)
- They often off-gas products which can have negative impacts on those with whom they come into contact (i.e during processing and installation or reducing the interior environment quality for users)
- Harmful products often bio-accumulate in the human organs and the food system (International Living Future Institute, 2018)

The International Living Future Institute (ILFI) was the first to come up with a Red List of Materials as part of it's Living Building Challenge (LBC). The list below summarizes items in the LBC Red List:

- Alkylphenols
- Asbestos
- Bisphenol A
- Cadmium
- Chlorinated polyethylene and chlorosulfonated polyethlene (CSPE)
- Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)
- Chlorobenzenes
- Chloroprene (neoprene)
- Chromium VI
- Formaldehyde (added)
- halogenated flame retardants (HFRs)
- Lead (added)
- Mercury
- Polychlorinated biphenyls
- Perfluorinated compound
- Phthalates
- Polyvinyl chloride, polyvinylidene chloride and chlorinated polyvinyl chloride
- Short Chain Chlorinated paraffins

- Wood treatments containing creosote, arsenic or pentachlorophenol
- Volatile organic compounds (VOCs) in wet applied products (International Living Future Institute, 2018)

The list contains both chemicals and chemical groups. ILFI published a spreadsheet in 2014 that displays the full list of chemicals and individual chemical compositions. Currently, this spreadsheet contains 815 chemicals.

Since ILFI's Red List first inception, other organizations and firms have followed in their footsteps by coming up with their own versions of the Red List. A few examples are:

- **Cradle to Cradle (C2C) Banned Chemicals List**
    - C2C is a non-profit organization that administers the C2C Certified® Product Standard, which evaluate a product's performance across five categories: material health, material reutilization, renewable energy and carbon management, water stewardship and social fairness. Certified products cannot contain listed chemicals above 1000ppm. C2C selects their materials due to bioaccumulation and hazards due to manufacturing, use and disposal (Cradle to Cradle, 2018)

- **Google's Portico**
    - Google is also working on their own version of material transparency using big data by creating a tool called Portico to help with its own construction projects. The Portico platform includes a database of products organized by manufacturer, product category and whether or not it meets LEED and LBC requirements. Materials are ranked in a 16-point scale according to which level manufacturers disclose ingredients, the material transparency of the product and the identification of hazards. Only materials above a certain points threshold will be specified in a project. Portico is still in its initial stages and not available for users outside of manufacturers and early project supporters (Budds, 2017).

- **Perkins + Will Transparency List**
    - Perkins + Will is a global architecture firm that created Transparency as a gathering point for data pertaining to building material ingredients. This list includes substances commonly found in the built environment that are classified as harmful to humans and

the environment by different regulations. The list is regularly updated to reflect new research (Transparency @ Perkins + Will, 2018).

- **Leadership in Energy and Environmental Design (LEED) Pilot Credit 11: Chemical Avoidance in Building Materials**
    - This pilot credit requires project teams to specify interior finish materials that do not contain phthalates and hydrogenated flame retardants (HFRs).

2.1. UBC Green Building Plan

Inspired by the Living Building Challenge, UBC is creating their Green Building Plan which focuses on actionable measures that promote human and ecological wellbeing in building design. UBC's goal is to create a net positive pathway for building design by demonstrating leadership and innovation in green buildings. The scope includes both residential and institutional development and considers eight themes:

- Energy and emissions
- Biodiversity
- Water
- Place-making
- Materials and waste
- Quality
- Adaptability
- Health and wellbeing. (planning.ubc.ca, 2018)

The themes are interconnected which is why the UBC-relevant Red List falls under the Materials and Waste category as well as Health and Wellbeing. Figure 1 shows the eight themes:

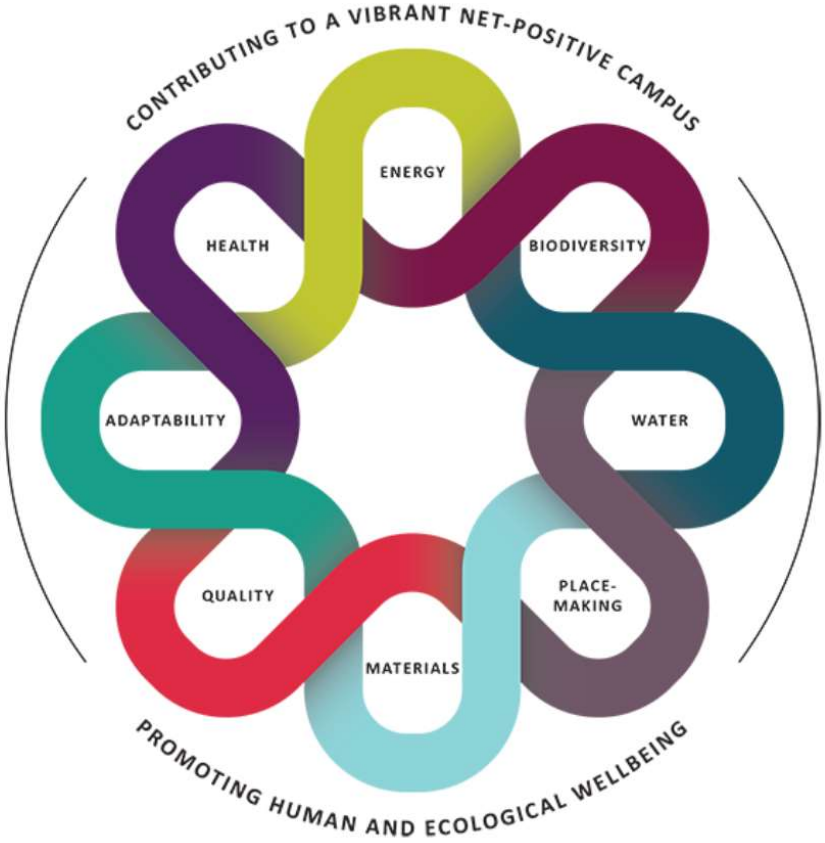

Figure 1 UBC Green Building Plan

2.2. UBC Technical Guidelines

The UBC Technical Guidelines are used by architects, engineers and contractors who provide design, construction and renovations services to UBC-owned institutional buildings. The guidelines are the minimum accepted standard for buildings, infrastructure and landscapes at UBC and include:

- Performance objectives
- Technical requirements
- Recommended practices
- Project documentation requirements
- Sample front-end documentation (technicalguidelines.ubc.ca, 2018)

3. Challenge

UBC has already constructed many buildings to high sustainability standards and is in the process of designing future developments on campus. To improve upon its sustainability initiatives, one of the actions identified is to research and analyze harmful building materials and synthesize that information across the board to identify a UBC-relevant Red List of Materials to support UBC's sustainable decision making for future projects.

The framework created in this project offers a tool to understand hazardous materials and is part of a longer process that requires further research and action from UBC. The tool would help inform the creation of the Red List, which will be a component of UBC's Green Building Plan. UBC aims to design buildings with materials that are not harmful to human and ecological health and one way the university will achieve this is by eliminating 100% of a UBC identified Red List of building materials that are known to be detrimental to human and ecological health by 2035. Through research and collaboration with stakeholders and a regard to market supply, a UBC-prioritized Red List of harmful materials needs to be created. Building materials that are potentially harmful to occupants when installed should have a high priority with those that are harmful in their manufacture having a lower priority.

4. Methodology

The research methodology includes researching existing organizations to review the information available on harmful materials. Through this research, organizations such as the Living Future Institute, Transparency @ Perkins + Will, and Healthy Building Network emerged as leaders in the field of material health. Other organizations were explored to supplement the research. Tables outline the benefits and challenging aspects of the research methods to summarize their uses.

4.1. International Living Future Institute

The International Living Future Institute is the original creator of the Red List. Their goal is to create sustainable communities through initiatives, transparency labelling, partnerships with designers and manufacturers and so on. They are known for creating the seven performance categories, also called seven "petals", as seen in Figure 2:

Figure 2 Performance Categories of the International Living Builiding Institute

The Red List falls mainly in the Materials and Health & Happiness categories.

The ILFI has a few initiatives that it uses to promote sustainability in communities and projects. These initiatives are:

- Living Building Challenge
- Living Product Challenge
- Zero Carbon
- Zero Energy etc...

In addition to its own Red List of Materials (see Section 2), the ILFI also has different transparency labels to promote healthy materials such as Declare, which is dubbed as “the nutritional label for products”. Declare is a transparency platform and product database aimed at building materials. Figure 3 shows an example Declare label:

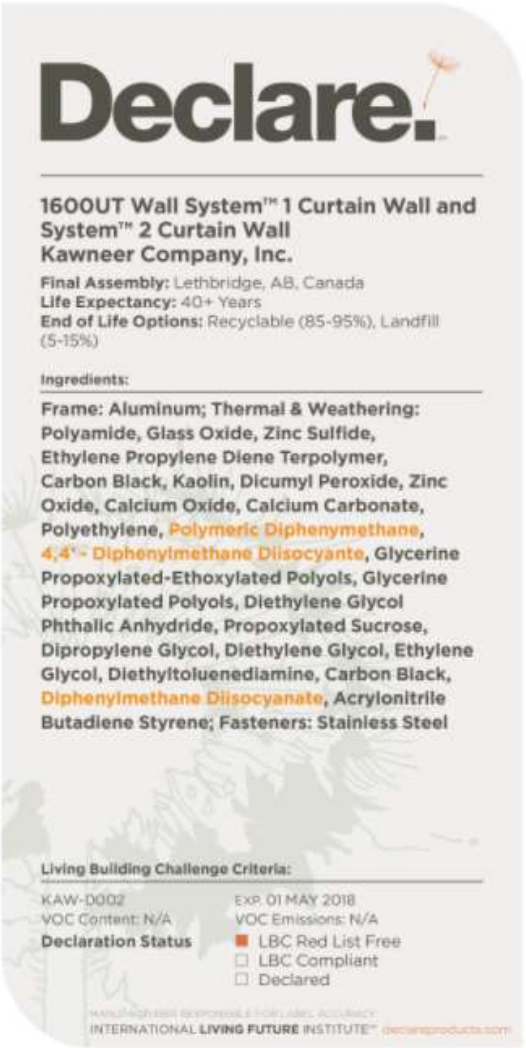

Figure 3 Example Declare Label

The label includes helpful information such as life expectancy, end of life options and most importantly, the ingredients that make up the product. The label also determines this product is LBC Red List Free.

Items that are coloured orange signify that while the ingredient is not on the LBC Red List, it has the potential to cause harm in certain quantities or has been identified by other organizations as an ingredient to watch out for.

4.2. Transparency @ Perkins + Will

Perkins + Will's commitment to sustainability led them to produce their own website called Transparency, which allows you to browse substances of concern through project type, product type, CSI specifications and hazards (perkinswill.com, 2018). The website is subdivided into three categories:

- Precautionary List
- Watch List
- Sunset List

The Precautionary List is the most comprehensive of all lists. It is used by making a selection (project type, product type, Masterformat and hazards) which then tells the user which harmful ingredients or chemicals are used in that specific material.

The Watch List includes substances of emerging concern for which alternatives and data are not yet available. Many items on the Watch List end up on the Precautionary List, so it is predictive of which substances will be researched in the future.

Items in the Sunset List are substances that have been retired from the Precautionary List usually because the substance is no longer in widespread use, has been removed from authoritative lists or has been taken out of regulation. The goal is to move harmful substances into this category over time (transparency.perkinswill.com, 2018).

4.3. Healthy Building Network (Pharos)

The Healthy Building Network (HBN) is a non-profit organization that focuses on understanding what goes into building materials in order to reduce hazardous chemicals. Similar to Declare, they research and encourage manufacturers to state what they use in their products.

The Pharos Project is one of HBN's material evaluation tools that aims to be transparent, comprehensive, independent, accurate and fair. There are over 20,000 items that can be searched based on various categories, manufacturers, resources and so on. Pharos is integrated with other databases

such as Declare, Cradle to Cradle and Health Product Declaration (HPD) to give the user a better picture regarding the health of products and materials.

4.4. Others

- **HPD Collaborative**

Health Product Declarations (HPDs) provide full disclosure of building product content and associated health information. Similar to Declare, it encourages manufacturers to submit their product ingredients and health information, which is then used by decision-makers to assess and compare different products. HPDs are incorporated in reporting tools such as LEED v4 (hpd-collaborative.org, 2018).

- **Quartz Project**

Quartz Project is another tool that promotes the transparency of building products and their impact on human and environmental health. Their database includes composition, environment and health hazard information on 102 building products. Items can be searched by keyword, Masterformat or Uniformat.

4.5. Advantages and Disadvantages

Each tool has its own advantages and limitations when it comes to researching, which are noted in Table 1 on the next page:

Table 1 Advantages and Limitations of Research Tools

	Advantages	Limitations
International Living Future Institute	• Established organization • Systems in place for material evaluation like Declare	• Costly certification preventing many manufacturers from registering their products
Transparency @ Perkins+Will	• Gathering point of information for harmful material ingredients • Gaining a snapshot of harmful chemicals to watch out for • Elementary research • Continually updated	• Does not tell the user the breakdown of ingredients • Only talks about harmful ingredient • No specific products/ manufacturers named
Healthy Building Network (Pharos Project)	• Integrated system of material information • Information synthesized with HPDs, Declare, C2C and other organizations • Over 20,000 materials on file • Robust research • Great for finding information for manufacturing stage	• Does not always have a full picture due to incomplete information • Not every type of product is included • Some products contain more information than others • Does not contain detailed information on effects for occupants and workers
HPD Collaborative	• Tells you exactly what chemicals go into a product	• Many HPDs are incomplete, inaccurate or out of date
Quartz Project	• Gives detailed breakdown on material components and possible impurities • Shows what percentage of a product can be harmful to human health and for what reason (cancer, reproductive…) • Shows detailed breakdown of environmental effects	• Only 102 items on database • Items were generic • Does not cover all categories

5. Proposed Solution

In order to identify a format in which to assemble and categorize this information that would be most useful to consultants on UBC projects, the problem was considered from a consultant's perspective. While it is commonplace knowledge that asbestos and formaldehyde are harmful to humans and the environment, for example, designers do not know which products contain these ingredients. They might even be recommending harmful products if they do not have the available resources.

The proposed tool is a framework for consultant audiences. The industry standard is currently a Red List of banned ingredients. The new framework is created in order to understand the harmful effects of chemicals in products throughout their life cycle. Common products are researched and analyzed to determine if they contain suspect chemicals and at what level of concern. This will give a snapshot of how healthy/unhealthy a product is, which can be used to outline products that are not very safe and recommend alternative options. Part of the project (and future projects) will be used to create a UBC Red List of ingredients and help identify specific products that should be eliminated over time (particular if harmful in the use phase).

5.1. Building Specifications

The Center for Interactive Research in Sustainability (CIRS) is a recent UBC building completed in 2011 with a high emphasis placed on sustainability and consideration of clean products. CIRS specifications are used in order in this project to get a snapshot of the products that are used on UBC buildings. The specifications were comprehensive and listed out specific items that designers recommend. Figure 4 shows the CIRS building on campus:

Figure 4 The Center for Interactive Research on Sustainability (CIRS)

5.2. Phases

The product was evaluated throughout its lifecycle, from the sourcing and manufacturing down to the disposal. There are five phases in total that describe the product in its different stages, as outlined in the following sections.

5.2.1. Sourcing

Sourcing describes the phase where the materials are mined, chemicals are created and the ingredients themselves are transported to the factory for manufacturing. In this phase there could be harmful chemicals created in the lab, excessive emissions released during mining or transportation, and so on.

5.2.2. Manufacturing

In the manufacturing phase, materials come together to produce the final product. It is at this phase that Red List materials are typically added, or they could react with other chemicals to off-gas harmful emissions. There could also be harmful effects to factory workers due to repeated exposure.

5.2.3. Installation

At this phase, there could be harmful effects to construction works as they install the products. For example, a certain product can emit a lot of dust as construction workers drill through it, and if Personal Protective Equipment (PPE) is not in place, then this can harm the worker over time.

5.2.4. Occupancy

The Occupancy phase is what we're most interested in because this is where harmful chemicals that are added to a product have a chance to harm the occupants of the building during exposure. Since most buildings last for 50-100 years or more, it is important to consider the long lasting effect that a certain product will have on the human body.

One item to point out is that some items can be harmful to the environment, but they are installed in such a way that they do not come into contact with occupants. Insulation is a good example of this trade-off as insulation products are usually installed in such a way that they are either encapsulated or separated with a barrier from the indoor environment which does not harm the occupants. Exposure to the interior environment is an important aspect to consider when selecting building materials.

5.2.5. Recycling/ Disposal

In this phase, some of the questions to consider are:

- Is this production recyclable?
- What percentage of it is recyclable?
- If it ends in the landfill, will it off-gas harmful gasses in the atmosphere?
- Will harmful chemicals leech into the ground?

5.3. Legend

To make the list as visually engaging as possible, the legend is organized into five colorful categories. A description of the effects of highest to lowest concern is given in Table 2:

Table 2 Legend

Concern	Colour	Description
Highest		Products in this category almost always contain items found in the LFI Red List and are hazardous for bioaccumulation and toxicity
High		High hazard carcinogens fall under this category
Moderate		Respiratory sensitizers fall under this category, along with flammable and reactive items
Low		Skin irritants fall under this catergory, along with chemicals that might have harmful but reversible health and environmental effects
None to Very Low		Materials in this category have not been found to pose any health or environmental risks

5.4. Spreadsheet Categories

Different categories are created to organize the framework into items that can be catalogued and referenced easily later. Table 3 shows the framework is organized and explanations are provided in the following sections.

Table 3 Framework for the UBC Red List of Materials

Masterformat	Product Type	Product Description	Product Name	Supplier/ Manufacturer	Potentially Harmful Ingredients	Phase I - Sourcing	Phase II - Manufacturing	Phase III - Installation	Phase IV - Occupancy Phase	Phase V - Recycling/ Disposal
09 65 19.23	Vinyl Flooring		Commercial Flooring Vinyl Composite Tile	Armstrong Flooring	BBP, DEHP, PVC, CASRN					
09 65 19.23	Vinyl Flooring		Vinyl Composition Tiles	Mannington	BBP, DEHP, PVC, CASRN					
08 01 44	Windows	Curtain Wall (aluminum window)	1600UT (Ultra Thermal) System™ 1 and 2 Curtain Walls	Kawneer Company Inc.	Diphenylmethanes					
08 02 53	Windows	Vinyl Windows			PVC, phthalates (Red List Items)					
08 54 30	Windows	Fiberglass Windows	Fiberglass Windows	Cascadia Windows and Doors	Octamethylcyclotetra-Siloxane (VOCs)					
06 16 33.31	Particle Board	Particle Board	Encore Particleboard	SierraPine Ltd.						
06 16 33.31	Particle Board	Particle Board	TemStock-FR Particleboard	Temple-Inland	Formaldehyde, Boric Acid, SLS					
06 16 33.31	Particle Board	Particle Board	Collins Pine Particleboard	Collins Compnanies	Polymeric MDI, formaldehyde based resins					
05 12 00	Steel	Steel Framing	R-STUD SLOTTED STEEL FRAMING	R-Stud LLC						
09 51 13	Ceiling Tiles		OPTIMA® PB FIBERGLASS CEILING PANELS	Armstrong World Industries	Proprietary Ingredients <1%					

07 52 16	Roof	SBS Roofing	Generic	Generic	Formaldehyde, Phenols, Ammonia…					
07 54 23	Roof	Thermoplastic Membrane Roofing	Ultra Ply TPO	Firestone Building Products	Phenols, Carbon, Polypropolene					
04 21 13	Cladding	White Brick	Firth Brick Veneer	Firth Industries Ltd.	Proprietary Ingredients <1%					
09 64 53	Flooring	Engineered Wood Flooring	Engineered Wood Flooring	Model Hardwood Inc	Formaldehyde based resins					
08 14 00	Doors	Wood	Generic	Generic						
08 11 19	Roof	Steel	Generic	Generic	Acetone, Formaldehyde, Toluene, TGIC					
09-91-23	Paint (low VOC)	Low VOC Eggshell Acrylic Paint	Generic	Generic	NPEs, Titanium Dioxide, Petroleum Byproducts					

5.4.1. Masterformat

Masterformat is the standard for organizing specifications for building projects in the US and Canada and is a format very familiar to all consultants working in the building industry. Since the Masterformat is universal, building products that were selected are tagged by the Masterformat code to make things easy to categorize and find.

5.4.2. Product Category

This is the general category that a product falls in. This category is broad to encapsulate a variety of items, but the main idea is to capture key building elements. Some of these categories are things like insulation, cladding, doors, flooring and so on.

5.4.3. Product Description

This is a general description of the product in question.

5.4.4. Product Name

This is the name of the product that is used in the building. It is a specific product that is found in the marketplace.

5.4.5. Supplier/Manufacturer

This is the supplier or manufacturer that made the product. Note that it falls on the manufacturer to produce HPD's and EPD's for their products.

5.4.6. Potentially Harmful Ingredients

A note was made if a product contained harmful ingredients, especially if they were found in the LFI Red List. These notes are in no way comprehensive but only provide some detail in the make-up of the product.

5.4.7. Five Phases

The product is then analyzed by the five phases outlined in Section 5.2. Information was not available for all phases of a product's lifecycle and some information was inferred. In the future, the spreadsheet can become more populated as information becomes more available.

5.4.8. Comments

General comments about the product, specific ingredients or particular items or concern. This is not displayed in Table 3 for lack of space but can be found in Appendix A – Spreadsheet.

5.4.9. References

A reference of where the information was found. This is not displayed in Table 3 for lack of space but can be found in Appendix A – Spreadsheet.

6. How It Works

The spreadsheet is a compilation of common building products used in UBC buildings. It is meant to be used as a catalogue to get a snapshot of what goes into the building products. One way to use it is by the Product Category; for example, you can see different products that fall under insulation. The five phases and general notes can give you an idea of what this building consists of, and whether it has an HPD or further specification.

There are different ways to use the framework, but one of the easiest ways is to look items up through the Product Category or Masterformat number. You can find information on one product or specific manufacturer or you can compare different products. Refer to Appendix A – Spreadsheet for the full spreadsheet.

6.1. Information on One Product – SBS Roofing

For this example, Styrene Butadiene Styrene (SBS) Roofing is chosen. SBS Roofing is a common type of synthetic rubber roofing system known for its durability, resistance to weather and longevity. From the spreadsheet we identify that the Masterformat number is 07 52 16. The product and supplier of SBS roofing in the spreadsheet is listed as Generic, meaning no specific information on a particular brand was found, but there is enough information and understanding to analyze its components.

SBS Roofing contains chemicals like formaldehyde, phenols and ammonia, which are identified as chemicals of high concern due to their effect on human health and the environment. The different phases label SBS Roofing as follows:

Table 4 Information on one product – SBS Roofing

Concern	Colour	Description
Phase I – Sourcing		Sourcing the ingredients of this product high health and environmental effects. For example, the bitumen is a oil product which has to be drilled and refined and this is a very energy intensive process.
Phase II – Manufacturing		In this phase, the formaldehyde is added to create the product which has very high bioaccumulation effects and is a known carcinogen. Manufacturing is also very energy intensive and releases a lot of CO2 emissions.
Phase III – Installation		Installing the SBS roof should not cause any issues if proper PPE and installation measures are taken. However, high VOCs level can be harmful for workers.

Phase IV – Occupancy		Since the product is on the exterior of the building and occupants do not come into contact with it, there are no health and environmental effects once the product is installed.
Phase V – Recycling/ Disposal		This product is not recycleable. Ingredients in the product could leach into the ground or the atmosphere and have negative effects.

6.2. Comparing Different Types of Products - Windows

Another way to use the framework is to compare different types of products, such as windows. In this example, a user can compare and contrast aluminum, vinyl and fiberglass windows and see which one has better health and environmental effects.

Table 5 shows the different types of windows and how they compare. For the full breakdown, see Appendix A – Spreadsheet.

Table 5 Comparison between Aluminum, Vinyl and Fiberglass Windows

Product Description	**Product Name**	**Supplier/Manufacturer**	**I**	**II**	**III**	**IV**	**V**
Curtain Wall (aluminum window)	1600UT (Ultra Thermal) System™ 1 and 2 Curtain Walls	Kawneer Company Inc.					
Vinyl Windows	Generic	Generic					
Fiberglass Windows	Fiberglass Windows	Cascadia Windows and Doors					

Even though the spreadsheet is not completely filled out due to a lack of information on these specific products, it can be seen that vinyl windows are not as healthy as aluminum or fiberglass windows. This is because vinyl windows use formaldehyde during manufacturing and are not recyclable (see Appendix A for full list of comments). Obtaining exact ingredients for products is very challenging as not very many companies complete HPDs or declare their ingredients.

6.3. Comparing Suppliers and Manufacturers

Another viable tool to use with this framework is comparing and contrasting different suppliers and manufacturers who create similar products. Particleboard can serve as an example, as seen in Table 6:

Table 6 Comparing Particleboard Products

Product Name	Supplier/Manufacturer	I	II	III	IV	V
Encore Particleboard	SierraPine Ltd.					
TemStock-FR Particleboard	Temple-Inland					
Collins Pine Particleboard	Collins Companies					

It can be seen that Encore Particleboard is healthier than the others, as it does not contain harmful ingredients such as formaldehyde (see Appendix A for full comments). Although the information is not completely available, it is still gives the user an idea of different products available and how they compare.

7. Research Challenges and Limitations

Finding information on products was a big challenge of this research. It is easy to see that manufacturers are not keen in releasing the ingredients of their products. This could be because they want to protect copyright or patented information for proprietary reasons. They also might not want to disclose their ingredients because they do not want to take responsibility for the chemicals that are placed in their products. Many manufacturers publish a Material Safety Data Sheet (MSDS), which lists out the hazards (health, fire, reactivity and environmental) and how to work safely with the product. Although it is a necessary step for health and safety, it does not list out the chemical makeup of the product.

Finding HPD's for products was especially challenging as this information was not always readily available, and if it was, it was not always complete or up to date. This made it difficult to assemble the information, and so some products are more complete than others. It is hoped that the list can be continually updated as additional information becomes available so that it can become a useful tool for future UBC projects.

It is important to note that transparency is the main goal of the Red List and there should be a push to label products the same way that packaged food lists out ingredients and calories. Due to the lack of information, it is currently unfeasible to make recommendations on certain products and ingredients that should be eliminated.

8. Recommendations

8.1. Industry

A few recommendations for industry are listed below:

- Educating the public and construction industry on what the Red List is and how it can help us move towards a sustainable future.
- The name Red List itself sounds intimidating, especially to builders and manufacturers who may see it as another hurdle to use their product instead of working toward a sustainable future. Although Red List is attention grabbing and marketable, changing the name to Material Transparency for example, still sends the message through without sounding intimidating
- There has been a lot of backlash by manufacturers towards LEED v4 which wants building material manufacturers to declare all chemical ingredients. Protecting manufacturers proprietary rights while declaring chemical ingredients is an issue that needs to be addressed
- More common standards that material manufacturers can use and comply with that are interchangeable in different buildings
- Mandatory to report product ingredients and percentages
- Mandatory for manufacturers to report health and environmental effects during all phases of a products lifecycle
- The Ministry of Environment should enable rules and regulations that make declaring product ingredients no longer an option
- There should be rewards or preference shown for manufacturer's that report products

  Explore alternatives such as Passivhaus and Minergie-P as alternatives to building sustainable, eco-friendly buildings

8.2. UBC

UBC recommendations are categorized into recommendations for further study and recommendations for policy change. This is done to differentiate between items that require more research versus items that are actionable.

8.2.1. Further Study

The following items are recommended for further study:

- Continue researching UBC building specifications
- Study a variety of institutional and residential buildings
    - Institutional – Life Sciences Center, Engineering Student Center, Kaiser…
    - Residential – Orchard Commons, Ponderosa…
- Organize information for common products
- Streamline framework
- Explore alternatives such as Passivhaus and Minergie-P as alternatives to building sustainable, eco-friendly buildings

8.2.2. Action Items

The framework is a tool to gather information that can be used to influence policy change. The following recommendations highlight ways the framework can be used to eliminate harmful materials:

- Use the framework in conjunction with LEED to create a UBC-Relevant List of Materials. Since all UBC institutional buildings are designed to LEED Gold, it should be easier to incorporate the material requirements if there is a system in place
- There should be priority in eliminating products that have the most harmful or toxic chemicals.
- The most prioritized products should be those that have a high occupancy exposure. Examples of this are vinyl flooring, PVC pipes, engineering wood products containing formaldehyde, etc.…
- Categories that have the highest occupancy exposure should have highest priority of being removed. For example, carpets, ceiling tiles and paint should have higher priority over insulation because occupants come in more contact with them
- Propose alternatives to products that are not very healthy
- Transparency should be the first priority followed by energy efficiency. Typically, healthy products are also energy efficient but not all energy efficient products contain healthy ingredients

9. References

Busby Perkins + Will (2009, October 16). CIRS IFC Specifications [PDF]. Vancouver: Busby Perkins + Will.

Budds, D. (2017, February 13). Google's Plan To Make Our Buildings Less Poisonous. Retrieved April 26, 2018, from https://www.fastcodesign.com/3066686/googles-plan-to-make-our-buildings-less-poisonous

Declare Products. (n.d.). Retrieved February 16, 2018, from https://living-future.org/declare

Healthy Building Network. (n.d.). Retrieved March 6, 2018, from https://healthybuilding.net/

The Living Future Institute Homepage. (n.d.). Retrieved February 15, 2018, from https://living-future.org/

Pharos Project. (n.d.). Retrieved March 6, 2018, from https://www.pharosproject.net/

Portico. (n.d.). Retrieved April 26, 2018, from https://portico.healthymaterials.net/

Open data for a healthier, more sustainable future. (n.d.). Retrieved April 15, 2018, from http://quartzproject.org/

Green Building Plan (n.d.). Retrieved February 2, 2018, from https://planning.ubc.ca/vancouver/projects-consultations/consultations-engagement/green-building-plan

Transparency – Precautionary List (n.d.). Retrieved February 15, 2018, from https://transparency.perkinswill.com/lists/precautionary-list

Appendix A – Spreadsheet

Masterform	Product Type	Product Category	Product Name	Supplier/ Manufacturer	Potentially Harmful Ingredients	Phase I - Source	Phase II - Manufac	Phase III - Install	Phase IV - Occupancy	Phase V - Recyclin	Comments	Resources
	Sealant	Polyisobutylene sealant tape conforming to AAMA 804.1.	Tremco 440 Tape	Tremco	Naphtalene (category)						Cancerous (Category 1A), harmful to aquatic life	
		Polyurethane Sealant: Conform to CAN2-19.24-M80, for 2-part polyurethane sealant	Tremco Dymeric 240/240FC,	Tremco								
			Sonolastic NP-2									
			PRC Rubber Calk 210									
		Polysulphide Sealant (Interior Joints)	WR Meadows "Deck-O-Seal One Step"									
			PRC Rubber Calk 5000-S									
		Foam Sealant: Blown with hydrocarbon or HFC-134a										
		Structural Silicone Sealant	Dow Corning® 995 Silicone Structural Glazing Sealant									
	Building Insulation	Extruded Polystyrene Insulation (XPS) - type 4		Dow Canada								
				Owens Corning Canada								
				Roxul Inc.								
				Fibrex Insulations								
		Cellulose Fiber	Mountain Fiber Cellulose Insulation	Mountain Fiber Insulation	Fiber treated with Boric Acid			Skin and eye irritant	No issues if installed proper	Not recycleable; can be	Material is recycled; final product considered harmless (acc. To manuf)	
		Fiber Batt Insulation	General	General	Treated with Formaldehyde						Considered harmless in final product	
		Mineral Fibre Insulation - Type 1										
		Foundation Insulation	Styrofoam CT									
		Adhesives	Bakor, 230 21 Rigid Insulation Adhesives									
		Adhesive Materials	Trowlable polystyrene insulation adhesive									
		Spray Foam Insulation	Biobased 1701s									
		Sprayed Fiber Glass Insulation	Monoglass Spray-On White Fiber									
			Monoglass Liquid Bonding Adhesive									
	Air Barrier Membrane	Self-adhering Composite Membrane	Bakor "Blueskin SA"									
			Soprema "Sopraseal Stick 1100 Air Barrier Membrane									
		Transition Membrane	Bakor "Blueskin SA"									
			Soprema Soprasolin HD membrane									
		Through Wall Flashings	Bakor "Blueskin TWF"									
		Breathable Weather Barrier: High-performance, spunbonded polyolefin, nonwoven, non-perforated	DuPont Tyvek CommercialWrap									
			DuPont Tyvek Tape (seam tape)									
			Tyvek Wrap Caps									
	Vapour Barrier	Polyethylene film	Reinforced Dual Polycrepe	Steels Industrial Products								
		Elastomeric Paint Coating	Colorcoat, Colorflex	Sonneborn by ChemRex Inc.								
	Concrete	Plywood or Shiplap										
		Air-entraining admixtures	NVR	Sternson Ltd	Check VOC limits for all below							
			DAREX AEA	Grace Construction Materials	*							
			MB-VR	Masters Builders	*							
		Isolation Joint Filler	Flexcell	Sternson Ltd								
			Giventake	Spicers								
			Kork-Pak	Grace Construction Materials								
		Water Stops	Vololay waterstop rx101									
		Joint Sealants	Iso-Flex 880 GB (Self-Levelling) Sealant	Harry S. Peterson								

Masterform	Product Type	Product Category	Product Name	Supplier/ Manufacturer	Potentially Harmful Ingredients	Phase I – Sourc	Phase II – Manufa	Phase III – Instal	Phase IV – Occupand	Phase V – Recycl	Comments	Resources
	Concrete		Sternson RC-2SL									
			Sonneborn SL2									
			Vulkem 245									
		Non Shrink Grout	Embeco Mortar	Master Builders Company Limited.								
			Pre-mixed "Fast-Set Patching Concrete"	Target Products Ltd.								
	Timber	Studs, nailers, plates and	KD SPF #2									
		Wood Preservatives??										
		Laminating Stock (Glulam)	DFL (CSA 0122)									
		PVL										
		LVL										
		LSL										
	Architectural Woodw	High Pressure Laminate		Formica								
				Nevamar								
				Arborite								
				Szolyd "G-Roc".								
		Cementitious and Reactive Waterproofing	Krystol T1 and T2	Kryton International								
			Xypex Concentrate	Xypex Chemical								
		Water Repellents	Kryton Hydrostop WB Clear Sealer.	Kryton International								
			"Enviroseal Double 7	Degussa Constructio n Chemicals								
			Fabrikem "Fabrishield									
			400 liquid hardener and sealer,									
			.3 Elsro Eucosil #738,									
			.4 Websen Acrylene									
			.5 Kryton Krystol Floor Hardener,									
			Fabrikem Manufacturing Ltd.									
			.2 "Florseal" by Sternson Limited.									
			.3 "Cure and Seal" by Target Products Ltd.									
		Cedar Panels										
	Roofing	Thermoplastic Membrane Roofing	Ultra Ply TPO									
		Roofing Membrane	Blueskin RF200	Henry Company	PBT, Cancerous							
		Bonding Adhesive	Ultra Ply TPO bonding adhesive									
		Pourable Sealer	FillGard	Firestone								
		Molded Flashing	Ultra Ply TPO Pipe	Firestone								
		Roof Insulation	Polyisocynurate Insulation	Firestone								
		Filter Drainage Layer	Drainage Composition Panels.									
			.2 Laticrete Drain Mat									
			.3 Mirafi Miradrain 6000 Drainage Panels.									
	Firestopping											
09 21 16	Gypsum Board Assen	Gypsum Wallboard	PABCO Brand	PABCO Gypsum	Boric acid, Ammonium, Sodium PNS			Skin irritation; inhalation damage to lungs		None pointed out	Calcium Sulfate Dihydrate has developmental concerns	
09 21 16			ToughCo Gypsum	Georgia-Pacific Gypsum LLC	Mercury, Boric acid, Ammonium...						Mercury emmitted in plants producing gypsum; banned on C2C	
	Tile	Waterproof Membranes and Setting Materials		Mapei Inc.								
				Laticrete								
09 51 13	Acoustic Ceiling		Vector item number 1920	Armstrong Product								

Masterform	Product Type	Product Category	Product Name	Supplier/ Manufacturer	Potentially Harmful Ingredients	Phase I – Sourc	Phase II – Manufa	Phase III – Install	Phase IV – Occupand	Phase V – Recycl	Comments	Resources
	Carpet Tile		Tall Story 4TZ240AB0T	Bentley Prince Street.								
	Paints and Stains											
09 65 19.23	Vinyl Flooring		Commercial Flooring Vinyl Composite Tile	Armstrong Flooring	BBP, DEHP, PVC, CASRN							
09 65 19.23	Vinyl Flooring		Vinyl Composition Tiles	Mannington	BBP, DEHP, PVC, CASRN							
08 01 44	Windows	Curtain Wall (aluminum window)	1600UT (Ultra Thermal) System™ 1 and 2 Curtain Walls	Kawneer Company Inc.	Diphenylmethanes						Red List Free, Declare ID KAW-0001, KAW	https://living-future.org/declare-products/1600ut-wall-system-1-curtain-wall-and-system
08 02 53	Windows	Vinyl Windows	Generic	Generic	PVC, phthalates (Red List Items)							https://hrti.com/windows/pros-cons-vinyl-windows/
08 54 30	Windows	Fiberglass Windows	Fiberglass Windows	Cascadia Windows and Doors	Octamethylcyclotetra-Siloxane (VOCs)						Red List Free, Declare ID CAW-2002	https://living-future.org/declare-products/fiberglass-windows/
06 16 33.31	Particle Board	Particle Board	Encore Particleboard	SierraPine Ltd.							No added formaldehyde	Pharos
06 16 33.31	Particle Board	Particle Board	TemStock-FR	Temple-Inland	Formaldehyde, Boric Acid, SLS						Pharos	
06 16 33.31	Particle Board	Particle Board	Collins Pine Particleboard	Collins Compnanies	Polymeric MDI, formaldehyde based resins						Red List Free, Declare ID CCO-3002	https://living-future.org/declare-products/collins-pine-freeform-particleboard/ ; Pharos
05 12 00	Steel	Steel Framing	R-STUD SLOTTED STEEL FRAMING	R-Stud LLC							Red List Free, Declare ID RSD-0001	https://living-future.org/declare-products/r-stud-slotted-steel-framing/
03 21 13	Steel	Galvanized Steel Rebar	Hot-Dip Galvanized Steel - High Grade/Special High Grade Zinc	Galvanize It							Respiratory problems and physical hazard	https://www.galvanizeit.org/uploads/default/HPD_SHG_HG.pdf
09 51 13	Ceiling Tiles		FIBERGLASS CEILING PANELS	Armstrong World Industries	Proprietary Ingredients <1%						LBC Compliant, Declare ID ARM-1002	https://living-future.org/declare-products/optima-pb-fiberglass-ceiling-panels/
07 52 16	Roof	SBS Roofing	Generic	Generic	Formaldehyde, Phenols, Ammonia...							Pharos; https://www.pharosproject.net/uploads/files/sources/1828/Commercial_Roofing_
07 54 23	Roof	Thermoplastic Membrane Roofing	Ultra Ply TPO	Firestone Building Products	Phenols, Carbon, Polypropolene						Bioaccumulation of some ingredients give 'high concern' categories	
04 21 13	Cladding	White Brick	Firth Brick Veneer	Firth Industries Ltd.	Proprietary Ingredients <1%						LBC Compliant, Declare ID FIR-1005...	https://living-future.org/declare-products/firth-brick-veneer-range/
09 64 53	Flooring	Engineered Wood Flooring	Engineered Wood	Model Hardwood Inc	Formaldehyde based resins						Not recycleable	Pharos
08 14 00	Doors	Wood	Generic	Generic							Renewable product; fiberboard can conta	https://www.pharosproject.net/material/show/2086368
08 11 19		Steel	Generic	Generic	Acetone, Formaldehyde, Toluene, TGIC						78% recycleable (steel); impurities in the st	http://quartzproject.org/p/CP127-a03
09-91-23	Paint (low VOC)	Paint	Generic	Generic	NPEs, Titanium Dioxide, Petroleum Byproducts						No information on tinting before application	

Appendix B – Proposal

Research Proposal – SEEDS Red List of Materials

Introduction

The University of British Columbia is focused on sustainability as it relates to the economic, social and environmental impact of the diverse projects it is involved in. UBC aims to achieve "a place of mind" by constructing sustainable buildings that meet the needs of its students and faculty. Many new constructions at UBC are at minimum LEED Gold certified to evaluate the buildings environmental performance through the selection of building materials, energy conservation and sustainable design, among other criteria.

UBC is also in the process of creating their own Green Building Plan, which aims to develop a strategy for achieving buildings that promote human and ecological wellbeing. Part of that initiative is developing policies that target identifying and reducing the use of harmful building materials on campus. Harmful chemicals found in building materials affect the health and productivity of its users and can be detrimental to the ecosystem. These chemicals can be otherwise created at any point during the extraction, production, use and disposal of the materials and can affect manufacturers, construction workers, building inhabitants, wildlife, and ecosystems.

Notable organizations such as the Living Future Institute, Transparency @ Perkins + Will and the Healthy Building Network already conduct research and bring attention to harmful materials that are banned or to be avoided in buildings because they are potentially hazardous to the environment or human and animal health. To summarize their findings, these organizations have developed lists or recommendations for hazardous materials. This project aims to build upon existing research and propose a UBC-relevant Red List of harmful construction materials.

Statement of Problem

UBC has already constructed many buildings to high sustainability standards and is in the process of designing future developments on campus. To improve upon its sustainability initiatives, one of the actions identified is to research and analyze harmful building materials and synthesize that information across the board to identify a UBC-relevant Red List of Materials.

Objectives

The objective of this research is to develop a UBC prioritized red list of harmful building materials which will be used to incrementally reduce the use of such materials on campus and in the surrounding neighborhoods. The aim of this project is to engage stakeholders in the development of the list.

Plan of Action

By exploring and building on existing research done by different organizations, a list of harmful construction materials for UBC will be completed at the end of the project. The work will be done in the following steps:

- Reviewing existing research by different organizations around the world with regard to harmful materials
- A literature review of research done by different institutions and organizations on the topic, to include as a minimum LEED credit and LBC
- Research specifications of UBC buildings to identify building components and materials that are commonly used
- Identify health benefits and detriments of construction products using health data sheets provided by manufacturers
- Assess construction materials market to identify potential health and environmental hazards
- Recommend alternatives to harmful products
- Compile a list of potential harmful components present in Canadian construction materials available in the market
- Engage with relevant UBC staff and stakeholders in developing a UBC red list
- Policy recommendations for green building design at UBC that considers, banishes, or disincentives the use of materials in the Red List, to inform potential updates to UBC policy

The research will focus on UBC institutional buildings with potential to conduct a similar project for residential buildings on campus.