

Checking on chemicals of high concern

What online tools can help?



Ask and you shall receive.

What information do you need before doing an on-line search?

You don't need to be a chemist to find out about the health effects of products and their ingredients. Easy-to-use on-line resources on line can help you better understand the hazards of chemical ingredients in products you use at home or on the job.

But first you need to find the names of chemicals and/or their Chemical Abstract Services (CAS) number. (The number is like the chemical's fingerprint; it should be unique to the substance.)

There are three basic steps to get information about the hazards of chemicals in cleaning products:

- 1 Get the **data sheet** for the product.
- 2 Look at Section 3 of the **WHMIS 2015** version and the ingredients section of the WHMIS 1988 ones. Also check out Section 11 of the new SDSs; sometimes other chemicals are listed there.
- 3 You could write down the name of each ingredient. But some chemicals have many names or their name is a lot like another chemical. So it is best to use the **CAS number** that must be on the data sheet, with the dashes. That way you're sure you've got the same chemical as is in the product.

If there are a lot of chemicals, it might be good to set up a chart to keep track of which chemicals are in which products, and what their hazards are.

If there isn't a regular WHMIS data sheet for the chemical, or there's not

much information (remember the reasons), ask your health and safety rep or supervisor to get you the names and the CAS numbers. (Remind them about Section 5.2 of the *Occupational Health and Safety Regulation*.)

Where does the information in these on-line tools come from?

The tools we describe let you check out (i.e., screen) chemicals using information the organisations have put together from recognised authoritative international lists of different types of hazards. This gives you summarized information about a chemical's hazards. It is a great way to do a quick check.

There are more comprehensive ways to study chemicals, using scientific publications and reports about new research and practices. But these on-line tools, based on scientifically validated databases and sources, provide ways to prioritize action about chemicals of most concern. Plus they are fun to use.

What's the Pharos database?

The Pharos Project is the work of the Healthy Building Network. The HBN's goal is to improve human health and the environment by reducing the use of hazardous chemicals in building products. But anyone can use their database to get information about chemical hazards.

The tool searches for those hazards using 60 internationally-recognized and authoritative (i.e., reliable) lists about the human health and environmental impacts of chemicals. These effects range from a chemical's ability to cause cancer, reproductive system problems, or asthma, to toxic impacts on fish and other things living in water, and more.

The results from all the available lists are presented in a rating system that uses colour codes. The relative hazard levels go from **purple** (highest concern) through **red, orange, and yellow** to **green** (lowest concern). **Grey** means that the result is ambiguous/unclear and **blue** tells you that the substance is on a restricted list. Each result names the lists behind it so you know the source of information behind the result.

Pharos also uses a resource based on the GreenScreen® for safer chemicals, from the Canadian-US group, Clean Production

Action. The GreenScreen is a popular way to understand which chemicals are more hazardous than others by placing a substance in one of four benchmarks or categories. Benchmark 1 is the most hazardous (for which the advice is "Avoid – Chemical of high concern"). Benchmark 4 is the goal of a safe option (where the advice is "Prefer – Safer chemical"). An additional Benchmark U is also used. This means the chemical is 'unspecified' because there is simply not enough information about the human health or environmental impacts of a chemical to know much about it. (This fact sheet has more details.)

This resource was built into the Pharos tool to tell users if a chemical likely is a "Benchmark 1" (BM1). Because the information comes from lists (each of which has its own criteria and process),

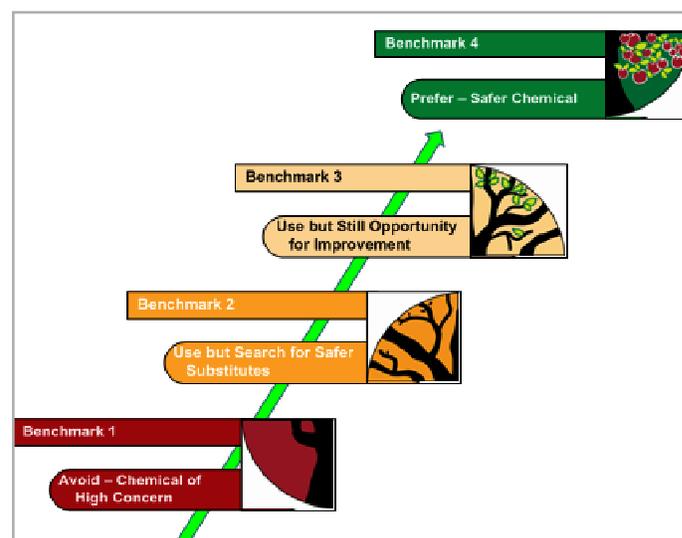


Figure 3.1
The GreenScreen® benchmarks

the scoring is called a GreenScreen® List Translator 1 (LT-1). They are considered likely to be chemicals of high concern.

Pharos has another important category. It says some chemicals are a GreenScreen (GS) LT-P1 – a possible Benchmark 1 chemical. This means they have some characteristics of chemicals of high concern.

Pharos also may use what it calls “LT-U”. This means the chemical’s hazard is “unspecified” because the lists do not provide enough information about a chemical’s human health or

environmental hazards. This could be a good sign, since only hazardous chemicals usually are found on hazard lists. *But*, it also could mean that a chemical has not been fully tested (especially for long-term effects), which is quite common.

Therefore, GS LT-1 chemicals are a priority for informed substitution with safer alternatives – the evidence is very clear that they are chemicals to avoid. After dealing with them, GS LT-P1 chemicals should be the next priority. We explain both categories below in more detail.

How do you find a chemical’s hazards with Pharos?

Example 1: A chemical that Pharos calls LT-1

Let’s use the example of a common chemical in cleaning products, d-limonene. It gives off a citrus smell that many consider “natural”. The SDS should give you some information about its hazards but is it something to worry about? Get a clear snapshot by checking it in the Pharos database.

Here’s how:

1

Use the Safety Data Sheet to find d-limonene’s **CAS number**: 5989-27-5. Make sure you include the dashes between the numbers.

2

Go to www.pharosproject.net. Log in as a BCGEU user (you'll get the password from the union; if you're not a BCGEU member there often are free trial offers). Click on the Chemicals and Materials Library tab in the middle of the top line. Then go to the tab called Search chemicals and materials.

3

Type in the CAS number in the Search Term box on the upper right (to avoid confusion with the wrong chemical). This is what you'll see.

The screenshot shows the 'Chemicals and Materials' search interface. At the top, there are search boxes for 'Search Chemicals and Materials (1)' and 'Search Hazard Lists (67)'. Below the search boxes, it says 'Showing 1 - 1 of 1 results'. The search term '5989-27-5' is entered in the 'Search term' box, and the 'Type' is set to 'Any type'. The results table has columns for 'CAS RN', 'Material Name', 'Hazard', and 'GreenScreen'. Under 'Hazard', there are sub-columns for 'Substance', 'Residual', and 'Manufacturing'. The result for '5989-27-5' is 'D-LIMONENE', which has a red dot under the 'Substance' sub-column and 'LT-1' in the 'GreenScreen' column.

CAS RN	Material Name	Hazard			GreenScreen
		Substance	Residual	Manufacturing	
5989-27-5	D-LIMONENE	●			LT-1

Figure 3.2

The chemical has a red dot under “Substance” in the hazard column. This means it’s a high hazard. The GreenScreen column calls it a GS LT-1, i.e., GreenScreen List Translator Benchmark 1. This means it’s a chemical of high concern, whose use should be avoided. That’s the summary.

4

For details behind the red dot and LT-1 results, click on the actual name – D-LIMONENE. On the new page, you will see the chemical’s CAS number (5989-27-5) next to the name, at the top. There are four tabs right underneath it. Clicking on the Hazards tab will take you to the justification for labelling d-limonene a chemical of high concern.

The screen shot on the next page shows part of the web page that comes up. You can see that d-limonene has a variety of hazards of different levels of concern. (These aren’t the only ones, as this is not the full set of results.) They are listed in order of priority, according to the colour coding.

[5989-27-5] D-LIMONENE

General Information

Hazards

Life Cycle Research

GreenScreen

Direct Hazards:

PBT	 <chem>CC1=CCC(CC1)C</chem> ¹⁰ Health Product Declaration	EC/Oslo-Paris Conv - Priority PBTs & EDs & equivalent concern - PBT - Substance of Possible Concern	
DEVELOPMENTAL		German MAK - List of Substances - Pregnancy Risk Group C	
SKIN SENSITIZE	 <chem>CC1=CCC(CC1)C</chem> ¹⁰ Health Product Declaration	German MAK - List of Substances - Sensitizing Substance Sh - Danger of skin sensitization	+2
ACUTE AQUATIC	 <chem>CC1=CCC(CC1)C</chem> ¹⁰ Health Product Declaration	EC - CLP/GHS Hazard Statements - H400 - Aquatic Acute 1 - Very toxic to aquatic life 	+3
CHRON AQUATIC	 <chem>CC1=CCC(CC1)C</chem> ¹⁰ Health Product Declaration	EC - CLP/GHS Hazard Statements - H410 - Aquatic Chronic 1 - Very toxic to aquatic life with long lasting effects 	+1
RESPIRATORY		AOEC - Asthmagens - Suspected asthmagen (R) - but does not meet AOEC criteria)	
MAMMALIAN		Québec CSST - WHMIS 1998 Classifications - Class D2B - Toxic material causing other toxic effects	+1
EYE IRRITATION		New Zealand HSNO/GHS - 6.4A - Irritating to the eye	

Figure 3.3

The top red bar means d-limonene is a high hazard in the PBT category. “PBT” is highly persistent (P), it bioaccumulates easily in the environment (B), and it’s highly toxic (T). (Hover over the bar to see the explanation.)

On its own, this result tells us that d-limonene should not be used in a cleaning product – or any product. (Like many other products, cleaning products get flushed down the drain, and can affect whatever is in the water they reach.)

The other categories in the screen shot show some of the international lists behind each hazard category. (There is more than one list for many of them; click on the grey oblong symbol with the + sign to find out which ones.)

The environmental and human health effects in the “Direct hazards” column are colour coded. Pharos assigns specific meanings to the colours, as explained in the chart below. (Note they use the word “endpoint”; that just means the hazard or effect, such as skin irritation, reproductive effects, breathing allergies).

Colour	Meaning
Purple	Urgent concern to avoid
Red	Very high concern to avoid
Orange	High concern to avoid
Yellow	Moderate concern to avoid
Grey	Uncertain concern. Wide range or ambiguous hazard levels, and/or endpoint not included in GreenScreen
Blue	Potential concern. Included on a Restricted Substances List for avoidance, monitoring, or careful management
Green	Low concern for this endpoint

So, if this is an ingredient in a product you use, or one used in your workplace, it should be a priority to replace with a less toxic or non-toxic alternative. Talk to your supervisor and your health and safety representative about why it should be re-formulated or replaced. (See more about procurement policies in Section 5 of this toolkit, and how to find ecolabel products in Section 4. For more about how to implement these kinds of changes, see the checklist in Section 6.)

Example 2: A chemical that is rated LT-P1

A product with a GS LT-P1 ingredient simply means it may be a GS-LT1. The only way to find out more about why it may be something to avoid is to do a deeper dive into the information. For example, one chemical we investigated is called alkylbenzene sulfonic acid (CAS # 68584-22-5); it's found in Bio Washroom Cleaner and Deodorizer. The MSDS says it makes up 1 to 5 percent of the product.

When we checked it out with Pharos, we found that the chemical is considered to be a GreenScreen LT-P1 (GreenScreen List Translator Possible Benchmark 1). (See the screen shot below.)

The screenshot shows the Pharos web application interface. At the top, there is a navigation bar with the Pharos logo and menu items: Building Products, Chemicals and Materials (selected), Hazards, Certifications, Dashboard, and Logout. Below the navigation bar, the breadcrumb trail reads 'Dashboard / Chemicals and Materials'. The main heading is 'Chemicals and Materials'. A search bar on the right contains the search term '68584-22-5' and a dropdown menu for 'Type' set to 'Any type'. Below the search bar, the results section shows 'Showing 1 - 1 of 1 results'. The results table has columns for 'CAS RN', 'Material Name', 'Hazard', and 'GreenScreen'. The 'Hazard' column is further divided into 'Substance', 'Residual', and 'Manufacturing'. The 'GreenScreen' column shows 'LT-P1'. The result row for CAS # 68584-22-5 shows the material name '(C10-C16) ALKYL BENZENESULFONIC ACID' and an orange hazard indicator in the 'Substance' sub-column.

CAS RN	Material Name	Hazard			GreenScreen
		Substance	Residual	Manufacturing	
68584-22-5	(C10-C16) ALKYL BENZENESULFONIC ACID	●			LT-P1

Figure 3.4

Again, click on the name of the chemical and in the new page click on the Hazards tab.

This time, the orange hazard is about eye irritation to people and high hazard to fish (acute aquatic). There are moderate hazards (yellow) to skin and to terrestrial organisms or if consumed. (To find out what phrases in the colour coded bars mean, as well as the colour coding, hover over the bar. In this case, “terrestrial” is about ecotoxicity – harm to land-based plants, animals or micro-organisms.) Click the plus tabs for even more information (as shown below).

[68584-22-5] (C10-C16) ALKYL BENZENESULFONIC ACID

General Information

Hazards

Life Cycle Research

GreenScreen

Direct Hazards:

EYE IRRITATION



New Zealand HSNO/GHS - 8.3A - Corrosive to ocular tissue

ACUTE AQUATIC



New Zealand HSNO/GHS - 9.1A (crustacean) - Very ecotoxic in the aquatic environment

+ 1



New Zealand HSNO/GHS - 9.1A (fish) - Very ecotoxic in the aquatic environment

MAMMALIAN



New Zealand HSNO/GHS - 6.1D (oral) - Acutely toxic

SKIN IRRITATION



New Zealand HSNO/GHS - 6.3A - Irritating to the skin

TERRESTRIAL



New Zealand HSNO/GHS - 9.3C - Harmful to terrestrial vertebrates

+ 1

RESTRICTED LIST



German FEA - Substances Hazardous to Waters (VwVwS) - Class 2 Hazard to Waters

+ 2



Environment Canada - Domestic Substances List - Inherently Toxic to Humans: DSL substances that meet human health categorization criteria



US EPA - DfE SCIL - Green Circle - Verified Low Concern

This is a good example about why a chemical being on a list doesn't mean a chemical is of high concern. The organisation might consider it a low concern, as EPA does in this example, but still list it. That's why it's important to check the information behind the colour coded bars, and to look at what each list says about the chemical. Pharos lets you do all of this.

In this example, the chemical has a green circle from the U.S. Environmental Protection Agency (EPA). Its Design for Environment (DfE) Safer Chemicals Ingredient List (SCIL) – used in the Safer Choices label products – put alkylbenzene sulfonic acid on its list of preferred chemicals. At the same time,

Environment Canada considers it to be a possible concern (it's on the [Domestic Substances List](#)) and New Zealand says it does affect health and the environment enough to fit into several GHS hazard classes. You can find out more about each one by clicking on the list name, or going to the original website if you want.

This is confusing, but here's what's happening. The chemical does have some toxic properties. However, when the EPA screened it, the DfE reviewers decided alkylbenzene sulfonic acid is of lower concern than other chemicals like it. That makes it "best in class". In other words, it has no red coded (i.e., it's not a priority to replace) health or environmental effects and its corrosive hazards can be controlled.

Given the EPA's information, this chemical is not a high priority for substitution. However, it needs to be used with good prevention measures (e.g., ventilation, avoid spraying, or – as a last resort – personal protection equipment that is appropriate for the chemical and fits the person wearing it). Workers also should report any problems they have using it. And it is worth considering in a second round of informed substitution, after higher priorities are dealt with.

What's the take-away from these examples?

These are two examples of using the Pharos database as an on-line chemical screening tool.

The take-away is: **start the substitution process by figuring out which chemicals are GS LT-1. Since these are ones to avoid (as chemicals of high concern), they should be priorities for informed substitution.**

Then move onto the LT-P1 category chemicals. These "possible Benchmark 1 chemicals" will show only some signs of concern (based on list information) but they do warrant a longer look at the information provided in Pharos. New studies may provide more information in the future, changing the lists scores as a result.

If you want more help or information, talk about screening results with health and safety specialists. It's always important to ask questions and understand the warnings we find.

Ultimately, the Pharos tool allows purchasing staff, workers, health and safety reps, and others to find out more about a chemical's known hazards than

may be provided on a SDS. They also can understand why some chemicals should be a priority for informed substitution.

From here, finding safer cleaning products is relatively easy. [Section 4](#) explains how to search for informed substitutions.

What other on-line tools could you use?

You can get information about chemicals and their hazards from other on-line tools that are useful for workplace hazards. Two of them are particularly helpful: the Chemical Hazard and Alternatives Toolbox (ChemHAT) and RISCTOX.

Chemical Hazard and Alternatives Toolbox (ChemHAT)

[ChemHat](#) is a free hazard and alternatives tool designed by workers for workers' general use. (They worked with a variety of specialists who are interested in informed substitution.)

Based on the same information sources as the Pharos tool, it uses the same colour coding but different symbols. It does not include the List Translator scores so you won't be able to clearly prioritize chemicals of high concern for substitution the way you can with Pharos. Other than that, the information is basically the same but represented differently visually.

For example, a search for information about [d-limonene](#) (one of our earlier examples) starts out like this:

ChemHAT.org

Chemical Hazard and Alternatives Toolbox

Home / Search About ChemHAT Safer Chemicals For Workers Breast Cancer Safer Families

D-limonene

CAS: 5989-27-5

How can this chemical affect my health?

Stronger effect / evidence ... Weaker effect / evidence

■ Acute (Short Term) Effects [How do we know?](#)

-  **Toxic to Humans & Animals** – Can be fatal on contact, ingestion or inhalation for humans and other mammals.
-  **Irritates the Eyes** – Can cause irritation or serious damage to the eye.
-  **Irritates the Skin** – Can cause irritation or serious damage to the skin.

■ Chronic (Long Term) Effects [How do we know?](#)

-  **PBT (Persistent Bioaccumulative Toxicant)** – Does not break down readily from natural processes, accumulates in organisms concentrating as it moves up the food chain, and is harmful in small quantities.
-  **Sensitizes the Skin** – Can lead to allergic reactions on the skin.
-  **Birth Defects** – Can cause harm to the developing child including birth defects, low birth weight and biological or behavioral problems that appear as the child grows.
-  **Asthma Trigger** – Can result in high sensitivity so that small quantities trigger asthma, nose or sinus inflammation or other allergic reactions in the respiratory system.
-  **Cancer** – Can cause or increase the risk of cancer.

Inherent Hazards [How do we know?](#)

-  **Flammable** – Easily ignited and capable of burning rapidly.
-  **Restricted List** – This chemical is on a list from an authoritative body recommending that its use be avoided.

Figure 3.6

There is a “How do we know?” link beside each effect category. Using it takes you to the sources of information for the statements next to the coloured symbols (which are explained [here](#)). Scroll down to see more information about routes of exposure and a [glossary](#). There also are [training materials](#) about the tool, along with information for workers, information about breast cancer and the *Putting Breast Cancer out of Work* campaign.

There also are links to an offsite website called [Subsport](#); it can provide some information about alternatives, although it’s a work in progress that depends on voluntary submissions.

RISCTOX

RISCTOX is a slightly different type of screening tool. Put together by the technical foundation, the Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS) – the Union Institute for Work, Environment and Health – it focuses on chemicals of concern in the European Union (EU), providing information for about 100,000 substances.

See the site's front page for information about the content and definitions.

The results of a search include the new pictograms and other information required by the GHS (WHMIS 2015), when the chemical has been classified. (Find those classifications via the definitions of different effects or when Regulation 1272/2008 – the equivalent to WHMIS 2015 – is named.) It also has a lot of references to EU lists and regulations, which may be useful (e.g., if something's banned or its use is restricted).

Again, we used the example of d-limonene to demonstrate this screening tool. (With this database, it is best to use CAS numbers, rather than chemical names. If you do use the chemical name, be sure to change the box beside "Name" to "part of the name" in case you don't have the full one they use.)

Here's what the top of the page looks like:

The screenshot shows the RISCTOX website interface. At the top, there is a blue header with the text "risctox 100,000 substances" and logos for the "EUROPEAN ENVIRONMENTAL BUREAU" and "istas". Below the header, the page title is "Trade Union priority list for REACH authorization". The breadcrumb trail indicates "You are in: Risctox > Substance card". The main content area is titled "substance identification" and contains the following information:

- Chemical name:** (R) - p - mentha - 1, 8 - diene
- Identification numbers:** CAS: 5989-27-5, EC EINECS: 227-813-5
- Uses:** cleaner, degreaser, flavor, pesticide, solvent
- International Chemical Safety Card (ICSC):** 0918
- Additional information:** Substance included in the List of Substances of concern for Trade Unions. Reason: Sensitizer, toxic, persistent and bioaccumulative, may cause long term adverse effects in the aquatic environment.
- CLASSIFICATION AND LABELLING (67/548/EEC):**
- CLASSIFICATION AND LABELLING (Regulation 1272/2008):**

Below the identification section, there are three expandable sections:

- health effects:** Carcinogen, Sensitiser
- environmental effects:** Persistent, Bioaccumulative and Toxic

Figure 3.7

The results of this search tell us that d-limonene is on the “List of substances of concern for Trade Unions” because it is considered to be a sensitizer, a PBT chemical, and may cause long-term adverse effects in water.

This also is a time when you need to delve deeper to find out what lists are being used in the screening, and where the chemical is on that list.

In this case, the health effects for d-limonene also uses “Carcinogen”. However, you’ll notice that ISTAS does not mention this effect.

When you hit the + button for more information, it is in Group 3 from the International Agency for Research on Cancer (IARC). The “?” button beside that explains that IARC cannot classify it yet (usually for lack of information). Only chemicals in IARC categories 1, 2A and 2B are considered carcinogens.

At the same time, if you go to the “Sensitizer” category, you’ll see that there’s a regulation saying d-limonene fits this category and a document about why it’s considered to cause allergies. Similarly, there is more information about its environmental hazards.

What other resources can help us know what to avoid?

For lists of chemicals to avoid, see:

- Disinfectants and asthma and Disinfectants and asthma: Part II from Michigan State University;
- Hazardous substances in frequently used professional cleaning products (a study published in 2014);
- “Ingredients to avoid” in Green cleaning, sanitizing, and disinfecting: A curriculum for early care and education;
- “Keep these substances out of your workplace” and “Try to get substitutes for these substances” in the WorksafeBC funded Cleaners and Toxins Guide;
- “Selecting safer janitorial cleaning products: What to avoid and what to look for” in Cleaning for health: Products and practices for a safer indoor environment;
- “Summary of active ingredients rejected during screening”, in San Francisco Environment’s Safer products and practices for disinfecting and sanitizing surfaces; and
- The dirt on toxic chemicals in household cleaning products, from the David Suzuki Foundation.

What's next? Finding third-party ecolabel products

Now we know how to prioritize chemicals of high concern for informed substitution, after starting with our right-to-know about the hazards of chemicals used in our workplace and B.C.'s substitution regulation.

The big questions always are: What else could we use? How do we know it's safe for people or the environment? How can we find less toxic alternatives that have been properly tested for their hazards? Section 4 describes how to find certified third-party ecolabel products that should fit the bill.



TOOLS FOR INFORMED SUBSTITUTION

HOW DO YOU FIND SAFER CHEMICALS FOR THE WORKPLACE?

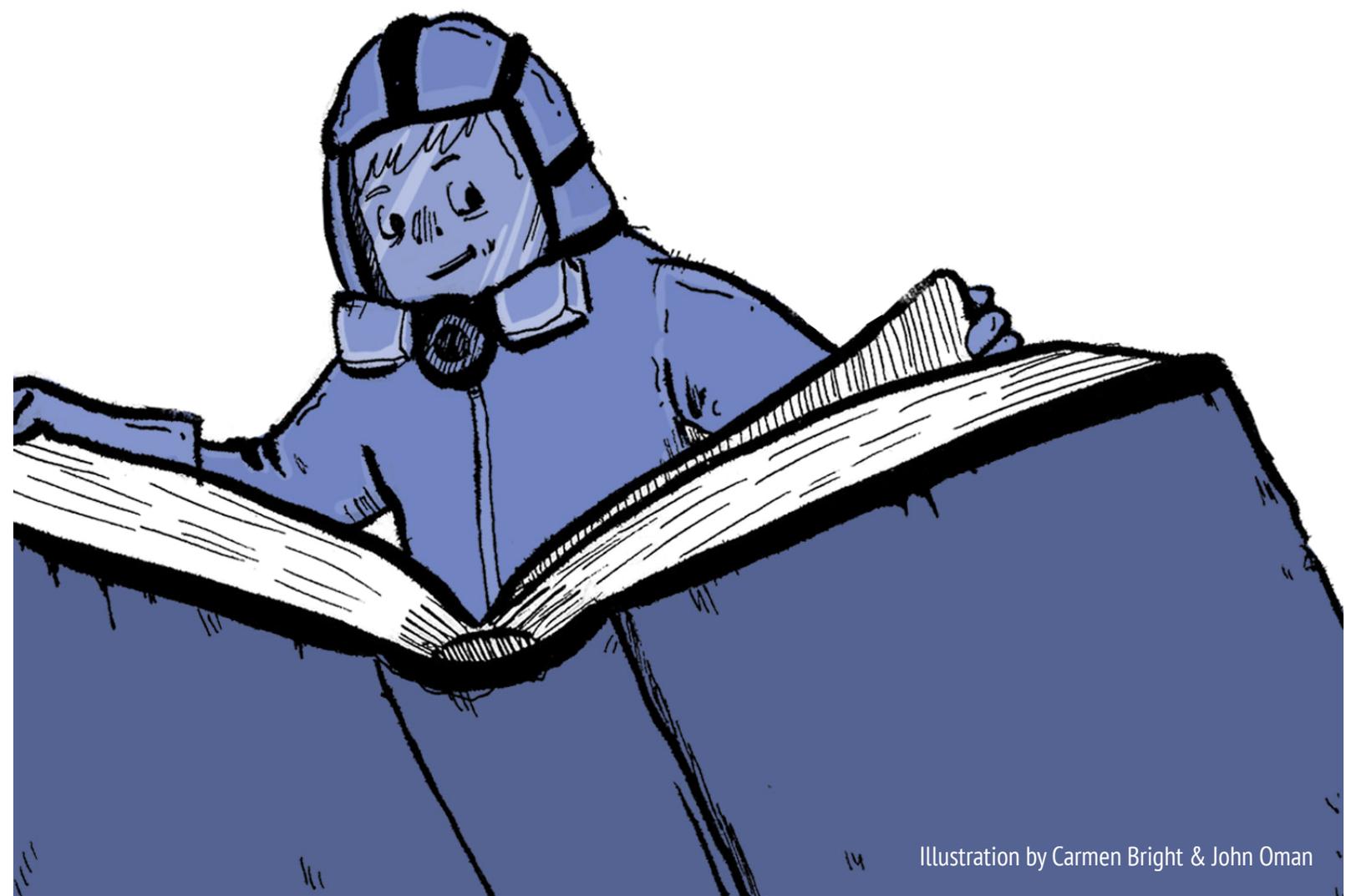


Illustration by Carmen Bright & John Oman

Table Of Contents

Introduction

Why this toolkit?

Section 1

Toxics in our cleaning products.

Why do chemicals matter?

- *How do cleaning products affect people and the environment?*
- *What resources are out there to help people understand how cleaning products can affect our health and environments?*
- *What's next? How do we find out what's a hazardous cleaning product?*

Section 2

From the right -to-know to the need to act. *How can WHMIS 2015 and B.C.'s safer substitution regulation take us there?*

- *What's new with WHMIS?*
- *What are the new hazard symbols? What do they mean?*
- *What are the new labels? What are they supposed to say?*
- *How are data sheets different?*

- *Does WHMIS apply to every product used at work? At home?*
- *How can you use a SDS to get to safer substitutes? Moving from right-to-know to action*
- *Where can you get more information?*
- *What's next? Prioritizing the most hazardous cleaning products for substitution.*

Section 3

Checking on chemicals of high concern. *What on-line tools can help?*

- *What information do you need before doing an on-line search?*
- *What's the Pharos database?*
- *How do you find a chemical's hazards with Pharos?*
- *What other on-line tools could you use?*
 - Chemical Hazard and Alternatives Toolbox (ChemHAT)
 - RISCTOX
- *What other resources can help us know what to avoid?*
- *What's next? Finding third-party ecolabel products*

Section 4

Finding informed substitutes. *How can you find third party certified ecolabel cleaning products?*

- *What are third party certified cleaning products?*
- *What's Ecologo?*
- *What's Green Seal?*
- *What's Safer Choice?*
- *What is SF approved?*
- *What else is available to help find informed substitutes?*
 - A Cleaning Solutions database
 - Microfibre mops and cloths
- *What resources are out there to help choose informed substitutes?*
- *What's next? Preparing a good procurement policy*

Section 5

Buying safer cleaning products. *How do you set good procurement policies for informed substitution?*

- *What are the best practices for green procurement policies?*
- *What about the costs?*
- *Where can you get more information?*
- *What's next? Implementing informed substitution in your workplace*

Section 6

Keeping the workplace healthy and safe. *How do you implement informed substitution?*

- *What are the steps?*
- *What are the benefits of informed substitution?*
- *What can you do to get informed substitution of cleaning products?*
 - *What can health and safety reps and staff do?*
 - *What if you're a worker?*
 - *What about supervisors, employers, and procurement staff?*
- *What does all this add up to?*
- Some resources for screening chemicals (especially in cleaning products)
- Some resources for informed substitution for workplaces
- Some resources for informed substitution for consumers

Appendices

More resources about hazardous chemicals and informed substitution

- Appendix 1
- Appendix 2
- Appendix 3