Best Practices for Chemicals Management

1. Why care about chemicals?

Chemicals are present in almost all products. Taken together, tens of thousands of chemicals provide useful features that assist the needs of our daily lives. Chemicals are a vital part of electronic gadgets, toys, apparel, furniture, … You name it.
They come with a downside, though. A significant portion of chemicals in daily use - up to forty per cent of all manufactured chemicals, according to some scientists - have intrinsic hazards that might negatively affect the health of humans and wildlife. In other words, they are considered toxic[1].

The chemical content of your product is the sum of a long chain of activities, reaching upstream through the manufacturing chain. The manufacture of a product can involve anything from a few common chemicals up to hundreds of synthetic chemicals. (A typical household cleaning product contains a dozen or so different chemicals, while an electronic gadget might be the result of several hundred used throughout its making.) Some chemicals end up in the final product while others serve as intermediates in the production chain.
Toxic chemicals will most likely be part of the mix. Chemicals with special attributes are used to achieve product properties such as durability, texture, distinct color or fragrance, etc. It is not a coincidence that chemicals with toxic properties are abundant among these special chemicals. For instance, the strive to create "enduring" properties (such as water repellant textiles) tends to favor chemicals that are more difficult for biological, living systems to recognize and to break down. Instead, they resist breakdown and build up to harmful levels in nature.
So you can assume that toxics may be part of your product, too. And you need to deal with it. Preferably sooner than later.

2. Toxic chemicals – a hidden business risk

Anyone involved in the manufacturing, marketing, selling, transport and handling of products needs to be aware of the chemicals involved. First and foremost, chemical ignorance can cause harm to your workers, consumers and the environment. But it also poses a financial threat to your business. Many companies have been the targets of litigation, product recalls and damaged brand reputations because they haven't considered the impact of chemicals closely enough. For example, toy maker Matell recalled almost one million toys from the US market because they were

[1] Toxic chemicals constitutes a large number of intrinsic properties - Chemicals known as "CMR"s, can cause (c)ancer, induce (m)utations to DNA, or harm our (r)eproductive system. Others, for example Endocrine Disrupting Chemicals, known as EDCs, interfere with our hormones, triggering various adverse effects in particular during developmental phases.

covered with lead paint, and electronic giant Sony had to recall Playstation due to illegal cadmium concentrations.

Ignorance also means a risk of breaching regulations; such as construction company Skanska's use of the neurotoxic substance acrylamide in the construction of a tunnel. Toxic chemicals are subject to increasing legal requirements and non-compliance can cause severe disturbances in production processes. If an unacceptable toxic ingredient needs to be eliminated, it may cause shortage of supply. In severe cases, non-compliance could lead to prosecution.

3. So toxics are everywhere - Where do I begin?

Chemical advisers, toxicologist, epidemiologists, governmental and local inspectors... the toxic chemicals issue engages a long list of professionals attempting to define and control the toxic threat. It can seem like a jungle out there – so many chemicals in use, and such a lack of knowledge. Most companies neither have the staff resources nor the time to dig into the details. However, it's worthwhile getting acquainted with some basics. There is a limited number of toxic "hot spots" that are under scrutiny. Screening through this shortlist will make you better equipped to understand where your toxic footprint might be.

Plastics

Plastics are a wide group of materials based on polymers. Commonly used polymers are polyethylene (PE), polypropylene (PP), polyvinylchloride (PVC), polystyrene (PS) and polyurethane (PU or PUR). However, the list of polymers is much longer, and new inventions are constantly being added. Mixing different polymers (to co-polymers or multilayer solutions) is also common to improve the functionally of plastic materials. The choice of polymer depends on desired function.
Almost all polymers are produced from fossil material. Biobased polymers, such as PLA made from agricultural feedstock, are increasingly being used although they still have a very marginal market share. Most plastic materials contain numerous additives (functionality chemicals) to enhance performance. The amount of additives applied can vary from 0-95 per cent depending on the polymer and product type . Many of the negative properties of plastics come from the additives rather than from the polymers themselves.

Plasticisers

These are used to soften plastics. While some polymers are intrinsically "soft", other polymers require substantial amounts of plasticisers to become flexible. PVC represents the dominant use of plasticisers.
Phthalates are one common group of plasticisers that are being used in large quantities, often around 30-60 per cent of the plastic's total composition. Several phthalates have hazardous properties, such as being toxic to reproduction. Because

phthalates are not chemically bound to the plastic material and can leach out, users are likely to be exposed to them.

Flame retardants

Flame retardants are used to make a product less flammable. Depending on national regulations, flame retardants may be required in a product. Examples of such products are protective clothing, curtains and fabrics used in furniture, to name but a few. Some currently used flame retardants, especially halogenated compounds, have been shown to have hazardous properties and some are subject to international and/or national regulations.
Historically, brominated flame retardants (BFR) have been extensively used. BFRs have proved to be toxic, to bioaccumulate and to persist in the environment.

Biocides & Pesticides

Biocides and pesticides are used to prevent living organisms from thriving on your goods. Biocides and pesticides can be used to prevent anything from bacterial growth to grazing by large animals. They are common ingredients in products that are sensitive to bacterial growth, either during shelf life or consumer use, or both. Biocides can also be used during manufacture and transportation and to give the end product antibacterial properties.
Since these chemicals are actually designed to kill, they are inherently risky to include in products. It is a great challenge to develop biocides and pesticides that will not harm other organisms, including humans.

POPs

Persistent Organic Pollutants (POPs) are a group of chemicals that possess a particular combination of properties that make them extremely long-lasting and widespread in the environment. Since they are also toxic and bioaccumulate, they have received special attention from the international community. A global treaty, the Stockholm Convention, has been created to reduce and ultimately eliminate their use. Beginning with 12 chemicals in 2004 (called “The dirty dozen”) the convention has currently expanded to cover 24 substances/substance groups. Effects of POPs include cancer, allergies and hypersensitivity, damage to the nervous system, reproductive disorders and disruption of the immune system. As POPs degrade so slowly and are often transported over large distances, in practice it is impossible to clean them from environment.

Heavy metals

Heavy metals is a wide group of elements, of which many have toxic properties, for example causing mental and physical disorders among humans and other mammals. Common examples are chromium, arsenic, cadmium, mercury and lead. Because of their extensive use in society, heavy metals are found in unhealthy levels in the environment. Even though the toxicity of heavy metals has been known for decades, lead and mercury are still widely used in all sorts of articles, from batteries to electronic equipment and toys.

Hormone Disrupting Chemicals (EDCs)

Some chemicals act by interfering with the hormones in animals and plants. The hormone system is also called the endocrine system. Since hormones regulate everything from behaviour to organ development, reproduction and growth, messing with this system can have serious effects. Endocrine Disrupting chemicals (EDCs) work through numerous mechanisms, and have been shown to play a role in many public health issues such as obesity, autism and developmental disorders.

CMRs

Chemicals known as “CMR”s, can cause (C)ancer, induce (M)utations to DNA, or harm our (R)eproductive system.
If a substance is identified as having one or more of these properties (there are standardized tests to check this) a number of obligations kick in for companies. For instance: requirements for warning labels signalizing the danger and making sure safety data information is available to those using the product.

4. Navigating the regulatory landscape

Just as toxic chemicals are complex and wide reaching, so is the legislation set up to regulate them.
This was not always the case. For decades chemicals were hardly regulated at all, with some specific exemptions[2], and the vast majority of chemicals could be used without the need to provide evidence they were safe. If a substance was identified as a severe toxic pollutant, it was more based on coincidence rather than systematic scrutiny. No general testing of chemicals for harmful properties was required.

This has slightly changed in recent years. The EU has enforced REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals), a comprehensive legal framework that address all chemicals in use, requiring companies marketing chemicals to present a set of test data. The US equivalent, TSCA (Toxic Substances Control Act), set some basic requirements but is much more limited in scope.

[2] Regulations existed for functional groups where legislators had obvious reasons to intervene – pesticides (designed to kill!), biocides, food additives (we eat them!) and cosmetics (we use them on our bodies).

5. Spotting the toxic footprint of your products

The complex web of suppliers, where products are intrinsically composed of materials and chemicals from around the world, makes it challenging to keep track of chemicals.

From raw material to finished product, manufacturing involves several processes that use chemicals. What chemicals are present in your supply chain? It's time to start managing your company's toxic footprint.

6. Your suppliers - Your best source of information

Your suppliers are key to obtaining information about your product's chemicals history. This is therefore the natural starting point for gathering information. As their client, you should expect them to provide all necessary details to map your product's toxic footprint.

However, many suppliers are reluctant to provide information on chemicals content. In an air of confidentially, suppliers restrict information severely and often only certify that the chemicals are in accordance with legal requirements. This sort of certification is of course important as a first step, but far from enough when you want to define your footprint. Ideally, you would like to have from your supplier a complete list of chemical content to be sure of what you have in your product.
You might have to flex your financial muscles in order to attract their attention. De-selecting a supplier because they are not helping you map your chemicals is sometimes a necessary step to take. Hopefully, the pure threat of loosing a client will make your supplier more collaborative.

If you operate inside the EU, you can make use of legal requirements. Suppliers are required through REACH to provide information whether their products contains a "Substance of Very High Concern (SVHC)". These are substances the EU has prioritized because they have dangerous intrinsic properties. Suppliers of articles that contain a SVHC in concentration above 0.1 per cent must always declare this to professional clients.
For products that contain toxic chemicals, the supplier must also provide you with a safety data sheet.

8. I want to be proactive. Where do I start?

Defining your footprint is an important prerequisite, but is only there to enable you to protect and improve your business situation. Knowing your toxic "hot spots" gives you the base for a better position with opportunities and controlled business risks.

Your second step is to setup a priority list of chemicals. In this process you need to look for external and internal factors that make certain chemicals more of a priority than others.

External? There might be some obvious reasons for you to act based on external pressure. This refers to things such as laws that forbid you using a certain chemical or consumer pressure around a specific product of yours.

- *Legal*
  Chemicals that are already banned or restricted for your particular purpose need your immediate attention. Substances that are listed for priority attention (e.g. on the EU Candidate List) give you more time, but you should initiate the search for alternatives as soon as possible. Substances having a harmonized classification and labeling for being hazardous should also be prioritized. This information should be provided by your supplier in a safety datasheet. The SIN List by ChemSec has been set up to help you also avoid substances which may be regulated in the future.

- *Supply chain*
  Your customer or others in the supply chain might ask you to avoid certain chemicals or tell you that a specific chemical will be unavailable in the future. In these cases you need to agree the timeline for phasing out with the other party.

- *"Hot" chemicals and consumer preferences*
  Some chemicals gain extra attention in the media and consumers become aware and ask for alternative products that are free from them. It is wise to be prepared by monitoring which chemicals are being discussed and highlighted by campaigning NGOs, otherwise your brand may be hurt.

Internal? For those chemicals where there is no external pressure, you need to set your own priorities according to company policy. When considering a phase out, you need to take several things into consideration. The following aspects may be of relevance:

- Chemicals used in products intended for children.
- Other types of products that are especially "close" to the consumer: items related to food and feeding, bed linen, underwear etc.
- The type of hazard in relation to the product. Sensitizers, for example, are of very high concern when in contact with the skin, while substances with environmental hazards are particularly problematic when they have low wash fastness on textiles.
- Chemicals that are extensively used in high volumes.
- "Flagship products" of particular importance to the company and company reputation.
- Chemicals for which alternatives are easily available

9. A beginners guide to substitution

After defining your priority list, the real fun begins. How do I switch from a toxic treat to a safer and better alternative?

Remember that substitution is rarely only about switching from chemical A to chemical B. You will need to take much more into the picture to make sure you make a wise choice.

Depending on the situation, substitution can be easy or sometimes more difficult. But the added value once it has been done is always the same – your product is safer.

Substituting hazardous chemicals with safer alternatives is a very effective way to improve the toxic footprint of your products. It will not only make the final product safer, but also create better working conditions.

In short, the substitution process starts with identifying a chemical that needs to be removed, and understanding what function it has in the production process or properties it gives the product.

In best case it may not be needed at all, or it could easily be swapped with only a slight modification of the process.

It is also important to think of the aesthetic appearance and properties of the product. Is it possible to accept a slightly different nuance or a good enough property by using a less hazardous chemical as a substitute?

If you are thinking about substitution, you need to take extra care not to introduce other hazardous chemicals.

How substitution works – step by step

- Define the function, use and need of the substance you want to replace
- Define criteria for the alternative
- Search for available alternative solutions
- Evaluate and compare alternatives
- Test on a pilot scale
- Implement substitution

Use, function and need

It is very useful to think about substitution using these different levels – function, use and need. Let's look at the use of phthalates in PVC printing on textiles as an example

The function of the phthalate is to make the PVC plastic soft.

If you only consider the function you might find an alternative non-phthalate plasticiser.

You can also look at the use, which is PVC for textile printing. Bearing this in mind you might consider changing to another type of printing paste that does not require plasticisers: polyurethane or silicone for example.

The ultimate need is to produce textiles that are attractive. Perhaps this can also be achieved by other means, such as embroidery.

Depending on the question you ask, you might end up with several possible alternatives. Our recommendation is to take a broad perspective and look at all the possibilities so that you have as many solutions as possible at this stage.

Before moving on to assessing and comparing alternatives it is important to think through what you want from an alternative. What would you like to achieve in terms of hazard profile and functionality: Is there a cost limit? How urgent is the substitution? Are there already legal requirements in place or do you have time to wait for an alternative that is currently at the research stage?

Evaluate and compare alternatives

Assessing alternatives is about making sure you choose the best of the available alternatives, given the criteria you have set. The following aspects can be considered when assessing alternatives:

Hazard assessment
Functionality of alternatives
Availability of alternatives
Costs
Changes to processes
Life-cycle considerations: energy, waste/discharge, carbon dioxide emissions, etc.

If the aim of substitution is to reduce hazardous chemicals, the hazard assessment is where you should start. Once you are sure you have one or more alternatives that are less hazardous than the substance you are substituting, you can look at all the other aspects.

Assessment of alternatives is widely discussed, and new and better methodologies are under development. Some regulations require that alternatives are assessed before hazardous chemicals can be routinely used, i.e. the European chemicals regulation REACH.

There are a number of available methods; some are simple and require only information from Material Safety Datasheets, while others require information from scientific publications or even re-testing of chemicals.

The OECD has worked with stakeholders to create a “toolbox” that is designed to help you choose a method of alternatives assessment that suits your competence and requirements.

http://www.oecdsaatoolbox.org/Home/Tools

The most comprehensive method for assessing alternatives is called the “GreenScreen for safer chemicals”. This was developed by the organisation Clean Production Action and provides a rigorous comparative hazard assessment based on 18 different hazardous endpoints. Chemicals are benchmarked on a scale of 1 to 4, which makes the comparison visible and easy. The GreenScreen is also a part of some US regulatory initiatives and standards for the building and electronics sector.

http://www.greenscreenchemicals.org/

One common problem when assessing alternatives is the lack of data, especially for newer chemicals. For chemicals where little or no data is available, one can estimate hazardous properties based on chemical structure. The most popular methodology for this is called q-SAR, but this requires chemicals expertise and training.

For use with the SIN List, ChemSec has developed a tool called SINimilarity. This gives you the opportunity to type in a chemical’s CAS number and find out if this chemical is structurally similar to any of the substances on the SIN List. If so, it is not unlikely that the chemical has similar problematic properties.

http://sinlist.chemsec.org/
http://sinimilarity.chemsec.org

Even after thorough investigation of the feasibility of an alternative, there may be things that you could not foresee. It is therefore always wise to do a practical pilot test before implementing full-scale substitution.

Having come this far you can be very pleased. You could take this opportunity to pass on news of the substitution to your supply chain and perhaps even to consumers. However be aware that you may not yet have found the final and ultimate solution. Substitution is an ongoing process, since new scientific findings and regulations may turn up. Having done a proper alternative assessment though, you are prepared in the best possible way for this.

10. Useful links

BizNGO

www.biznGO.org

California's Safer Consumer Products (CSCP) Program

http://www.dtsc.ca.gov/SCP/

Safer Choice Programme – USEPA (formely: Design for Environment)

https://www.epa.gov/saferchoice

Green Screen for Safer Chemicals

www.greenscreenchemicals.org/

OECD Substitution and Alternatives Assessment Toolbox (SAAT)

- *Inventory* of chemical hazard assessment tools and data sources to help identify suitable tools to use. A listing of non-hazard assessment tools is also available.
- A summary of the current *frameworks* that can be used to assess alternatives.
- Links to *case studies*, toolkits, and product rating systems that provide examples, insights, and lessons learned on substitution and alternatives assessment approaches.
- A list of *regulations and restrictions* throughout OECD member countries that are driving the increased need for chemical substitution

www.oecdsaatoolbox.org

Toxic Use Reduction Institute (TURI) – Massachusetts

- *CleanerSolutions Database* - provides information about safer alternatives to hazardous solvents for surface cleaning.
- *Chemical Databases.* A list of databases on chemical characteristics, preferred products, undesirable materials, and other related databases.
- *Finding Environmental, Health and Safety Information*. Provides links to resources on environmental, health and safety data on chemicals.

http://www.turi.org