Manufacturing CEOs: closing the product safety gap

When specifying materials, manufacturers must also consider chemical safety

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A report published recently showed that a major consumer products manufacturer failed to verify compliance of its televisions with chemical substance restrictions in its markets. The result? It sold televisions that, surprisingly, contain an illegal chemical flame retardant.

DecaBDE was phased out of manufacture in 2013 in the US under a voluntary agreement with the EPA. However, it is still produced in and available to manufacturers in China and so can continue to find its way into products consumed around the world.

There was a similar failure among toy manufacturers a few years ago, when they were caught selling toys that illegally contained lead in paint. When this came out, it caused an uproar.

Manufacturers like Mattel, RC2 and others issued huge product recalls. This was very costly for them – Mattel alone lost at least $110m, worth 2% of sales, in 2007 – and brand equity.

The final embarrassment to the industry was the US Federal Consumer Product Safety Commission (CPSC) coming down hard with new regulations, banning additional substances and requiring expensive testing. The CPSC was effectively saying: "If you can't control product safety yourselves, we're going to force you to control it our way."

Toy manufacturers could have avoided this draconian regulation by defining, controlling and properly managing their materials and supply chains. They seemingly chose instead to maximise profit and give their suppliers free rein when selecting product materials, either explicitly or by their passivity. When cost is king, quality and conformance to specification can suffer.

However, it is not only a focus on cost that can cause these problems. When manufacturers fail to identify and embrace market requirements at the design stage, for example taking into acount factors such as substance restrictions or harmful environmental or human health impacts, they can inadvertently market products that put themselves at risk of recall costs and brand damage, and their industry at risk of more regulation.

Safety standards vs. safety

Flame retardants – which are the subject of the report – are particularly challenging for manufacturers of electronic products. These products operate by controlling and managing electrical energy. Their components can use and dissipate the energy provided in various ways, including thermally as heat.

To save costs and improve flexibility, many parts and materials used in electronic products are made of plastics. Whether derived from fossil fuels or plants, plastics are flammable. To use them in locations where they could be subjected – usually under fault conditions as opposed to normal operating conditions – to heat levels that exceed the safe threshold for flammability is dangerous, unless the risk can be mitigated.

The International Electrotechnical Commission (IEC) creates and maintains standards for a variety of electronic products. These define safety requirements, including flammability. For televisions and IT products in general, IEC 62368-1:2014 stipulates guidelines that, when followed, reduce the likelihood of ignition and, should ignition occur, control the spread of fire.

The standard also offers advice on design and materials that help in meeting its requirements. For example, a design engineer could separate flammable parts by a specified distance from potential sources of ignition, such as a hot part or a site that could short-circuit and generate higher than normal temperatures, or use a barrier made of a less flammable or non-flammable material.

The standards do not tend to be prescriptive; rather, they define what the design must achieve. Parts and barriers may be made of various materials, for instance, but those materials must possess minimal levels of non-flammability. In choosing a plastic material, design engineers must be aware that most plastics are flammable, unless they are sufficiently treated with chemical flame retardants.

While a wide variety of flame retardant chemicals are available, organohalogens – those based on chlorine or bromine for their functionality – comprise most of the substances restricted or eliminated under the Stockholm Convention. Two types of these flame retardants are also restricted under the EU RoHS Directive and, as a broader class, they are all targeted for restriction in electronic casings as well as children's products, upholstered furniture and mattresses by the US Consumer Product Safety Commission.

These are toxic chemicals that, of themselves, pose a safety risk to the environment and human health. Using them to mitigate thermal safety may not always be an appropriate trade-off, particularly in customers' minds, and this may put a manufacturer at risk of having to re-engineer products to replace them once they are restricted.

While IEC 62368-1:2014 and similar standards cover classical thermal safety, they do not cover environmental or human health impacts from material and substance selection. This gap is an aspect of how manufacturers' products can get into trouble with regulators.

Rethinking safety

Awareness of these kinds of details should make engineers think twice about using plastic materials in high energy, high temperature or high risk environments. Plastics have fantastic and compelling properties, but they may not be the only materials that do. Many laptop computers now come in metal enclosures; in the past, nearly all were enclosed in flame-retarded plastics.

An increasing number of consumer-class routers and switches have metal enclosures. This is not by accident. While there are many reasons for it, this approach eliminates the problems related to flame-retarded plastic enclosures now and in future designs.

Electronics manufacturers are not alone: in fact, manufacturers of nearly all products - and authors of product safety standards for them as well - must rigorously consider environmental and human health safety as a critical aspect of product safety.

Furthermore, flame retardancy is not the only chemical function that can get manufacturers into trouble, nor are plastics the only problematic material. REACH restrictions, authorisation and disclosure requirements identify many functions (extending beyond classical product safety considerations) that may cause problems if the wrong substance is selected to fulfil them, including:

- corrosion resistance (for example, chromates);
- UV stability;
- product/material colour; and
- plastic flexibility (for example, phthalates).

Engineers responsible for selecting materials throughout the supply chain must review their choices and ask themselves certain questions:

- Will this choice risk exposing my customers to toxic substances, regulated or not?;
- Are there other design or material options that will achieve the same result with lower safety and redesign risk?;
- What is the lifecycle cost/risk trade-off between these options?;
- If a plastic must be used, what are the trade-offs among the various types of plastics that do and do not require flame retardants, stabilisers, etc?;
- Is this specific chemical (or product-level) function required? And if so, how do I define which chemicals are acceptable?; and
- Is 'acceptability' defined simply by compliance with regulatory requirements, or are there future risks – to the brand, to my customers and to future designs – attached to selecting a particular chemical type or family for this product or product line?

CEOs must ensure that their engineers are asking themselves these types of questions. They must be a fundamental part of product development and part of the company's product lifecycle processes.

Engineering departments in electronics companies and others that manufacture articles often do not have sufficient knowledge of chemicals and toxicology.

Rather than ignoring this problem, such expertise should be sought out and incorporated into the product lifecycle process, design reviews and specifications.

The inclusion of procurement and supply management (at least) in these decisions is critical to help understand not only the availability and cost of the various design options, but also the ability of suppliers to meet the defined material quality (including substances incorporated) and volume requirements.

If a manufacturer simply specifies 'black PC/ABS plastic that meets UL94V-1 flammability requirements', the suppliers will use whatever sources of resin, colourant, stabilisers and flame retardants they, or their resin suppliers, choose.

Unless the manufacturer defines the sources and parameters on acceptable substances – either based on or including toxicity – and ensures that its suppliers remain within those constraints, its risk mitigation strategies have a serious and increasingly dangerous gap.

Manufacturers must do their part to avoid an experience like that of the toy industry. They must therefore take product environmental and human health impacts - and, at the very least, compliance - as seriously as any other product safety attribute.

The views expressed in this article are those of the expert author and are not necessarily shared by Chemical Watch