Substitution of brominated flame retardants with non-halogenated alternatives using the GreenScreen™ for safer chemicals alternatives assessment tool.

Abstract

HP is working to phase out brominated flame retardants (BFRs) in new products that currently contain BFRs. To evaluate whether the commercially available alternatives to BFRs have a lower adverse impact to human health and the environment, an integrated assessment approach was developed for analyzing potential replacements. This integrated approach incorporates a comparative chemical hazard screening step based on a tool called the GreenScreenTM for Safer Chemicals [http://www.cleanproduction.org/greenscreen.php], a framework developed by the non-governmental organization Clean Production Action. This case study examines the integrated assessment approach in the search or suitable alternatives to BFRs.

Substituted substance(s)

1. **Hexabromocyclododecane (HBCDD)**
   CAS No. 3194-55-6, 25637-99-4 **EC No.** 221-695-9, 247-148-4
   Chemical group Brominated flame retardants
   Other adverse effects

   The substance is: fulfilling PBT criteria (EC PBT working group), as listed in the Substance Database according to SUBSPORT Screening Criteria (SDSC)

   Classification
   The substance has no harmonised classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)
   » Search ECHA's Classification and Labelling Inventory

2. **DecaBDE**
   CAS No. 1163-19-5 **EC No.** 214-604-9
   Other adverse effects

   The substance is: on the OSPAR list of substances of possible concern, endocrine disruptor (SIN List), as listed in the Substance Database according to SUBSPORT Screening Criteria (SDSC)

   Classification
   The substance has no harmonised classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)
   » Search ECHA's Classification and Labelling Inventory

3. **Tetrabromobisphenol A (TBBPA)**
   CAS No. 79-94-7 **EC No.** 201-236-9 **Index No.** 604-074-00-0
   Chemical group Brominated flame retardants
   Classification: R-phrases
   R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
   Classification: hazard statements
   H400 Very toxic to aquatic life
   H410 Very toxic to aquatic life with long lasting effects
   Other adverse effects

   The substance is: on the OSPAR list of substances of possible concern, as listed in the Substance Database according to SUBSPORT Screening Criteria (SDSC).

   » Check classification at official site

Alternative substance(s)

1. **Aluminium hydroxide**
   CAS No. 21645-51-2 **EC No.** 244-492-7

   Classification
   The substance has no harmonised classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)
   » Search ECHA's Classification and Labelling Inventory

2. **Melamine polyphosphate**
   CAS No. 218768-84-4 **EC No.** 243-601-5

   Classification
   The substance has no harmonised classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)
   » Search ECHA's Classification and Labelling Inventory

3. **Diethylphosphinic acid aluminium salt**
   CAS No. 225789-38-8

   Classification
   The substance has no harmonised classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation)
   » Search ECHA's Classification and Labelling Inventory

4. **Boehmite**
   CAS No. 1318-23-6 **EC No.** 215-284-3
   » Check classification at official site

Application

Sector
Manufacture of computer, electrical, electronic and optical products
Function
Flame retardants

Enterprise using the alternative

Hewlett Packard

www.hp.com

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State of Implementation Full capacity
Availability of alternative(s)

On the market

Producer or supplier

The phosphorus, inorganic and nitrogen flame retardants association (pinfa)

Reliability of information

Evidence of implementation: there is evidence that the solution was implemented and in use at time of publication

Hazard assessment

The alternatives disclosed are not on the database of hazardous substances according to SUBSPORT screening criteria, and have no official risk or hazard classification.

Substitution description

In response to these restrictions, several flame retardant manufacturers promoted alternate BFRs as replacements. However, the primary concern with the use of BFRs in electronics, and the driving force behind the RoHS restrictions, is the formation of dioxins and furans in incineration [at insufficiently high temperatures] at end-of-life. The alternatives promoted as BFR replacements also would give rise to dioxins and furans in the same way so these alternatives do not address the end-of-life concerns that were important to the electronics industry and the driving force behind RoHS.

Recognizing the need for a better way to evaluate whether alternatives have a lower overall adverse impact to human health and the environment, an integrated assessment approach was developed for analyzing potential replacements. This integrated approach incorporates a comparative chemical hazard screening step based on a tool called the GreenScreenTM for Safer Chemicals [http://www.cleanproduction.org/greenscreen.php], a framework developed by the non-governmental organization Clean Production Action.

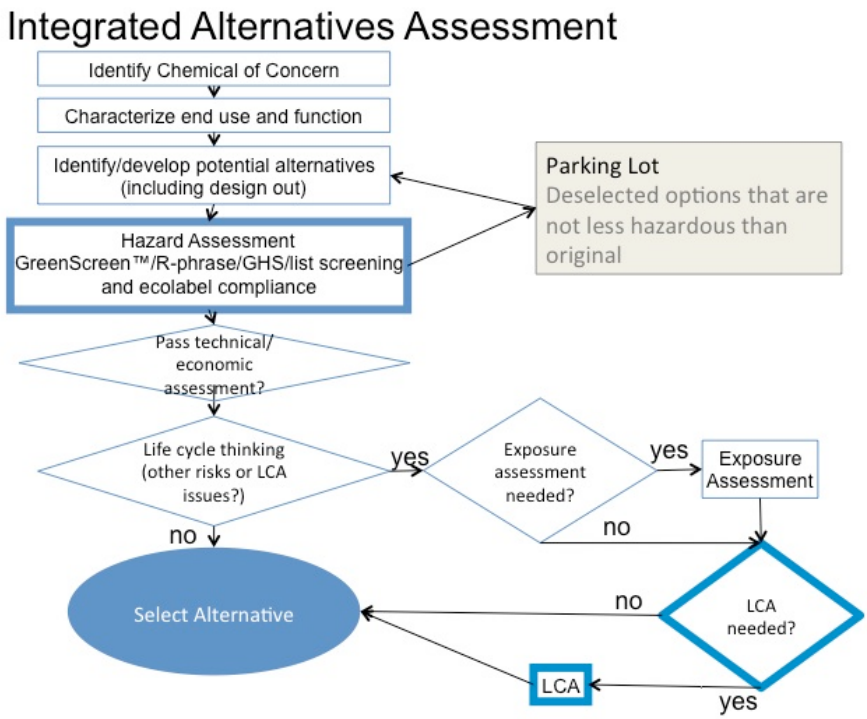
HP works with suppliers to identify alternatives to BFRs, and we use the GreenScreen™ as a core part of our analysis of replacement substances. Using the GreenScreen™, we assess individual components of a formulation to obtain a simple one to four benchmark score. The benchmark scoring system enables us to quickly and easily evaluate the human health and environmental impacts of the substance. Since the pilot program began in 2007, we have performed more than 130 chemical assessments.

Using the GreenScreen™ benchmark score and hazard table, HP is able to communicate the desired attributes of alternative flame retardants directly with formulators. Additionally, the direct communication with the formulators has resulted in greater understanding of the human health and environmental attributes of the materials used in electronic products. Simply communicating that human health and environmental attributes would be considered has triggered our suppliers to examine their materials and look for alternatives that have lower impact.
A key success factor in the search for preferred alternatives is the relationship between HP and the suppliers formulating solutions. HP does not formulate resins or force suppliers to use certain substances; we depend on the expertise of our suppliers to innovate solutions that meet the environmental, regulatory and quality requirements our customers demand. To maximize efficiency and effectiveness, we began to work directly with flame retardant manufacturers and resin formulators to identify preferable materials. One outcome of this direct engagement was that the non-halogenated flame retardant group, pinfa, performed a pilot GreenScreen™ project to identify preferred alternatives. Their comments are included below:
“The phosphorus, inorganic and nitrogen flame retardants association (pinfa) has engaged in a pilot project with Clean Production Action and HP to have the following substances assessed:

- Ammonium polyphosphate, CAS# 68333-79-9
- Diethylphosphinic acid aluminium salt, CAS# 225789-38-8
- Aluminium trihydroxide, CAS# 21645-51-2
- Aluminium oxide hydroxide, CAS# 1318-23-6
- Melamine polyphosphate, CAS# 218768-84-4

pinfa opted for GreenScreen™, because it promised to be a tool to quickly assess the hazard profile of chemicals and categorize them into an easily understandable grading system. However, we also realized that the simplified GreenScreen™ approach does not allow for in-depth studies or the inclusion of exposure aspects which is normally done in a risk assessment. Nevertheless, it has proven to be a valuable tool to quickly gain insight into data gaps or ambiguous or contradictory data, often coming from public domain sources. For pinfa, tools like GreenScreen™ are important to prove and communicate the environmental and health profile of existing or new products. This also helps us achieve our goal of continuously improving our products. However, we still see room for improvement within the GreenScreen™ methodology, like the appraisal of persistence for inorganic materials or the simplification of peer review and criteria review processes. Some of these are being addressed already. “

The GreenScreen™ is complementary to exposure and life-cycle assessments, and is incorporated into our integrated alternatives assessment framework. As shown in the flow chart below, the GreenScreen™ is used early in the material selection process in order to eliminate unsuitable alternatives before investing the significant time and resources needed to conduct performance, exposure, and life-cycle assessments. Importantly, the GreenScreen™ evaluates constituents and breakdown products of substances, enabling a thorough and balanced evaluation of exposure and life cycle in subsequent analyses.



Based on the success of this program, HP has screened other classes of substances beyond flame retardants, and has found this method to be extremely useful in differentiating between the various alternatives to restricted substances with respect to impacts on human health and the environment. Additional material types are now being targeted for inclusion in the screening program in the future.

For more information on assessing chemical and material alternatives, visit the BizNGO website (**http://www.bizngo.org/**), and for more information on the GreenScreen™ visit the Clean Production Action website (**http://www.cleanproduction.org**).

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Background Documents: GreenScreen™ TV Enclosures (**http://www.cleanproduction.org/library/Green_Screen_Report.pdf**), HP Global Citizenship Report (**http://www.hp.com/hpinfo/globalcitizenship/environment/sustainable_design.html**)

Case/substitution evaluation

This is a case description from a user. The case description provides a useful methodology of how a company can work with substitution and alternatives assessment, in this case using the GreenScreen™ for safer chemicals. The chemical alternatives disclosed pass SUBSPORT criteria and have been evaluated to perform better using the GreenScreen™, than the original chemicals.

Further information

For more information on assessing chemical and material alternatives, visit the BizNGO website (http://www.bizngo.org/), and for more information on the GreenScreen™ visit the Clean Production Action website (http://www.cleanproduction.org).

Background Documents: GreenScreen™ TV Enclosures (**http://www.cleanproduction.org/library/Green_Screen_Report.pdf**)

Citizenship Report (**http://www.hp.com/hpinfo/globalcitizenship/environment**

/sustainable_design.html)

Subsport link: http://www.subsport.eu/wp-content/uploads/2012/05/Green_Screen_Report.pdf

Who provided the information

Type of information supplier
User

Contact

Hewlett Packard

www.hp.com

Contact person: Pieter Paul Laenen

Type of publication and availability All documents listed are freely available

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