

## REPORT SUMMARY

September 2010

Sustainable Innovation, Waste Economics, Low Carbon Technologies

### The impact of implementing EC Regulations on POPs

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**Defra commissioned Oakdene Hollins to assess the impact in the UK of new EC Regulations on the recycling and management of waste containing persistent organic pollutants (POPs), and to recommend threshold concentrations of the relevant chemicals: perfluorooctane sulfonic acid (PFOS) and its derivatives, used as inert surfactants, and four of the polybrominated diphenyl ethers (PBDEs) present in the mixtures c-pentaBDE and c-octaBDE, used as flame retardants in plastics.**

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In 2004 the EU banned the use of PBDE flame retardants, having stopped their production in 1998; and we expect almost no PBDE to be in new products in the UK. Polyurethane foam used in the automotive and furniture industries accounted for 68% and 31% of the UK consumption of c-pentaBDE. We estimate the concentration of c-pentaBDE to be 150-240 mg/kg in automotive shredder residue and 42-70 mg/kg in waste furniture foam, and predict this will fall rapidly in the next 2-5 years. Wastes containing c-pentaBDE from furniture or automotive foam are not recycled at present, so we do not expect any impact to the recycling industry from the new regulations. The low concentrations in these wastes should not preclude them being sent to landfill if the regulations are implemented.

C-octaBDE is mainly used as a flame retardant in plastic CRT/VDU housings. We estimate it to be present in current waste streams at 20,300-25,000 mg/kg (13,200-16,300 mg/kg for the most common single PBDE). We predict this figure will remain high, though reduce over time. We suggest monitoring c-octaBDE concentrations in waste: its high concentration in CRT housings is well above that allowed by regulations covering hazardous waste for electronic equipment and could impact the recycling of these materials. We estimate 3,350 tonnes p.a. of waste plastics containing brominated flame retardant could be separated out, and destroyed by hazardous waste incineration at a cost of £2million.

PFOS and its derivatives are no longer used in the UK, but significant quantities may be present in old and imported products. We estimate there may be up to 0.04 mg/kg of PFOS in the waste streams of carpets and textiles, water-proofed clothing, and coated paper. While around 70% of all paper produced in the UK is derived from paper waste, carpet and textile recycling rates are very low and

recycling of products containing PFOS is insignificant. Recycling is the environmentally preferable option, as it avoids the manufacture of new products that, on average, contain more PFOS than end-of-life material.

We recommend setting the threshold for each individual PBDE at 650 mg/kg. To prevent additional PBDEs entering the waste streams in the future, we recommend strong enforcement of the existing ban on importing products containing over 0.1% c-pentaBDE and c-octaBDE. The threshold for PFOS is recommended at 1 mg/kg. As most PFOS emission from carpets and textiles happens in-use, the best way to reduce PFOS levels in the environment is not by restricting waste or via recycling routes, but by enforcing the existing limit of 0.001 mg/m<sup>2</sup>.

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**Background to this report:**

The aim of this study was to assess the impact of the addition of the Annexes of EC Regulation 850/2004 on Persistent Organic Pollutants (POPs) on UK recycling and waste management, and to recommend suitable concentration limits for waste. The new regulation (implementing the Stockholm Convention) means that, for new POPs, allowable concentration levels need to be set for waste containing these chemicals. Above these levels, the POPs in the waste are required to be destroyed or irreversibly transformed.

Polybrominated diphenyl ethers (PBDEs) are historically used as additive-type flame retardants, primarily in plastic products. PBDEs consist of two aromatic phenyl moieties connected by an oxygen atom, and they are commonly categorised by the number of bromine atoms (between 2 and 10) they contain. Those used as fire retardants are present in mixtures rather than as a single PBDE or congener. The common mixtures are: commercial-pentaBDE, c-octaBDE and c-decaBDE. These regulations will impact the use of c-pentaBDE and c-octaBDE, as these formulations contain the PBDEs listed by the Stockholm Convention.

Perfluorooctane sulfonate (PFOS) and its derivatives were used as a process aid in a wide range of applications, notably in the chrome plating and semiconductor industries, where they do not appear in the final product. In the textile sector PFOS was used as an anti-stain agent and is present in the final product. Hence it will occur in the disposal routes of carpet, apparel, leather, fabric and upholstery. PFOS and its derivatives were also used to impregnate paper, especially in food packaging, and thus PFOS may end up in recycling streams from imported packing.

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## **About Oakdene Hollins Ltd:**

*Oakdene Hollins is a research and consulting company working to support change toward more sustainable and less carbon-intensive products, processes, services and supply chains. The business sectors we work with include Food & Drink, Textiles & Clothing, Metals & Mining, Wastes Management, Chemicals & Materials, Sustainable Innovation and European & UK Policy. We have built a strong reputation for integrity, reliability and excellence with public sector and private industry clients alike. We operate at a European scale and manage the Ecolabel scheme in the UK in collaboration with TUV/NEL.*

*Oakdene Hollins employs people with science, economics, business administration and manufacturing disciplines, so that within each industry sector we can offer the following core services:*

- *Market Appraisal*
- *Technology Appraisal*
- *Protocol and Standards Development*
- *Economic Modelling*
- *Lean Manufacturing Projects*
- *Financial Impact Assessment*
- *Management of Research Projects*
- *Ecolabelling Advice*
- *Carbon Footprinting*
- *Critical Review of Life Cycle Assessments.*