

<p>Institution: BRUNEL UNIVERSITY (H0113)</p>
<p>Unit of Assessment: 7 – Earth Systems and Environmental Sciences</p>
<p>Title of case study: Recognition of endocrine disrupting chemicals as global health hazards</p>
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>The burden of endocrine disease and disorders in global societies is higher than ever before and The Institute for the Environment's (IfE) research labelling chemicals in everyday use as endocrine disrupting chemicals (EDCs) has been instrumental in closing a gap in chemicals regulation that previously left pregnant mothers insufficiently protected from exposures to endocrine disrupting chemicals that could cause irreversible damage to their unborn life. Key impacts are: a) regulation, leading to bans and restrictions on the use of specific chemicals; b) a European Parliament call to implement better health protection (procedure reference 2012/2066 INI) from EDCs; c) Development of regulatory frameworks and decision criteria for identifying and restricting the use of EDCs; and d) a global (UN) strategy and workplan to support the safe management of these chemicals and to reduce their health risks in developing countries.</p>
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>Several staff members at IfE were pioneers in identifying alkylphenols (in industrial detergents), phthalates (widely used in plastics and present in almost every conceivable personal-care item) and parabens (preservatives in personal care products) as endocrine disrupting chemicals (EDCs) (Jobling et al. 1995; Routledge and Sumpter, 1996; Routledge et al. 1998), chemicals that may interfere with the production or activity of hormones in the endocrine system. They were also instrumental in identifying endocrine disruption as an issue of environmental and public health concern.</p> <p>More recent synthesis and critical analysis of the scientific literature by IfE researchers (Kortenkamp, 2011; EEA, 2012; WHO/UNEP 2012), as well as original research conducted at IfE, has shown that approximately 800 chemicals in modern commerce are endocrine disrupting chemicals causing irreversible disruption of hormonal processes in animal studies leading to deleterious effects on health. On the strength of this work, they subsequently synthesized accumulated scientific evidence on effects of endocrine disrupting chemicals on human health and wildlife, with the aim of assessing whether endocrine disruptors should be classed as substances of a concern equivalent to carcinogens, mutagens and reproductive toxicants. The weight of evidence linking exposure to these chemicals with adverse effects in humans and wildlife was also assessed. This synthesis took the form of reviews, published in several key reports.</p> <p>Under the auspices of the European Commission and the Finnish EU presidency in 2006, an international conference was held in Helsinki in December 2006, to summarize scientific findings of regulatory relevance produced by EU-funded projects. With organizational support from the European Environment Agency (EEA), Professor Susan Jobling was instrumental in finalizing the analysis, with collaborative efforts from EEA staff (David Gee) and several coordinators of EU-funded projects, including Professor John Sumpter. It resulted in a report, entitled "The Impacts of Endocrine Disruptors on Wildlife, People and Their Environments" ("Weybridge+15 (1996-2011) report", EEA 2012) which was launched in May 2012 during a conference at Brunel University (Sumpter was a contributor).</p> <p>Between July 2011 and December 2012, Professor Andreas Kortenkamp, Professor Susan Jobling and Dr Jayne Brian researched the strength of evidence linking endocrine disrupting chemicals with human health and wildlife effects by compiling and reviewing the scientific literature published between 2002 and 2010. The analysis involved drawing up systematic criteria for the attribution of adverse effects to an endocrine disrupting mode of action. A concept was developed that allowed the assessment of human health and wildlife observations in one coherent framework. The results of this work were published as part of a World Health Organisation / United Nation Environmental Programme report entitled "State of the science of endocrine disrupting chemicals 2012" (WHO / UNEP 2013) edited by Jobling.</p>

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From July 2011 to December 2011, **Professor Kortenkamp** and **Drs Olwenn Martin (ECR)** and **Richard Evans (postdoc)** assessed scientific findings about endocrine disrupters in terms of their regulatory relevance, in a European Union context. The suitability and availability of tests for the identification of endocrine disrupting properties were evaluated, in particular in terms of their ability to cover various endocrine disrupting mechanisms. The results of this analysis were published as "The State of the Art Assessment of Endocrine Disrupters" (Kortenkamp et al. 2011). Its essence was the development of a weight-of-evidence approach for endocrine disrupting chemicals which was recommended as the basis for criteria to be used to designate endocrine disrupters for regulation in the EU.

With an emphasis on chemicals that can disrupt the functioning of the thyroid gland, **Dr Daniel Pickford** carried out a similar analysis between December 2012 and March 2013. This work found entry into an opinion of the European Food Safety Authority about endocrine active chemicals (EFSA 2013).

3. References to the research (indicative maximum of six references)

EEA (2012) *The impacts of endocrine disrupters on wildlife, people and their environments*. The Weybridge+15 (1996–2011) report. ISSN 1725-2237

EFSA Scientific Committee (2013) *Scientific opinion on the /hazard assessment of endocrine disruptors: Scientific criteria for identification of endocrine disruptors and appropriateness of existing test methods for assessing effects mediated by those substances on human health and the environment*. EFSA Journal 2013: 11(3): 3132. <http://dx.doi.org/10.2903/j.efsa.2013.3132>

Kortenkamp et al. (2011) *State of the art assessment of endocrine disrupters*, Project Contract Number 070307/2009/550687/SER/D3. WHO/PCS/EDC/02.2

Jobling, S., Reynolds, T., White, R., Parker, MG. and Sumpter, JP. (1995), *A variety of environmentally persistent chemicals, including some phthalate plasticizers, are weakly estrogenic*, Environmental Health Perspectives 103 (6): 582- 587. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1519124> (800 citations)

Routledge, EJ. and Sumpter, JP. (1996), *Estrogenic activity of surfactants and some of their degradation products assessed using a recombinant yeast screen*, Environmental Toxicology and Chemistry 15 (3): 241- 248. <http://dx.doi.org/10.1002/etc.5620150303>. (881 citations)

Routledge, EJ; Parker, J; Odum, J; et al. (1998), *Some alkyl hydroxy benzoate preservatives (parabens) are estrogenic*, Toxicology and Applied Pharmacology 153(1): 12-19 <http://dx.doi.org/10.1006/taap.1998.8544> (270 citations)

WHO UNEP (2013) *State of the science of endocrine disrupting chemicals 2012*, eds Ake Bergmann, Jerrold Heindell, Susan Jobling, Karen E Kidd, Thomas R Zoeller. ISBN: 978-92-807-3274-0 (UNEP) and 978 92 4 150503 1 (WHO) (NLM classification: WK 102)

4. Details of the impact (indicative maximum 750 words)

IfE research on endocrine disrupters has provided the scientific underpinnings for decision making processes in the European Union, USA and in organisations of the United Nations, specifically the UN Environmental Programme. This took place through three distinct types of activity; first, by raising awareness of endocrine disrupting chemicals, second, by examining and demonstrating the strength of the scientific evidence for harmful effects of endocrine disrupters, and third, by developing ways of handling these chemicals within the framework of EU chemical regulations.

Critical analyses of the literature by IfE researchers (Kortenkamp et al. 2011, Weybridge +15)

concluded that exposures to endocrine disruptors are likely causal contributors to the total global endocrine-related disease burden (e.g. hormonal cancers, declines in reproductive health) which is now unprecedented (WHO / UNEP 2012). They also concluded that endocrine disruptors should be regulated as strictly as carcinogens, mutagens and reproductive toxicants. This work exposed a critical gap in EU chemicals regulations with insufficient protection especially of mothers and their unborn life.

In the European Union, three pieces of European Community legislation deal explicitly with endocrine disruptors: The Plant Protection Product Regulation, PPPR (1107/2009); the chemicals regulation, Registration, Authorisation and restriction of Chemicals, REACH (1907/2006) and the new Biocidal Product Regulation, BPR. Under all these regulations the European Commission is now mandated with developing scientific criteria for the identification of endocrine disrupting chemicals, with the aim of removing them from use entirely, or restricting their use significantly. It is here that IfE research also created impact by finding ways of implementing better regulation for endocrine disruptors.

IfE research showed that the ways in which endocrine disruptors act pose several challenges to the existing EU regulatory regime. The life stage where exposure takes place is absolutely critical, but also whether the toxicity is irreversible and whether endocrine-related toxicity occurs at low exposures. This meant that a tailor-made matrix had to be developed to translate the outcome of toxicity tests into decision criteria for restricting the use of chemicals identified as endocrine disruptors. Recommendations for such decision criteria were elaborated in Kortenkamp et al. (2011) and have found entry into the blueprint of endocrine disrupter regulation in the EU, the "Report of the Endocrine Disruptors - Expert Advisory Group (ED EAG)" from the European Commission DG Joint Research Centre (Munn and Goumenou 2013). The "State of the Art Assessment of Endocrine Disruptors" (Kortenkamp et al. 2011) and the "Weybridge +15 report" (EEA 2012) were also listed as important reference documents for a motion of the European Parliament which was passed on 14 March 2013 and called on the European Commission to implement better protection from endocrine disruptors (procedure reference 2012/2066 INI). Professor Kortenkamp has been called twice to brief MEPs on endocrine disruptors in connection with the drafting of this motion, first on 18 September and then again on 14 November 2012.

In autumn 2012, the European Commission DG Health mandated the European Food Safety Authority (EFSA) with elaborating criteria for the regulation of pesticides with endocrine disrupting properties, by end of March 2013. The "State of the Art Assessment of Endocrine Disruptors" was one key document for the deliberations of the EFSA scientific committee. **Dr Daniel Pickford** was called to serve on the working group which produced the EFSA Scientific Opinion on the topic (EFSA 2013).

Professors **Susan Jobling and Andreas Kortenkamp** engaged in translational activities at the UN level and were called by the UN Environmental Programme to present their research in support of a motion to adopt endocrine disruptors as an emerging policy issue under the Strategic Approach to Chemicals Management (SAICM). SAICM was adopted by the International Conference on Chemicals Management (ICCM) of the UN Environment Programme as a policy framework to foster the sound management of chemicals. It supports achieving the goal of ensuring that by 2020 chemicals are produced and used in ways that minimize significant adverse impacts on the environment and on human health. On the strengths of the presentations by Jobling and Kortenkamp, the ICCM3 meeting in Nairobi (17-21.9.2012) comprising 540 participants, representing more than 150 governments, other SAICM stakeholders from international organizations, industry and civil society adopted endocrine disruptors as an emerging issue under SAICM (UNEP 2012). The delegates decided to develop a workplan for this group of chemicals, with a view of reducing health risks in developing countries.

In summary, endocrine disrupter research at IfE has created global impact by first making the scientific case for the need for regulatory action, and second by developing regulatory approaches that pave the way for restricting their use significantly. This will contribute to better health protection. As much as 24% of human diseases and disorders globally are estimated to be due to environmental factors, and many of the most prevalent diseases are associated with the endocrine system. IfE researchers have therefore catalysed the improvement of human and wildlife health by

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influencing regulation that will lead to improvement in elements of the environment that impact public and wildlife health.

For some groups of chemicals first labelled as endocrine disruptors by IFE scientists, the strength of the incriminating evidence is such that the use of these chemicals is no longer permitted in some countries. For example some phthalates (identified as EDCs by **Jobling**) cannot be used in toys and childcare articles in the EU and, in the USA, the Consumer Product Safety Improvement Act (2008) banned the use of six phthalates in toys and child care articles at concentrations greater than 0.1% (**Kortenkamp** sits on the USA Chronic Hazard Advisory Panel on Phthalates). In response to a European ban, plasticizers with no endocrine disrupting properties have been developed. In 2011, the Danish government decided to ban the use of some parabens (first identified as EDCs by **Routledge**) in personal care products intended for children up to three years old as a precautionary measure, as children might be especially vulnerable to hormone-like effects. The Danish ban triggered a new assessment at EU level which led in November 2011 to a recommendation by the EU's Scientific Committee on Consumer Safety (SCCS) for an entire EU-wide ban on parabens in products aimed at children under six months old. Growing awareness about parabens has inspired a number of manufacturers to banish them in favour of safer preservatives, while some have simply accepted a shorter shelf life as the price of doing healthy business. You can often find personal-care products labeled "paraben free," Signers of the Compact for Safe Cosmetics have committed to avoiding their use; the list of these companies can be found at www.safecosmetics.org.

5. Sources to corroborate the impact (indicative maximum of 10 references)

EFSA Scientific Committee (2013) *Scientific opinion on the hazard assessment of endocrine disruptors: Scientific criteria for identification of endocrine disruptors and appropriateness of existing test methods for assessing effects mediated by those substances on human health and the environment*. EFSA Journal 2013: 11(3): 3132

European Parliament, Legislative Observatory (2013), *Motion for a European Parliament Resolution on the protection of public health from endocrine disruptors (2012/2066(INI))*, <http://www.europarl.europa.eu/oeil/popups/summary.do?id=1253927&t=d&l=en>

Munn, S and Goumenou M (2013) *Report of the Endocrine Disruptors - Expert Advisory Group (ED EAG) 'Key scientific issues relevant to the identification and characterisation of endocrine disrupting substances'*, http://ec.europa.eu/dgs/jrc/index.cfm?id=1410&dt_code=NWS&obj_id=16530&ori=RSS

UNEP (2012) *Report of Technical Briefing on Endocrine-Disrupting Chemicals (EDCs) Followed by a side-event on recent and on-going efforts*, Sunday 16 September (12:00 - 14:00), UNEP Headquarters, Gigiri Centre, Nairobi, Kenya
<http://www.unep.org/hazardoussubstances/Portals/9/EDC/EDC%20ICCM3%20technical%20briefing%20Report.pdf>

http://www.saicm.org/index.php?option=com_content&view=article&id=458&Itemid=687

The Health Controversies of Parabens http://www.medscape.com/viewarticle/780590_1

Ban on phthalates USA: <http://www.cpsc.gov/Regulations-Laws--Standards/CPSIA/Phthalates/FAQs-Bans-on-Phthalates-in-Childrens-Toys/>