Health, Chemicals, Plastics and a Non-Toxic Circular Economy

INC-1 Health & Science Information Briefing
November 30th (14:00-15:00)

Hosted by the Governments of Uruguay & Switzerland with the Endocrine Society and the International Pollutants Elimination Network (IPEN)
Part 1: Health & Science Information Briefing

Part 2: Discussion Panel
Plastics, Endocrine Disrupting Chemicals and Health

Leonardo Trasande, MD, MPP
Jim G. Hendrick, MD Professor of Pediatrics
Vice Chair for Pediatrics and Director, Division of Environmental Pediatrics
Professor of Environmental Medicine and Population Health
NYU School of Medicine
Many plastic additives are known to interfere with hormone functioning and are, by definition, endocrine disrupting chemicals.

There is clear and extensive evidence of the human health impacts of many chemicals in common plastics.

The health and economic impacts of these widely used chemicals can be profound and life threatening.
What is the Endocrine Society?

It is the world’s oldest, largest, and most active organization devoted to research on hormones and the clinical practice of endocrinology.

Its membership consists of over 18,000 scientists, physicians, educators, nurses, and students in more than 120 countries.
What are endocrine disrupting chemicals?

Endocrine disrupting chemicals (EDCs) interfere with hormonal signaling systems

- Mimic, block, or modulate the synthesis, release, transport, metabolism, binding, or elimination of natural hormones
- Brain, pituitary, gonads, thyroid, and other components of the endocrine system

### Representative EDCs

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td>Trenbolone acetate, ethinylestradiol, dexamethasone, levonorgestrel, rosiglitazone</td>
</tr>
<tr>
<td>Cosmetics, personal care products</td>
<td>DBP, benzophenones, parabens, triclosan, DEET</td>
</tr>
<tr>
<td>Pesticides, herbicides, fungicides</td>
<td>Chlorpyrifos, glyphosate, pyraclostrobin, DDT, atrazine</td>
</tr>
<tr>
<td>Industrial chemicals</td>
<td>BPA, PCBs, triphenyl phosphate, PBDEs</td>
</tr>
<tr>
<td>Metals</td>
<td>Lead, cadmium, mercury, arsenic</td>
</tr>
<tr>
<td>Synthetic and naturally occurring hormones</td>
<td>Progesterone, testosterone, cortisol, oestrone</td>
</tr>
</tbody>
</table>

Representative EDCs from diverse functional use categories. EDC=endocrine-disrupting chemical. DBP=dibutyl phthalate. DEET=N,N-diethyl-m-toluamide. DDT=dichlorodiphenyltrichloroethane. BPA=bisphenol A. PCB=polychlorinated biphenyl. PBDE=polybrominated diphenyl ether.

**Table 1: List of representative EDCs in use**
Endocrine-Disrupting Chemicals: An Endocrine Society Scientific Statement

Evantha Diamanti-Kandarakis, Jean-Pierre Bourguignon, Linda C. Giudice, Russ Hauser, Gail S. Prins, Ana M. Soto, R. Thomas Zoeller, and Andrea C. Gore

Endocrine Section of First Department of Medicine (I.D.K.), Laiko Hospital, Medical School University of Athens, 11527 Athens, Greece; Department of Pediatrics (I.P.B.), Centre Hospitalier Universitaire de Liège, 4000 Liège, Belgium; Department of Obstetrics, Gynecology, and Reproductive Sciences (L.C.G.), University of California San Francisco, San Francisco, California 94131; Department of Environmental Health (R.H.), Harvard School of Public Health, Boston, Massachusetts 02115; Department of Urology (G.S.P.), University of Illinois at Chicago, Chicago, Illinois 60612; Department of Anatomy and Cell Biology (A.N.K.), Tufts University School of Medicine, Boston, Massachusetts 02111; Biology Department (R.T.Z.), University of Massachusetts, Amherst, Massachusetts 01002; and Division of Pharmacology and Toxicology (A.C.G.), The University of Texas at Austin, Austin, Texas 78712

There is growing interest in the possible health threat posed by endocrine-disrupting chemicals (EDCs), which are substances in our environment, food, and consumer products that interfere with hormone biosynthesis, metabolism, or action resulting in a deviation from normal homeostatic control or reproduction. In this first Scientific Statement of The Endocrine Society, we present the evidence that endocrine disruptors have affects on male and female reproduction, breast development and cancer, prostate cancer, neuroendocrinology, thyroid, metabolism and obesity, and cardiovascular endocrinology. Results from animal models, human clinical observations, and epidemiological studies converge to implicate EDCs as a significant concern to public health. The mechanisms of EDCs involve divergent pathways including (but not limited to) estrogenic, antianogetic, thyroid, peroxisome proliferator-activated receptor γ, retinoid, and actions through other nuclear receptors: steriodogenic enzymes; neurotransmitter receptors and systems; and many other pathways that are highly conserved in wildlife and humans, and which can be modeled in laboratory in vitro and in vivo models. Furthermore, EDCs represent a broad class of molecules such as organochlorinated pesticides and industrial chemicals, plastics and plasticizers, fuels, and many other chemicals that are present in the environment or are in widespread use. We make a number of recommendations to increase understanding of effects of EDCs, including enhancing increased basic and clinical research, invoking the precautionary principle, and advocating involvement of individual and scientific society stakeholders in communicating and implementing changes in public policy and awareness. (Endocrine Reviews 30: 293–342, 2009)
Response to WHO/UNEP Report


EDC-2: The Endocrine Society’s Second Scientific Statement on Endocrine-Disrupting Chemicals


Pharmacology and Toxicology (A.C.G.), College of Pharmacy, The University of Texas at Austin, Austin, Texas 78713; Division of the National Toxicology Program (J.A.F.), National Institute of Environmental Health Sciences, National Institutes of Health, Research Triangle Park, North Carolina 27709; Department of Comparative Biosciences (R.T.Z.), University of Illinois at Urbana-Champaign, Urbana, Illinois 61801; Institute of Bioengineering and Bioinformatics (M.E.M.), Miguel Hernandez University of Elche, G0202 Elche, Alicante, Spain; Department of Urology, Pathology, and Physiology & Biophysics (G.S.P.), College of Medicine, University of Illinois at Chicago, Chicago, Illinois 60612; Departments of Physiology and Pediatrics (J.T.), University of Turku and Turku University Hospital, Turku 20520, Finland; and Biology Department (R.T.Z.), University of Massachusetts at Amherst, Amherst, Massachusetts 01003

The Endocrine Society’s first Scientific Statement in 2009 provided a wake-up call to the scientific community about how environmental endocrine-disrupting chemicals (EDCs) affect health and disease. Five years later, a substantially larger body of literature has solidified our understanding of plausible mechanisms underlying EDC actions and how exposures in animals and humans—especially during development—may lay the foundations for disease later in life. At this point in history, we have much stronger knowledge about how EDCs alter gene-environment interactions via physiological, cellular, molecular, and epigenetic changes, thereby producing effects in exposed individuals as well as their descendants. Causal links between exposure and manifestation of disease are substantiated by experimental animal models and are consistent with correlative epidemiological data in humans. There are several caveats because differences in how experimental animal work is conducted can lead to difficulties in drawing broad conclusions, and we must continue to be cautious about inferring causality in humans. In this second Scientific Statement, we reviewed the literature on a subset of topics for which the translational evidence is strongest: 1) obesity and diabetes; 2) female reproduction; 3) male reproduction; 4) hormone-sensitive cancers in females; 5) prostate; 6) thyroid; and 7) neurodevelopment and neuroendocrine systems. Our inclusion criteria for studies were those conducted predominately in the past 5 years deemed to be of high quality based on appropriate negative and positive control groups or populations, adequate sample size and experimental design, and mammalian animal studies with exposure levels in a range that was relevant to humans. We also focused on studies using the developmental origins of health and disease model. No report was excluded based on a positive or negative effect of the EDC exposure. The bulk of the results across the board strengthen the evidence for endocrine health-related actions of EDCs. Based on this much more complete understanding of the endocrine principles by which EDCs act, including nonmonotonic dose responses, low-dose effects, and developmental vulnerability, these findings can be much better translated to human health. Armed with this information, researchers, physicians, and other healthcare providers can guide regulators and policymakers as they make responsible decisions. (Endocrine Reviews 36: 0000–0000, 2015)
Mainstream recognition

ENDOCRINE DISRUPTING CHEMICALS AND OBESITY RISK: A REVIEW OF RECOMMENDATIONS FOR OBESITY PREVENTION POLICIES

Tim Lobstein1,2 and Kelly D. Brownell3

1World Obesity Federation, London, UK
2Bodle Collaboration, University of Sydney, Concord, New South Wales, Australia
3Duke World Food Policy Center, Sanford School of Public Policy, Durham, North Carolina, USA

Correspondence
Tim Lobstein, World Obesity Federation, Suite 404, 107-111 Fleet Street, London EC4A 2AB, UK.
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Summary
Emerging evidence suggests that industrially produced endocrine-disrupting chemicals (EDCs) may be as obesogenic as poor dietary patterns and should be considered in obesity prevention policies. The authors conducted two reviews: (a) a systematic search of four electronic databases for papers published since January 2010 to identify the policy recommendations contained in scientific reviews of EDC exposure and obesity risk and (b) a narrative review of obesity policy documents published since January 2012 to identify the recommendations of national and international agencies. A search of four electronic databases found 63 scientific reviews with policy recommendations, of which 26 suggested individual responsibility to avoid exposure, 11 suggested medical interventions to counter the effects of exposure, and 42 suggested regulatory control of hazardous chemicals. Of sixty policy documents examined, six mentioned pollutants as a possible risk factor for obesity, and only one made explicit reference to strategies for reducing exposure to EDCs. The UN Sustainable Development Goals include targets to prevent ill health from hazardous chemicals (Targets 3.9 and 12.4) and to remove unsafe industrial chemicals from the environment (Targets 6.3, 11.6, 12.4, and 14.15). The authors suggest these should be explicitly linked to World Health Assembly targets to halt the rise in obesity.
Plastics are a crucial source of EDCs

Bisphenols (polycarbonate plastics, aluminum can linings)

Phthalates (food packaging)

Per- and polyfluoroalkyl substances (PFAS, nonstick cooking and fluoropolymer plastics)

Brominated flame retardants (additives to reduced flammability)

Burning plastics → dioxins
# Environmental chemicals and endocrine mechanisms for adiposity and insulin resistance

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Source/commercial use</th>
<th>Potential mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarette smoke</td>
<td>First-hand and second-hand smoke</td>
<td>Prenatal nicotine exposure alters neurological development and exposures ↑ rates of preterm and low-weight births&lt;sup&gt;41,46,47&lt;/sup&gt;</td>
</tr>
<tr>
<td>Air pollution</td>
<td>Incomplete combustion of fossil fuels</td>
<td>↑ Accumulation of visceral fat&lt;sup&gt;55&lt;/sup&gt; Inflammation&lt;sup&gt;56&lt;/sup&gt;</td>
</tr>
<tr>
<td>Polycyclic aromatic hydrocarbons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tributyltin</td>
<td>Fungicide in paints and components of polyvinyl chlorides</td>
<td>Activation of peroxisome proliferator-activated receptor γ&lt;sup&gt;27,58,59&lt;/sup&gt; and increased fat cell differentiation&lt;sup&gt;60-63&lt;/sup&gt;</td>
</tr>
<tr>
<td>Bisphenol A</td>
<td>Plastics and epoxy resins</td>
<td>Estrogenic&lt;sup&gt;82,83&lt;/sup&gt; Inhibition of proliferation of neural progenitor cells&lt;sup&gt;86&lt;/sup&gt;</td>
</tr>
<tr>
<td>Flame retardants</td>
<td>Chemicals applied to furniture and electronics</td>
<td>↑ Rate of adipogenesis&lt;sup&gt;106&lt;/sup&gt; ↑ Glucose intolerance&lt;sup&gt;106&lt;/sup&gt;</td>
</tr>
<tr>
<td>Polychlorinated biphenyls</td>
<td>Coolants, plasticizers and flame retardants</td>
<td>Altered thyroid function&lt;sup&gt;56,101&lt;/sup&gt; Altered metabolism&lt;sup&gt;112&lt;/sup&gt; Bioaccumulation in fat cells&lt;sup&gt;109&lt;/sup&gt;</td>
</tr>
<tr>
<td>Phthalates</td>
<td>Plasticizers, adhesives and personal care products</td>
<td>↑ Rate of adipocyte differentiation&lt;sup&gt;117,120-122&lt;/sup&gt;</td>
</tr>
<tr>
<td>Perfluorooctanoic acid Perfluorooctanoate sulphonate</td>
<td>Components of lubricants, nonstick coatings and stain-resistant compounds</td>
<td>↑ Serum levels of insulin&lt;sup&gt;126&lt;/sup&gt; ↑ Serum levels of leptin&lt;sup&gt;126&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Bisphenols

Used in polycarbonate plastics and epoxy resins (aluminum cans, thermal paper receipts)

Experimental studies suggest that bisphenol A disrupts multiple metabolic mechanisms, at levels commonly seen in US population

• Increases fat cell size, disrupts adiponectin function and low-grade synthetic estrogen

As concern has increased, ~40 chemically similar replacements now in use: bisphenol S (BPS), BPF, BPAF, BPZ, BPP…

• BPS: similar estrogenicity, embryotoxicity (potentially others)

Phthalates

Low-molecular weight (LMW) phthalates used in shampoos, cosmetics, lotions and other personal care products to preserve scent

• Anti-androgenic properties (reduced transcription of the androgen receptor)

High molecular weight (HMW) phthalates used to produce vinyl plastic for flooring, clear food wrap and intravenous tubing.

• Mono-(2-ethylhexyl) phthalate (MEHP), a metabolite of one HMW phthalate used in food packaging, di-2-ethylhexylphthalate (DEHP), increases expression of three peroxisome proliferator-activated receptors (PPARs) which play key roles in lipid and carbohydrate metabolism

Bornehag and Nanberg 2010; Colon et al. 2000; Engel et al. 2010; Miodovnik et al. 2011; Sathyanarayana 2008; Swan 2008; Swan et al. 2005; Desvergne et al. 2009, Grun and Blumberg 2007, Philips et al Repro Tox 2019
BPA $\rightarrow$ cardiovascular mortality

BPA associated with:
- reduced carotid intima-media thickness of 12-30 and >70 year olds
  Lin et al Atherosclerosis 2015, Lind et al Atherosclerosis 2011)
- BPA associated with severity of coronary artery disease in angiography
  Melzer et al PLOS One 2012
- Reduced heart rate variability in adults
  Bae et al Hypertension 2012
- All-cause mortality, and cardiovascular disease mortality
  Bao et al JAMA Network Open 2020
Phthalates → cardiovascular mortality

Low T either predictor of or marker of cardiovascular mortality in adult men

High molecular weight phthalates were associated with lower total, free, and bioavailable testosterone among men age ≥60.

Attina et al Lancet Diab Endo 2016; Hauser et al JCEM 2015

High molecular weight phthalates associated with all-cause mortality, and cardiovascular disease mortality

• Extrapolating to the population of 55-64 year old Americans, 90,761-107,283 attributable deaths and $39.9-47.1 billion in lost economic productivity.

Trasande et al Env Pollution 2021
Per- and polyfluoroalkyl substances (PFAS)

Synthetic organic fluorinated compounds with high stability and thermal resistance

- Detectable in blood of >98% of the population.
- Food packaging is a major route of exposure (nonstick cooking, microwaveable popcorn bags)
PFASs restrict fetal growth and increase childhood obesity

Meta-analysis of 24 studies: $-10.5$ g (95% CI: $-16.7$, $-4.4$) birth weight per ng/ml increase in maternal or cord blood PFOA

Steenland et al Epidemiology 2018

Meta-analysis of 10 studies: 25% increase in childhood overweight and 0.10 unit increase in BMI z-score per ng/mL PFOA in maternal blood

Liu et al 2018
PFAS contribute to adult weight gain/diabetes

Diabetes Prevention Program lifestyle intervention trial:
• Total PFAS were associated with increased weight gain exclusively among the control group.

Cardenas et al 2018

Follow-up of the successful POUNDS LOST trial:
• Perfluorooctane sulfonate (PFOS) and perfluorononanoic acid (PFNA), were associated with reductions in resting metabolic rate.

Liu et al 2018

PIVUS (Sweden), Nurses (US), DPPOS (US):
• PFAS associated with incident diabetes

Phthalates and other EDCs in plastic reduce fertility

Fertility is a condition of a couple, where reproductive health of both sexes plays a role

Fetal exposure to phthalates with reduced infant anogenital distance (AGD)
• Shortened adult AGD is associated with reduced semen quality and testosterone level

Multiple studies have identified reduced male fertility and poor semen quality with multiple EDCs, including phthalates, bisphenol A, and polyfluorinated chemicals
What is the burden of disease burden and are the health costs due to EDCs?

Expert panels identified conditions where the evidence is strongest for causation

- Developed ranges for fractions of disease burden that can be attributed for EDCs

- Adapted GRADE Working Group and WHO criteria for evaluating Adapted IPCC approach to integrate epidemiology and toxicology evidence and estimate probability of causation

Trasande et al J Clin Endo Metab 2015
HEALTH EFFECTS FROM ENDOCRINE DISRUPTING CHEMICALS COST THE EU 157 BILLION EUROS EACH YEAR. This is the tip of the iceberg: Costs may be as high as €270B.

€157B Cost by Health Effect

NOTE: The economic estimates do not include all costs associated with these conditions.

<table>
<thead>
<tr>
<th>Health Effect</th>
<th>Cost (€10B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Reproductive Disorders</td>
<td>4</td>
</tr>
<tr>
<td>Premature Death</td>
<td>6</td>
</tr>
<tr>
<td>Obesity &amp; Diabetes</td>
<td>15</td>
</tr>
<tr>
<td>Neurological Impacts (including ADHD)</td>
<td>132</td>
</tr>
</tbody>
</table>

€157B Cost by EDC Type

<table>
<thead>
<tr>
<th>EDC Type</th>
<th>Cost (€10B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides</td>
<td>120</td>
</tr>
<tr>
<td>Plastic Phthalates &amp; BPA</td>
<td>26</td>
</tr>
<tr>
<td>Flame Retardants</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
</tr>
</tbody>
</table>

SOME EDC-RELATED HEALTH OUTCOMES NOT INCLUDED:
- Breast Cancer
- Prostate Cancer
- Immune Disorders
- Female Reproductive Disorders
- Liver Cancer
- Parkinson's Disease
- Osteoporosis
- Endometriosis
- Thyroid Disorders
- Polycyclic Aromatic Hydrocarbons
- Bisphenol S
- Cadmium
- Arsenic
- Ethylene glycol

Endocrine Disrupting Chemicals (EDCs) interfere with hormone action to cause adverse health effects in people.

“THE TIP OF THE ICEBERG”
The data shown to the left are based on fewer than 5% of likely EDCs. Many EDC health conditions were not included in this study because key data are lacking. Other health outcomes will be the focus of future research.

See Trasande et al. The Journal of Clinical Endocrinology & Metabolism
http://press.endocrine.org/edic
Health Effects From Endocrine Disrupting Chemicals Cost The U.S.

$340 Billion Annually

Endocrine Disrupting Chemicals (EDCs) interfere with hormone action to cause adverse health effects in people.

$340 Billion by Health Effect

- Neurological Conditions (Including ADHD): 282
- Endometriosis & Fibroids: 43
- Premature Death: 8
- Obesity & Diabetes: 5
- Male Reproductive Problems: 2

$340 Billion by EDC Type

- Flame Retardants: 240
- Plastic, Cans: 56
- Pesticides: 42
- Other Mixes of Chemicals (Including Teflon-like materials): 2

Does not include $39.9-47.1 billion in mortality costs (more recent publication)

Attina et al Lancet Diab Endo 2016
PFAS disease burden and costs

We leveraged systematic reviews and used meta-analytic inputs whenever possible, and identified PFAS-attributable disease costs in the US of $5.52-62.6 billion in overall costs.

- LBW due to prenatal exposure
- Childhood obesity due to prenatal exposure
- Kidney cancer due to lifetime exposure
- Testicular cancer due to lifetime exposure
- Hypothyroidism in females due to lifetime exposure
- Adult obesity due to exposure over the lifespan
- T2D in females due to exposure over the lifespan
- GDM due to exposure measured in pregnancy
- Endometriosis due to exposure over the lifespan
- PCOS due to exposure over the lifespan
- Couple infertility due to lifetime exposure in females
- Female breast cancer due to lifetime exposure, and
- Pneumonia in children due to prenatal exposure

Obsekov et al Exposure and Health 2022
Global costs of EDCs

Likely similar as industrializing nations become predominant consumers and producers of chemicals as expected by OECD by 2030

Data from 70 countries suggest exposure to PFOA contributed to approximately 461,635 (95% CI: 57,418-854,645) cases per year of LBW during the past two decades

• Predominantly from Asian regions
Summary

Many plastic additives are known to interfere with hormone functioning and are, by definition, endocrine disrupting chemicals.

There is clear and extensive evidence of the human health impacts of many chemicals in common plastics.

The health and economic impacts of these widely used chemicals can be profound and life threatening.
Thank you!

Leotrasande.com
Leonardo.Trasande@nyulangone.org
Plastics Pollution Affects the Function of the Planet

Patricia Villarrubia-Gómez,* Bethanie Carney Almroth, Marcus Eriksen, Morten Ryberg, and Sarah E. Cornell
The Planetary Boundaries

2009: 3 boundaries crossed

2015: 4 boundaries crossed

2022: 6 boundaries crossed

Credit: Azote (2022)
Life cycle of plastics
Proposing novel thinking to control variables: The Impact Pathway

Volume produced

Shared of under-regulated plastics
Proposing novel thinking to control variables: The Impact Pathway

Production and Use

Environmental Release and Fate

Earth System Effects

Volume produced → Quantity released

Shared of under-regulated plastics → Plastics presence in remote environments
Proposing novel thinking to control variables: The Impact Pathway

Production and Use

- Volume produced
- Shared of under-regulated plastics

Environmental Release and Fate

- Quantity released
- Plastics presence in remote environments

Earth System Effects

- Number of perturbed planetary boundaries
- Exacerbation of other planetary boundaries
- Toxicity and harm to biosphere integrity

Exacerbation of other planetary boundaries

Toxicity and harm to biosphere integrity

Exacerbation of other planetary boundaries

Toxicity and harm to biosphere integrity
Plastics and Planetary Boundaries: Impacts on Climate Change

Credit: E. Wikander / Azote (2022)
Plastics and Planetary Boundaries: Impacts on Climate Change

Credit: E. Wikander / Azote (2022)
Plastics and Planetary Boundaries: Impacts on Climate Change

Credit: E. Wikander / Azote (2022)
Plastics and Planetary Boundaries: Impacts on Loss of biodiversity integrity

Credit: E. Wikander / Azote (2022)
Plastics and Planetary Boundaries: Impacts on Loss of biodiversity integrity
Plastics and Planetary Boundaries

All planetary boundaries are impacted:

- Disruption to Earth-system processes;
- Changes in one boundary have a knock on effects on another boundary:
- Exacerbation of the impacts of other planetary boundaries.
Planetary Boundaries: A challenge to move beyond…

Look Up! at the Big picture: is it a Complex system

Social – Ecological System

International Policy 📝

Business 👤

Society
- Environmental Justice
- Language justice
- Cultural and context specific aspects
Conclusions

- Plastics drive systemic problems with planetary consequences;
- Impacts on all Earth system processes;
- Exacerbation of the impacts of other planetary boundaries;
- Plastics trigger unexpected changes through interactions and altered feedbacks.

We call for experts and policymakers to take urgent action, considering plastics pollution not only as a waste management problem but as an integrative part of climate change, biodiversity and natural resource use policy.
Do you need more information?

GREAT!!

Let’s discuss!

www.stockholmresilience.org/subscribe
New Data: Plastic’s Toxic Chemicals in Africa, Asia, E. Europe & Latin America

Griffins Ochieng
IPEN Plastics Working Group Co-Chair
Center for Environment Justice & Development
Kenya

International Pollutants Elimination Network (IPEN)
www.ipen.org | ipen@ipen.org | Twitter: @ToxicsFree
Mission: a toxics-free future for all
600+ Member NGOs
126 Countries
25 Years Treaty Experience
Health Threats from Plastic’s Toxic Chemicals
New Data: Africa, Asia, CE Europe & Latin America
Phase 1: Production of Pellets

PCBs & UV Stabilizers
22 coastal locations across Africa, Americas, Asia, Europe & Latin America

100% contain PCBs and UV stabilizers

50% of the locations had highly or extremely PCB levels
Phase 2 Production: BPA Plastic Material Products

BPA & Baby Bottles
78% of Products tested
61% of samples labelled
“BPA-free” contained BPA

Data from:
• Bangladesh
• Bhutan
• China
• Indonesia
• Malaysia
• Russia
• Sri Lanka
• Tanzania
Plastic Material’s Life-Cycle

Phase 3 Recycled Plastic Materials (Recycled Pellets)

BPA, Frame Retardants & UV Stabilizers
24 locations across Africa, Asia, Europe & Latin America

100% of samples contain 1 or more of the 3 substances

84% of samples contain all 3 substances
Phase 4: Recycled Plastic Material Products

BFRs in Recycled Plastic Products

100% of Materials test showed Banned BFRs (penta/octa/deca/HCBCD)

Data from
- China
- Indonesia
- Russia
Phase 5: Recycled Plastic Material Products

BFRs in Recycled Plastic Products
- 72% of Products BFR (PBDE levels) exceeding 50 ppm (POPs Waste)
- 9 of 83 samples had high Brominated dioxin levels

Data from
- Burkina Faso
- Cameroon
- Egypt
- Ethiopia
- Gabon
- Jordan
- Kenya
- Morocco
- Syria
- Tanzania
- Tunisia
Recycled Plastic Toys can Exposes Children to Dioxin

Publish peer review
Contribute to
daily dioxin
intake in children

Chemosphere article:
bit.ly/DioxinToys
Plastic Material’s Life-Cycle

Phase 6: End-of-Life Toxic Emissions & Release (Local)

Dioxin in Eggs from Plastic Waste Burning
Review of previous and new data since 2000
  waste incinerators, open burning
  cement plants & metal industries
Data from Africa, Asia, Americas & Europe

92% of eggs sampled near incinerations were above EU health standards
Monitoring dioxins and PCBs in eggs as sensitive indicators for environmental pollution and contaminated sites and recommendations for reducing and controlling releases and exposure

Jindrich Petrlik, Lee Bell, Joe DiGangi, Serge Molly Allo'o Allo'o, Gilbert Kuepouo, Griffins Ochieng Ochola, Valeriya Grechko, Nikola Jelinek, Jitka Strakova, Martin Skalsky, Yuyun Ismawati Dwiega, Jonathan Hogarth, Eric Akortia, Sam Adu-Kumi, Akarapon Teebhaisong, Maria Carcamo, Bjorn Beeler, Peter Behnisch, Roland Weber

PLASTICS POISON THE CIRCULAR ECONOMY

Plastic Recycling = Recycling Toxic Chemicals

Production
Oil & Gas

Use
Store

Recycling

Recycling Toxic Chemicals

Global Waste Trade

Plastic Fuel

Landfill & Marine Litter

IPEN
for a toxics-free future
Generating Data For You
Thank You

Online Access
IPEN Reports
IPEN Policy Views & Analysis
www.ipen.org
Plastic Production:  Africa (7%) &  Latin America (4%)
Panel Discussion:

Dr. Amalia Laborde | Head, Centre in Human Environmental Toxicology (CIAT), Uruguay

Amanda Finger | Scientific Officer, Federal Office for the Environment, Switzerland

Teeraporn Wiriwutikorn | Specialist on Waste & Hazardous Substance Management, Ministry of Natural Resources and Environment, Thailand

Dr. Sam Adu-Kumi | National Focal Point, Chemicals & Waste MEAs, Environmental Protection Agency, Ghana

Jacqueline Alvarez | Chief of the UNEP Economy Division’s Chemicals and Health Branch
Panel Discussion:

• What are the opportunities for a plastics treaty to protect human health and the environment

• How can the Plastics Treaty help control the use and exposure to hazardous chemicals throughout the life cycle of plastics

• What guiding principles should be adopted to achieve a non-toxic circular economy for plastics

• What are some of the gaps in international law in relation to recycling plastics with hazardous chemicals, and trading of plastic waste