

# 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)



Schweizerische Eidgenossenschaft  
Confédération suisse  
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for a toxics-free future

# Part 1: Health & Science Information Briefing

## Part 2: Discussion Panel



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# Plastics, Endocrine Disrupting Chemicals and Health

Leonardo Trasande, MD, MPP  
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Vice Chair for Pediatrics and Director, Division of Environmental Pediatrics  
Professor of Environmental Medicine and Population Health  
NYU School of Medicine

# 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

# 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
Pharmaceuticals	Trenbolone acetate, ethinylestradiol, dexamethasone, levonorgestrel, rosiglitazone
Cosmetics, personal care products	DBP, benzophenones, parabens, triclosan, DEET
Pesticides, herbicides, fungicides	Chlorpyrifos, glyphosate, pyraclostrobin, DDT, atrazine
Industrial chemicals	BPA, PCBs, triphenyl phosphate, PBDEs
Metals	Lead, cadmium, mercury, arsenic
Synthetic and naturally occurring hormones	Progesterone, testosterone, cortisol, oestrone

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.

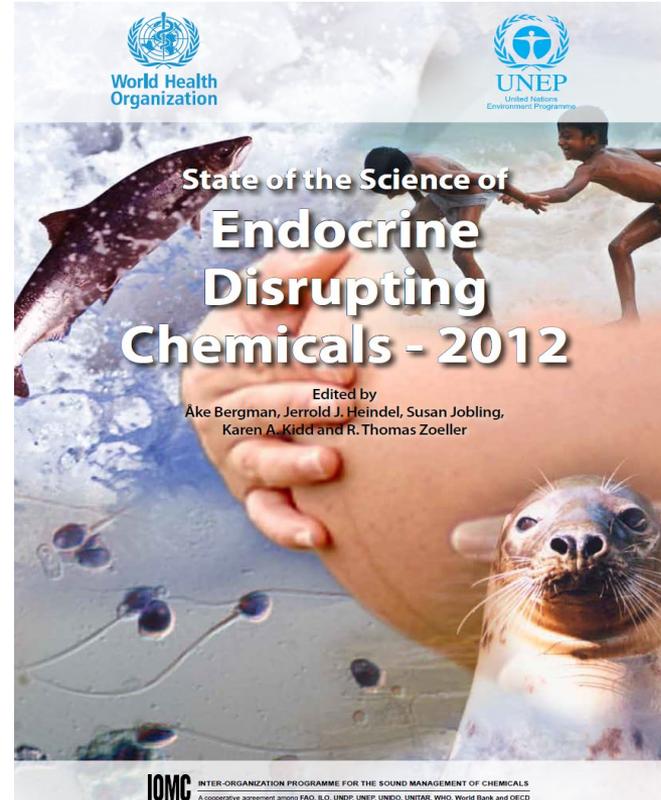
**Table 1: List of representative EDCs in use**

## Endocrine-Disrupting Chemicals: An Endocrine Society Scientific Statement

Evanthia 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 (E.D.-K.), Laiko Hospital, Medical School University of Athens, 11527 Athens, Greece; Department of Pediatrics (J.-P.B.), Centre Hospitalier Universitaire de Liege, 4000 Liege, 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.M.S.), Tufts University School of Medicine, Boston, Massachusetts 02111; Biology Department (R.T.Z.), University of Massachusetts, Amherst, Massachusetts 01003; 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 effects 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, antiandrogenic, thyroid, peroxisome proliferator-activated receptor  $\gamma$ , retinoid, and actions through other nuclear receptors; steroidogenic 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

WHO/UNEP report (2012) “welcomed” by all participant countries at 2015 Strategic Alliance for International Chemicals Management



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

A. C. Gore, V. A. Chappell, S. E. Fenton, J. A. Flaws, A. Nadal, G. S. Prins, J. Toppari, and R. T. Zoeller

Pharmacology and Toxicology (A.C.G.), College of Pharmacy, The University of Texas at Austin, Austin, Texas 78734; Division of the National Toxicology Program (V.A.C., S.E.F.), National Institute of Environmental Health Sciences, National Institutes of Health, Research Triangle Park, North Carolina 27709; Department of Comparative Biosciences (J.A.F.), University of Illinois at Urbana-Champaign, Urbana, Illinois 61802; Institute of Bioengineering and CIBERDEM (A.N.), Miguel Hernandez University of Elche, 03202 Elche, Alicante, Spain; Departments 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, 20520 Turku, 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 predominantly 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 EDGs. Based on this much more complete understanding of the endocrine principles by which EDGs 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

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DOI: 10.1111/obr.13332

ETIOLOGY AND PATHOPHYSIOLOGY

OBESITY  
Reviews WILEY

## Endocrine-disrupting chemicals and obesity risk: A review of recommendations for obesity prevention policies

Tim Lobstein<sup>1,2</sup> | Kelly D. Brownell<sup>3</sup>

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### Correspondence

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### Summary

Emerging evidence indicates 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 14.1). The authors suggest these should be explicitly linked to World Health Assembly targets to halt the rise in obesity.

**POLICY STATEMENT** Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

American Academy  
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN<sup>®</sup>

## Food Additives and Child Health

Leonardo Trasande, MD, MPP, FAAP,<sup>a</sup> Rachel M. Shaffer, MPH,<sup>b</sup> Sheela Sathyanarayana, MD, MPH,<sup>b,c</sup>  
COUNCIL ON ENVIRONMENTAL HEALTH

**TOXIC CHEMICALS & PREGNANCY**  
**10 WAYS TO AVOID TOXICS DURING AND AFTER PREGNANCY**

- 1 Avoid eating, drinking or storing food in plastic
- 2 Don't microwave in plastic
- 3 Cook with cast iron or stainless steel rather than non-stick pans
- 4 Avoid eating fish high in mercury or PCBs like shark and swordfish
- 5 Eat fresh, organic foods whenever possible
- 6 Limit cosmetics use
- 7 Avoid dry cleaning or stain treating clothes
- 8 Use a wet mop when cleaning
- 9 Avoid consumer products with flame retardants
- 10 Remove shoes before entering your home

**WHAT HEALTH PROFESSIONALS AND POLICYMAKERS CAN DO**

- Advocate for policies to prevent exposure to toxic environmental chemicals
- Work to assure a healthy food system for all
- Make environmental health part of health care
- Champion environmental justice

# 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 1** | Environmental chemicals associated with obesogenic properties

Chemical	Source/commercial use	Potential mechanism
Cigarette smoke	First-hand and second-hand smoke	Prenatal nicotine exposure alters neurological development and exposures ↑ rates of preterm and low-weight births <sup>41,46,47</sup>
Air pollution Polycyclic aromatic hydrocarbons	Incomplete combustion of fossil fuels	↑ Accumulation of visceral fat <sup>55</sup> Inflammation <sup>56</sup>
Tributyltin	Fungicide in paints and components of polyvinyl chlorides	Activation of peroxisome proliferator-activated receptor $\gamma$ <sup>37,58,59</sup> and increased fat cell differentiation <sup>60–63</sup>
Bisphenol A	Plastics and epoxy resins	Estrogenic <sup>82,83</sup> Inhibition of proliferation of neural progenitor cells <sup>86</sup>
Flame retardants	Chemicals applied to furniture and electronics	↑ Rate of adipogenesis <sup>105</sup> ↑ Glucose intolerance <sup>106</sup>
Polychlorinated biphenyls	Coolants, plasticizers and flame retardants	Altered thyroid function <sup>96,101</sup> Altered metabolism <sup>112</sup> Bioaccumulation in fat cells <sup>109</sup>
Phthalates	Plasticizers, adhesives and personal care products	↑ Rate of adipocyte differentiation <sup>117,120–122</sup>
Perfluorooctanoic acid Perfluorooctanoate sulphonate	Components of lubricants, nonstick coatings and stain-resistant compounds	↑ Serum levels of insulin <sup>126</sup> ↑ Serum levels of leptin <sup>126</sup>

# 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)

Masuno et al. *J Lipid Res.* 2002;43(5):676-684; Sakurai K et al. *Br J Pharmacol.* 2004;141(2):209-214;



# 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 → 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  $\geq 60$ .

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

Cardenas et al 2019, Sun et al 2018, Lind et al 2014

# Phthalates and other EDCs in plastic reduce fertility

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

Louis et al 2013

Fetal exposure to phthalates with reduced infant anogenital distance (AGD)

- Shortened adult AGD is associated with reduced semen quality and testosterone level

Swan et al EHP 2005, Bornehag et al EHP 2014

Multiple studies have identified reduced male fertility and poor semen quality with multiple EDCs, including phthalates, bisphenol A, and polyfluorinated chemicals

Juul et al Nat Rev Endo 2014

# What is the burden of disease burden and are the health costs due to EDCs?

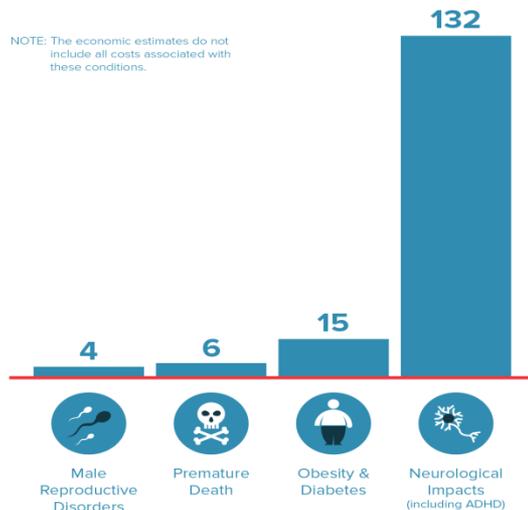
Expert panels identified conditions where the evidence is strongest for causation

- 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

## 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.

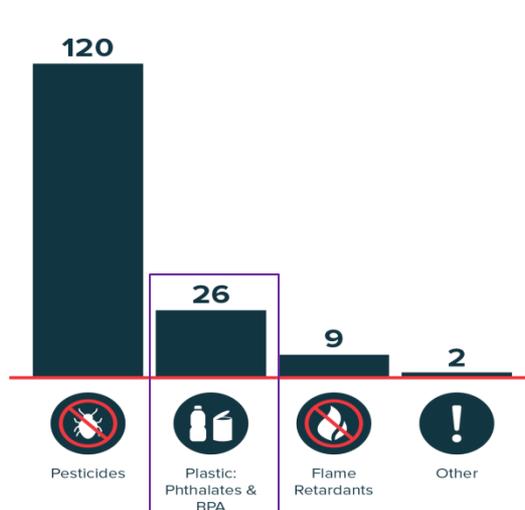
### €157B Cost by Health Effect



#### 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

### €157B Cost by EDC Type



#### SOME EDCs NOT INCLUDED:

- Atrazine
- 2, 4-D
- Styrene
- Triclosan
- Nonylphenol
- 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/edc>

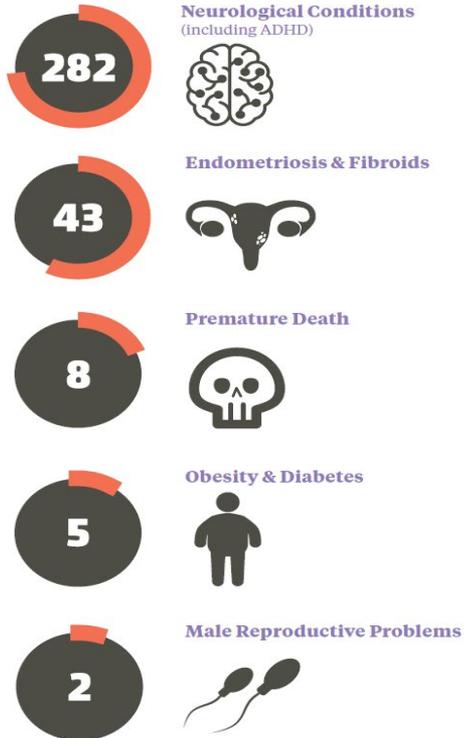


## Health Effects From Endocrine Disrupting Chemicals Cost The U.S.

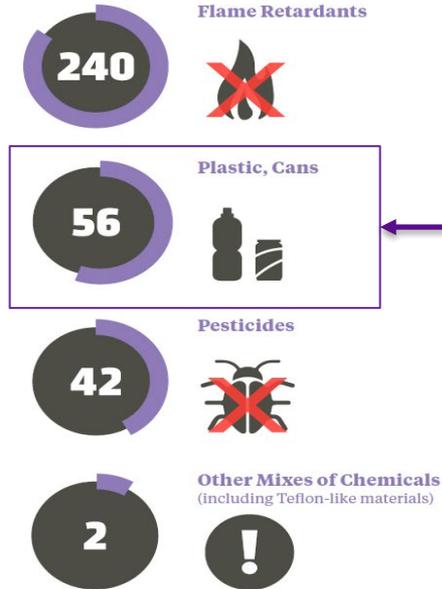
**\$340** Billion Annually

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

### \$340 Billion by Health Effect



### \$340 Billion by EDC Type



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

# 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

# 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!

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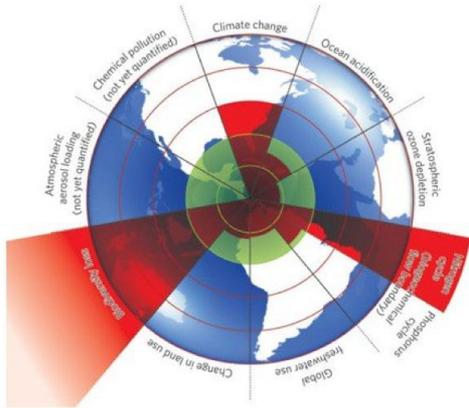


# Plastics Pollution Affects the Function of the Planet

Patricia Villarrubia-Gómez,<sup>\*</sup> Bethanie Carney Almroth, Marcus Eriksen, Morten Ryberg, and Sarah E. Cornell

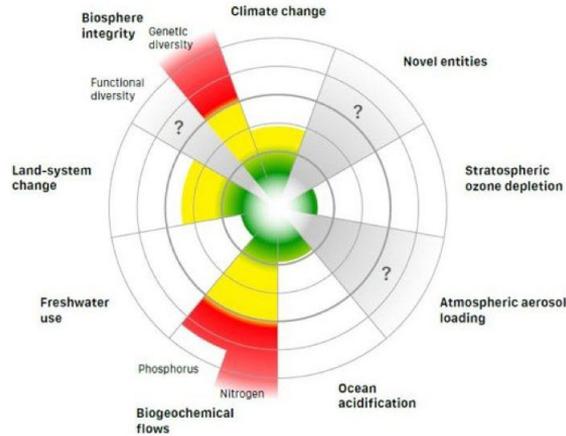
# The Planetary Boundaries

2009



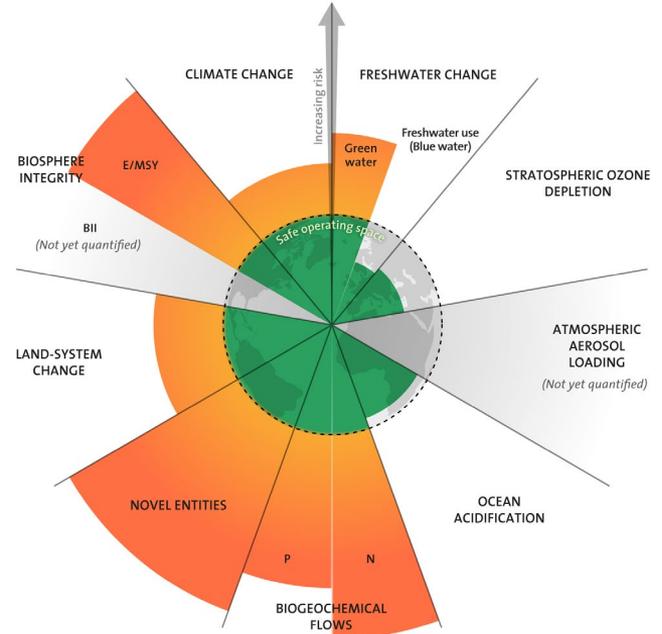
*3 boundaries crossed*

2015



*4 boundaries crossed*

2022



*6 boundaries crossed*

# Life cycle of plastics



# Proposing novel thinking to control variables: The Impact Pathway

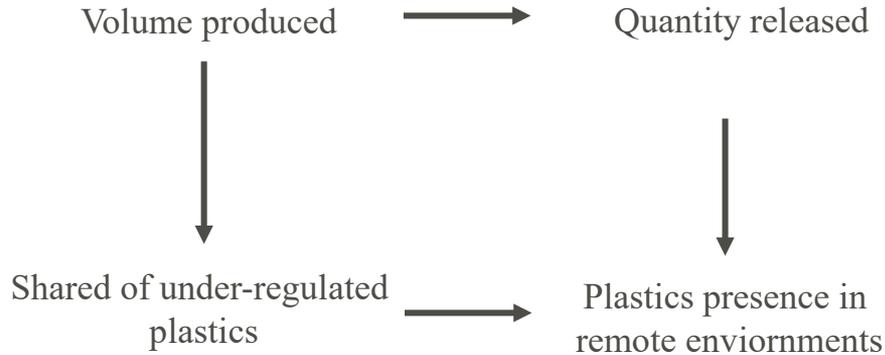


Volume produced

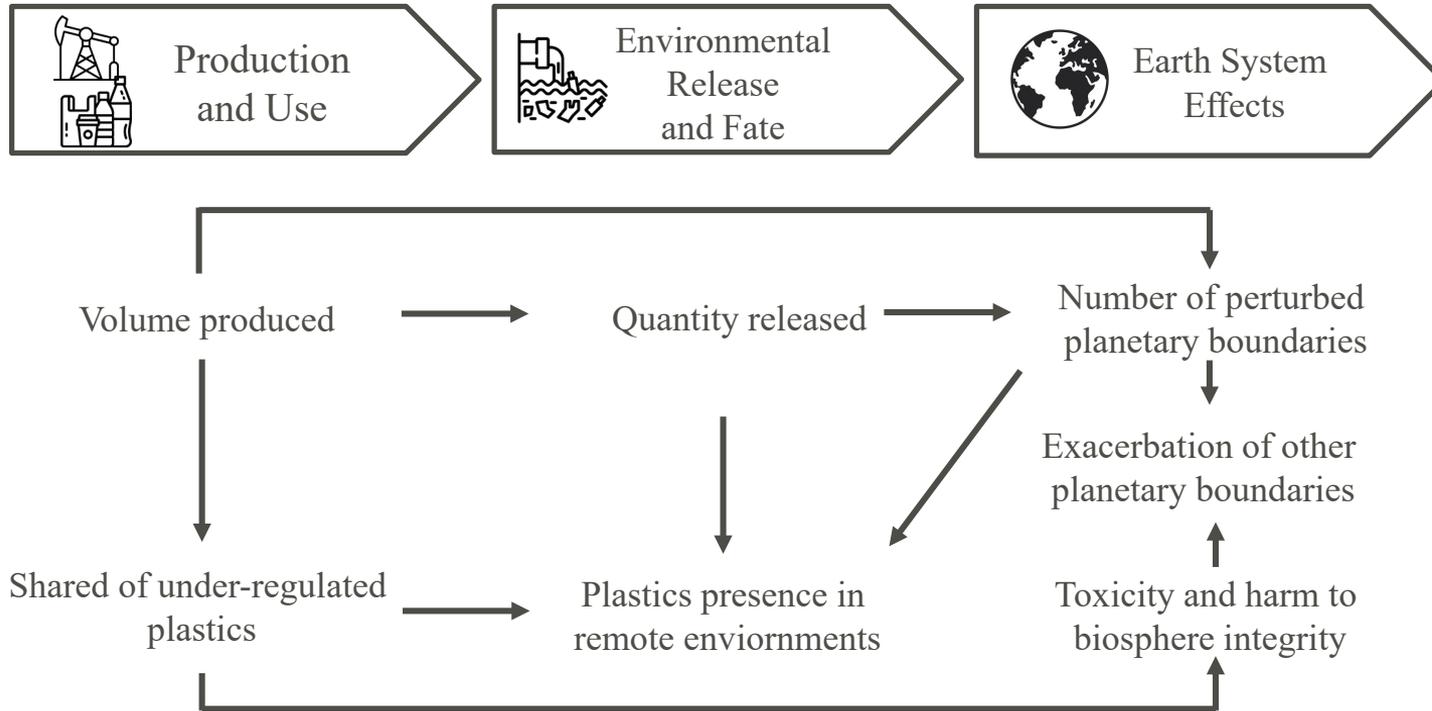


Shared of under-regulated  
plastics

# Proposing novel thinking to control variables: The Impact Pathway



# Proposing novel thinking to control variables: The Impact Pathway



# Plastics and Planetary Boundaries: Impacts on Climate Change



Credit: E. Wikander / Azote (2022)

# Plastics and Planetary Boundaries: Impacts on Climate Change

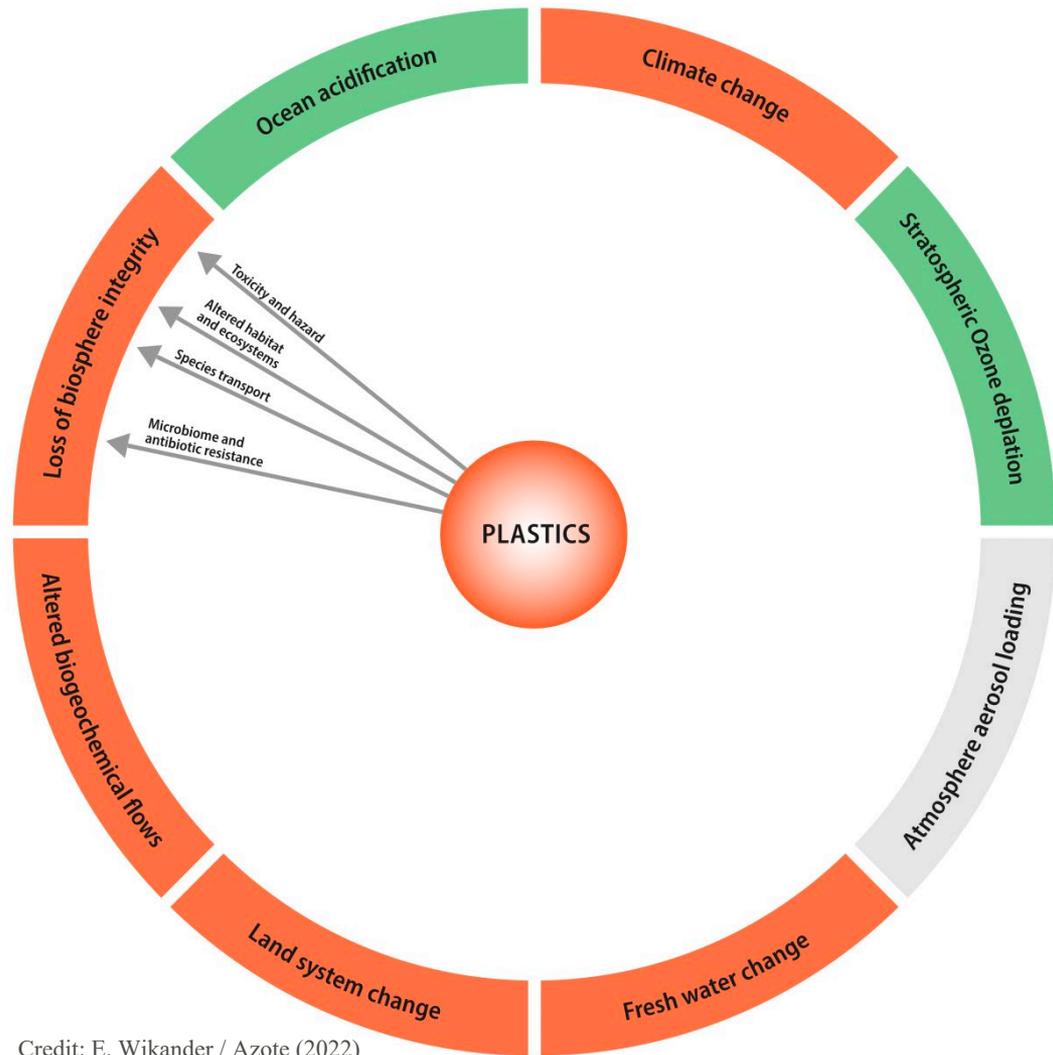


# Plastics and Planetary Boundaries: Impacts on Climate Change

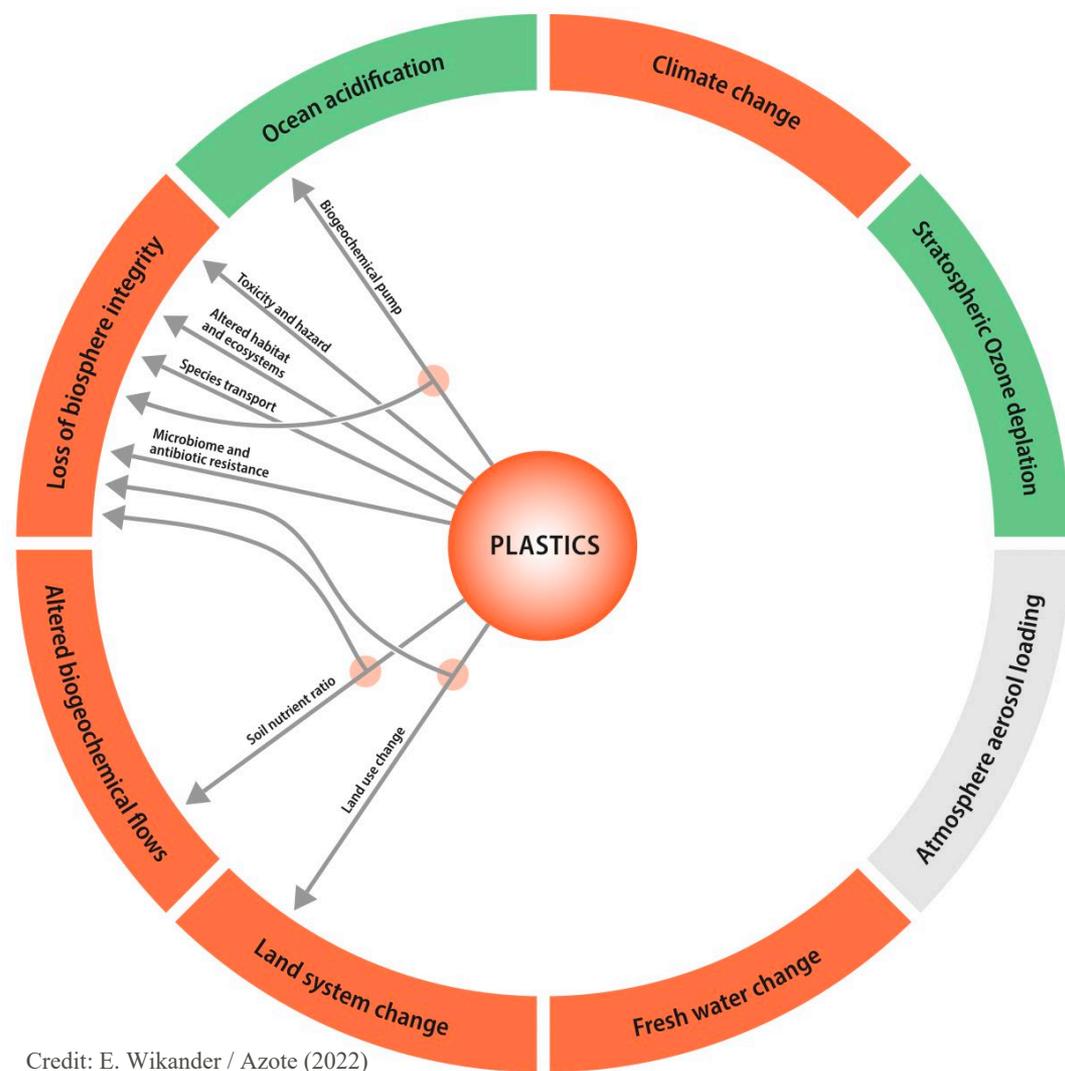


Credit: E. Wikander / Azote (2022)

# Plastics and Planetary Boundaries: Impacts on Loss of biodiversity integrity



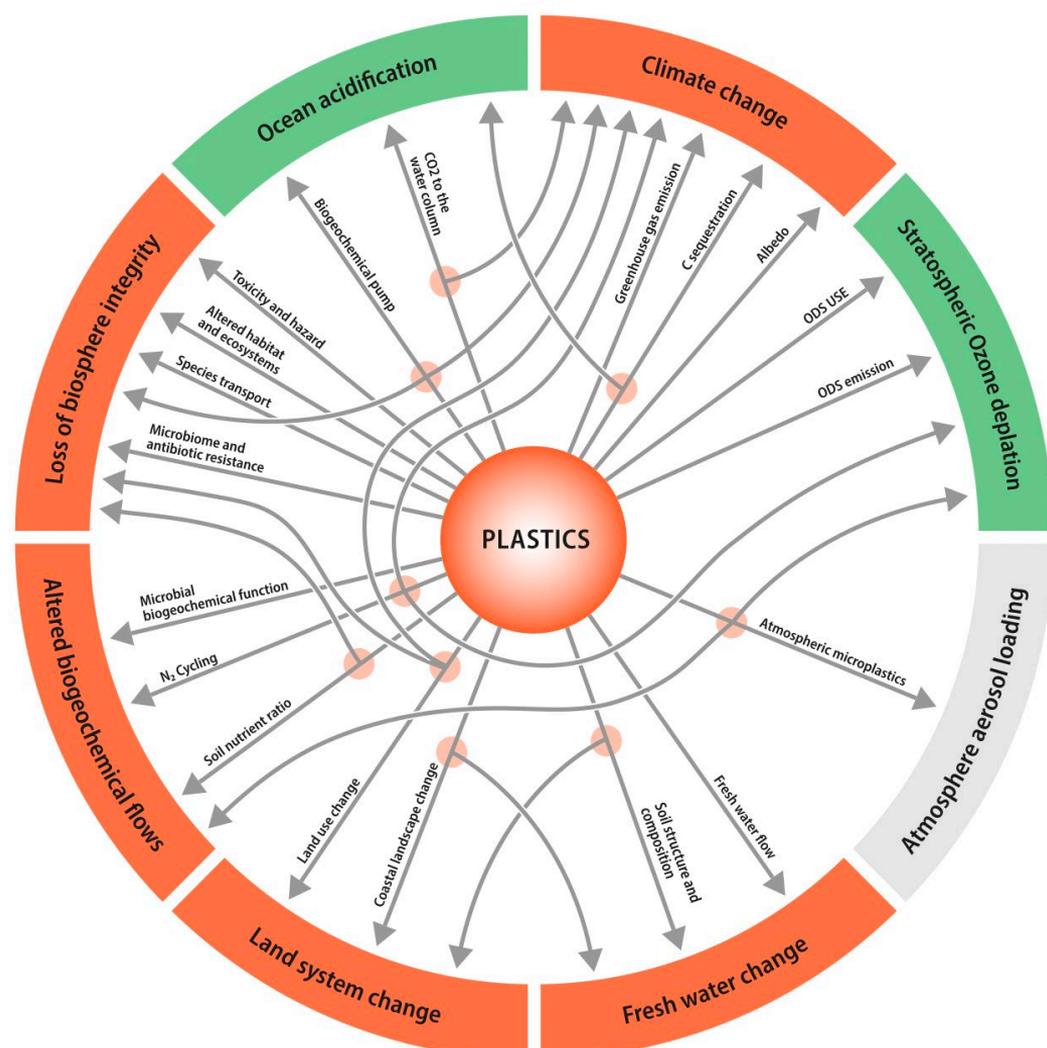
# Plastics and Planetary Boundaries: Impacts on Loss of biodiversity integrity



# 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.





Credit: Chris LeBoutillier



Credit: Zeljkosantrac / Getty Images



Credit: Gettyimages / Stockphoto



Credit: Andrew Gemmell

# 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](http://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](http://www.ipen.org)

| [ipen@ipen.org](mailto:ipen@ipen.org)

| Twitter: @ToxicsFree

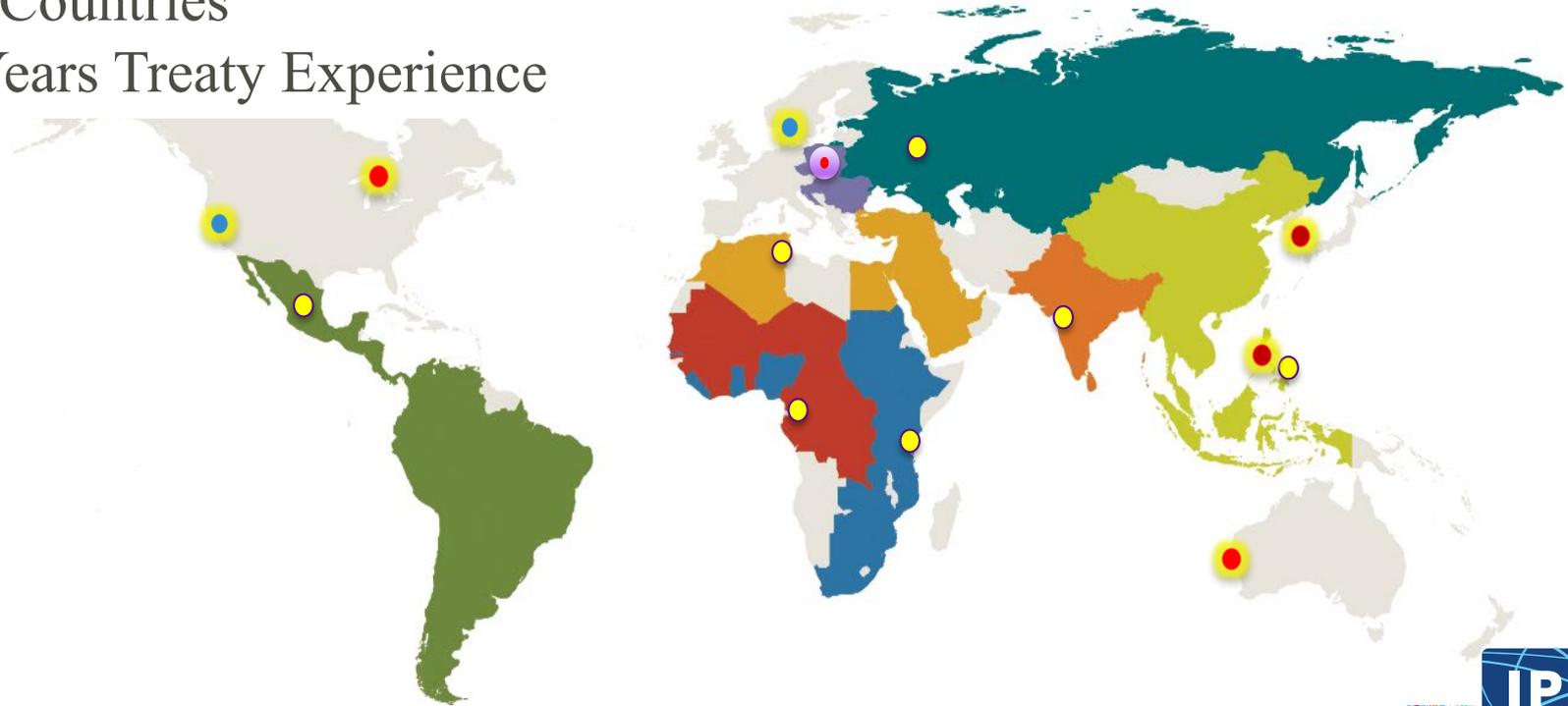
# Global Network of Public Interest Organization

**Mission:** a toxics-free future for all

**600+** Member NGOs

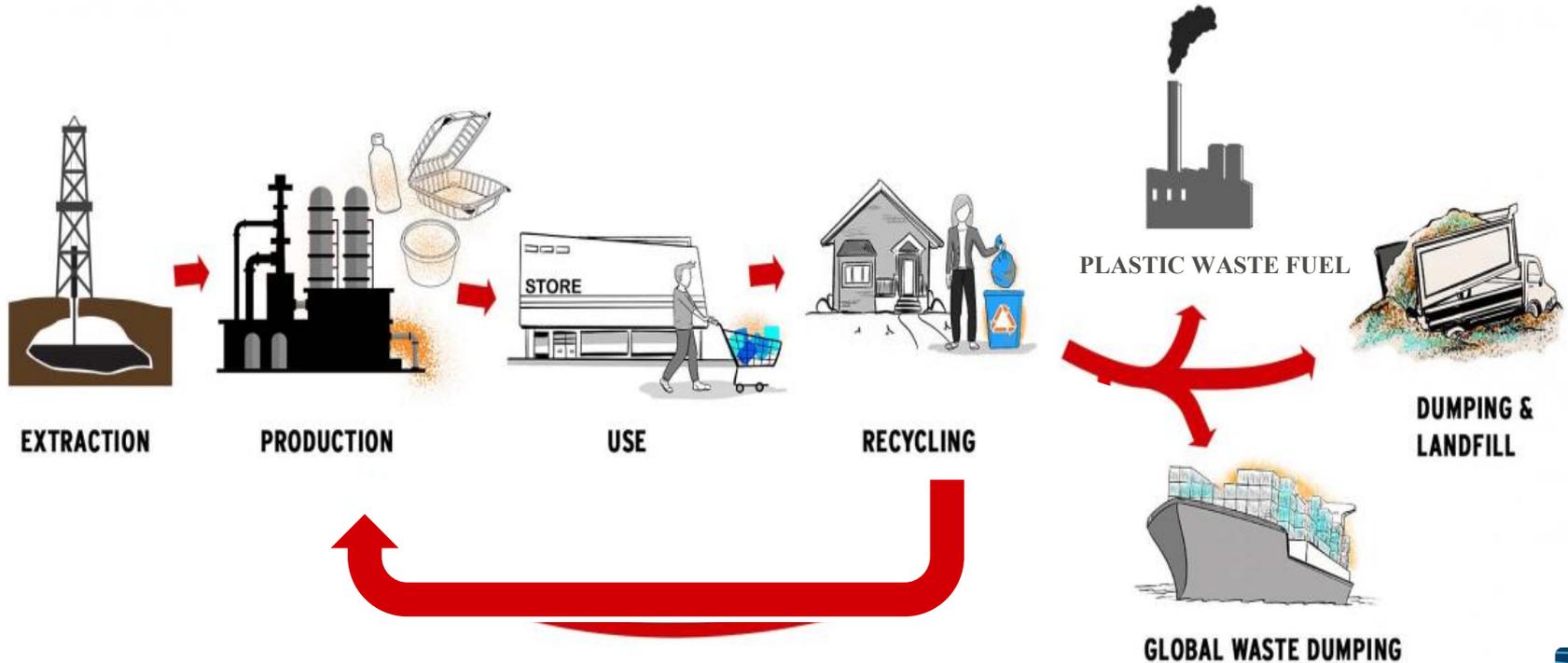
**126** Countries

**25** Years Treaty Experience



# Health Threats from Plastic's Toxic Chemicals

## New Data: Africa, Asia, CE Europe & Latin America



# Plastic Material's Life-Cycle

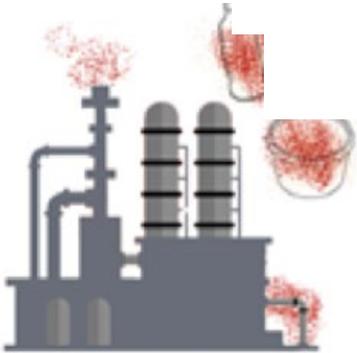
## Phase 1: Production of Pellets

### 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



PRODUCTION



PLASTIC PELLETS



# Plastic Material's Life-Cycle

## 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



**A CALL TO ACTION: FREE CHILDREN FROM BPA'S TOXIC LEGACY**

BPA IN PLASTIC PRODUCTS FROM BANGLADESH, BHUTAN, CHINA, INDONESIA, MALAYSIA, RUSSIA, SRI LANKA & TANZANIA THAT ARE IN CONTACT WITH FOOD OR WITH CHILDREN'S MOUTHS

February 2022

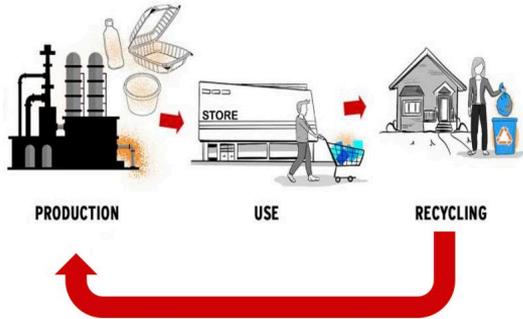


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Toxics Link  
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# Plastic Material's Life-Cycle

## Phase 3 Recycled Plastic Materials (Recycled Pellets)

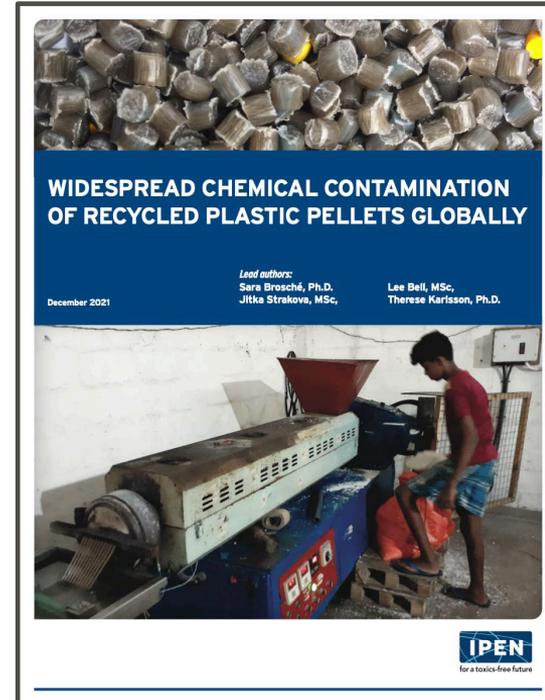


### **BPA, Flame Retardants & UV Stabilizers**

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



# Plastic Material's Life-Cycle

## 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



**BROMINATED FLAME RETARDANTS  
IN PLASTIC PRODUCTS FROM CHINA,  
INDONESIA, AND RUSSIA**

February 2022

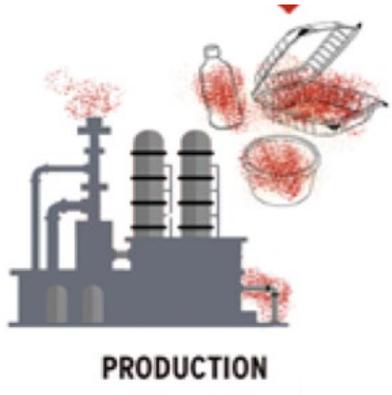


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# Plastic Material's Life-Cycle

## 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](https://bit.ly/DioxinToys)



Chemosphere  
journal homepage: [www.elsevier.com/locate/chemosphere](http://www.elsevier.com/locate/chemosphere)

## Detection of high PBDD/Fs levels and dioxin-like activity in toys using a combination of GC-HRMS, rat-based and human-based DR CALUX® reporter gene assays

Clémence Budin<sup>a,b,\*</sup>, Jindrich Petřík<sup>c</sup>, Jitka Straková<sup>c</sup>, Stephan Hamm<sup>d</sup>, Björn Beeler<sup>e</sup>, Peter Behnisch<sup>f</sup>, Harrie Besselink<sup>g</sup>, Bart van der Burg<sup>g</sup>, Abraham Brouwer<sup>a,b</sup>

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<sup>d</sup> Also environmental analytical group, Wilhelm-Schickel-Strasse 5, 48149 Münster, Germany  
<sup>e</sup> ZIN, Cottbus, Germany

### HIGHLIGHTS

- We determined DR CALUX and DR<sub>human</sub> CALUX REP values for PBDD/Fs
- In sampled plastic toys, we measured high levels of PBDD/Fs using GC-HRMS
- GC-HRMS-based TEQ calculated using PCDD/F TEQ were up to 2821 µg TEQ/g
- Toxicity equivalents up to 2550 µg TEQ/g were measured by DR CALUX® bioassays
- Munching of contaminated plastics may significantly contribute to dioxin TEQ

### ARTICLE INFO

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Handling Editor: Myrta Ferreira

### ABSTRACT

Brominated dibenzo-p-dioxin (PBDD) levels in various types of plastic toys were measured but are not yet reported.

### Keywords:

Polychlorinated dibenzo-p-dioxin and dibenzofuran (PBDD/Fs)  
Children's toys  
Reporter gene assays  
DR CALUX



# Plastic Material's Life-Cycle

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



**PLASTIC WASTE FUEL**

**Incineration  
Chemical Recycling  
Cement Kilns**

### **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



**PLASTIC WASTE POISONING FOOD  
AND THREATENING COMMUNITIES IN  
AFRICA, ASIA, CENTRAL & EASTERN  
EUROPE AND LATIN AMERICA**

June 2021



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# Plastic Material's Life-Cycle

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



**PLASTIC WASTE FUEL**  
**Incineration**  
**Chemical Recycling**  
**Cement Kilns**

**KeAi**  
CHINESE ROOTS  
GLOBAL IMPACT

Emerging Contaminants

Available online 26 May 2022

In Press, Journal Pre-proof



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 <sup>a, b</sup>, Lee Bell <sup>a, c</sup>, Joe DiGangi <sup>a</sup>, Serge Molly Allo'o Allo'o <sup>d</sup>, Gilbert Kuepouo <sup>e</sup>, Griffins Ochieng Ochola <sup>f</sup>, Valeriya Grechko <sup>b, g</sup>, Nikola Jelinek <sup>b</sup>, Jitka Strakova <sup>a, b</sup>, Martin Skalsky <sup>h</sup>, Yuyun Ismawati Drwiega <sup>i</sup>, Jonathan Hogarh <sup>j</sup>, Eric Akortia <sup>k</sup>, Sam Adu-Kumi <sup>l</sup>, Akarapon Teebthaisong <sup>m</sup>, Maria Carcamo <sup>n</sup>, Bjorn Beeler <sup>a</sup>, Peter Behnisch <sup>o</sup> ...  
Roland Weber <sup>q</sup> ✉

<https://bit.ly/DioxinEggOEWG>

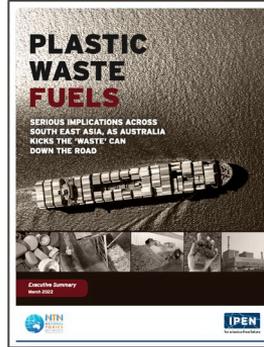
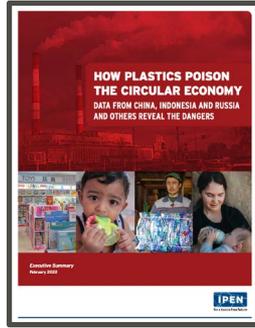
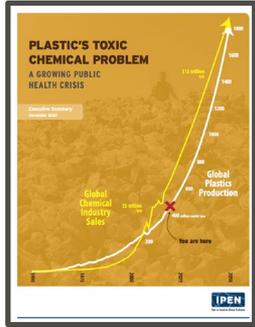
# PLASTICS POISON THE CIRCULAR ECONOMY



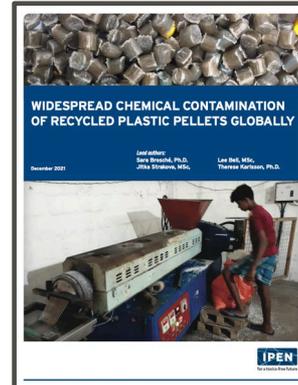
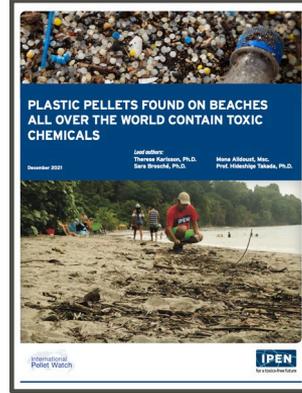


# Generating Data For You

## Thank You

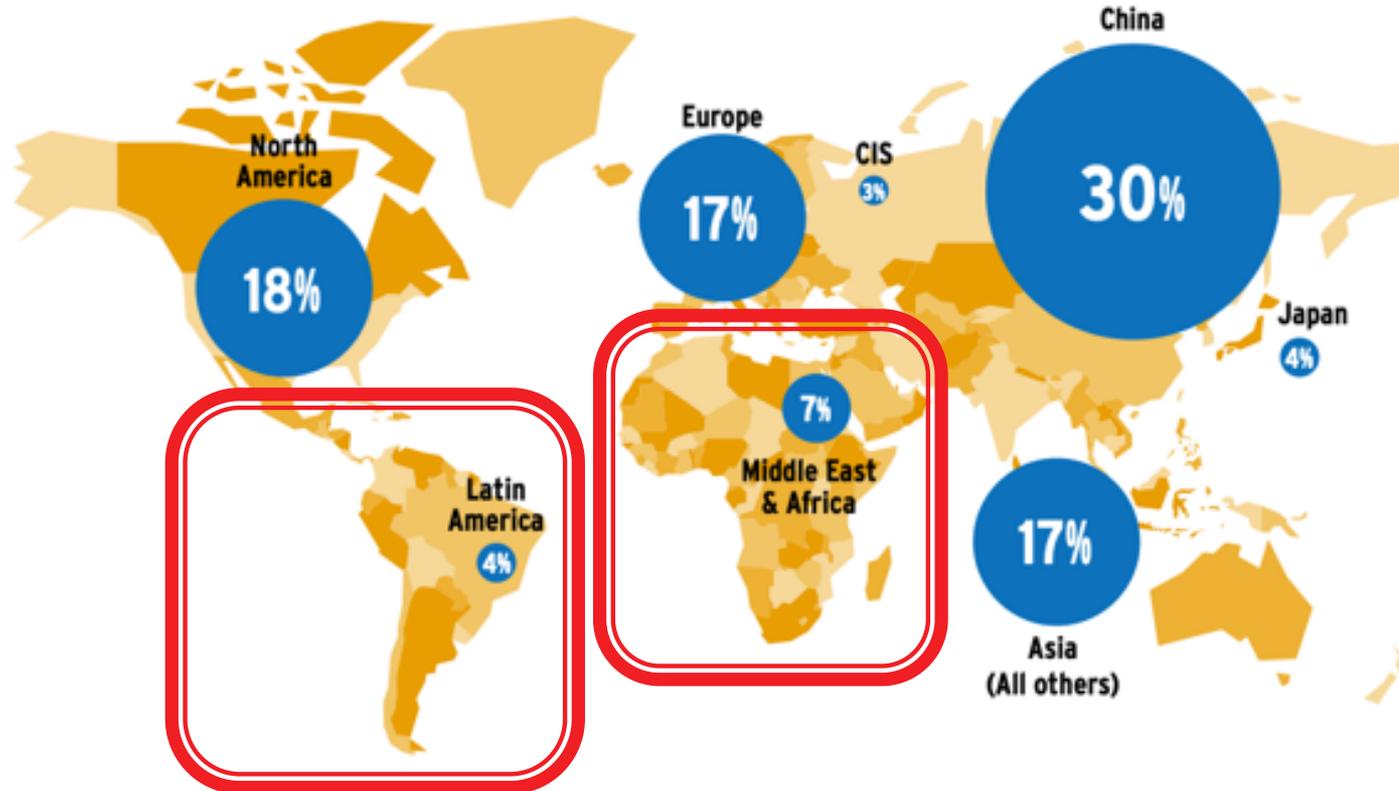


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# Plastic Production: Africa (7%) & Latin America (4%)

## Global Plastic Production Regional Production 2018





# 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



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## 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



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