SIDE EVENT

THE INVISIBLE GLOBAL CRISIS: EXCEEDING THE LIMITS OF THE POLLUTION PLANETARY BOUNDARY

NEW SCIENCE AND OPPORTUNITIES TO TACKLE THREATS TO HUMAN AND MARINE LIFE

Lisbon, FIL, Auditorium 1 & Online

27 June 2022 | 13:30-15:00 WEST, 14:30-16:00 CEST
GENEVA
BEAT PLASTIC POLLUTION
DIALOGUES

Will be at the 2022 UN Ocean Conference

www.tiny.cc/UNOceanConference
The Invisible Global Crisis: Exceeding the Limits of the Pollution Planetary Boundary

New Science and Opportunities to Tackle Threats to Human and Marine Life

SPEAKERS

Bethanie CARNEY ALMROTH
Professor in Ecotoxicology, Department of Biological and Environmental Sciences, University of Gothenburg

Martin HASSELLÖV
Professor in Analytical Environmental Chemistry, Department of Marine Sciences, University of Gothenburg

Björn BEELER
General Manager and International Coordinator, International Pollutants Elimination Network

H.E. Luis VAYAS
Vice-Minister for Foreign Affairs and Cooperation, Ministry of Foreign Affairs, Ecuador

Jessica BROWN
Head of Engagement, Back to Blue Initiative, The Economist

Therese KARLSSON
Science and Technical Advisor, International Pollutants Elimination Network

Lena GIPPERTH
Professor in environmental law and member of the Centre for Sea and Society, University of Gothenburg | Moderator

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27 June 2022 | 13:30 WEST | 14:30 CEST
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- Lena GIPPERTH | Professor in environmental law and member of the Centre for Sea and Society, University of Gothenburg

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New Science and Opportunities to Tackle Threats to Human and Marine Life
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Panel Discussion
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Q&A

Closing Remarks
The Invisible Global Crisis: Exceeding the Limits of the Pollution Planetary Boundary

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Q&A

Closing Remarks
Outside the Safe Operating Space of the Planetary Boundary for Novel Entities

Linn Persson,* Bethanie M. Carney Almroth, Christopher D. Collins, Sarah Cornell, Cynthia A. de Wit,* Miriam L. Diamond, Peter Fantke, Martin Hassellöv, Matthew MacLeod, Morten W. Ryberg, Peter Søgaard Jørgensen, Patricia Villarrubia-Gómez, Zhanyun Wang, and Michael Zwicky Hauschild
The Planetary Boundaries

Nine anthropogenic impacts on key components that regulate the stability and resilience of the Earth system.

1. Ozone depletion
2. Loss of biodiversity
3. Climate change
4. Ocean Acidification
5. Fresh water consumption
6. Land system changes
7. Nitrogen and phosphorous flows to the biosphere and oceans
8. Atmospheric aerosol loading
9. Release of chemical pollution and novel entities

Rockström et al., 2009
Novel Entities

- New substances, new forms of existing substances
- Chemicals and other new types of engineered materials not previously known to the Earth system
- Naturally occurring elements (for example, heavy metals) mobilized by anthropogenic activities

Rockström et al., 2009; Steffen et al., 2015; Persson et al. 2013; Villarubia-Goméz et al. 2018; Arp et al., 2021
Pollution of an entire Planet?

Novel entities: global concern when exhibiting persistence, mobility across scales with widespread distribution and accumulation in organisms and the environment, and potential negative impacts on vital Earth Systems processes or subsystems

Steffen et al., 2015
Henderson Island

Human population zero
Distance to nearest continent (>5000 km)
Global pollution measurements

* Limited global chemical measurements
* Lead (Pb)
* Main source is gasoline
Globalized trade of chemicals, commodities and waste

Spread of chemicals to polar regions

Gouin et al., 2004
Changing pollution perspectives...

Barbapapas, 70s
350,000 chemicals and mixtures

- Wang et al., 2020, ES&T
- 22 chemical inventories, 19 countries
- 50,000 confidential
- 70,000 ambiguously described
10 000 substances used in plastics

- Weisinger et al., 2021, ES&T
- 63 industrial, scientific, and regulatory data sources
- 10 000 substances used in plastics
- > 2400 chemicals of concern
Bethanie CARNEY ALMROTH
Professor in Ecotoxicology, Department of Biological and Environmental Sciences, University of Gothenburg
Ecotoxicological research has focused on 65 chemicals

- Kristiansson et al, 2021, Envir Sci Pol
- 3500 chemicals in 130,000 papers
- Pharmaceuticals, biocides, metals, plant production products, REACH substances
Life cycle of Novel Entities
Impact pathway

- Natural resource extraction and Production capacity
- Novel entities production and use
- Environmental release – intended and unintended
- Environmental distribution and fate
- Exposure of other Earth system components
- Disturbance of Earth system processes

Production and use volumes
Environmental mass and/or concentrations
Earth system effects
How to inform selection of control variables???

- **Feasibility**: Can it be measured?
- **Relevance**: Can it be robustly linked to effects?
- **Comprehensiveness**: Does it capture the planetary scale of the problem?
Technological control variables

Trends in production of novel entities

- Production volume of chemicals
- Production volume of plastics
- Share of chemicals on the market that have safety data or regulatory assessment
REACH: European chemicals legislation

- 143,000 chemicals on European market
- Registration of chemicals >1000 kg/yr
- 48,000 dossiers have been submitted
- ECHA only checks app 25% of dossiers, 74% fail to provide “important safety information”
Environmental control variables

Trends in release of novel entities

* Emission quantities of hazardous chemicals

* Release quantities of plastics into the environment
Annual global plastic emissions into aquatic ecosystems

Borrelle et al., 2020
Environmental control variables

Unwanted impact of novel entities on Earth system processes

- Toxicity of chemical pollution
- Disturbance to biosphere integrity by plastic pollution
The solution to pollution is dilution?

Metalochlor (pesticide) and BPA (polymer/plastic additive) occupy 1/1000\(^{th}\) of the available 'space' in fresh water systems in Europe.
Connections to other planetary boundaries

- Atmospheric aerosols
- Loss of Biodiversity
- Climate change
- Ocean Acidification
- Land systems
- N and P flows
Have we transgressed the boundary for novel entities?

- Trends in production volume of chemicals
- Trends in production volume of plastics
- Share of chemicals on the market that have safety data or regulatory assessment
- Trend in emission quantities of hazardous chemicals
- Trend in release quantities of plastics into the environment
- Toxicity of chemical pollution
- Disturbance to biosphere integrity by plastic pollution
- Can’t say we are safe
- Can’t say we are safe
- High risk
- Yes
- Yes
- Yes
- Yes
How do we move forward from here?
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Björn BEELER
General Manager and International Coordinator, International Pollutants Elimination Network
International Pollutants Elimination Network
Global network
600+ NGO/organizations
127 countries
IPEN Lead by Local-National-International Leaders
Mission:
a toxics-free future for all

Change Theory Model:
Local to
    Global to
    Local

Solutions:
- Use Science to
  Generate Data
- Create Public Policies
  for Public Health
World’s Worst Chemicals
Persistent Organic Pollutants (POPs)
Stockholm Convention
43 Banned Chemicals/Chemical Groups (12 + 31)

Pesticides:
Toxics sprayed directly into the environment

Plastics:
Toxic Chemicals used to Make Plastics
Toxic Chemical Releases from Plastic Wastes
Pesticides
Poisoning the Food Web

Fishery collapse ‘confirms Silent Spring pesticide prophecy’

Common pesticides found to starve fish ‘astoundingly fast’ by killing aquatic insects
Persistent herbicides are believed to pose one of the greatest risks to ecosystems and organisms in the Great Barrier Reef.
Plastics: Poisoning Marine & Human Life
Plastics = Carbon + Chemicals

99% Oil
10,000+ Chemicals used
¼ are known hazardous chemicals

Deep Dive into Plastic Monomers, Additives, and Processing Aids
Helene Wiesinger*, Zhanyun Wang*, and Stefanie Hellweg
Visible:
Plastic Waste

Invisible:
Plastic’s Toxic Chemical Harm
Toxic chemicals in plastics affect marine life

“The fertility of marine fish decreased as they bioconcentrated persistent Endocrine Disrupting Chemicals (EDCs)”
Regulators missing pollution’s effect on marine life, study finds

Chemicals and plastics, not just overfishing, threaten aquatic food chain with ‘disaster’, report warns
Differing chemical additives are used as fillers, plasticizers, flame retardants, colorants, UV stabilizers, biocides, heat stabilizers, antioxidants, lubricants, foaming agents, and catalysts. In addition to the additives that are intentionally put into plastics, unwanted side products can arise during the manufacturing process, often introduced as impurities associated with additives, or result from incomplete polymerization. For example, polystyrene plastics can contain residual styrene monomer, which is a carcinogen; plasticizers can contain polycyclic aromatic hydrocarbons as impurities; and brominated flame retardants may be contaminated with brominated dioxins and furans. No systematic catalogues of chemicals used in the manufacture of plastics exist; however, the number ranges in the order of magnitude of thousands. The most common additives include plasticizers such as bisphenols and phthalates, flame retardants, cadmium and lead compounds, alkyl phenols, curing agents like formaldehyde, biocides like arsenic compounds, organic tin compounds and triclosan, and colorants like azo colorants and cadmium compounds. Many of these are EDCs. The amounts that are added to plastics vary. Plasticizers and flame retardants can comprise 70% and 25% of the final product by weight, respectively, whereas stabilizers, curing agents and colorants typically only constitute 2-3%.
Different chemical additives are used as fillers, plasticizers, flame retardants, colorants, UV stabilizers, biocides, heat stabilizers, antioxidants, lubricants, foaming agents, and catalysts [61]. In addition to the additives that are intentionally put into plastics, unwanted side products can arise during the manufacturing process, get introduced as impurities associated with additives, or result from incomplete polymerization. For example, polystyrene plastics can contain residual styrene monomer, which is a carcinogen; plasticizers can contain polycyclic aromatic hydrocarbons as impurities; and brominated flame retardants may be contaminated with brominated dioxins and furans [61,62].

No systematic catalogues of chemicals used in the manufacture of plastics exist; however, the number ranges in the order of magnitude of thousands [61-63]. The most common additives include plasticizers such as bisphenols and phthalates, flame retardants, cadmium and lead compounds, alkyl phenols, curing agents like formaldehyde, biocides like arsenic compounds, organic tin compounds and triclosan, and colorants like azo colorants and cadmium compounds [61]. Many of these are EDCs. The amounts that are added to plastics vary. Plasticizers and flame retardants can comprise 70% and 25% of the final product by weight, respectively, whereas stabilizers, curing agents and colorants typically only constitute.

Cancer, Reproductive Harm & More
Why the future of oil is in chemicals, not fuels

With gasoline consumption expected to wane, crude-to-chemicals complexes could dominate the petrochemical industry by the 2020s

by Alexander H. Tullo

February 20, 2019 | A version of this story appeared in Volume 97, Issue 8

https://cen.acs.org/business/petrochemicals/future-oil-chemicals-fuels/97/i8
Global Trends:

Fossil Fuels shift from Fuel to Materials/Plastic
Global Trends:

You Are Here
Worldwide fertility has dropped more than 50% over the past 50 years and is continuing to decline.

Plastic’s Toxic Chemicals: PFAS, BFRs, Phthalates & BPA

Trends: Chemical Production UP & Fertility DOWN

COUNT DOWN
Shanna H. Swan, PhD with Stacey Colino

2021
Global Community Monitoring: Toxics in Plastics

23 Countries, All Regions
Global Community Monitoring: Toxics in Plastics

BPA in Bottles

BFRs in Toys

PFAS in Clothing
Don’t freak out: There is hope!
Action Plan for Hope:

1. Identify A **Common** Problem
2. Discuss Solutions
3. Create Rules (Laws)
4. Enforce Laws
Defining the Problem, and Solutions for the Problem

Problem:
Chemical Pollutants

Solution:
Global Controls via Global Public Policies
Progress: Global Bans on Toxic PFAS / Forever Chemicals

Opportunity: Plastics Treaty (2022 it begins)
Plastics Treaty = Global Health Treaty

Opportunity: Protect Human Health & Marine-life/Biodiversity from Toxics
Ban Production of Toxic Chemicals in Plastics
Shift Responsibility to Chemical & Plastic Producers to Pay
Conclusions

• Toxic chemicals increasing global threat to human & marine life
• Plastics = carbon + chemicals
  (many toxic chemicals)
• Opportunity:
  Global Health Treaty, the Plastics Treaty
• Hope: “instead of looking for hope, start creating that hope yourself”
  - Greta Thunberg
Making the invisible, visible

Online Access
IPEN Reports
IPEN Policy Views & Analysis
www.ipen.org
Thank you
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WHAT'S NEXT?

#StopShippingPlasticWaste

EVENT | VIRTUAL
How Plastic Waste Shipments Undermine Real Solutions to Ocean Plastic Pollution | UN Ocean Conference Side Event
28 JUN 2022 14:00 – 16:00
Online | Webex
EEB, Break Free From Plastic, GEN

EVENT | AFTERWORK
Green Summer in Geneva 2022
21 JUN – 15 SEP 2022
Geneva

Chemicals and Pollution | Plastics
SDG3 | SDG12

Genevaenvironmentnetwork.org