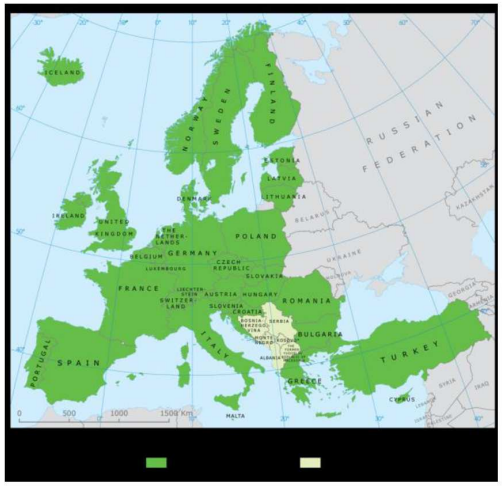
Chemicals for a Sustainable Future

Scientific Committee Seminar
May 17th 2017, EEA Copenhagen

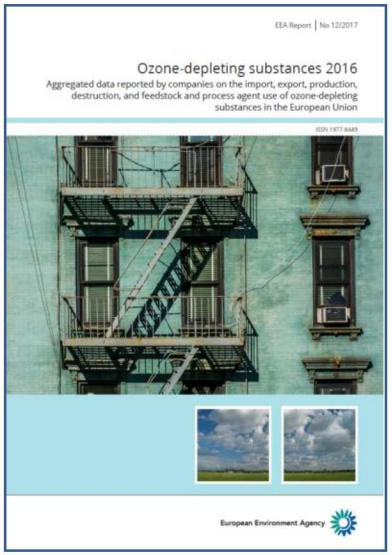
Dr Xenia Trier



The problems of the past – visible pollution

Evolving regulations

- Single substances
- National => EU sector legislations, e.g.
  - Industrial emissions directive, Pesticides, Food contact materials, Pharmaceuticals, Water Framework Directive, REACH, Biocides, RoHS+WEEE haz. subst's in electronic equipment
- International agreements, e.g.
  - UNEP Stockholm convention on POPs,
  - Basel Convention on Hazardous Wastes
- Monitoring, reporting and access to data, e.g. via
  - Waterbase and Airbase (EEA)
  - Green house gasses and Ozone depleeting substances
  - European Pollutant Release and Transfer Register (E-PRTR)
  - Information Platform for Chemical Monitoring (IPCheM)
  - EU research projects, e.g. SOLUTIONS and HBM4EU



Risk assessment and management of chemicals

Risks of chemicals based on scientific risk assessment of *known hazards* and management of *foreseen* uses and effects

Risk α Hazard x Exposure

Type, severity of harm

Type of toxicity, potency

Time of exposure

Mixture toxicity

Frequency of events

Various sources, routes of exposure

Uptake, degradation

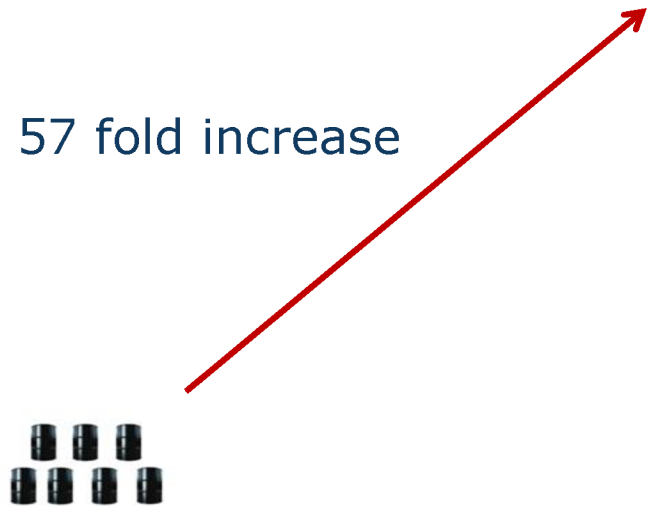
Final external/internal concentrations

Persistent and 'pseudo-persistent' chemicals

Take action or not: Balance scientific risk vs. societal needs
=> completeness of the cost-benefit models?

Increase of world production of chemicals 1950-2000

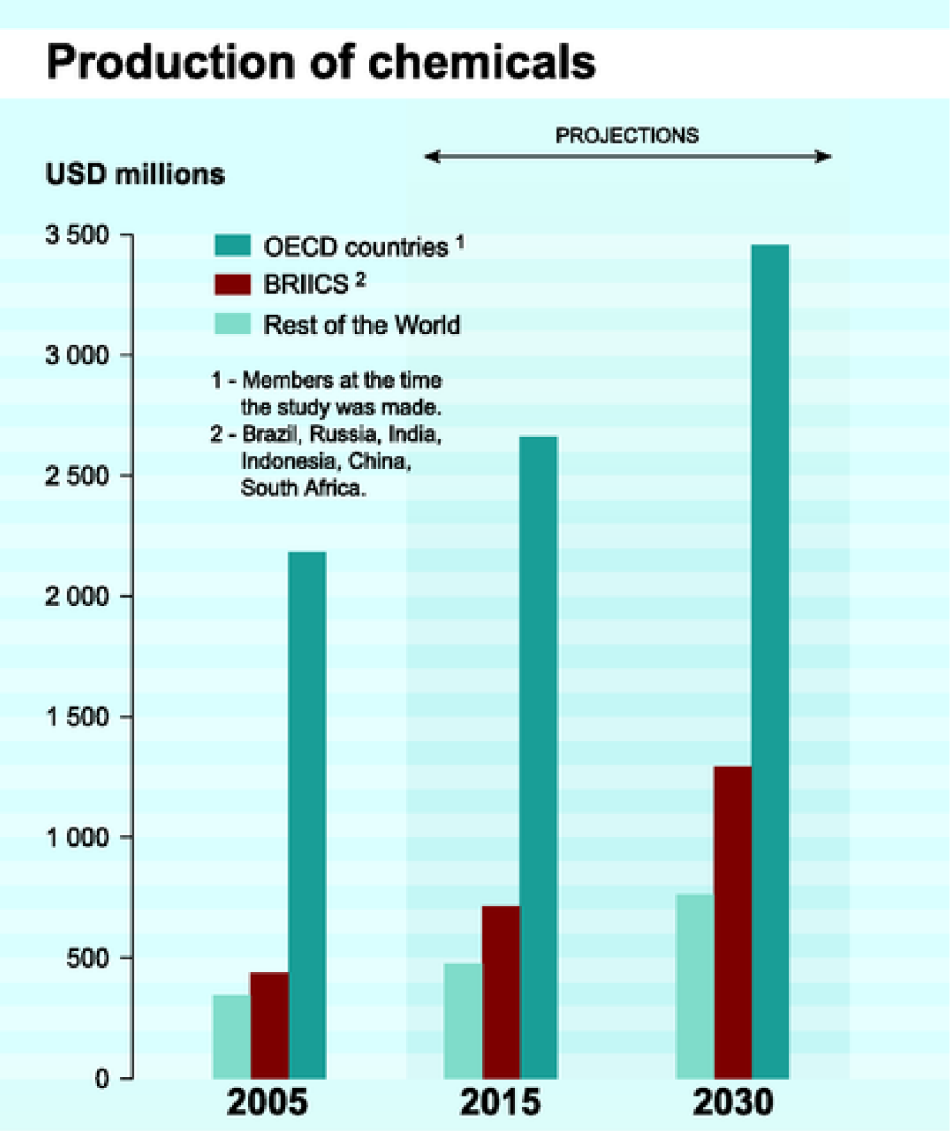
- 100,000 -150,000 synthetic chemicals produced/used globally
- 15,000 new CAS # registered/day



European Commission (2001) "Towards Sustainability", A European Community Programme of Policy and Action in Relation to the Environment and Sustainable Development, Commission of the European Communities, COM(92) 23/II final, Brussels; White Paper - Strategy for a future Chemicals Policy. Commission of the European Communities, COM(2001) 88 final, Brussels.

Credit: Urban Boije, DG ENV

Megatrend – increasing dependency on chemicals



(OECD 2008: *Environmental Outlook to 2030*)

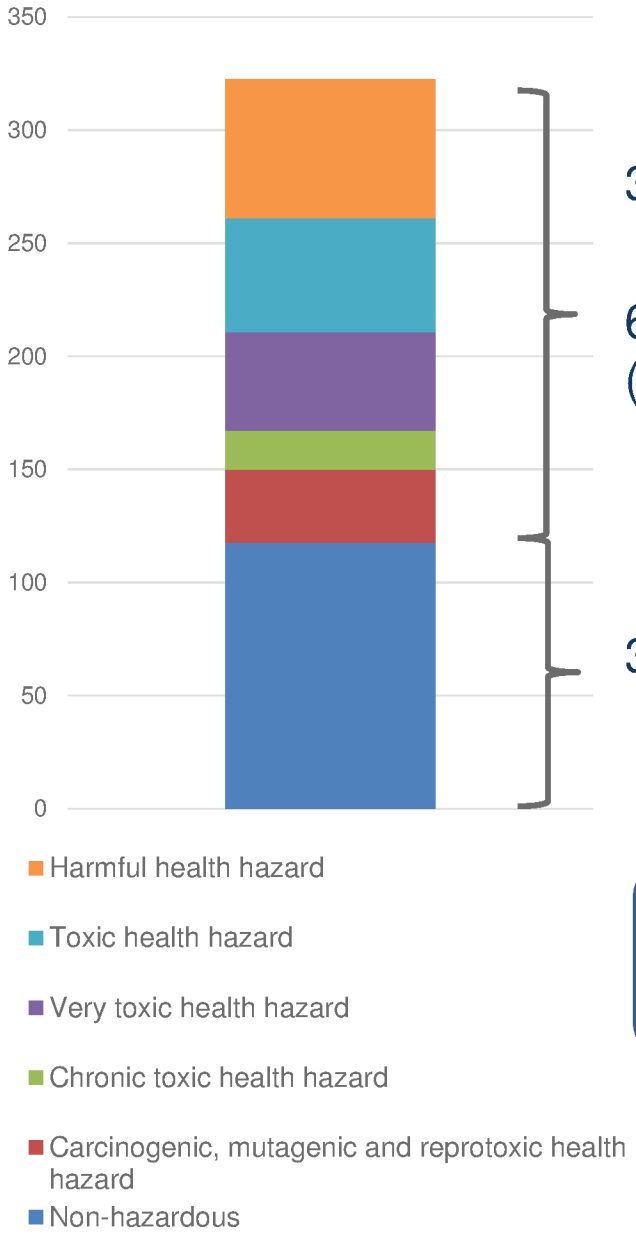
Global chemical production increases

Risk ↑ α Hazard x Exposure ↑

exposures increase => risks increase

- Can risk assessment keep up?
- Possible to manage chemicals safely, now and in the future?

Known chemical hazards – EU production data



323 millions tonnes total

64% hazardous to health
(43% haz. to ecosystems)

36% non-hazardous

REACH chemicals and classification according to CLP

REACH does not cover:

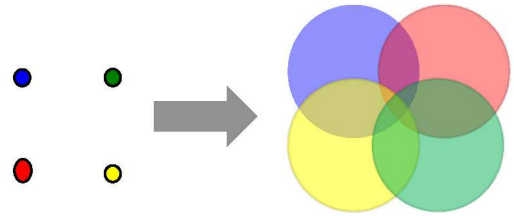
- < 1 ton subst./yr/user
- 'polymers'
- existing regulations

REACH
=> Knowledge has increased ☺
=> Issue with quality of data and risk assessments

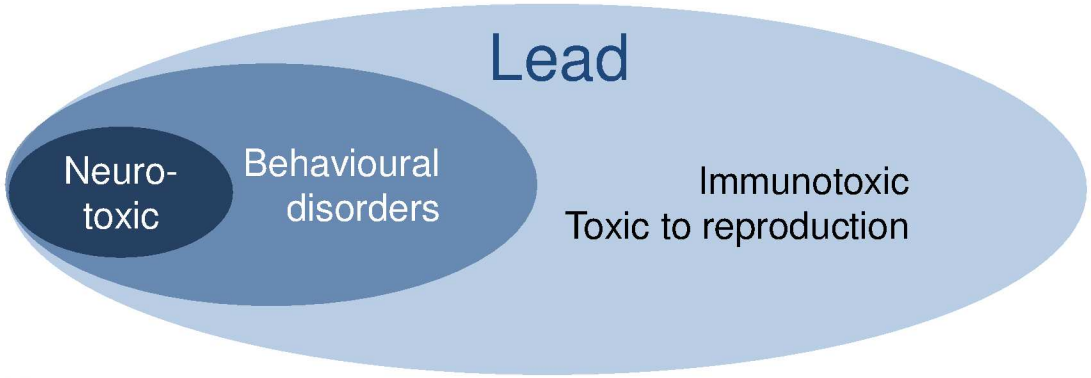
Source: Eurostat, 2017, based on 2015 data

Evolving understanding of chemical risks

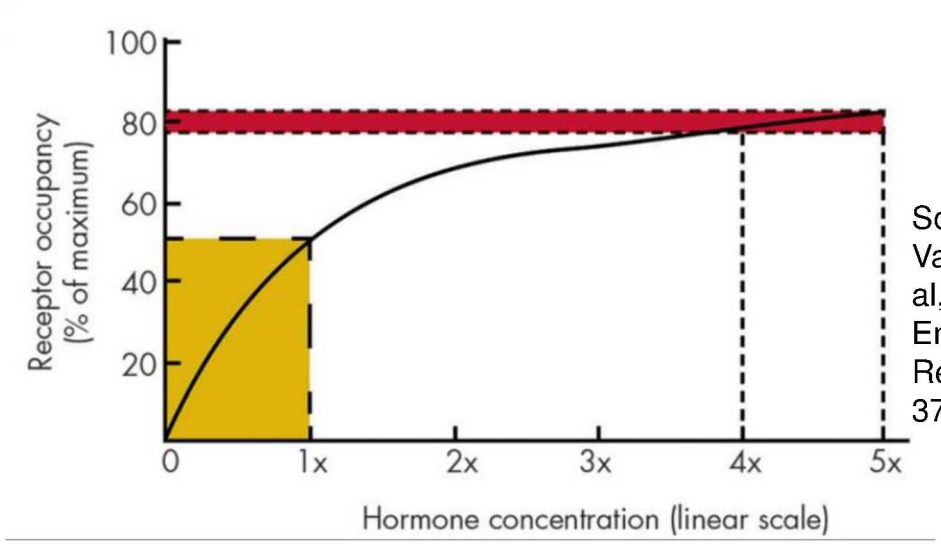
Single exposures



Combined exposure



Expansion of harm lower thresholds



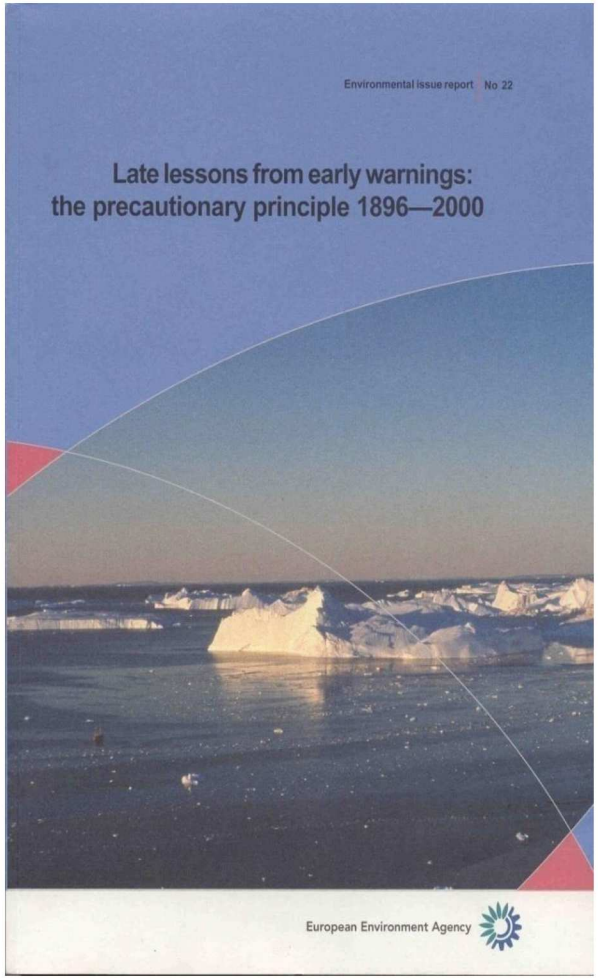
Source: Vandenberg et al, 2012, Endocrine Reviews 33(3): 378-455

From "dose makes the poison" to low-dose effects

Critical times of exposure

Two volumes of ‘Late lessons, from early warnings’

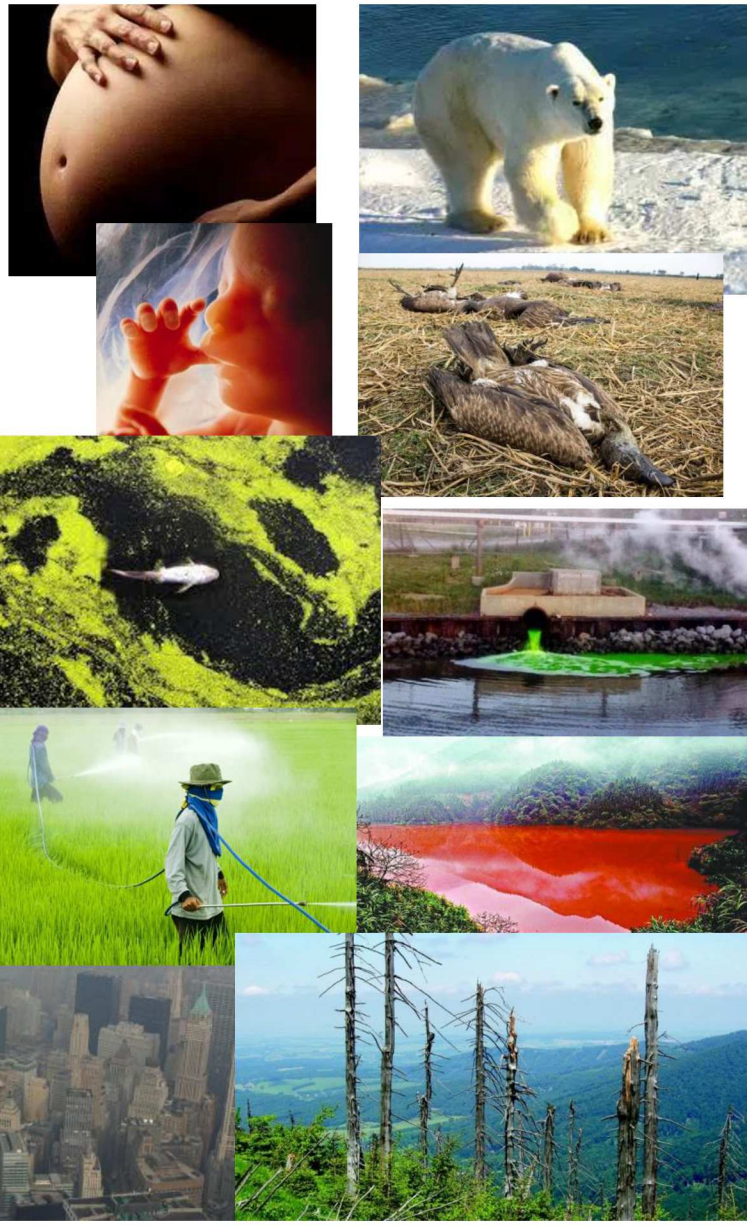
2001



2013

Evidence of harm of chemicals?

- **Impacts of chemicals keep increasing**
  => deaths/illnesses due to air pollution
  => deaths from workplace exposure (100,000 deaths/yr/EU)
  => decreased fertility, testicular cancer (EDCs)
  => suppressed immune systems (fluorocarbons)
  => 'brain drain' from neurotoxins (e.g. Mercury)
- **Decreasing biodiversity** (pesticides)
- **Acid rain and dying forrests** from air pollution
- **Antimicrobial resistance**
  due to pharmaceuticals and biocides
- **Caused by** current and legacy POPs
  heavy metals, pesticides,
  consumer chemicals
- **Spills/mismanagement**

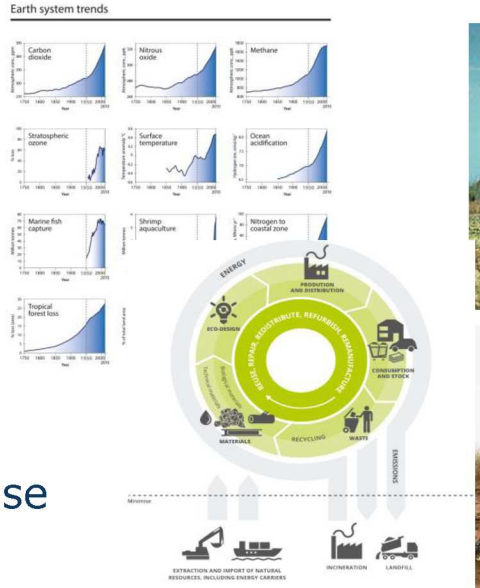


Changing context – new uses and combined pressures

- **Resource scarcity => Circular Economy**
  - Spreading of industrial sludge on farmland
  - Hazardous chemicals in articles
- **Globalisation**
- **Climate change**
  - Warmer climate: pests/pesticide use increase
  - Remobilisation of legacy chemicals from landfills
  - Refigerant gasses: From CFC to F-gasses
- **Demography**

Difficult to foresee future uses

Multiple pressures affect health
.. but chemical pressures can be reduced!



Top 10 solutions to climate change
Total gigatons of CO2-equivalent emissions that could be reduced by 2050

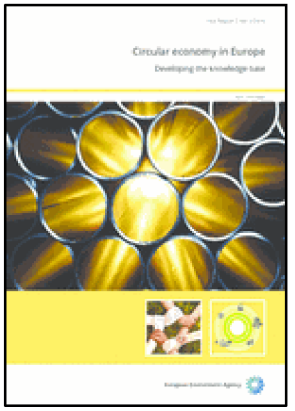
SOLUTION		PLAUSIBLE SCENARIO		DRAWDOWN SCENARIO		OPTIMUM SCENARIO
Refrigerant Management	1	89.74	2	96.49	3	96.49
Wind Turbines (Onshore)	2	84.60	1	146.50	1	139.31
Reduced Food Waste	3	70.53	4	83.03	4	92.89
Plant-Rich Diet	4	66.11	5	78.65	5	87.86
Tropical Forests	5	61.23	3	89.00	2	105.60
Educating Girls	6	59.60	7	59.60	8	59.60
Family Planning	7	59.60	8	59.60	9	59.60
Solar Farms	8	36.90	6	64.60	7	60.48
Silvopasture	9	31.19	9	47.50	6	63.81
Rooftop Solar	10	24.60	10	43.10	13	40.34

Source: Project Drawdown

Vox

https://www.vox.com/energy-and-environment/2017/5/10/15589038/top-100-solutions-climate-change-

Combined pressures – how to assess overall impacts?



- **Traditionally assessments are done**
  - For single substances
  - In sectors
  - For a linear economy
  - On either production or use or disposal
  - On relative efficiency improvements
  - Optimisation of seperate goals: resource-/energy efficiency, low toxicity,

- **For future assessments it is relevant to consider**
  - Combined exposure and mixture toxicity
  - Full life cycle
  - A circular economy – chemicals compatible with a CE
  - Burden shifting btw various pressures
    => Overall environmental sustainability assessments

=> **Need for harmonisation of risk/life cycle assessments**
across chemicals legislations, and *compatible with a CE*

Is it possible to foresee all hazards and future uses?

EEA, SOER 2015

Mitigation

- *Setting limit values for specific chemicals*

Adaptation

- *Minimising exposure*

Restoration

- *Reversible pollution*
- *Irreversible pollution*

Avoidance

precautionary measures to avoid potential harm in complex and uncertain situations.

- ***Avoid use of chemicals of concern***
- ***Design chemicals to avoid hazardous properties***

Avoid: Reduce known risks, and reduce future risks

Risk α Hazard x Exposure

.. by decreasing hazard of chemicals

- **avoiding use of chemicals of concern:** *SVHC and persistent chemicals*
- use grouping to avoid regrettable substitution
- planetary boundary threats

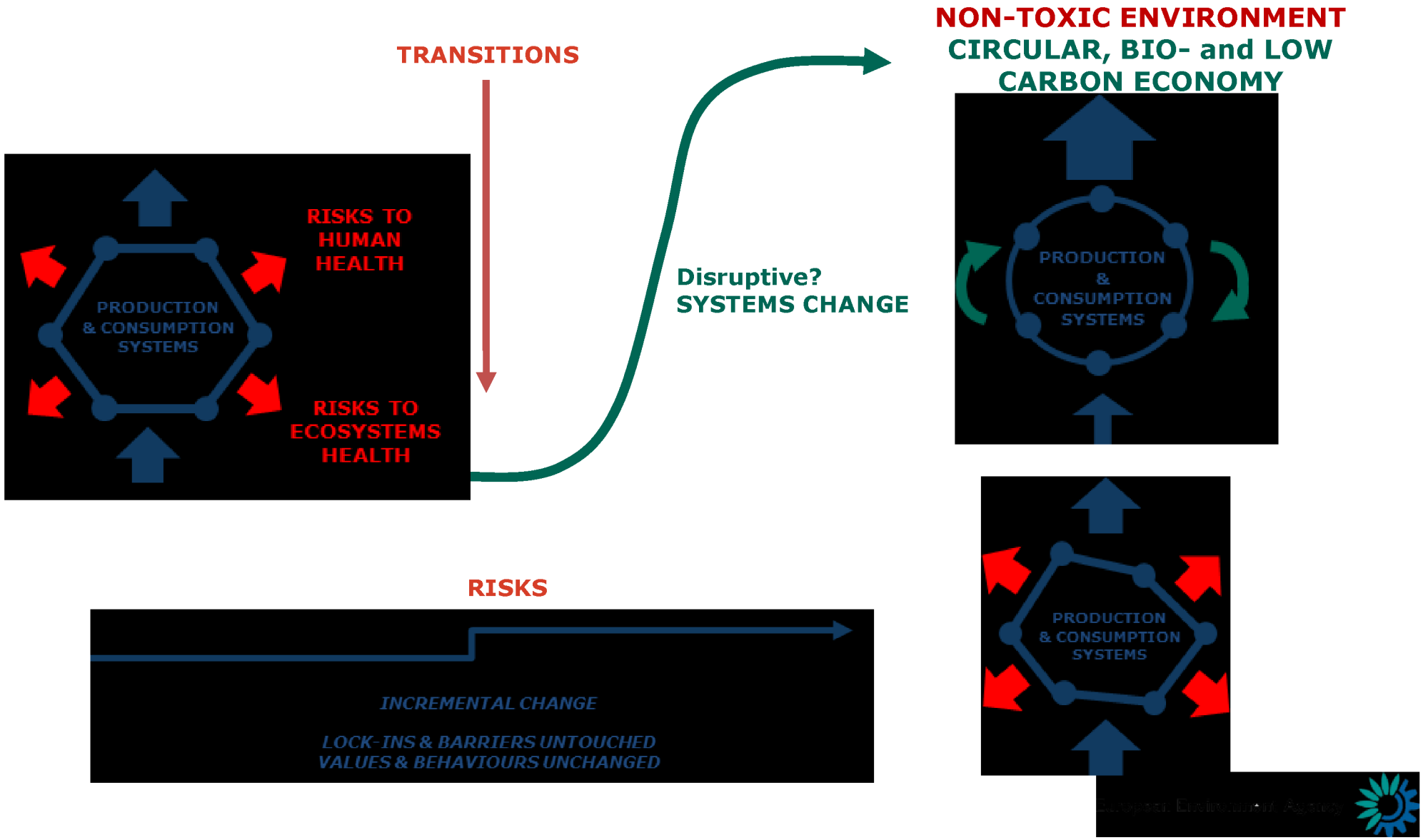
.. by increasing sustainable chemicals

- most effective strategy, recognised by SAICM
- innovation potential for new products and chemicals!
- Include in all R&D programs

... by decreasing exposure

- **decrease absolute volume** of chemicals
- focus on service rather than chemical
  - => non-chemical solutions
  - => new business models (chemical leasing)

Transition towards a non-toxic environment



Take-away messages

- ***Combined sum of chemicals* impacts human and environmental health**
  => need integration across legislative silos

- **Volumes of chemicals increase => Risks increases**
  => cannot keep up with risk assessment

- **Incomplete scientific knowledge**
  Mix toxicity, critical times of exposure, combined exposures across life cycles,´unknowns

- **Impossible to foresee all future uses and exposures to chemicals**
  => demography change, CE and BE, climate change; policy synergies!

Paradigm shift: reduce overall risk by avoiding use of chemicals of concern

=> avoid use of *known* chemicals of concern (persistent, SVHCs, EDCs..) in the design phase

=> apply and innovate: *green and sustaibale chemistry* and *non-chemical solutions*

=> close collaboration with industry, supply-chain, designers, academia, authorities, NGOs, public

=> alternatives often exist and can be cost-effective

Thank you!

Contact details

Xenia Trier, Ph.D.

Project Manager on Chemicals, Environment and Human Health

Green economy group, Integrated Environmental Assessments (IEA) Programme

Kongens Nytorv 6
1050 Copenhagen K, Denmark

xenia.trier@eea.europa.eu
eea.europa.eu

eionet.europa.eu/]eionet.europa.eu
Phone: (+45) 33367100 / Direct: (+45) 33367102

Thanks to contributers

EEA Colleagues: Catherine Ganzleben, Caroline Whalley, Vincent Viaud, Ybele Hoogeveen, Jock Martin. DG ENV: Urban Boije

Reducing complexity is necessary but tricky

Scientific problems are complex:
are often affected by multiple factors

⇒ All factors not included (costly) in every study

⇒ Recuction leads to loss of information

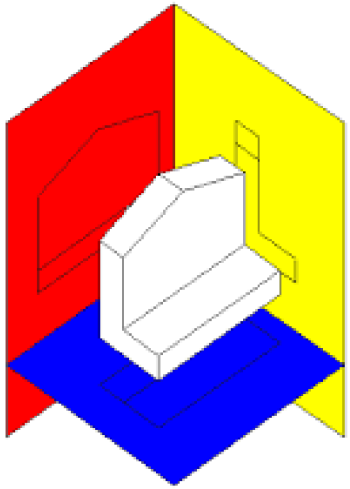
⇒ Design of studies related to observers deliberate/ unaware choice to reduce complexity

Eszter Barbara Bakó, My City/EEA

⇒ Combination of studies from different angles is necessary to reconstruct reality

⇒ Differently reduced studies can result in different conclusions

⇒ Scientific 'controversies'



Kovacic 2017: **Investigating science for governance through the lenses of complexity** .. (https://doi.org/10.1016/j.futures.2017.01.007)