

Global NIP Update Webinar –

1

POP action plan options for the National Implementation Plans: Unintentional POPs & PFAS (20. January 2026, 14:00 -16:30 CEST, GMT 2)

CET	Theme	Speaker
14:00	Moderator: Ms. Janalezza Thuaud (GGKP, UNEP) Welcome and Opening Remarks	Ms. Carla Valle-Klann (BRS Secretariat)
14:05	Some basic Considerations on Action Plan Development and Integrated Approach	Dr. Roland Weber; POPs Environmental Consulting
14:30	Action Plan Options for Reduction and Elimination of Unintentional POPs (Article 5) and Considerations for an Integrated Approach	Prof. Harald Schönberger
15:15	From BAT/BEP for Unintentional POP Reduction to Integrated Pollution Prevention and Control of Pollutants to Tackle the Triple Planetary Crisis	Dr. Roland Weber
15:45	Options for Action Plan Activities to Control, Manage and Phase out of POP-PFAS and Synergy with GFC Issue of Concern for all PFAS	All
16:15	Q&A session	
16:30	Closing remarks	



Global NIP Update Webinar “Activity Options for Action Plans for Stockholm Convention NIPs: 2
Unintentional POPs and POP-PFASs”, 20. January 2026, 14:00 -16:30 CET, UTC+1

Some Basic Considerations on Action Plan Development and Integrated Approach

Dr. Roland Weber

POPs Environmental Consulting,
73527 Schwäbisch Gmünd, Germany
<https://www.researchgate.net/profile/Roland-Weber-2>



37 POPs listed in the Stockholm Convention (2025)

Chemical	Pesticides	Industrial chemicals	Unintentional production	Annex
<i>DDT</i>	+			B
Aldrin, Dieldrin, Endrin, Chlordane, Chlordecone, Toxaphene	+			A
Alpha-, Beta-, Gamma-HCH,	+		By-product of lindane	A
Endosulfan, Heptachlor, Mirex, PCP,	+			A
Dicofol, Methoxychlor, Chlorpyrifos	+	+		A
Commercial PentaBDE		+		A
Commercial OctaBDE (Hexa/HeptaBDE)		+		A
Commercial DecaBDE		+		A
Hexabromobiphenyl (HBB)		+		A
Hexabromocyclododecane (HBCD)		+		A
PFOS, its salts and PFOSF	+	+		B
PFOA and related compounds		+		A
PFHxS and related compounds		+		A
Long-chain PFCAs (C9-C21)		+		A
SCCPs, MCCPs, Dechlorane Plus		+		A
UV-328		+		A
PCB, PeCBz, HCB, PCN, HCBD	+	+	+	A/C
PCDD, PCDF			+	C

Many are **chlorinated** compounds including **most pesticides and all unintentional POPs**.

7 unintentional POPs listed in Annex C. Most are also listed in Annex A as industrial POPs (like PCBs and PCNs).

4 PFAS groups used in wide range of uses.

5 are brominated flame retardants.

3 chlorinated FRs (Dechlorane Plus & MCCP/SCCPs)

First **non-halogenated POP (UV-328)**; plastic UV stabilizer).

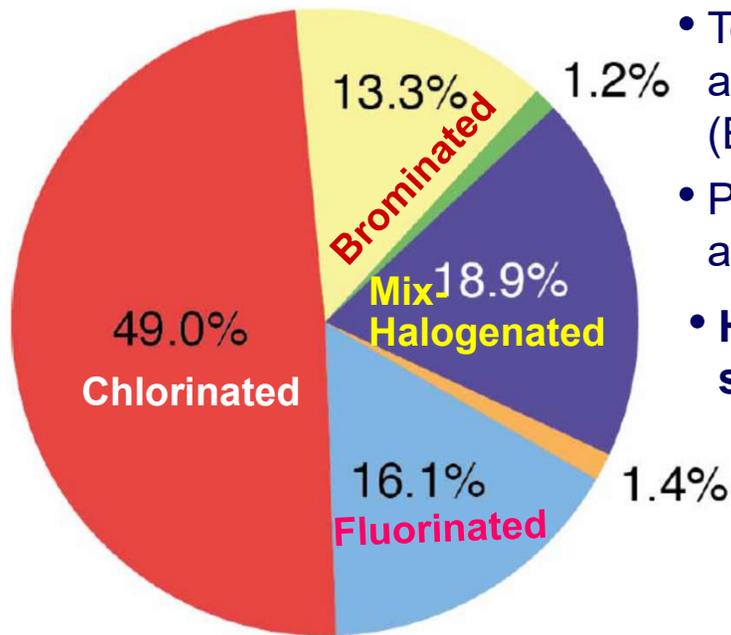
These POPs plastic additives will be addressed in the action plan webinar on Thursday.

Register: <https://bit.ly/ActionPlans3>

How many potential POPs are in use?

Approximately 100,000 chemicals have been scientifically evaluated in a study according to the Annex D POP criteria of the Stockholm Convention, with following results:

574 potential POPs



- Today many chemicals in use have POPs-like/PBT properties and many of them are used in consumer goods often in plastics (EEE, cars, buildings, furniture, textiles, synthetic carpets).
- PBTs in products pose a risk for human health, the environment and the recycling/recovery flows.
- **Here, chlorinated, brominated and fluorinated persistent toxic substances need to be assessed and managed systematically.**



The 37 POPs listed – are only the tip off the ice-berg!

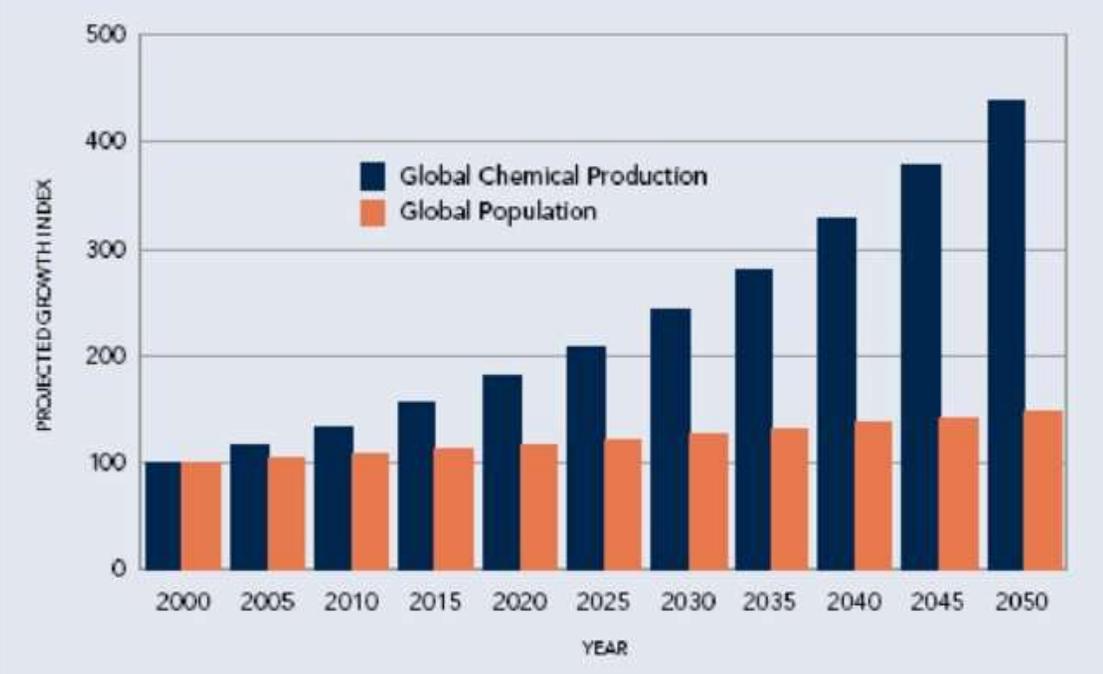


- **>350'000 chemicals produced** (Wang et al. 2020)
- Many are in daily products (>13,000 in plastics) (UNEP 2023)
- **>100 million chemicals registered (CAS)**

Wang et al. (2020) ES&T 54(5), 2575-2584.



OECD report projects that **overall chemical production** is expected to **quadruple between 2020 and 2060**



Global Framework on Chemicals

European Commission Study for the strategy for a non-toxic environment of the 7th EAP, Sub-study g: Early Warning Systems for emerging chemical risks Technical Report08/2017

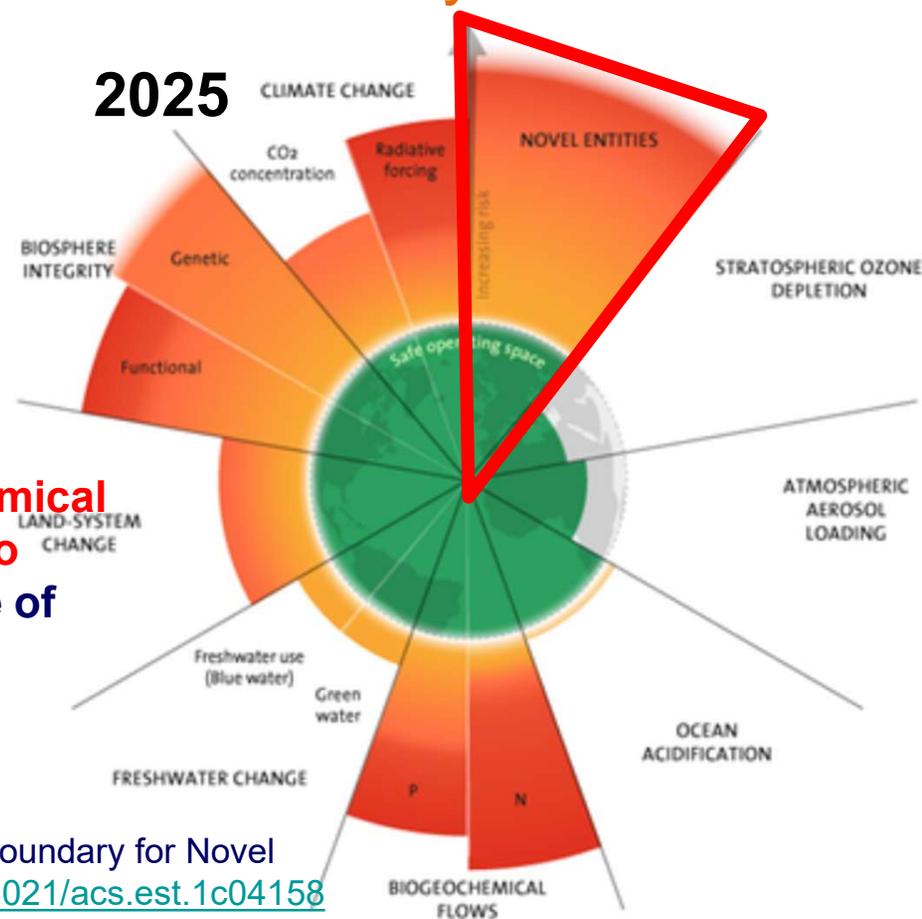
“Novel Entities” chemicals & plastic crossed Planetary Boundaries

- The planetary boundaries – which define the environmental limits within which humanity can safely operate – have been evaluated for 9 critical anthropogenic pressure on the Earth System and 7 have crossed by 2025 (e.g. climate change, biodiversity; Rockström et al. 2009).

<http://www.ecologyandsociety.org/vol14/iss2/art32/>

<https://www.stockholmresilience.org/research/planetary-boundaries.html>

- Studies concluded that **“Novel entities” including chemical of concern (e.g. PFAS) and plastics pollution have also crossed planetary boundaries by far and are therefore of high concern for humanity and a risk for several ecosystem services** (Persson et al. 2022; Cousins et al. 2022).



Persson et al. (2022) Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. *Environ. Sci. Technol.* 2022, 56, 3, 1510–1521. <https://doi.org/10.1021/acs.est.1c04158>

Cousins IT, Johansson JH, Salter ME, Sha B, Scheringer M. (2022) Outside the safe operating space of a new planetary boundary for PFAS. *ES&T.* 56(16), 11172-11179. <https://doi.org/10.1021/acs.est.2c02765>

Rockström et al. (2009) *Ecology & Society* 14(2):32; Update: Richardson et al. (2023): <https://www.science.org/doi/10.1126/sciadv.adh2458>

United Nations: The World faces a Triple Planetary Crisis

- The United Nations highlight, that humanity faces a Triple Planetary Crisis of climate change, nature & biodiversity loss, and chemical pollution & waste (Antonio Guterres).
- There are interlinkages of chemicals/waste and other drivers of the Triple Planetary Crisis:
- **Strong links of chemicals & waste to climate change** (e.g. **open burning of waste**, or management of plastic foams containing POPs and **F-gases with high GWP**).
- Chemicals including POPs & HHPs are also a **relevant cause for biodiversity loss**, e.g., reduced reproduction of predators at the top of the food chain (killer whale population collapse; eagle eggshell thinning). Groh et al (2022) ES&T. 56(2):707-710.
- *“The “toxic trail” of economic growth – pollution and waste - results every year in the premature deaths of millions of people across the world.”*
Inger Andersen director of UNEP



CLIMATE STABILITY

LIVING IN HARMONY WITH NATURE

TOWARDS A POLLUTION FREE PLANET

TACKLING THE TRIPLE PLANETARY CRISIS: A NEW FUNDING PARADIGM

“The truth is, we have been poor custodians of our fragile home. Today, the Earth is facing a triple planetary crisis. Climate disruption. Nature and biodiversity loss. Pollution and waste. This triple crisis is threatening the well-being and survival of millions of people around the world.

The building blocks of happy, healthy lives – clean water, fresh air, a stable and predictable climate – are in disarray, putting the Sustainable Development Goals in jeopardy.

But there is still hope.”

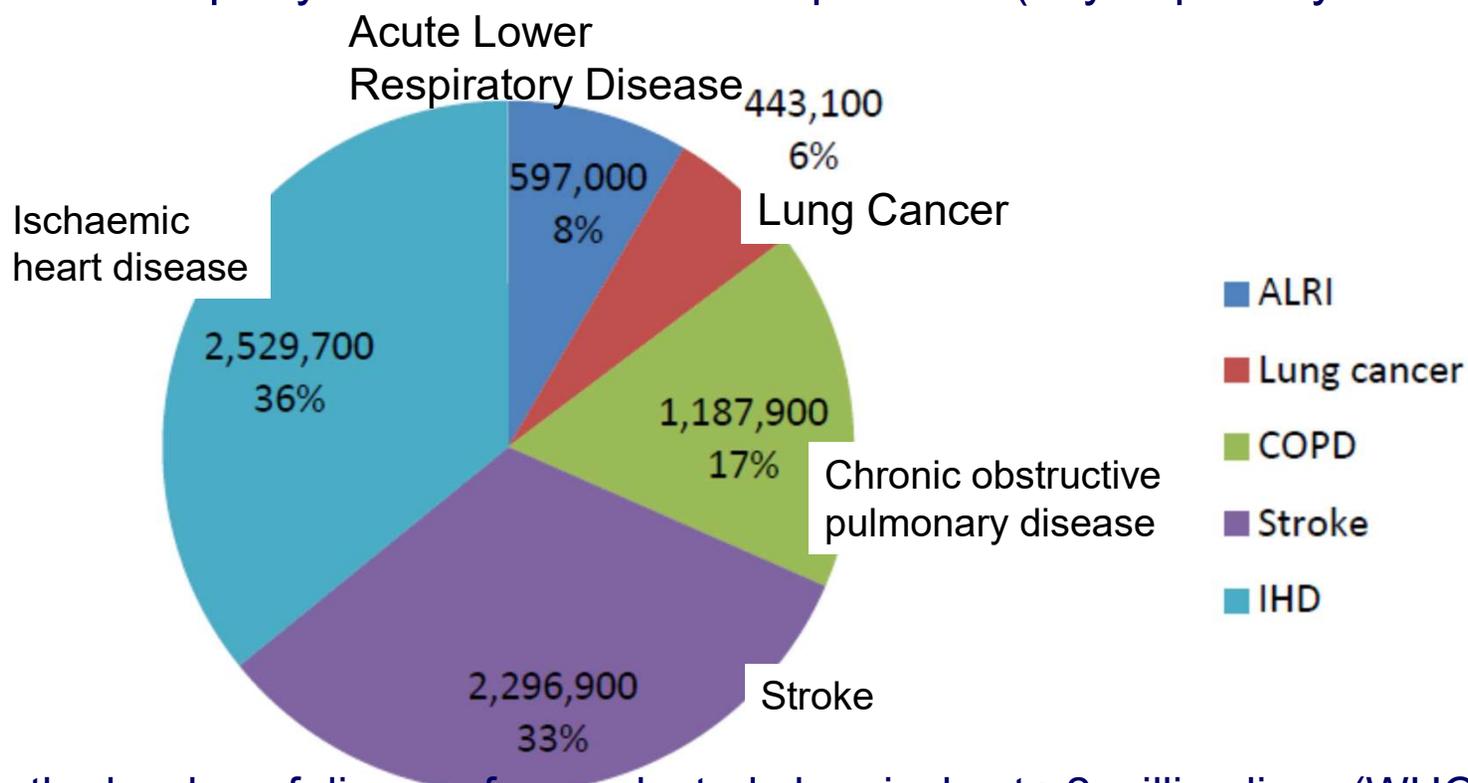
Antonio Guterres,
Secretary-General of the United Nations

<https://unfccc.int/news/what-is-the-triple-planetary-crisis>

<https://www.unep.org/news-and-stories/story/campaign-against-plastic-pollution-world-making-tentative-progress>

Pollution is a major source of death and diseases

WHO: 8 million deaths per year are attributable to pollution (key impact by ambient air & indoor air).



WHO estimates the burden of disease from selected chemicals at >2 million lives (WHO 2021). The lives of many more are negatively impacted (Global Chemical Outlook II 2019)

<https://www.unep.org/resources/report/global-chemicals-outlook-ii-legacies-innovative-solutions>

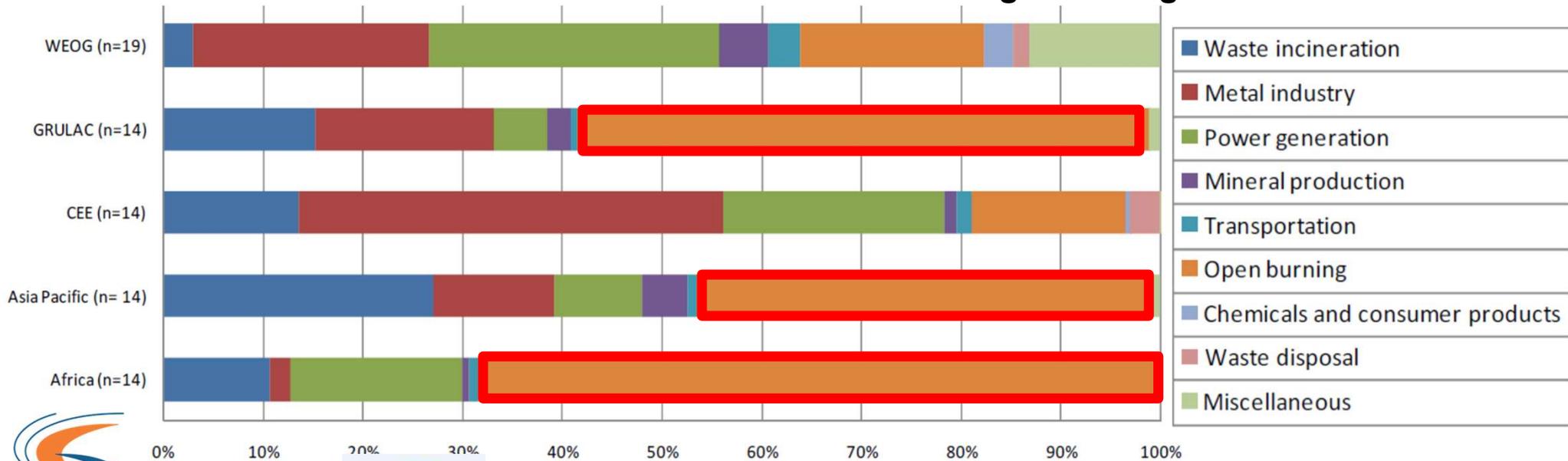
WHO. (2021). The public health impact of chemicals: Knowns and unknowns. Data addendum for 2019.

Similarly The Lancet Commission <http://www.thelancet.com/commissions/pollution-and-health>

Integrated approach: Unintentional POPs and air pollution reduction ⁹

- **Open burning and industrial emissions** are major sources for air pollution. **Open burning (plastic waste as major fuel) is the major contributor to PCDD/PCDF global emission to air and is the top source of UPOP release in Africa, Asia Pacific & GRULAC, followed by waste incineration, the metallurgical industry, and heat and power generation.**
- This result also in release of small particles (PM_{2.5/10}), heavy metals, PAHs and black carbon (SLCP).

Sources contribution to PCDD/PCDF releases to air according to UN region

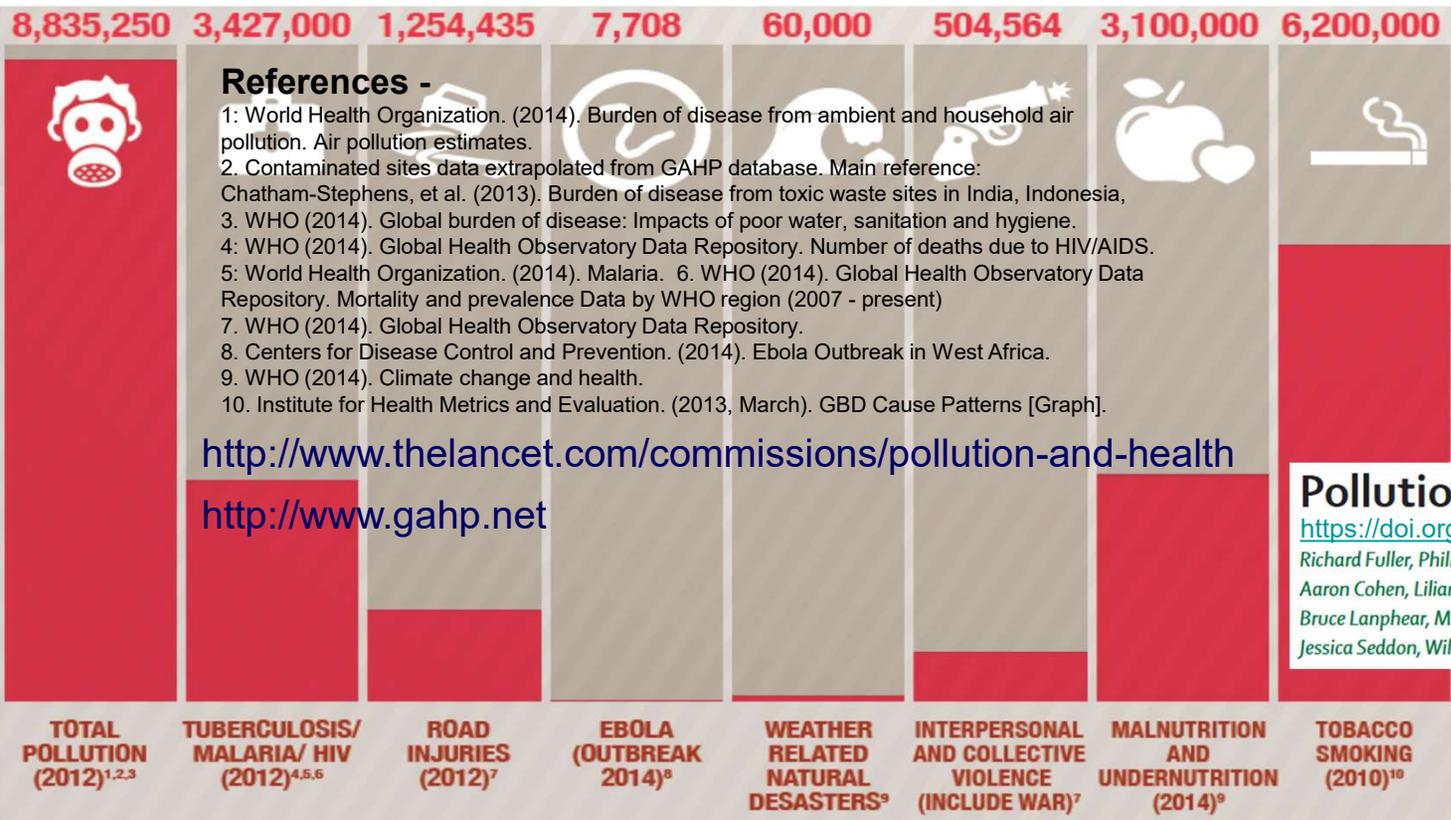


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(UNEP/POPs/COP.8/INF40)

Compilation of Lancet Commission on Pollution and Health and Global Alliance on Health & Pollution

- **Lancet Commission** and GAHP compiled information on exposure to pollution (air, soil and water): Approx. 9 million premature deaths (one in seven) were considered pollution-related.
- In addition to air pollution, **also contaminated sites have a crucial impact on global health.**



References -

1. World Health Organization. (2014). Burden of disease from ambient and household air pollution. Air pollution estimates.
2. Contaminated sites data extrapolated from GAHP database. Main reference: Chatham-Stephens, et al. (2013). Burden of disease from toxic waste sites in India, Indonesia,
3. WHO (2014). Global burden of disease: Impacts of poor water, sanitation and hygiene.
4. WHO (2014). Global Health Observatory Data Repository. Number of deaths due to HIV/AIDS.
5. World Health Organization. (2014). Malaria. 6. WHO (2014). Global Health Observatory Data Repository. Mortality and prevalence Data by WHO region (2007 - present)
7. WHO (2014). Global Health Observatory Data Repository.
8. Centers for Disease Control and Prevention. (2014). Ebola Outbreak in West Africa.
9. WHO (2014). Climate change and health.
10. Institute for Health Metrics and Evaluation. (2013, March). GBD Cause Patterns [Graph].

<http://www.thelancet.com/commissions/pollution-and-health>

<http://www.gahp.net>

THE LANCET
Planetary Health

Pollution and health: a progress update

[https://doi.org/10.1016/S2542-5196\(22\)00090-0](https://doi.org/10.1016/S2542-5196(22)00090-0)

Richard Fuller, Philip J Landrigan, Kalpana Balakrishnan, Glynda Bathan, Stephan Bose-O'Reilly, Aaron Cohen, Lilian Corra, Maureen Cropper, Greg Ferraro, Jill Hanna, David Hanrahan, Howard I Bruce Lanphear, Maureen Lichtveld, Keith Martin, Adetoun Mustapha, Ernesto Sanchez-Triana, Jessica Seddon, William Suk, Martha María Téllez-Rojo, Chonghuai Yan

Lancet Planet Health 2022; 6: e535–47

Integrated pollution reduction by linking measures of POPs action plan with wider national waste & chemical management and BAT/BEP

1) Sources for ambient air pollution (UPOPs, PM_{2.5/10}, PAH, Hg, GHG):

- Open burning of waste (mainly plastic waste as fuel) and biomass
- Industrial emissions (power plants; incinerator, metal industries, cement plants, etc.)
- House heating and cooking
- Emissions from transport

Most of these sources/emissions can be addressed by BAT/BEP and by waste management and are all assessed by the UPOP inventory.

2) Source of indoor pollution:

- Major sources: cooking/heating with fire, and hazardous chemicals in products & buildings.
- These sources can be addressed by BAT/BEP and by substitution of chemicals of concern!

3) Contaminated sites: Mainly result from waste disposal & industrial releases (POPs, heavy metals, PAH, others). Lack of BAT/BEP and waste management.

⇒ Integrated approach of addressing (U)POPs, heavy metals, PM, PAH, black carbon within a larger frame of managing waste and chemicals and reducing (industrial) releases.



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MINAMATA
CONVENTION
ON MERCURY

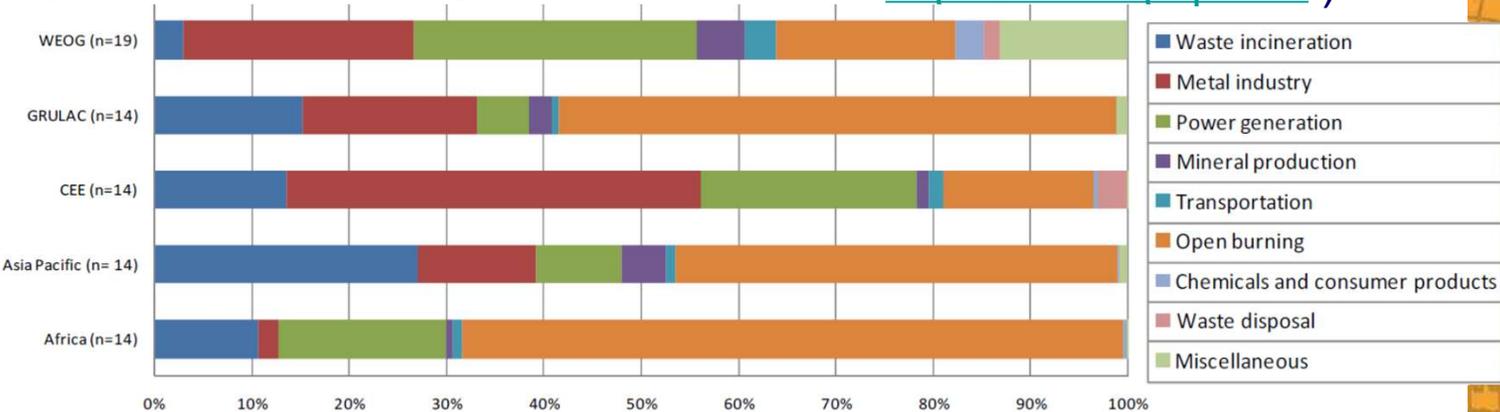


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Reduction of UPOPs by BAT/BEP towards an integrated approach

- A wide range of industrial facilities emit dioxins/UPOPs (e.g. incinerators, metal industries, mineral production, boilers; see Annex C Part II and III and UNEP Dioxin Toolkit <https://toolkit.pops.int/>).



- For the control of release of dioxins/UPOPs from emission sources listed in Annex C, a BAT/BEP guideline has been published in 2006 and sections of the guideline are continuously updated.
- The action plan and the NIP implementation can be an important impulse** for emission control in these major sources especially when considering an integrated pollution prevention and control of industries.



Stockholm Convention BAT/BEP Guideline: Guidance principles and cross-cutting considerations



The Stockholm Convention BAT/BEP Guideline stresses in the **general principles** and **cross-cutting** considerations (Section III.B):

- **Cleaner Production**
- **Integrated Pollution Prevention and Control**
- **Waste hierarchy**
- Sustainable Development and Sustainable Consumption and Production
- Precautionary Approach
- Use of science, technology and indigenous knowledge to inform environmental decisions
- Life Cycle Assessment (including env. inventories and energy)
- Internalising environmental costs and polluter pays principle.

<https://chm.pops.int/Implementation/BATandBEP/ReleasesfromunintentionalPOPs/BATandBEPGuidance/tabid/9647/Default.aspx>

The Integrated Pollution Prevention and Control (IPPC) approach of releases from industries is considered in the BAT Reference document (BREF) of the European Union. <http://eippcb.jrc.ec.europa.eu/reference/>

Dioxin and PCB contamination of meat/milk around a primary steel and sinter plant in the EU

L'Ilva di Taranto ci avvelena e io perdo

le pecore

Around steel plant in Italy PCDD/F & PCB contaminated meat & milk (sheep/goat).

(Diletti et al, Giua et al; Org. Hal Compounds 71; 2009)

➤ **1600 sheep and goats needed to be slaughtered**

➤ **2012: 20 km restriction zone for cattle.**



itvX

Inside Italy's 'toxic town', where children grow up fearing cancer

WORLD | ITALY | CORBY | ⌚ Tuesday 6 January 2026 at 10:25am

 **Amy Lewis**
ITV News Reporter
<https://www.itv.com/news/2026-01-06/inside-italys-toxic-town-where-children-grow-up-fearing-cancer>



➤ **Higher cancer rates in the area. What is the impact of dioxin/PCB and what is the role of other pollutants?**



Air Emissions of a primary steel plant (non-BAT; EU E-PRTR data) (10-12 Mio t steel/a)



	Release to air/year
PCDD/PCDF	99.6 g TEQ
PCB	0.13 tonnes
Benzene	237 tonnes
PAH	33.6 tonnes
Lead & compounds	79.2 tonnes
Chromium	3.87 tonnes
Mercury	1.5 tonnes
Cadmium & compounds	0.4 tonnes
Nickel	0.6 tonnes
PM10	5380 tonnes
HCN	3.94 tonnes
SOx	40,800 tonnes
NOx	28,100 tonnes
HF	568 tonnes
Carbon dioxide	11,300,000 tonnes
Carbon monoxide	569,000 tonnes
Ammonia	33.5 tonnes

The emissions of the plant were reduced in the last decade. However recent publications and documentary still reported on the increased death rates and cancer rates in this area also in children.

Article

Taranto's Long Shadow? Cancer Mortality Is Higher for People Living Closer to One of the Most Polluted City of Italy

Roberto Cazzolla Gatti ^{1,*} and Alena Velichevskaya ²

<https://doi.org/10.3390/su14052662>



Environment International
Volume 132, November 2019, 105030

Industrial air pollution and mortality in the Taranto area, Southern Italy: A difference-in-differences approach

<https://doi.org/10.1016/j.envint.2019.105030>
Simona Leogrande ^a, Ester Rita Alessandrini ^b, Massimo Stafoggia ^b

Inside Italy's 'toxic town', where children grow up fearing cancer

<https://www.itv.com/news/2026-01-06/inside-italys-toxic-town-where-children-grow-up-fearing-cancer>



Amy Lewis
ITV News Reporter



Review Article <http://dx.doi.org/10.1155/2013/753719>

Environment and Health in Contaminated Sites: The Case of Taranto, Italy

Emissions to water of a primary steel plant (non-BAT; EU E-PRTR data) (10-12 Mio t steel/a)

	Release to water (per year)
PAH	3.32 tonnes
Phenols	12.8 tonnes
Arsenic	0.88 tonnes
Copper	14.9 tonnes
Lead and compounds	0.91 tonnes
Chromium	10.9 tonnes
Mercury	0.46 tonnes
Cadmium and compounds	0.37 tonnes
Nickel	8.32 tonnes
Zinc	33.8 tonnes
Cyanides (as CN)	41.6 tonnes
Phosphorous	16.1 tonnes
TOC (as COD/3)	1250 tonnes
Total nitrogen	2140 tonnes

The steel plant also released high levels of heavy metals, PAHs and cyanides into the water.

Integrated approach for POPs management: Linking NIP activities with national priority activities on general chemicals and waste management

NIP Update Guidance stresses: “The development, review, and updating of a NIP should build on existing work and assessments....”. Therefore:

- **POPs should not be addressed on their own but should be linked/integrated with general chemicals and waste/plastic management.** This may include, National Profiles, national GHS implementation plans/strategies, national chemical and waste management plans.
- **Synergies of Basel, Rotterdam and Stockholm Convention and Minamata Convention.**
- **Synergies to release reduction of heavy metals (e.g. mercury, lead, cadmium, arsenic) & PM.**
- **Synergies with greenhouse gas (GHG) reduction (e.g. reduction open burning, BAT/BEP).**
- **Linking to issues of concern of the Global Framework on Chemicals (GFC) and synergies.**
- **Linking to the management of major plastic use and waste sectors.**
- **Linkage to SDGs & Sust. Production & Consump.**



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Intergovernmental
negotiating committee
(INC) on plastic pollution

Convention on
Biological Diversity



Global Framework
on Chemicals

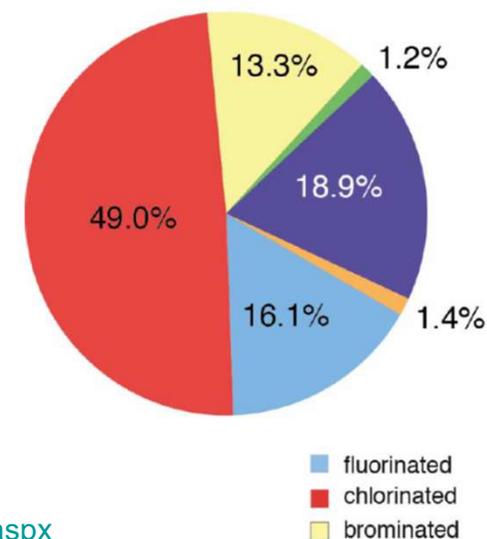
Integrated approach of POPs management: Stockholm Convention and synergies with the Global Framework on Chemicals (GFC/SAICM)

There are close links between POPs and GFC's (former SAICM) issues of concern:

- Highly Hazardous Pesticides (HHPs) (GGKP Webinar <https://www.youtube.com/watch?v=Ar6TYGXRTVg&t=1413s>)
- **Perfluorinated and polyfluorinated (as precursors) alkylated substances (PFAS) and the transition to safer alternatives.**
- **Chemicals in products**
- Hazardous substance within the life cycle of electrical and electronic products.
- Endocrine-disrupting chemicals
- Environmentally persistent pharmaceutical pollutants
- Lead in paints
- Nanotechnology and manufactured nanomaterials



Global Framework
on Chemicals



Here the specific POPs issue can/should be addressed within the larger frame of managing a wider group of POPs-like and other hazardous substances with a science-based approach.

<http://www.saicm.org/Implementation/EmergingPolicyIssues/tabid/5524/language/en-US/Default.aspx>

Action plans in the recommended NIP structure – Chapter 3

3. Strategy and action plan elements of the national implementation plan

3.1 Policy Statement

3.2 Implementation Strategy

This section can be used to elaborate on the integrated approach, including how the NIP links and can contribute to national chemical management and national waste management including plastic management. Also the link to Sustainable Consumption & Production, circular economy, and One Health can be elaborated.

3.3 Activities, strategies and action plans

- Subchapter 3.3 **would list country-specific activities, action plans, and strategies, including those required by the Convention, designed to meet Convention obligations.**



Guidance for Developing a National
Implementation Plan for the Stockholm
Convention on Persistent Organic Pollutants

2017

Secretariat of the Basel, Rotterdam and Stockholm
Conventions

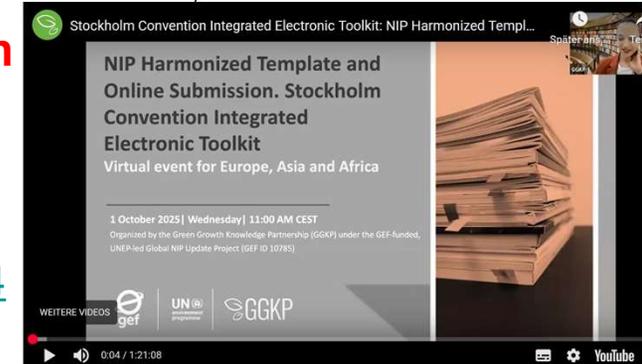
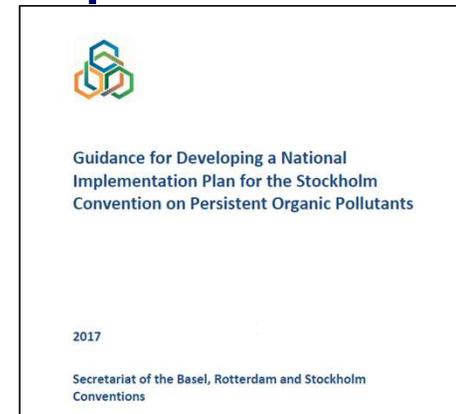
Structure and content of the NIP – Chapter 3

3. Strategy and action plan elements of the national implementation plan

3.3 Activities, strategies and action plans

- Each action plan would identify objectives/goals and activities.
- The NIP harmonized template includes also templates for the action plans considering **Objectives, Activities and Performance Indicators as content.**
- Also **Time Frames, Implementers and Resource Needs** are included.
- In today's webinar **options for objectives and activities for Action Plans for dioxins an other unintentional POP and the fluorinated POP-PFASs will be introduced.**

<https://www.youtube.com/watch?v=46Nd5ShR-I4>
<https://www.youtube.com/watch?v=cGJgmVcpp74>



Objectives	Activities	Performance indicators	Time Frame	Implementers (and stakeholder)	Resources / Needs	Remarks

Thank you for your attention ! Questions?

More Information <https://www.thegef.org/>; https://en.wikipedia.org/wiki/Triple_planetary_crisis

Basel Convention: www.basel.int

Rotterdam Convention: www.pic.int

Stockholm Convention: <http://chm.pops.int/>;

Montreal Protocol/Vienna Convention: <http://ozone.unep.org>

GFC: <https://www.chemicalsframework.org/> **FAO:** www.fao.org **WHO** www.who.int/

Climate Convention <https://unfccc.int/> **Biodiversity Convention:** <https://www.cbd.int/>

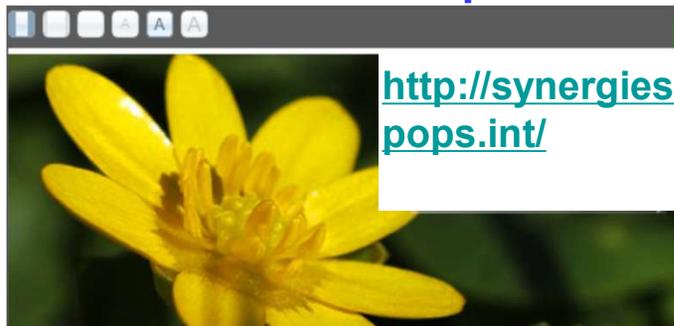
OECD/IOMC: <http://www.oecd.org/chemicalsafety/>

Science: <https://www.ipcc.ch/>; <https://www.ipbes.net/>; www.unep.org/oewg-spp-chemicals-waste-pollution

Industry: <http://www.suschem.org/>; <https://icca-chem.org/>; <https://cefic.org/>

NGO: www.ipcp.ch; www.ipen.org; www.ciel.org/; www.ban.org; www.chemsec.org; www.wecf.org

Better-world-links: <http://www.betterworldlinks.org/>



Global NIP Update Webinar “Activity Options for Action Plans of Stockholm Convention NIPs:
Unintentional POPs and POP-PFASs”, 20. January 2026, 14:00 -16:30 CET, UTC+1



Action Plan Options for Reduction and Elimination of Unintentional POPs (Article 5) and Considerations for an Integrated Approach

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73527 Schwäbisch Gmünd, Germany

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<https://www.researchgate.net/profile/Roland-Weber-2>



Unintentional POPs in the Stockholm Convention

- Four of the original 12 POPs in the Stockholm Convention are unintentionally produced POPs ('UPOPs'):
 - **Polychlorinated dibenzo-p-dioxins (PCDDs)**
 - **Polychlorinated dibenzofurans (PCDFs)**
 - Polychlorinated biphenyls (PCBs; main amount are intentionally produced PCBs!)
 - Hexachlorobenzene (HCB)
- In 2009 pentachlorobenzene (PeCB) was added to Annex A/C.
- In 2015 polychlorinated naphthalenes (PCNs) were added to Annex A/C
- In 2017: HCB added in Annex C (05/2017).

These UPOPs are commonly formed as by-products in:

- the production of organochlorine chemicals;
- processes where elemental chlorine is present;
- thermal processes in the presence of all forms of chlorine.

Synergies in addressing unintentional POPs

- The reduction of PCDD/Fs from sources reduces at the same time other unintentional POPs (unintentional PCBs, PCNs, PeCB, HCB, and HCBd).
- The reduction of dioxins/UPOPs from **incinerators or metal industries** can at the same time reduce **heavy metals, particulate matter (PM), PAHs, and black carbon (soot; SLCP)**.
- The reduction and control of **open burning** reduce at the same time particulate matter (PM₁₀; PM_{2.5}), PAHs, black carbon + other releases.
- Similarly, reducing indoor cooking over an open fire, optimising stove design and ensuring the use of suitable fuels result in the reduction of dioxins, other UPOPs and PM, PAHs.
- For an appropriate risk assessment and cost-benefit analysis, these other reductions need also to be considered. In some cases, like the open burning of biomass, which releases high PM, black carbon and PAH, the impact of these “co-pollutants” is more relevant than the UPOP emission.
- Black carbon is a short-lived climate pollutant (SLCP), contributes to global warming. Therefore synergies exist between UPOPs reduction and reduction of global warming.



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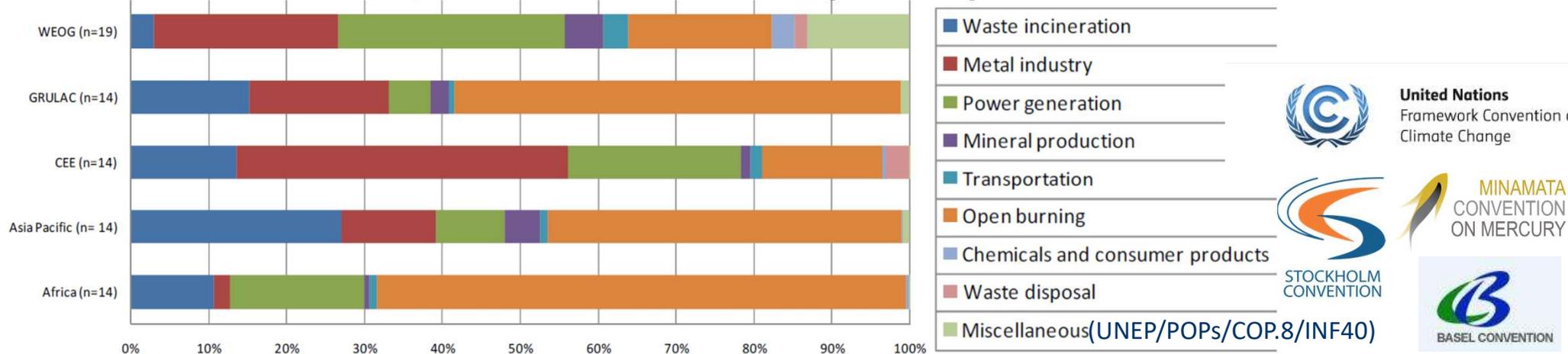
Global Framework
on Chemicals

UPOPs as an opportunity for promoting waste management and BAT/BEP by an integrated approach

Especially for low and middle-income countries the **action plan for unintentional POPs is an opportunity for promoting and addressing:**

- **General management of waste:** The reduction of open burning of waste as major source for unintentional POPs and other pollutants can only be addressed by improvement of general waste management. This is also key for the management of POPs in plastics.
- **General reduction of industrial emissions** from the large source categories listed in Annex C by BAT and BEP.

Sources contribution to PCDD/PCDF releases to air according to UN region



Air emissions of a primary steel plant (non-BAT; EU E-PRTR data) (10-12 Mio t steel/a)



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PCB	0.13 tonnes
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PAH	33.6 tonnes
Lead & compounds	79.2 tonnes
Chromium	3.87 tonnes
Mercury	1.5 tonnes
Cadmium & compounds	0.4 tonnes
Nickel	0.6 tonnes
PM10	5380 tonnes
HCN	3.94 tonnes
SOx	40,800 tonnes
NOx	28,100 tonnes
HF	568 tonnes
Carbon dioxide	11,300,000 tonnes
Carbon monoxide	569,000 tonnes
Ammonia	33.5 tonnes

- BAT filtration of air emissions is reducing PCDD/F, other UPOPs, heavy metals and particulate matter.

Article
Taranto's Long Shadow? Cancer Mortality Is Higher for People Living Closer to One of the Most Polluted City of Italy
 Roberto Cazzolla Gatti ^{1,*} and Alena Velichevskaya ² <https://doi.org/10.3390/su14052662>

Environment International
 Volume 132, November 2019, 105030
 Industrial air pollution and mortality in the Taranto area, Southern Italy: A difference-in-differences approach
<https://doi.org/10.1016/j.envint.2019.105030>
 Simona Leogrande ^a, Ester Rita Alessandrini ^b, Massimo Stafoggia ^b

Inside Italy's 'toxic town', where children grow up fearing cancer
<https://www.itv.com/news/2026-01-06/inside-italys-toxic-town-where-children-grow-up-fearing-cancer>
 Amy Lewis
 ITV News Reporter



Review Article <http://dx.doi.org/10.1155/2013/753719>
Environment and Health in Contaminated Sites: The Case of Taranto, Italy

Synergies of addressing unintentional POPs and heavy metals

- **UNEP highlighted that the global exposure risks posed by toxic metals and metalloids – lead, cadmium, arsenic, and organotins – remain inadequately addressed.**
- Therefore **UNEP published** in the recent 7th session of the UN Environmental Assembly (12/2025) a **“Report on options to address lead, cadmium, arsenic, and organotins pollution”**.
- The smelting industries are significant contributors to environmental contamination, often releasing heavy metals and other pollutants into surrounding environment.
- **Measures to reduce dioxins/UPOPs from incinerators or metal industries can at the same time reduce these heavy metals, particulate matter (PM), PAHs, and black carbon (soot; SLCP).**

United Nations Environment Assembly
of the United Nations Environment Programme
Seventh session

Nairobi, 8–12 December 2025

Item 5 of the provisional agenda

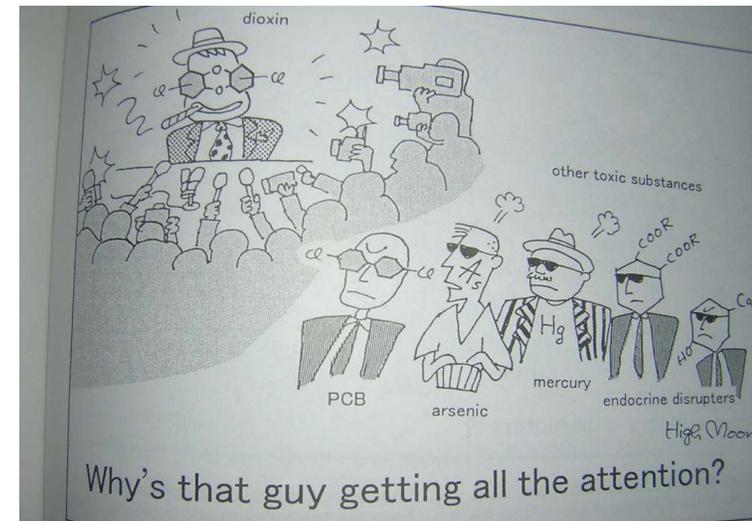
International environmental policy and governance issues

UNEP/EA.7/INF/10



United Nations
Environment
Programme

Information on the implementation of resolution 6/9 on sound management of chemicals and waste to address lead, cadmium, arsenic, and organotins*



Synergies of addressing UPOPs and mercury – thermal sources

- Unintentional POPs and mercury have major common sources which can be inventoried and reduced together.
- All thermal sources listed in the Minamata BAT/BEP guidance, are also UPOP sources and are also included in the UPOP BAT/BEP guideline.
- Major techniques to control UPOP releases (activated carbon spray, other adsorbents or specific wet scrubbers) also can reduce and control mercury releases.



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GUIDANCE ON BEST AVAILABLE TECHNIQUES AND BEST ENVIRONMENTAL PRACTICES

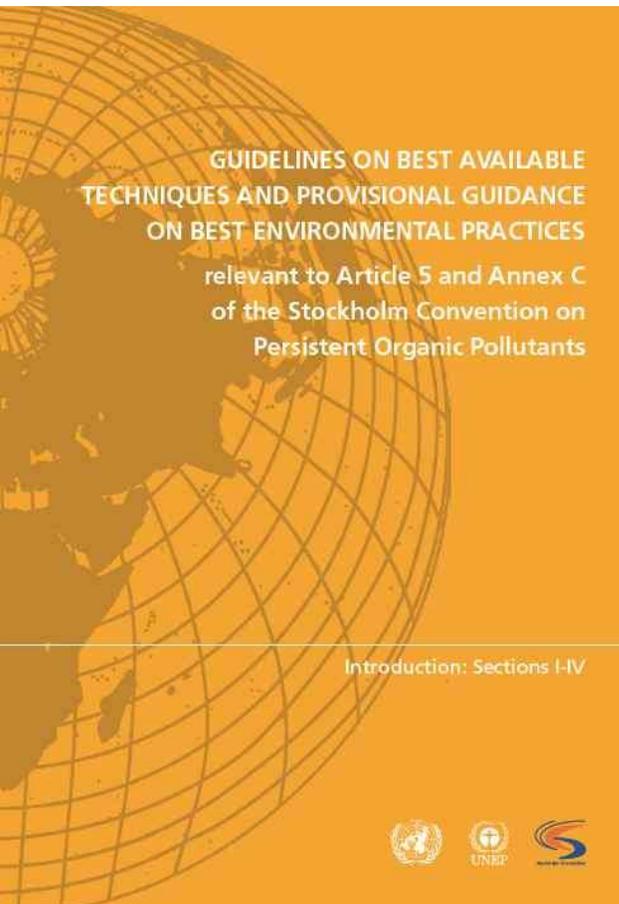


Stockholm Convention BAT/BEP Guideline: Guidance principles and cross-cutting considerations

The Stockholm Convention BAT/BEP Guideline stresses in the “general principles and cross-cutting considerations” (Section III.B):

- **Cleaner Production**
- **Integrated Pollution Prevention and Control**
- **Waste hierarchy**
- Sustainable Development and Sustainable Consumption and Production
- Precautionary Approach
- Use of science, technology and indigenous knowledge to inform environmental decisions
- Life Cycle Assessment (including env. inventories and energy)
- Internalising environmental costs and polluter pays principle.

<https://chm.pops.int/Implementation/BATandBEP/ReleasesfromunintentionalPOPs/BATandBEPGuidance/tabid/9647/Default.aspx>



Integrated Pollution Prevention and Control (IPPC) of the EU and Stockholm Convention BAT/BEP

9

The Integrated Pollution Prevention and Control (IPPC) approach has been developed and implemented in the European Union: Integrated means „Considering all aspects“:

- **All pollutants** (Particulate matter (PM), heavy metals, acid gases etc. - **PCDD/Fs as one of the parameters**)
- **Emissions to air, water, soil/land**
- **Accidents/incidents**
- **Occupational health aspects and noise**
- **Energy aspects**
- **Monitoring of pollutants or operation parameters**



Best Available Techniques Reference Documents (BREFs) were developed for different key industrial sectors

<https://bureau-industrial-transformation.jrc.ec.europa.eu/reference>

1. Regulatory framework for PCDD/Fs & other UPOPs (1)

Objective: To establish a policy and legal framework for reduction and minimization of unintentional POPs (PCDD/PCDF, PCBs, PCNs, HCB, PeCB, and HCBD).

Recommended activity options:

- Undertake law & policy assessment on PCDD/Fs and other UPOPs - national and international.
- **Amend existing laws, or develop new laws as appropriate**, related to the management of **PCDD/F and other UPOPs** considering Annex C Part V “General guidance on best available techniques and best environmental practices”, **possibly within an integrated pollution prevention and control approach**.
- **Development of release limit values or performance standards for UPOPs or surrogate in the frame of general emission limits.**
- **Setting unintentional trace contaminant (UTC) limits for unintentional POPs in chemicals, mixtures and products.**
- **Assess the need and possibly develop standards/limits in major media** considered relevant for the country (e.g. food, feed, soil, product, waste).

Alternative approach of Switzerland: Dioxin control with “Guiding parameters”

Objective: 1. To establish policy and legal framework for reduction and minimization of unintentional POPs (PCDD/PCDF, PCNs, HCB, PCBs and HCBD).

- **Develop release limit values or performance standards for UPOPs or surrogates in the frame of general emission limits.**

Background: Low income countries often do not have the sampling and analytical capacity for PCDD/F.

Switzerland (known as a country with strict environmental guidelines) did not set explicit limits for PCDD/F emission until 2008. **Alternative dioxin control policy:** Dioxin emission were minimized by setting stringent limits for dust emission and heavy metals as well as standards for combustion quality:

- CO: 50 mg/m³,
- TOC (20 mg/m³),
- NO_x (80 mg/m³), and
- Dust emission (10 mg/m³) and heavy metals.
- Temperature of dust filter normally below 170°C to avoid PCDD/F formation & increase adsorption.

A simple but effective strategy for PCDD/F emission control for incinerators! (this will often not result in a PCDD/F emission of <0.1 ng TEQ/m³ (considered BAT) but normally <1ng TEQ/m³)

1. Regulatory framework for PCDD/Fs & other UPOPs (2a)

Objective: To establish policy and legal framework for reduction and minimization of unintentional POPs (PCDD/PCDF, PCBs, PCNs, HCB, PeCB, and HCBD).

Recommended activity options: **Set unintentional trace contaminant (UTC) limit values for unintentional POPs in chemicals, mixtures and products.**

The European POP Directive sets UTC limits and low POP content limits (LPCL). UTC limits for PCBs are in a draft legislation which will enter into force and could be considered:

- **A UTC limit value of 0.2 mg/kg will be set for the Σ PCB in substances, mixtures & articles.**
- **PCB are unintentionally present in pigments/dyes >0.2 mg/kg. Therefore specific UTC limit of PCB in mixtures and articles containing organic pigments or dyes of 25 mg/kg upon entry into force of this Regulation and 10 mg/kg 3 years later were set (considered BAT).**

EU draft act for UPCB can be downloaded: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=intcom:Ares%282025%291300377>

- **A UTC limit value of 10 mg/kg was set for HCB in substances, mixtures & articles.**

[https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=PI_COM:C\(2022\)6122](https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=PI_COM:C(2022)6122)

1. Regulatory framework for PCDD/Fs & other UPOPs (2b)

Objective: To establish policy and legal framework for reduction and minimization of unintentional POPs (PCDD/PCDF, PCBs, PCNs, HCB, PeCB, and HCBd).

Recommended activity options are: **Set unintentional trace contaminant (UTC) limit values for unintentional POPs in chemicals, mixtures and products: PCDD/Fs.**

Background: The Basel Convention low POP content limits of 1,000, 5,000 or 15,000 ng TEQ/kg for PCDD/Fs is **too high for a UTC limit in products**. Some countries set regulatory limits for products with PCDD/F release/exposure risk to protect human health & the environment.

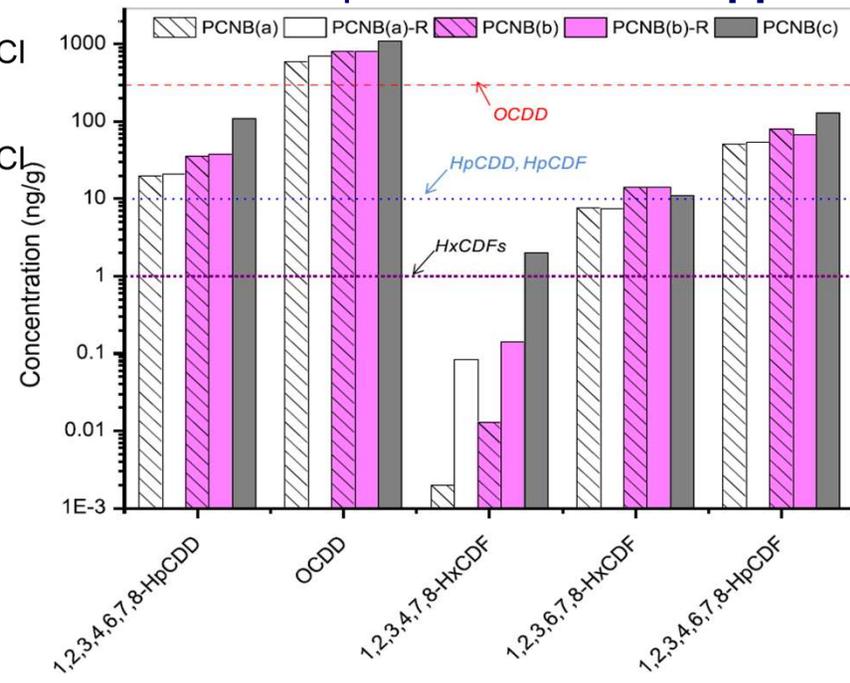
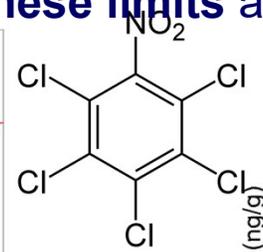
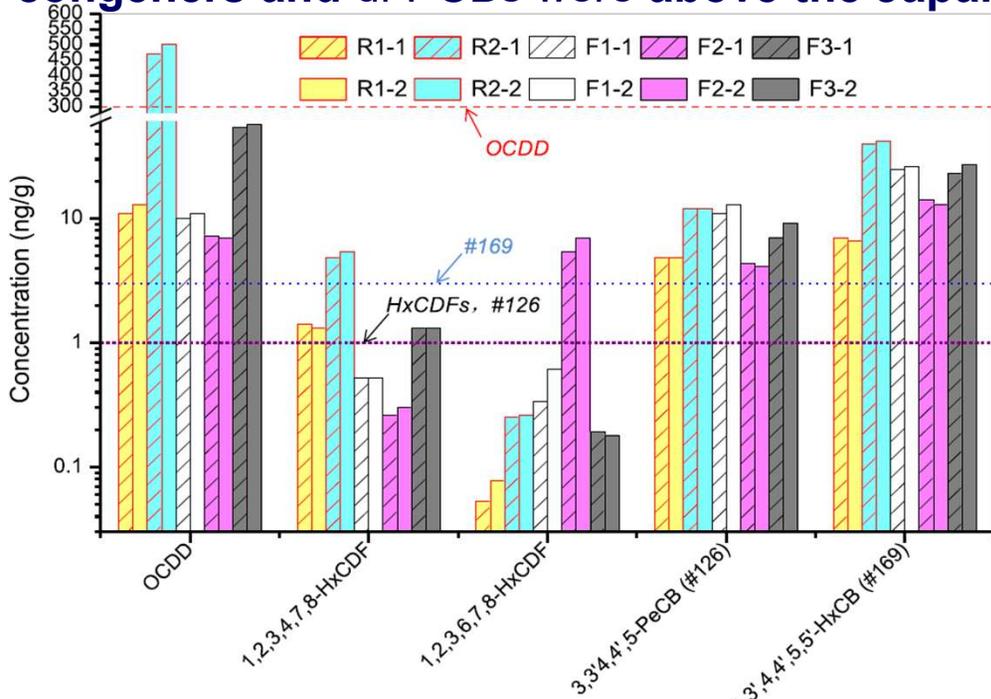
- **After German authorities discovered that e.g. levels of 5 ng TEQ/kg in soil can result in PCDD/Fs in eggs from free range chicken above EU maximum limit, the updated German fertilizer regulation set stringent **UTC limits of 8 ng TEQ/kg and 30 ng TEQ/kg**.**
(Deutsche Düngeverordnung (DüV) https://www.gesetze-im-internet.de/d_v_2017/BJNR130510017.html)
- **Certain pesticides can contain high levels of PCDD/PCDF if not controlled in production.** The Japanese authority set regulatory limit for PCDD/PCDF and dioxin-like PCBs in pesticides requiring contamination levels below **100 ng TEQ/kg for each 2,3,7,8-substituted PCDD/PCDF congener and dioxin-like PCB** (Japanese Government (2002). Agricultural Chemicals Regulation Law No.14, 3 (Nouyakutorisimari hou No.14, 3)).

1. Regulatory framework for PCDD/Fs/other UPOPs (2b) - Case study

Objective: 1. To establish policy and legal framework for reduction and minimization of unintentional POPs (PCDD/PCDF, PCBs, PCNs, HCB, PeCB, and HCBd).

Recommended activity options are: **Set unintentional trace contaminant (UTC) limit values for unintentional POPs in chemicals, mixtures and products.**

Case study: For all analysed quitozene formulations from China and Australia, some PCDD/F congeners and dl-PCBs were above the Japanese limits and the use of quitozene was stopped.



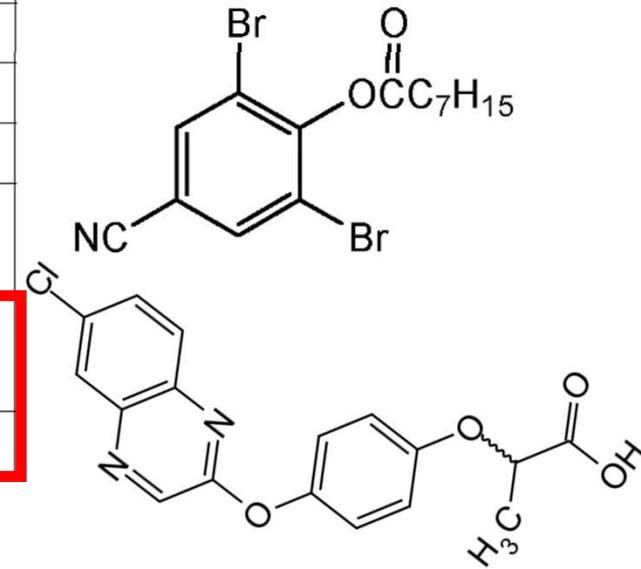
Huang et al. (2015) Environ. Sci. & Pollut. Res.. 22(19), 14462-14470.

Holt et al. (2010) ES&T. 44(14), 5409-5415

1. Regulatory framework for dioxin-like compounds - Gap

The US FDA screened some pesticides for their PCDD/F content and dioxin-like toxicity and found some high dioxin-like toxicity in aromatic pesticides containing bromine and heteroaromatic pesticides not detected by the analysis of PCDD/F (Huwe et al. 2003).

Pesticide	Collection Year	Active Ingredients	CALUX TEQ (n=3)	HRGC-MS TEQ
2,4-D Amine	1993	2,4-D dimethylamine, 46.9%	26.2 ± 0.5	8.7
See 2,4-D	1993	2,4-D isooctylester, 61.7%	1637 ± 212	731
2,4-D LV4	1993	2,4-D isooctylester, 66.2%	3392 ± 257	2627
2,4-D LV6	1993	2,4-D isooctylester, 88.8%	1882 ± 311	1379
Weedone LV4	1998	2,4-D isooctylester, 67.2%	45.7 ± 4.1	27.7
Tiller	1998	MCPA-2EH ester, 32.1% 2,4-D isooctylester, 10.4% Fenoxaprop-p-ethyl, 4.4%	34.2 ± 4.1	19.8
Bronate	1998	Bromoxynil octanoic acid ester, 31.7% MCPA isooctyl ester, 34%	800 ± 180	0.3
Assure II	1998	Quizalofop-p-ethyl, 10.3%	1668 ± 419	4.1



Huwe et al. (2003) Organohalogen Compounds 60, 227-230.

<https://dioxin20xx.org/wp-content/uploads/pdfs/2003/03-58.pdf>

What is the appropriate regulatory approach to regulate these dioxin-like substances?

1. Regulatory framework for PCDD/Fs & other UPOPs – Example Control & limit the PCDD/F and dl-PCB content in fertilizers/biosolids

Fertilizer (including biosolids or ashes from biomass) can be a dioxin/POP source for agriculture.

- Germany developed regulatory limits for fertilizers (DüMV 2019) including limits for PCDD/Fs & dl-PCBs.
- Also the EU Joint Research Center developed a proposal for a fertilizer regulation in the EU.

Regulation	Pollutant	Limit value	Application/remark
Germany	a) PCDD/Fs + dl-PCB	30 ng TEQ/kg	All with exemption of b)
Germany	b) PCDD/Fs + dl-PCB	8 ng TEQ/kg	b) pasture land and production of feed & farmland without plowing
EU (2019)	PCDD/Fs	20 ng TEQ/kg	Fertilizer to land (JRC proposal)
Basel „low POP content“	PCDD/Fs	1,000, 5,000 or 15,000 ng TEQ/kg	Misleading for further use; flaws in derivation (Swedish EPA 2011)!

- **The high “Basel low POP content” can mislead authorities in managing ashes/waste (circular push).**
- **And the limit has been derived with wrong assumptions** (Swedish EPA 2011; Weber et al. 2019; Lopes and Proença 2020; Wu et al. 2020).

EU (2019) JRC report EU fertilizer; ISBN 978-92-76-09888-1, doi:10.2760/186684, JRC117856

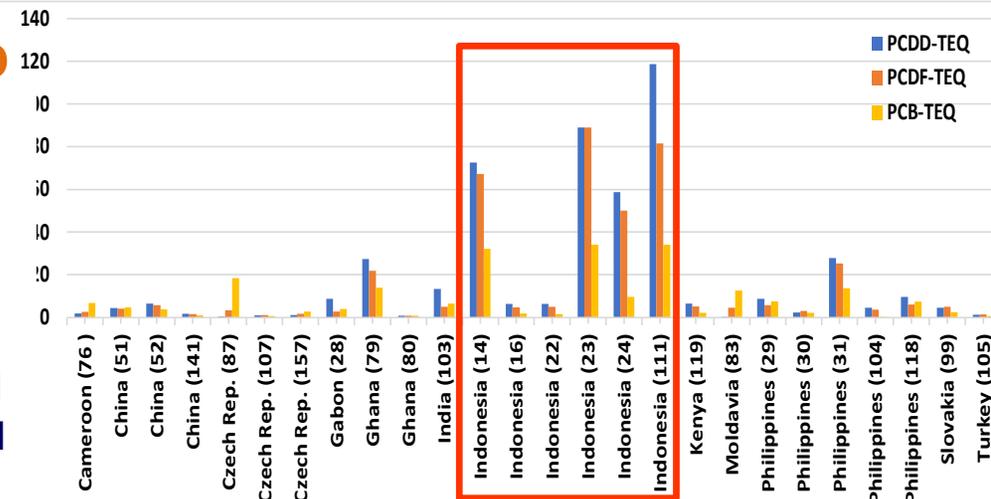
Swedish EPA (2011). *Low POP Content Limit of PCDD/F in Waste*. Report 6418; ISBN 978-91-620-6418. Lopes H, Proença S (2020) Appl.

Sci. 2020, 10, 4951 <https://doi.org/10.3390/app10144951>; Wu et al. Emerg. Contam. 6, 235-249. <https://doi.org/10.1016/j.emcon.2020.07.001>;

Weber et al. (2019) Environ Pollut. 249, 703-715. DüMV (2019) Düngemittelverordnung vom 5. Dezember 2012 (BGBl. I S. 2482), d

PCDD/F in ashes and regulatory gap

- 24 of 26 egg samples (92.3%) around waste incinerators in 12 countries (Cameroon, China (3), Czech Republic (3), Gabon, Ghana (3), India, Indonesia (6), Kenya, Moldova, Philippines (5), Slovakia, and Turkey) exceeded the EU limit for PCDD/Fs and dl-PCBs with a mean of **43.1 pg TEQ/g fat**.
- Eggs in Tropodo/Indonesia where **plastic wastes** were used as fuel for tofu boilers had **234 and 172 pg TEQ/g fat**. And two chicken flocks in Java, around lime kilns burning plastic waste as a fuel had **212 and 119 pg TEQ/g fat**.
- This highlights that co-incineration of plastic waste in non-BAT facilities results in environmental contamination and human exposure risk via chicken/eggs.
- The free-range chickens at both locations had access to ashes stored openly next to the kilns or used for paving sidewalks. The ashes contained PCDD/Fs at levels of **120 – 1300 ng TEQ/kg**. These ashes were 10 to 100 times below Basel upper provisional low POP content limit of **15,000 ng TEQ/kg**.

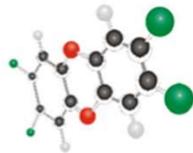


2. Updating the inventories for PCDD/Fs and other UPOPs

Objective: Updated sources inventories for PCDD/Fs and other listed UPOPs and data appropriately managed and harmonized with other release inventories.

Recommended activity options:

- Regularly update of the UPOP inventory (every 5 years along with review of strategies and reporting)
- Incorporate new listed UPOPs, where appropriate (for most sources, PCDD/Fs are sufficient).
- Quantify other co-pollutants, where appropriate (e.g. PM, heavy metals, PAHs, carbon black).
- Development of a mechanism ensuring appropriate storage and management of data.
- Development of an **integrated database of pollutant releases (e.g. UPOPs, mercury, GHG)**.
- Evaluate the option of developing a **Pollution Release and Transfer Register (PRTR)** (see UNITAR activities <https://unitar.org/sustainable-development-goals/planet/our-portfolio/pollutant-release-and-transfer-registers>; and presentation Katka Šebková RECETOX https://www.youtube.com/watch?v=GUFAP_XyhFs&t=3450s)

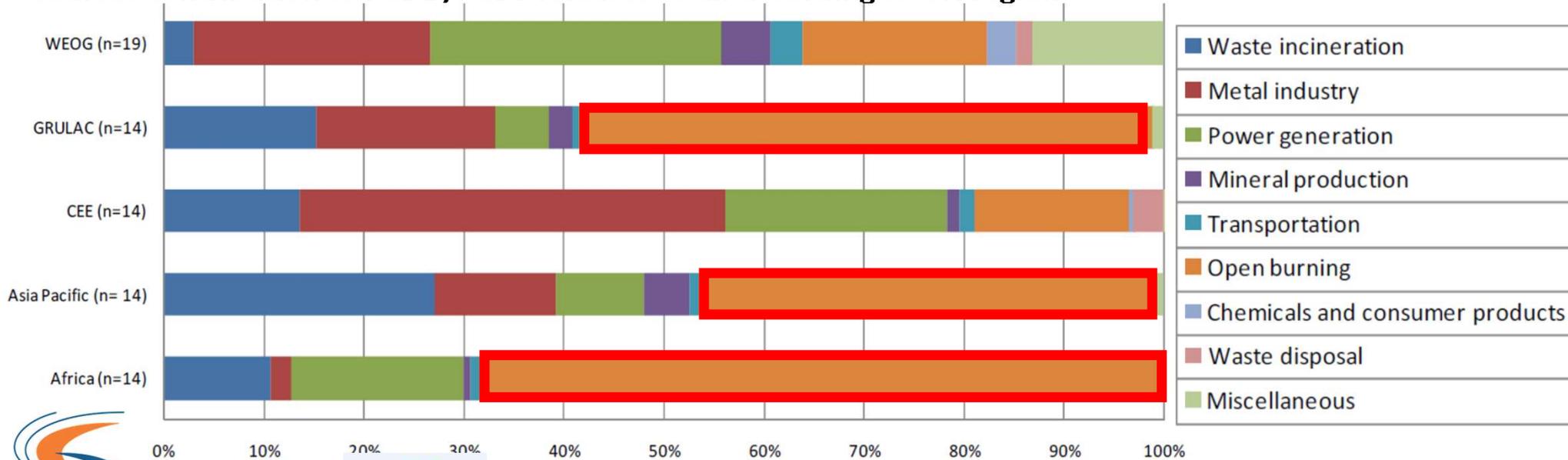


Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs
under Article 5 of the Stockholm Convention on Persistent Organic Pollutants

Open waste burning and other major source UPOPs require action

- **1) Open waste burning** is the major contributor to PCDD/PCDF global air releases and is the top source of UPOP release in LMICs, **followed by 2) waste incineration, 3) the metallurgical industry, and 4) heat and power generation.**
- Open burning and industrial emissions results also in air pollution by small particles (PM_{2/10}), heavy metals, PAHs and black carbon (a SLCP).

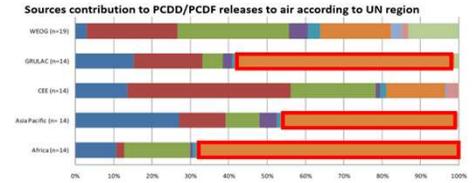
Sources contribution to PCDD/PCDF releases to air according to UN region



United Nations
Framework Convention on
Climate Change

(UNEP/POPs/COP.8/INF40)

3. Reduction of UPOPs by integrated waste management and the waste hierarchy

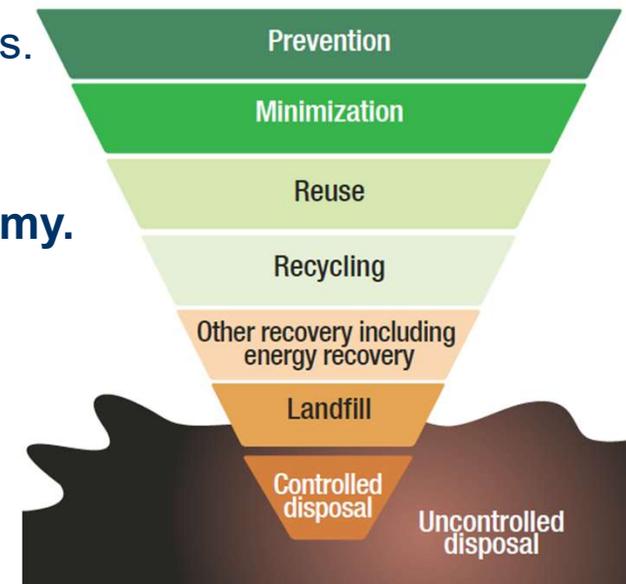


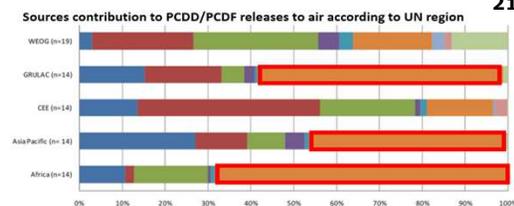
Background Open waste burning is a major UPOP source in most low/middle-income countries

Objective: Reduced UPOP releases from open burning of wastes (private & landfill) and from biomass burning by improved waste management (waste hierarchy; circular economy).

Recommended activity options:

- **Update the national waste management plan/strategy** including promotion of the **waste hierarchy** and circular economy (**Integrating UPOPs/POPs within national waste management strategy**).
- **Development of a waste catalogue** and related management options.
- **Implementation** of sound management of waste considering the **waste hierarchy**, with an increased focus on prevention, reuse, recycling and recovery in order to move towards a **circular economy**.
- **Evaluation of co-incineration capacity** (in particular cement kiln) in the **country or region** and establish co-incineration for waste which cannot be recycled (considering waste hierarchy).





3a. Reduction of UPOPs by control and reduction of open burning at landfills/dumps and backyards

Objective: Reduced UPOPs releases from open burning of wastes (backyard burning and landfill fires).

Background: In recent years **major landfill fires occurred** (e.g. Chile, Mauritius, Myanmar, Serbia) and were main UPOP sources. **Avoidance of such fires need to be a key activity.**

Recommended activity options:

- Assessment of available guidelines for the closure of dump sites; adaptation to national situation
- Closure of dump sites and prevention of illegal dumping of waste (fines).
- Awareness program for landfill operators on the impacts of open waste burning, as well as an educational program on fire control.
- Construction of engineered landfills for remaining waste disposal.
- Awareness program and fines for open waste burning (backyard).



3a. Reduction of UPOPs by control and reduction of open burning at landfills/dumps and backyards

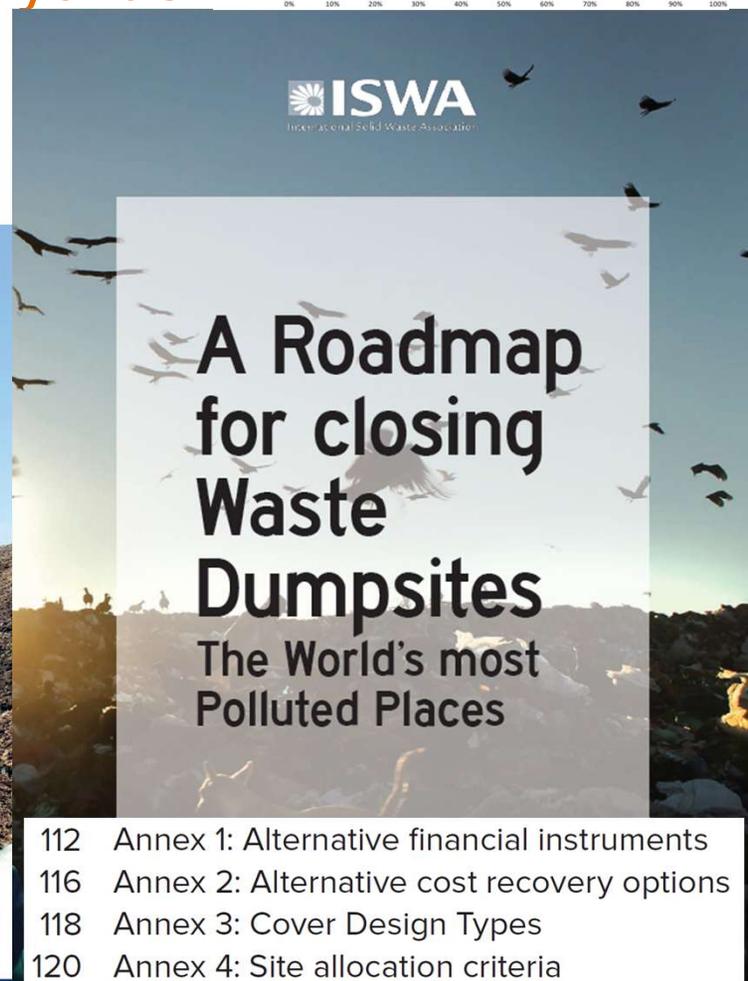
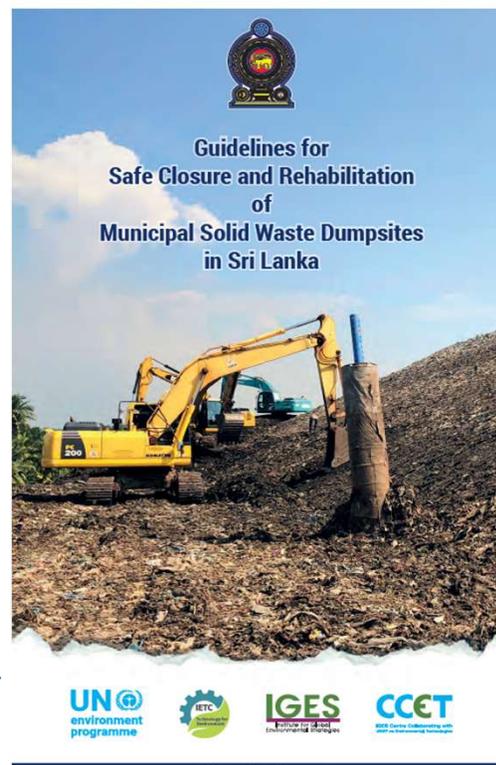
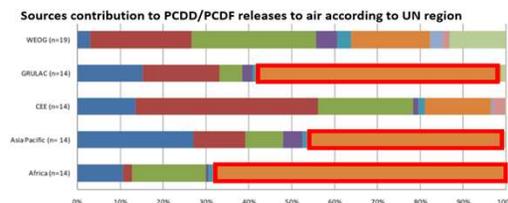
Objective: Reduced UPOPs releases from open burning of wastes (backyard burning and landfill fires).

Recommended activity options:

- **Assessment of available guideline for closure of dump sites and adopt to national situation.**
- **Closure of dump sites and stop illegal dumping of wastes (fines).**

International Solid Waste Association (ISWA) task force: <https://www.iswa.org/closing-the-worlds-biggest-dumpsites-task-force/?v=3a52f3c22ed6>

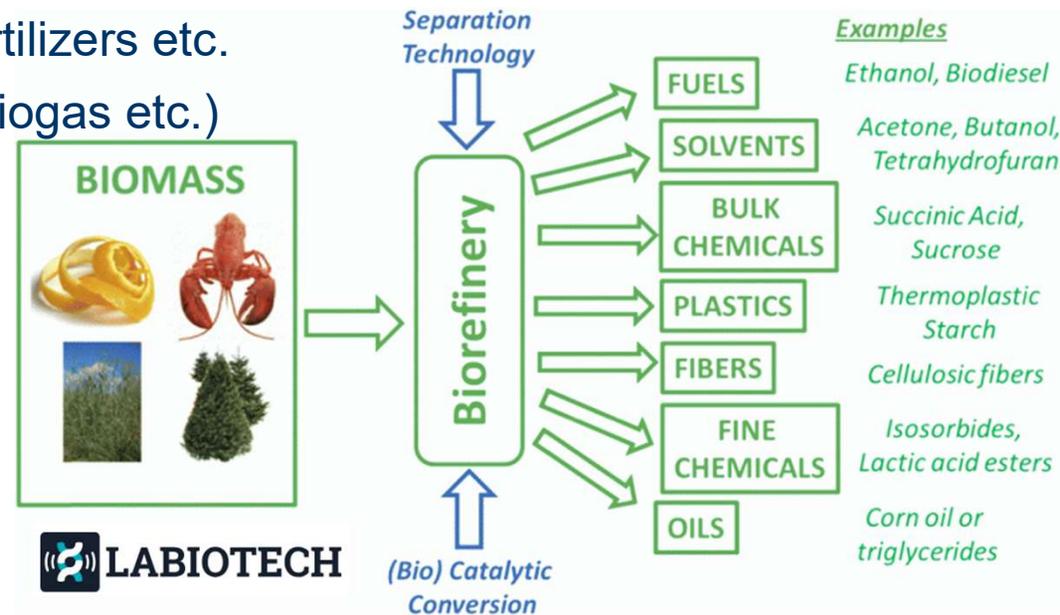
UNEP/IGES <https://www.unep.org/ietc/resources/toolkits-manuals-and-guides/guidelines-safe-closure-and-rehabilitation-municipal-solid>



3b. Reduction of UPOPs by control and reduction of open burning of biomass and landfilling of organics

Objective: Reduced releases from open biomass burning by improved national biomass management (biomass strategy; circular economy).

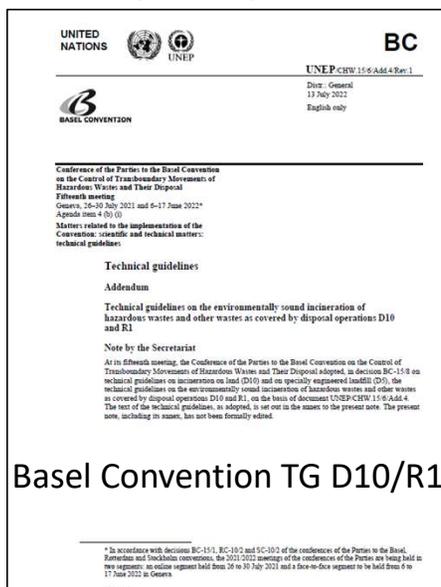
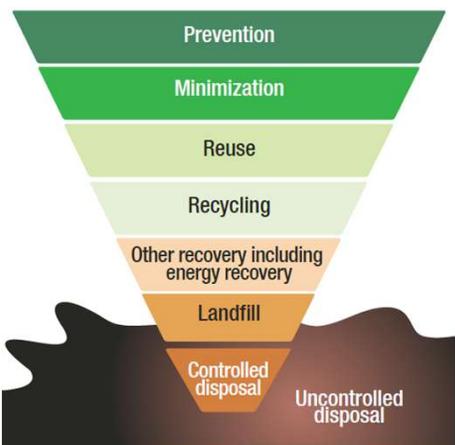
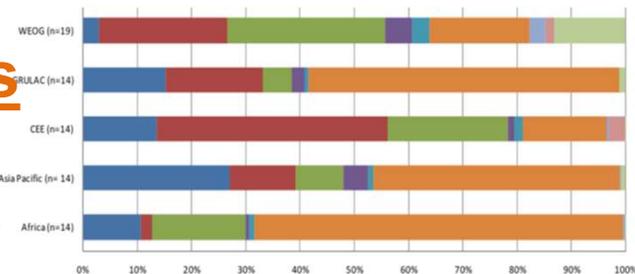
- Assess and develop approaches for reducing open biomass burning.
- **Development of a national strategy for biomass use within the national WM strategy.**
- Promote and implement the strategy by using biomass including agriculture residues - **options:**
 - For production of compost and organic fertilizers etc.
 - For energy production (biomass boilers, biogas etc.)
 - Consider and implement bio-refinery concept as appropriate (sustainable and green chemistry).



4. Reduction of UPOPs release from incinerators (Annex C Part II Source)

Objective: To reduce and minimize release of dioxins & other UPOPs from **waste incinerators** and improve medical waste management.

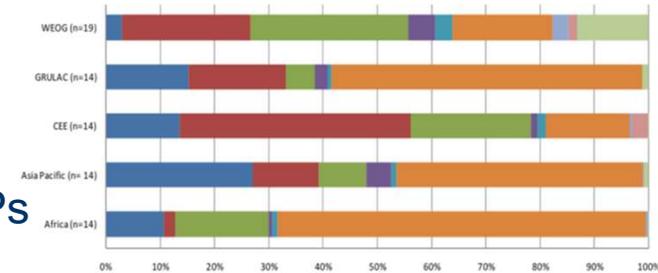
- **Assessment of the reduction potential of total amount of waste incinerated towards a more circular economy (but avoiding recycling of chemicals of concern).**
- **Assess available BAT guidance documents and adjust to national circumstances.**
- **Implement BEP and where required BAT in existing waste incinerators, including medical and require BAT for new incinerators (considering integrated pollution prevention & control).**



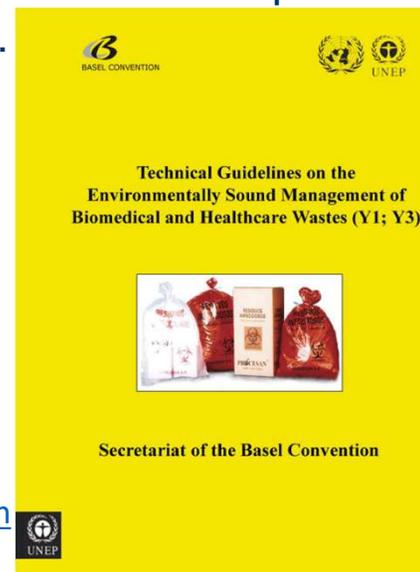
4. Reduction of UPOPs release from incinerators (Annex C Part II Sources)

Objective: To reduce and minimize release of dioxins and other UPOPs from waste incinerators and improve medical waste management.

- **Assessment of technologies to treat medical waste and selection and implementation of sound treatment methods, including non-combustion technologies.**
- **Develop national guidelines for sound management of medical waste** (considering WHO “*Safe management of wastes from health-care activities*” & Basel Conv. TG)
- **Strengthen institution and human resource capabilities** to implement environmentally sound medical waste management.



<https://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/TechnicalGuidelines/tabid/8025/Default.aspx>



Safe management of wastes from health-care activities

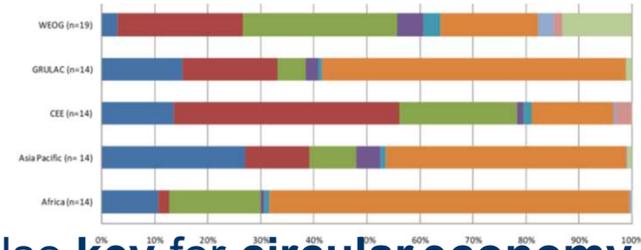
Second edition

Edited by Yves Charlier, Jorge Emmanuel, Ute Pieper, Annette Prüss, Philip Rushbrook, Ruth Stringer, William Townsend, Susan Wilburn and Raki Zghondi

<https://www.who.int/publications/i/item/9789241548564>



5. Reduction of UPOPs release from metal industries (Annex C Part II and III sources)



Background: Metal industries are **major emitters** of PCDD/F but also **key** for **circular economy**.

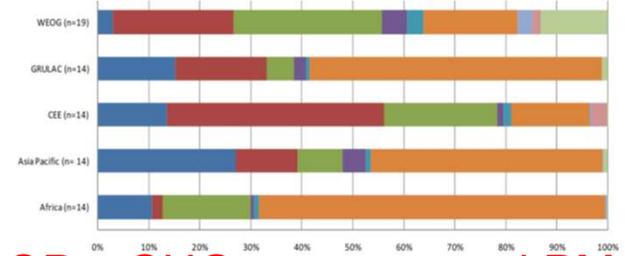
Objective: Adoption of BAT/BEP and Integrated Pollution Prevention and Control, as appropriate, in the ferrous and non-ferrous (secondary) metal production to reduce and minimize release of PCDD/Fs, other UPOPs and other priority pollutants (e.g. heavy metals, PM).

- **Assessment of metal recovery rates and losses as well as gaps for circular economy.**
- Develop or promote institutions that have the technical capacity to support the implementation of metal (& other resource) recovery and BAT/BEP.
- **Implement BAT for new Annex II sources** (secondary alumina, copper and zinc as well as sinter plants).
- **Promote the use of BAT and BEP (i) For existing sources**, within the source categories listed in Part II of Annex C and Part III of that Annex.

Annex C (vi) “New source” means any source of which the construction substantial modification is commenced at least one year after the date of: a) Entry into force of this Convention for the Party concerned; or



6. Reduction and elimination of UPOPs release from power plants (Annex C Part III sources)



Background: Combustion for energy production is a source of UPOPs, GHG, mercury and PM.

Objective: Adoption of BAT/BEP and, as appropriate, Integrated Pollution Prevention and Control (IPPC) for fossil fuel-fired boilers, firing installations for wood/biomass and residential combustion and switch to alternative and renewable energy sources.

- Promote the use of BAT and BEP for fossil fuel-fired utility and industrial boilers as well as firing installations for wood and other biomass fuels
- Substitute fossil fuel power plans with renewables. (synergy with GHG reduction UN)



JRC SCIENCE FOR POLICY REPORT
 Best Available Techniques (BAT)
 Reference Document for
 Large Combustion Plants

*Industrial Emissions Directive
 2010/75/EU
 (Integrated Pollution
 Prevention and Control)*

Thierry Lecomte, José Félix Ferrería de la Fuente, Frederik Neuwahl, Michèle Canova, Antoine Pinasseau, Ivan Jankov, Thomas Brinkmann, Serge Roubier, Luis Delgado Sancho.

2017

The Renewable Energy Transition in Africa

Powering Access, Resilience and Prosperity

https://www.giz.de/en/downloads/Study_Renewable%20Energy%20Transition%20Africa-EN.pdf



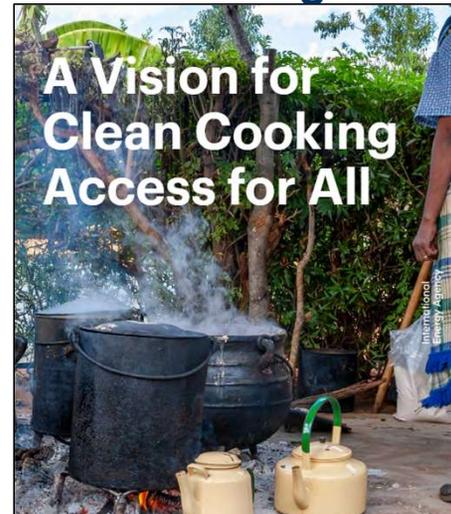
United Nations
 Framework Convention on
 Climate Change

7. Reduction of UPOPs from indoor cooking & heating with biomass

Background: Indoor heating & cooking with coal, charcoal and wood (Annex C Part III source) result in indoor air contamination with health effects that contribute heavily to the global burden of disease (about 3.7 million premature deaths from indoor air pollution)! Also “*The State of Access to Modern Energy Cooking Services*” report (WB 2020) finds that **4 billion people** around the world **still lack access to clean, efficient, convenient, safe, reliable, and affordable cooking energy.**

Objective: To improve stove performance, phase out open fires, and support alternatives to wood & charcoal for household cooking.

- Promotion of improved cooking stoves (ICS) intermediate solution).
- Substitute cooking and heating with fossil fuel by renewable energy.



<https://www.iea.org/reports/a-vision-for-clean-cooking-access-for-all/>



<https://www.worldbank.org/en/topic/energy/publication/the-state-of-access-to-modern-energy-cooking-services>

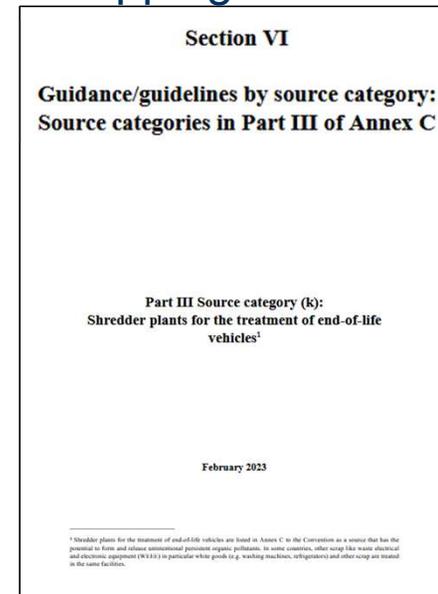
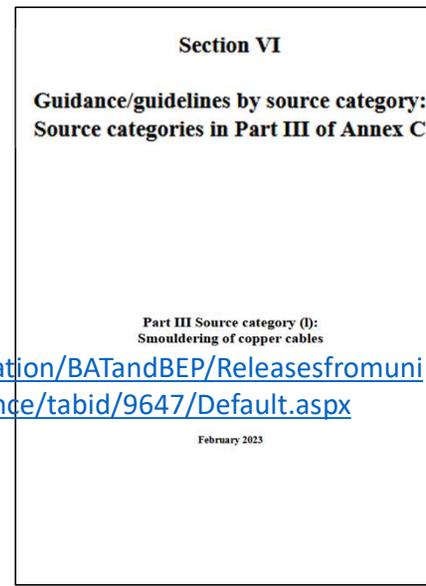
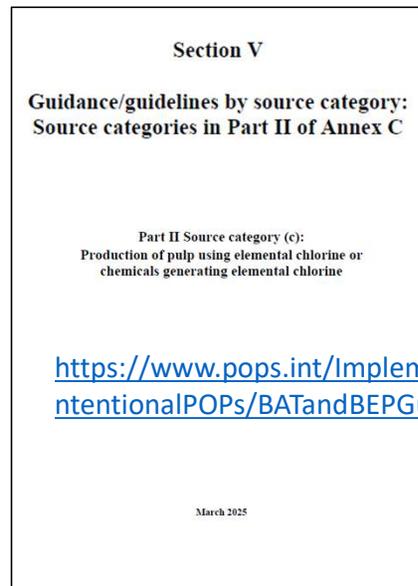
7. Reduction of UPOPs release from other Annex C sources

Background: There are further Annex C Part II and III sources which can be addressed by BAT/BEP or by alternative technologies

Objective: UPOPs from other Annex C sources are reduced and eliminated by BAT/BEP.

Recommended activity options:

- Substitution of elemental chlorine in remaining **pulp and paper industries** by alternatives.
- Apply BAT/BEP to **shredder plants** for the treatment of end-of-life vehicles and WEEE;
- Substitute the **smouldering of copper cables** by cable stripping and cable chopping.



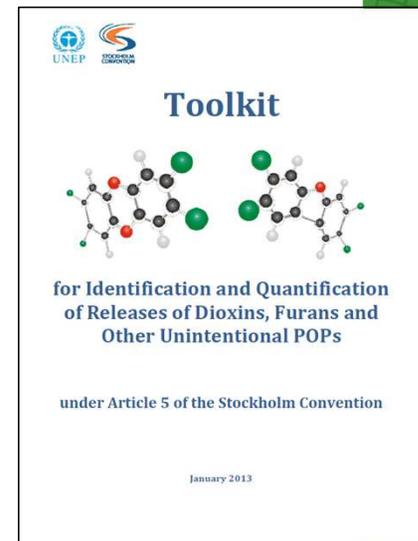
8. Reduction of UPOPs from specific chemical production processes and substitution of chemicals and materials (Annex C Part III)

Background: Chemicals such as pesticides have been major sources of PCDD/Fs and still can contain PCDD/Fs. Unintentional produced PCBs in pigment/dye & other OC-production are major PCB sources; HCBd in Arctic air is high & increasing likely from increased OC-solvent production. Weber et al. (2008) *ESPR* 15, 363-393; Zhao et al. (2020), *ES&T* 54, 2163–2171; Megson et al. (2024) *STOTEN* 924, 171436.

Objective: Use of substitutes or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C from chemical production processes.

Recommended activity options:

- Identify the production and use of chemicals containing UPOPs (e.g., certain pigments, pesticides, triclosan, or certain secondary HCl) and evaluate their UPOP content, release, resulting contamination and risk (see Dioxin Toolkit and updated Chapter of SC BAT/BEP guidance).
- Identify and promote feasible & affordable alternatives to chemicals and materials contributing to UPOPs release.



8. Reduction of UPOPs from specific chemical production processes and substitution of chemicals: unintentional PCBs in pigments

Background: Unintentional produced PCB in pigment/dye & other OC-production are major PCB sources and the environmental level of uPCB in some regions are higher than industrial PCB.

Evidence for major contributions of unintentionally-produced PCBs in the air of China: implications for the national source inventory

<https://doi.org/10.1021/acs.est.9b06051>

Shizhen Zhao, Kevin C. Jones, Jun Li, et al.

ENVIRONMENTAL
Science & Technology

Contents lists available at [ScienceDirect](#)

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Discussion <https://doi.org/10.1016/j.scitotenv.2024.171436>

Is current generation of polychlorinated biphenyls exceeding peak production of the 1970s?

David Megson^{a,b,*}, Ifeoluwa Grace Idowu^a, Courtney D. Sandau^{a,c}

Objective: Use of substitutes or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C.

Recommended activity options:

- Promotion of alternatives to chemicals containing unintentional PCBs (e.g. pigments/dyes, catalyst in silicone production).

<https://www.chemforward.org/ipcb-pigment-resource>





**CHEM
FORWARD**
know better chemistry

SAFE + CIRCULAR
INADVERTENT PCB (IPCB) PIGMENT **RESOURCE**

8. Reduction of UPOPs from specific chemical production processes and substitution of chemicals: Perchloroethylene & trichloroethylene

Background: Perchloroethylene and trichloroethylene production are major sources of HCBD in the environment with high and increasing levels in the Arctic.



FACT SHEET 2024 Final Risk Management Rule for Trichloroethylene under TSCA



<https://www.epa.gov/system/files/documents/2024-12/tce-fact-sheet.pdf>



20 Case Studies on

HOW TO PREVENT THE USE OF TOXIC CHEMICALS *frequently found in the Mediterranean Region*



https://backend.orbit.dtu.dk/ws/files/163013878/Weber_2018.pdf

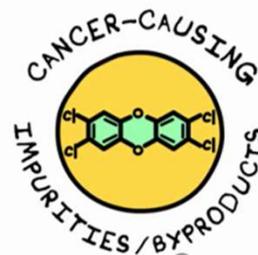
Objective: Use of substitutes or modified materials, products & processes to prevent the formation and release of the chemicals listed in Annex C.

Recommended activity option:

- Substitute perchloroethylene in cleaning of clothes with alternatives. (E.g., alternatives to dry cleaning systems are liquid carbon dioxide (LCO₂) or wet cleaning and hydrocarbon solvent-based systems).
- Assessment and substitution of the use of perchloroethylene & trichloroethylene in degreasing of metals, as lubricants and other uses by alternatives where feasible.

8. Reduction of UPOPs from specific chemical production processes and substitution of chemicals: Triclosan

Background: Triclosan containing and forming PCDD/F is included in soups and toothpaste as antimicrobial. Science shows that triclosan causes harm but does not provide relevant benefit.



<https://www.youtube.com/watch?v=JIAbs3lhbK4>

Objective: Use of substitutes or modified materials, products & processes to prevent the formation and release of the chemicals listed in Annex C.

Recommended activity option:

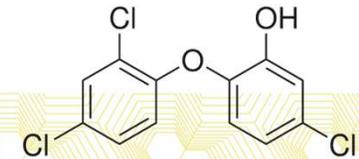
- Eliminate the use of triclosan (and triclocarban) in consumer products.

The Florence Statement on Triclosan and Triclocarban



Rolf U. Halden,¹ Avery E. Lindeman,² Allison E. Aiello,³ David Andrews,⁴ William A. Arnold,⁵ Patricia Fair,⁶ Rebecca E. Fuoco,⁷ Laura A. Geer,⁸ Paula I. Johnson,⁹ Rainer Lohmann,¹⁰ Kristopher McNeill,¹¹ Victoria P. Sacks,¹² Ted Schettler,¹³ Roland Weber,¹⁴ R. Thomas Zoeller,¹⁵ and Arlene Blum¹⁶

<https://doi.org/10.1289/EHP1788>



20 Case Studies on

HOW TO PREVENT THE USE OF TOXIC CHEMICALS
frequently found in the Mediterranean Region



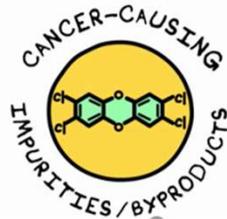
https://backend.orbit.dtu.dk/ws/files/163013878/Weber_2018.pdf



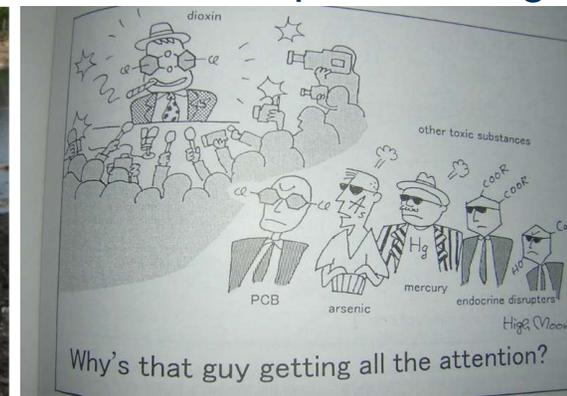
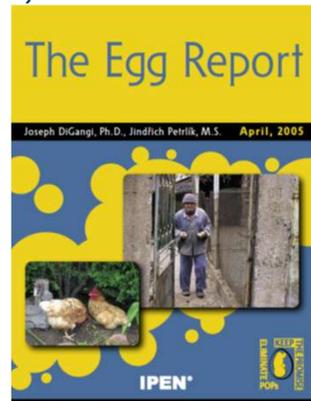
9. Awareness raising and education for relevant stakeholder groups on dioxins and other unintentional POPs

Objective: Major stakeholders are aware and know the fundamentals on PCDD/F, other UPOPs, and other major pollutant releases from SC Annex C Part II and III sources.

- Develop educational and awareness materials on the health and environmental impact of dioxins, other UPOPs and other co-pollutants (PM, PAH, black carbon/soot).
- Raise awareness among stakeholders and the public of the environmental and health impacts of PCDD/F and other UPOPs and human exposure from emissions, contaminated sites & food.
- Conduct awareness and training for stakeholders on legal issues of PCDD/Fs & other UPOPs.
- Run awareness-raising campaigns on dioxins, other POPs and pollutants of concern for relevant stakeholders and sources, such as industrial sources, incinerators, and open burning.



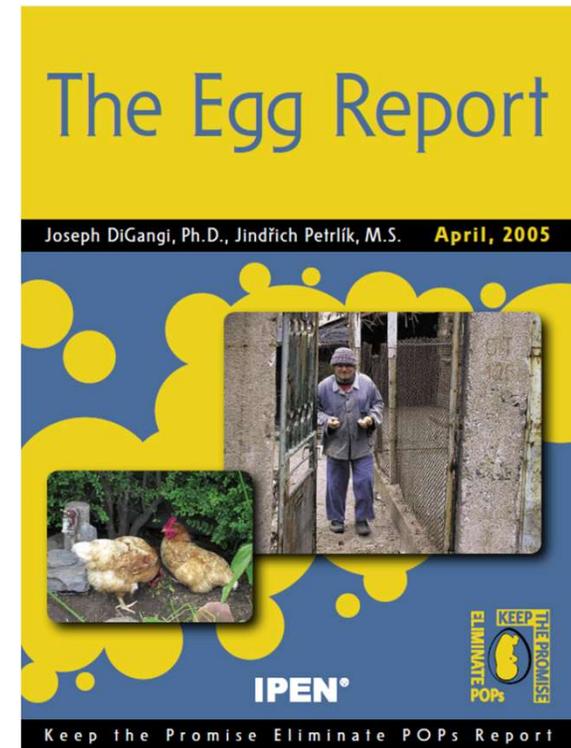
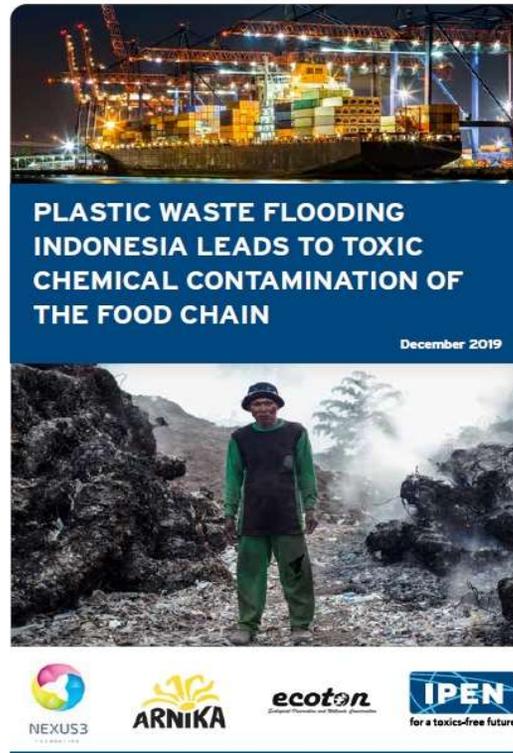
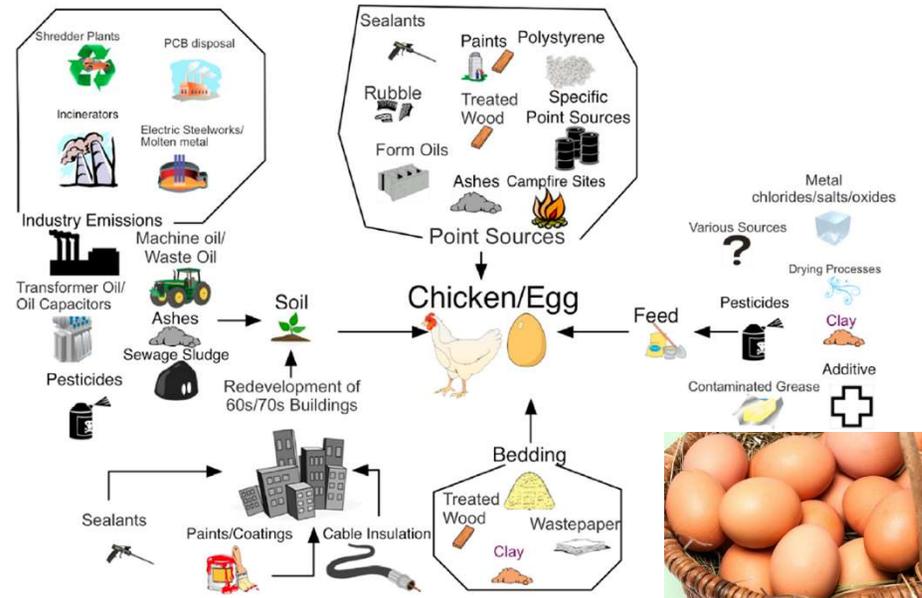
<https://www.youtube.com/watch?v=JIAb3lhbk4>



9. Awareness raising for relevant stakeholder groups on dioxins and other unintentional POPs

Objective: Major stakeholders are awareness and know the fundamentals on PCDD/F, other UPOPs, and other major pollutant releases from SC Annex C Part II and III sources.

- Chicken egg review paper and IPEN Reports on POPs in eggs around pollutant sources (Petrlik et al. 2022 Emerging Contaminants 8, 254-279 <https://doi.org/10.1016/j.emcon.2022.05.001>).
- Review on dioxins & PCBs in livestock. Weber et al. (2018) Environ Sci Eur 30, 42, <https://doi.org/10.1186/s12302-018-0166-9>



10. Analysis and monitoring of PCDD/F and other UPOPs in the technosphere and other priority areas

Objective: Established monitoring of PCDD/F and other UPOPs and relevant pollutants from Annex C Part II and III sources and human exposure.

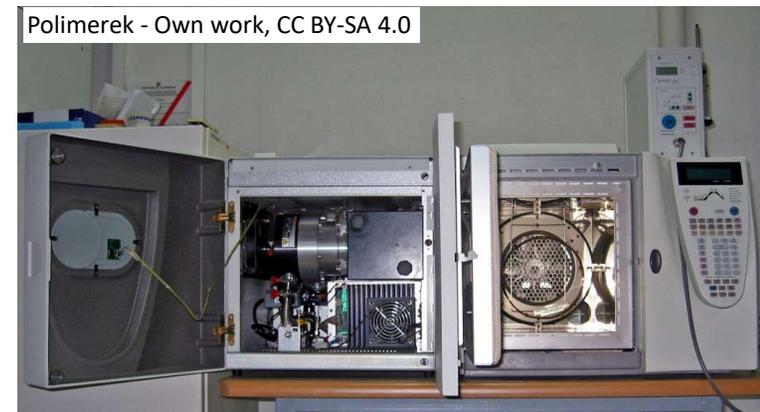
- **Assessment of the need and the options** for monitoring PCDD/F and other UPOPs from **industry/priority sources** (e.g., incinerators, metal industry) and for human exposure (food, feed, soils).
- Establish international **co-operations or strengthen the national capacity** for UPOPs monitoring.
- **Evaluating instrumental analysis and dioxin bio-assays** for potential use in the country.
- Monitoring of Annex C Part II and III priority sources in the country
- Monitor priority foods and environmental samples for PCDD/F and possibly other UPOPs (e.g. samples with potential human exposure for residents around suspected contaminated sites).

Bioanalytical screening methods for dioxins and dioxin-like compounds — a review of bioassay/biomarker technology

[https://doi.org/10.1016/S0160-4120\(01\)00028-9](https://doi.org/10.1016/S0160-4120(01)00028-9)

Peter A. Behnisch^{a,b,*}, Kazunori Hosoe^a, Shin-ichi Sakai^{b,c}

Behnisch et al. (2001) Environment International 27, 413-439



11. Assessment & management of UPOP contaminated sites - Background

- PCDD/F contaminated sites are a **large legacy** of the past nearly 200 years of industrial releases.
- PCDD/F are highly persistent and the generated contaminated sites have the potential to impact human health and the environment for long periods.
- **Article 6 of the Convention says (paraphrased) “that Parties shall endeavour to develop appropriate strategies to identify POPs contaminated sites; if remediation is undertaken then in an environmentally sound manner”.**
- To minimise the impacts on vulnerable population and current & future generations, it is important that PCDD/F and other UPOPs contaminated sites are identified, inventoried and assessed to evaluate the need for securing and possibly remediation of sites.

Dioxin- and POP-contaminated sites—contemporary and future relevance and challenges

<https://doi.org/10.1007/s11356-008-0024-1>

Overview on background, aims and scope of the series



Reviewing the relevance of dioxin and PCB sources for food from animal origin and the need for their inventory, control and management

Roland Weber^{1*}, Christine Herold¹, Henner Hollert², Josef Kamphues³, Markus Blepp⁴ and Karlheinz Ballschmiter⁵ <https://doi.org/10.1186/s12302-018-0166-9>

KeAi
CHINESE ROOTS
GLOBAL IMPACT

Emerging Contaminants

journal homepage: www.keaipublishing.com/cn/journals/emerging-contaminants

Review article <https://doi.org/10.1016/j.emcon.2022.05.001>

Monitoring dioxins and PCBs in eggs as sensitive indicators for environmental pollution and global contaminated sites and recommendations for reducing and controlling releases and exposure

Jindrich Petrlik^{a, b}, Lee Bell^{a, c}, Joe DiGangi^a, Serge Molly Allo'o Allo'o^d, Gilbert Kuepouo^e, Griffins Ochieng Ochola^f, Valeriya Grechko^{b, g}, Nikola Jelinek^b, Jitka Strakova^{a, b}, Martin Skalsky^h, Yuyun Ismawati Drwiegaⁱ, Jonathan N. Hogarh^j, Eric Akortia^k, Sam Adu-Kumi^l, Akarapon Teebthaisong^m, Maria Carcamoⁿ, Bjorn Beeler^a, Peter Behnisch^o, Claudia Baitinger^p, Christine Herold^q, Roland Weber^{q, *}

11. Assessment & management of UPOP contaminated sites – Background:



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Emerging Contaminants

journal homepage: www.elsevier.com



Timo Klostermeier_pixelio

Close to 90% of eggs @PCDD/Fs pollution sources are contaminated

Monitoring dioxins and PCBs in eggs as sensitive indicators for environmental pollution and global contaminated sites and recommendations for reducing and controlling releases and exposure

Jindrich Petrlik^{a, b}, Lee Bell^{a, c}, Joe DiGangi^a, Serge Molly Allo'o Allo'o^d, Gilbert Kuepouo^e, Griffins Ochieng Ochola^f, Valeriya Grechko^{b, g}, Nikola Jelinek^b, Jitka Strakova^{a, b}, Martin Skalsky^h, Yuyun Ismawati Drwiegaⁱ, Jonathan N. Hogarh^j, Eric Akortia^k, Sam Adu-Kumi^l, Akarapon Teebthaisong^m, Maria Carcamoⁿ, Bjorn Beeler^a, Peter Behnisch^o, Claudia Baitinger^p, Christine Herold^q, Roland Weber^{q, *}

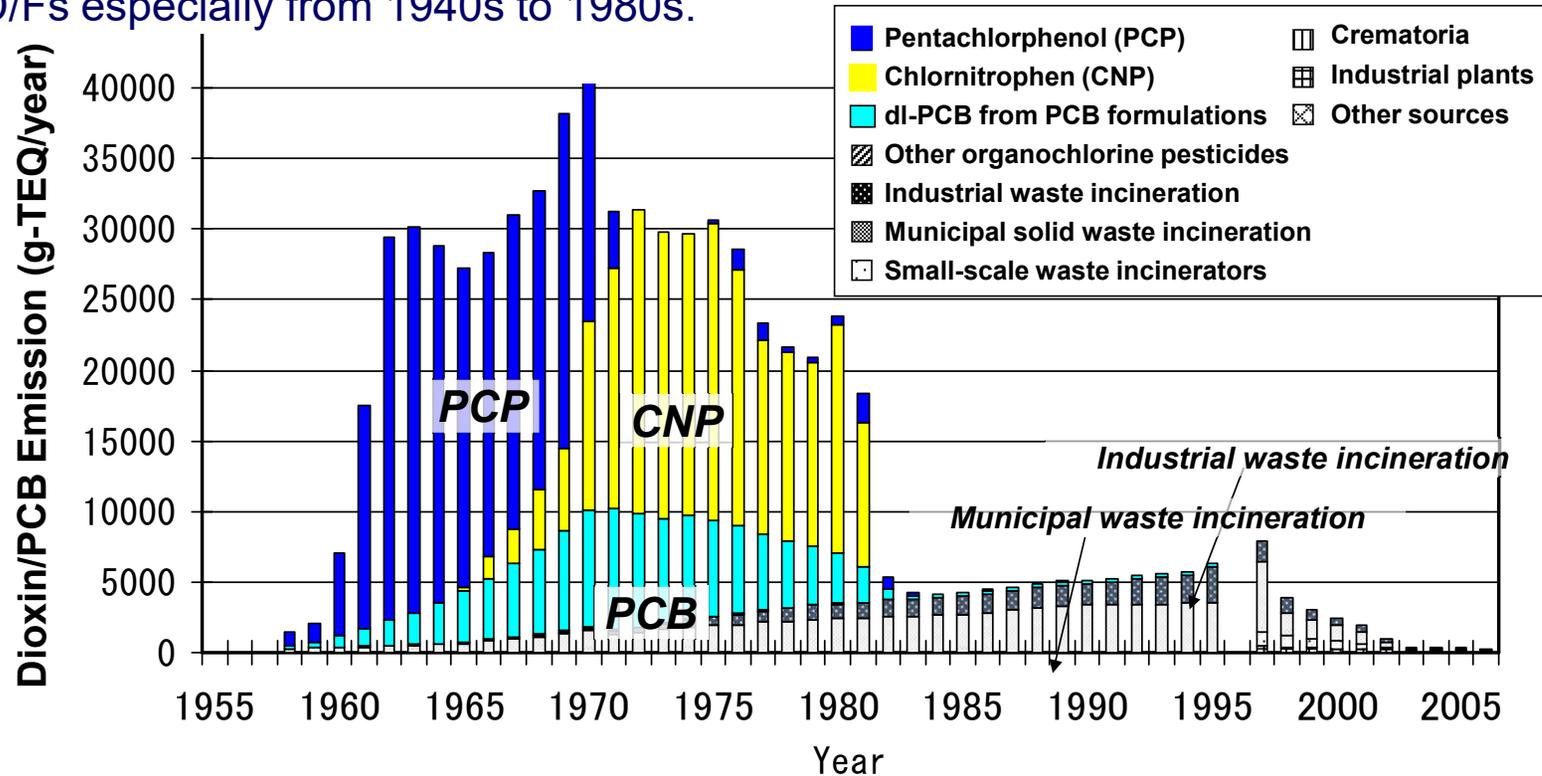
Petrlik et al. (2022) Emerging Contaminants 8, 254-79 <https://doi.org/10.1016/j.emcon.2022.05.001>



- By 2022, IPEN had monitored 113 chicken flocks at potential PCDD/F- and PCB-contaminated sites and **88% of the pooled egg samples were above the EU maximum limits** for PCDD/Fs (2.5 pg PCDD/F-TEQ/g fat) or the sum of PCDD/Fs and dioxin-like PCBs (5 pg PCDD/F-PCB-TEQ/g fat).
- **Children consuming just one egg per day exceed the guidance value of the FAO/WHO (70 pg TEQ/kg bw/month) as well as that of the EU (2 pg TEQ/kg bw/week). This indicates that close to 90% of areas around these industrial emitters and open burning sources in developing countries were unsafe for free-range egg production.**

11. Assessment & management of UPOP contaminated sites - Background

The production and use of chlorinated aromatic pesticides were a major source of global contamination with PCDD/Fs especially from 1940s to 1980s.



~460 kg TEQ has been released into the Japanese environment from pesticide use and ~120 kg TEQ from the PCB use. This can again be compared to the total global dioxin inventory of ~100 kg TEQ today.

Masunaga 1999; Weber et al. (2008) *Env Sci Pollut Res* 15, 363-393;

11. Assessment and management of PCDD/F and other UPOPs contaminated sites (1)

Objective: Identification, assessment and management of sites potentially contaminated with PCDD/F and other UPOPs and securing /remediation.

Recommended activity options:

- Develop/update legislation to set criteria for determining contaminated soils and sediments.
- Establish legislation on polluter pays principle for contaminated sites.
- Consider guidelines for identification and assessment of sites contaminated with unintentional POPs (see the Dioxin Toolkit Chapter on Hot Spots https://toolkit.pops.int/Publish/Main/II_10_HotSpots.html and the recent BAT/BEP guidance on POPs contaminated sites <https://www.pops.int/Implementation/BATandBEP/POPscontaminatedsites/Guidance/tabid/9649/Default.aspx>)
- Education and training in identification and management of contaminated sites.
- Establish conceptual site models of potentially UPOP contaminated sites, **develop a database and prioritization of the sites for further assessment & management.**
- Assessment/monitoring of UPOPs contamination and major co-pollutants for the identified locations (considering prioritization list).

POP contaminated site BAT/BEP guidance (2025)

Module	Title	English
	Executive Summary and Introduction	 
1	Background on POPs Contaminated Sites	 
2	Principles and Approaches for POPs Contaminated Sites Management and Remediation	 
3	Site Investigation, Assessment and Conceptual Site Model	 
4	Environmental Risk Assessment	 
5	Remediation Technologies and Techniques	 
6	Technology Selection Tool for remedial options to be used in Phase 3 - the Remediation Assessment	 
7	Stakeholder Engagement, Public and Worker Safety and Health	 
8	Contaminated Sites Remediation and Monitoring and Aftercare	 
9	Getting Started: Legislation, Policy, Inventory Development and Financing Remediation	 
10	Case study - Environmental Management Plan Lâm Hoá site, Viet Nam	

The guidance consists of nine modules, an executive summary and a first case study.

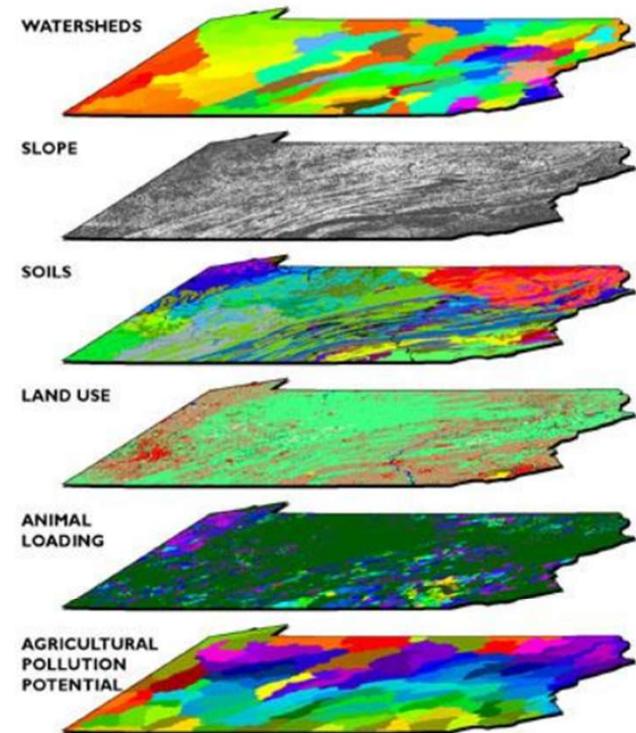
Guidance on best available techniques and best environmental practices for the management of sites contaminated with persistent organic pollutants

February 2025



Caribbean regional database on POPs contaminated sites and other POP inventory information

- The POPs – RIS was created to spatially represent the data that is provided and validated by each country, represented in the following data formats:
 - GPS Coordinates or Mapped boundaries** of where POPs chemicals are stores, used or disposed
 - Name and Information on Facility** – e.g Landfill, Warehouse, Incinerator
 - Nearby Sensitive Areas** – e.g Water bodies, Residential Areas, Protected Ecosystems or Agricultural Lands
- The data should be in a “**GIS-Ready**” format e.g Shapefiles, Attribute tables.
- **Key stakeholders** to support in this process would be Ministries of Planning (for geospatial data), Environment, Health, Agriculture etc. to provide data or information on the sites as well as technical personnel to be trained.



Synergies of addressing UPOPs and mercury – chemical industry

- Also some major sources of mercury in the chemical industry – chloralkali electrolysis and PVC production (acetylene) - are/were major UPOP sources which can be addressed together.
- The PVC production via acetylene releases mercury and UPOPs.
- Depending on the chloralkali technology used, chloralkali plants release mercury and UPOPs and often different technologies have been used over time at a site. Therefore chloralkali sites are frequently contaminated by mercury and PCDD/F, PCNs and other UPOPs. This needs to be considered in the assessment and remediation. Mercury electrodes are being phased out.



Relevance of mercury contaminated sites for global mercury release and implementation - synergy of Minamata & Stockholm Convention

<https://www.youtube.com/watch?v=ai1oIQPYT98&t=1113s>

0:00:00 Intro

0:00:40 1. Ben Vauter (ONLINE). CHLOR ALKALI INDUSTRY, GLOBAL MERCURY PARTNERSHIP AND THE MINAMATA CONVENTION ON MERCURY.

0:18:33 2. Roland Weber. RELEVANCE OF MERCURY CONTAMINATED SITES FOR GLOBAL MERCURY RELEASE AND IMPLEMENTATION SYNERGY OF THE MINAMATA & STOCKHOLM CONVENTION.

0:32:09 3. Nikola Jelinek. MERCURY CONTAMINATION AS A LEGACY OF CHEMICAL PRODUCTION IN THE CEE REGION.

0:45:00 4. Guido Van de Coterlet. WHERE STOCKHOLM MEETS MINAMATA – MERCURY AND HCH ISSUES AS CHLOR-ALKALI FACILITIES.

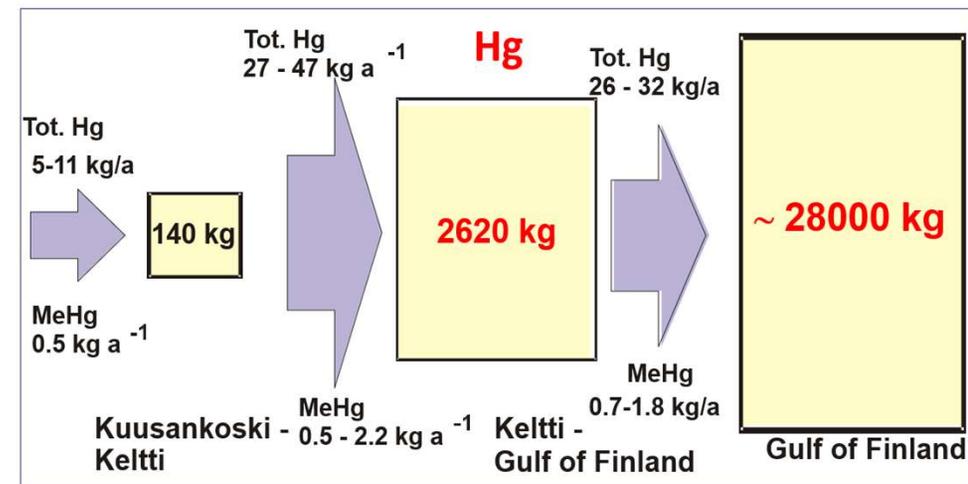
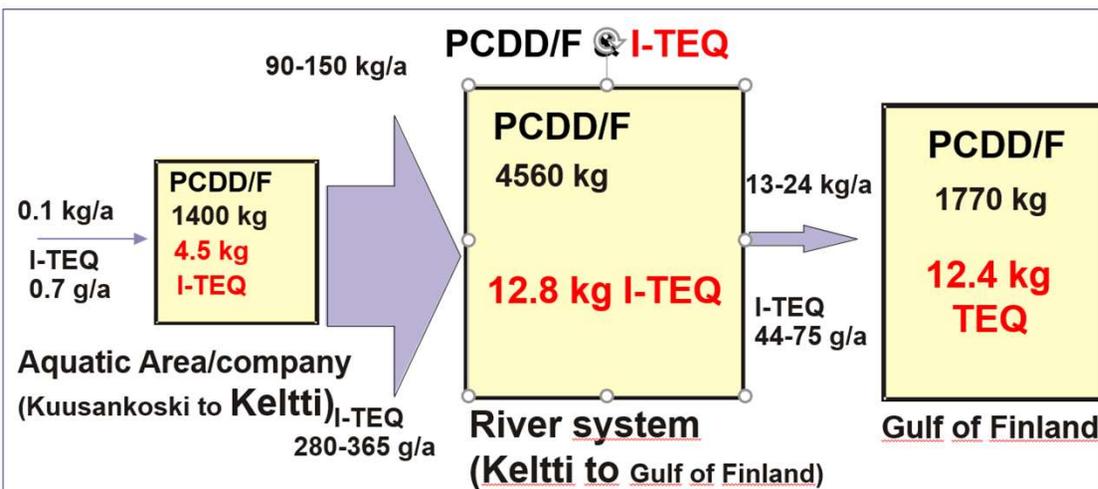
1:02:24 5. Xavier Ibarz. ECON INDUSTRIES: VACUDRY® TECHNOLOGY, CASE STUDY: MERCURY AND HCH WASTE TREATMENT FROM CHLOR-ALKALI PLANTS.



Dioxin & mercury contaminated site from chloralkali plant (Finland): Sediment burdens and fluxes

A chloralkali production site with organochlorine (PxCp) manufacturing (1940-1984) released:

- around 30 kg TEQ PCDD/F into the River Kymijoki, of which 12.8 kg TEQ still remain in the river sediments and 12.4 kg TEQ have migrated into the Baltic Sea contaminating the fishes there.
- More than 30 tonnes of mercury were released into the River Kymijoki, with 2760 kg still remaining in the river. 28 tonnes have migrated into the Baltic Sea, contaminating the fishes.



Sources: Verta et al. (2009) Environ Sci Pollut Res 16, 95–105

<https://doi.org/10.1007/s11356-008-0061-9>

11. Assessment & management of PCDD/F & other UPOPs contaminated sites (2)

Objective: Identification, assessment and management of sites potentially contaminated with PCDD/F and other UPOPs, and securing /remediation.

Recommended activity options:

- **Develop strategies** for the environmentally sound management of POPs contaminated sites.
- **Secure contaminated sites considering priority ranking and need to stop exposure.**
- Identification of clean-up measures and initiate clean-up procedures for high priority contaminated sites.
- Develop monitoring for contaminated and secured sites.

Guidance on best available techniques and best environmental practices for the management of sites contaminated with persistent organic pollutants

February 2025



MINAMATA
CONVENTION
ON MERCURY



Thank you for your attention ! Questions?

More Information <https://www.thegef.org/>; https://en.wikipedia.org/wiki/Triple_planetary_crisis

Basel Convention: www.basel.int

Rotterdam Convention: www.pic.int

Stockholm Convention: <http://chm.pops.int/>;

Montreal Protocol/Vienna Convention: <http://ozone.unep.org>

GFC: <https://www.chemicalsframework.org/> **FAO:** www.fao.org **WHO** www.who.int/

Climate Convention <https://unfccc.int/> **Biodiversity Convention:** <https://www.cbd.int/>

OECD/IOMC: <http://www.oecd.org/chemicalsafety/>

Science:; <https://www.ipcc.ch/>; <https://www.ipbes.net/>; <https://www.unep.org/isp-cwp>; <https://www.ipcp.ch/>

Industry: <http://www.suschem.org/>; <https://icca-chem.org/>; <https://cefic.org/>

NGO: www.ipcp.ch; www.ipen.org; www.ciel.org/; www.ban.org; www.chemsec.org; www.wecf.org

Better-world-links: <http://www.betterworldlinks.org/>



<http://synergies.pops.int/>

SYNERGIES
among the Basel, Rotterdam
and Stockholm conventions



Global Framework
on Chemicals



United Nations
Framework Convention on
Climate Change



**Convention on
Biological Diversity**