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# Dioxins and global boundaries

Recent monitoring of dioxin toxicity in eggs around potentially contaminated sites found approx. 90% of eggs unfit for human consumption compared to EU regulatory limits for dioxin in eggs. Consumption of these eggs easily exceeds WHO –TDI (tolerable daily intake) for dioxins. Persistent organic pollutants (POPs) and plastic pollution are both considered key pollutants which recently led to the scientific conclusion that “novel entities” have transgressed global boundaries (assimilative limits) for pollution (Persson, Carney Almroth *et al.* 2022). The related high levels of dioxin and PCB pollution from many human activities, that pollutes soils and the environment at large with manifold exceedances of the tolerable daily intake of dioxins in eggs, provides one very practical and figurative illustration of this global pollution and how it cycles back to humans in food.

There were documented examples of contamination of the food chain up to levels >20-times higher than the suggested EU limit for PCDD/Fs in food (2.5 pg TEQ/g fat) (European Commission 2016) at sites with unsafe disposal of waste incineration ash or other industrial ash contaminated with PCDD/Fs at levels of 500 pg TEQ/g dw and more (Katima, Bell *et al.* 2018, Petrlik, Ismawati *et al.* 2020).

The eggs from sites affected by ash also exceeded background levels from reference sites up to 280-times (Katima, Bell *et al.* 2018).

## Low POPs Content Levels (LPCLs)

The limit levels defining the distinction between POPs waste and non-POPs waste is called “Low POPs Content Levels” according to the Article 6 of the Stockholm Convention are important for the options of the disposal and destruction of such wastes. These limits also define whether the waste can be exported to countries without technologies that would allow environmentally sound management. POPs waste cannot be sent to countries that don't have the technology to dispose of it according to Stockholm Convention requirements.

IPEN proposes Low POPs content levels which meet the requirements to protect health and the environment. In the table below are the LPCLs suggested by IPEN, compared with the current provisional levels that are defined in the General Technical Guidelines on POPs Waste.

POP	IPEN proposal	Current Low POP content
HBCD	100 mg/kg	100 mg/kg or 1,000 mg/kg
Hexa-, hepta-, tetra-, and pentabromodiphenyl ether (PBDEs)	50 mg/kg as a sum (including decabromodiphenyl ether)	50 mg/kg or 1,000 mg/kg as a sum*
PCDDs and PCDFs	1µg TEQ/kg (including dioxin-like PCBs)	1µg TEQ/kg or 15 µg TEQ/kg**
SCCPs	100 mg/kg	10,000 mg/kg
PFOA and related compounds	0.25 mg/kg for PFOA + salts, and 10 mg/kg for PFOA related compounds	50 mg/kg

\* The limit value has been set for the sum of tetra-, penta-, hexa-, and hepta-BDE, because commercial mixtures have varying congener composition (see section I.B.1 of the POP-BDE guidelines), and for analytical efficiencies.

\*\* TEQ as referred to in Annex C, part IV, paragraph 2, to the Stockholm Convention, but only for PCDDs and PCDFs.

## Weak regulations mean losing control of dioxin contamination

**Dioxins in fly ash are sufficient to exceed the tolerable intake for the entire human population of up to 133 planet Earths.**

The widely used current limit value for POPs in waste (Low POPs Content Levels) leaves vast amounts of industrial wastes containing dioxins out of control. With this weak limit level there is no requirement to destroy or irreversibly transform dioxin content in those wastes and it is not even necessary to register reuse of such waste as construction material or backfill in remediation projects. This is how dioxins in wastes can get spread without control and contribute to overall contamination of environment.

It was estimated recently that the amount of PCDD/Fs in waste incinerator fly ash, which is virtually without control in the environment, is approximately 7.5 kg TEQ/year and can accumulate in the food chain over time. While this may not seem a large volume, PCDD/DFs are toxic in the part per billion range. So this yearly amount would be sufficient to exceed the tolerable weekly intake (WHO-TWI) of 14 pg TEQ/kg body weight for the entire human population by 19 times, or if considering the recently updated European Food Safety Authority (EFSA) TWI, 7.5 kg TEQ/year of dioxin is sufficient to exceed the TWI of the population of this planet by 133 times (Petrlik, Kuepouo *et al.* 2021).

## A single kilogram of ash meeting the current, weak dioxins “Low POPs content level” could contaminate 7 tonnes of soil

It needs to be highlighted that the current provisional low POPs limit established by the Basel Convention for dioxin contaminated waste of 15,000 ng TEQ/kg is much too high and needs urgently to be re-evaluated and reduced. **A single kilogram of ash meeting the Basel “low POPs” level could contaminate 7 tonnes of soil to a level where eggs would not meet EU regulatory limits** if laying chickens were kept on that soil (Weber, Watson *et al.* 2015).

Therefore, a more appropriate low POPs content level for dioxin contaminated waste is needed, in particular if this waste is recycled or reused e.g. for soil amendments like ashes from combustion processes (Lopes and Proenca 2020). For such wastes, the regulatory limit of German fertilizer regulation for pasture land and non-tilling soil cultivation (8 ng TEQ/ kg dm) and other agricultural land (30 ng TEQ/kg dm) (German Federal Ministry of Justice and Consumer Protection 2017) should be applied. The same applies to the use of ashes for construction purposes on the land surface where some EU countries also introduced a specific limit of 10 ng TEQ/kg dm for PCDD/Fs (French Republic 2011, MŽP ČR 2021). These limits are suggested to be included in General Technical Guidelines for POPs Waste as they can give some idea to legislators as to what levels it is necessary to regulate use of wastes containing dioxins on land surfaces to maintain control of dioxins in the environment.

## Export of waste incineration ash

In Belaruchi, Belarus, packaged ash waste was found which was declared as a “mining binder”. In reality it was a mixture made from waste incineration (WI) ash and was discovered in an abandoned area near the village of Belaruchi, Belarus in 2007. That was just a small part of 5,000 tons of the mixed WI ash export (permit granted to German company UTR) to CEE countries including Poland, Belarus and Ukraine (Gluszynski 2007). The dioxin laboratory has measured levels of PCDD/Fs in this mixture at 1,626 ng TEQ/kg. This case shows that export of fly ash with dioxin levels over 1,000 ng TEQ/kg from developed countries to countries with economies in transition or developing countries, under the label of recycled material, is happening. Such export is allowed due to the current, very weak Low POPs Content Levels for dioxin (15,000 ng TEQ kg) so it does not breach the Basel Convention requirements to restrict transboundary movement. The amount of waste found in Belaruchi as construction material was low but overall the total amount of 5,000 tons WI ash was exported from Germany to Poland, Ukraine and Belarus (Petrlik and Bell 2017).

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