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Dioxins and global boundaries

Recent monitoring of dioxin toxicity in eggs around potentially contaminated sites found approximately 90% of all eggs being unfit for human consumption compared to EU regulatory limits for dioxin in eggs. Consumption of these eggs easily exceeds the 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 pollute soils and the environment at large, with manifold exceedance of the

tolerable daily intake of dioxins in eggs, provides one very practical and representative illustration of this global pollution and how it cycles back to humans through their food.

There are documented examples of contamination of the food chain up to levels more than 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).

POP	IPEN proposal
HBCD	100 mg/kg
Hexa-, hepta-, tetra-, penta-, and decabromodiphenyl ether (PBDEs)	50 mg/kg as a sum
PCDDs, PCDFs, and dioxin-like PCBs	1µg TEQ/kg
SCCPs	100 mg/kg
PFOS, PFOA, PFH _x S and related compounds	0.025 mg/kg for PFOS, PFOA or PFH _x S and their salts individually; 10 mg/kg for sum of PFOS, PFOA,PFH _x S and related compounds

Weak regulations mean losing control of dioxin contamination

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

The widely used current limit value for POPs in waste (Low POPs Content Levels) leaves vast amounts of dioxin-containing industrial wastes out of control. Because of this weak limit level, there is no requirement to destroy or irreversibly transform the dioxin content in those wastes and it is not even necessary to register the reuse of such waste as construction material or backfill in remediation projects. This is how dioxins in waste can be spread uncontrolledly and contribute to the overall contamination of the environment.

It was estimated recently that the amount of PCDD/Fs in waste incinerator fly ash, which is spread in the environment virtually without any controls, amounts to approximately 7.5 kg TEQ/year and can accumulate in the food chain over time. While this may not seem to be 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 (WHOTWI) 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 dioxins are 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 can contaminate 7 tons of soil

It needs to be highlighted that the current provisional low POPs limits established by the Basel Convention for dioxin-contaminated waste of 15,000 ng TEQ/kg is much too high and urgently needs to be re-evaluated and reduced. **A single kilogram of ash meeting the Basel “low POPs” content level could contaminate 7 tons of soil to a level where eggs would not meet the 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 the 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 is

valid for the use of ashes for construction purposes on 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 are necessary for regulating the 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 declared as a “mining binder” was found. In reality, it was a mixture made of waste incineration (WI) ash and it was discovered in an abandoned area near the village of Belaruchi, Belarus in 2007. That was just a small part of the 5,000 tons of mixed WI ash export (from a permit granted to the German company UTR) to Central and East European countries, including Poland, Belarus and Ukraine (Gluszynski 2007). A dioxin laboratory measured levels of PCDD/Fs in this mixture amounting to 1,626 ng TEQ/kg. This case shows that exports 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 materials, is happening. Such exports are allowed due to the current, very weak low POPs content levels for dioxin (15,000 ng TEQ kg), and consequently do not breach the Basel Convention’s requirements to restrict transboundary movements. The amount of waste found as construction material in Belaruchi was low, but the total amount of WI ash that was exported from Germany to Poland, Ukraine and Belarus amounted to 5,000 tons (Petrlik and Bell 2017).

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