

to expect the original polluters to compensate them for loss of the use of land and in some cases for historic (and current) exposure. Any regulatory or legal framework for addressing POPs contamination in these circumstances should incorporate a system for compensating those food producers who are negatively impacted by the changes in the acceptable concentrations that result in lost production.

Development of frames for limiting exposure and promote safe food management

As mentioned above, a major reason for developing inventories of POPs and otherwise contaminated sites, is the reduction of human exposure and the improvement of food safety. Since for industrial areas a considerable portion of the land is above acceptable contaminant levels (e.g. in an industrialized region in Germany more than 50% of eggs were above EU food limits⁶ and in the investigation of the International POPs Elimination Network (IPEN) more than 90% of eggs were above EU food limits- sometimes by an order of magnitude and higher⁷).

Such management measures have, for example, been established for cows and sheep in the PCDD/F contaminated flood plains of the Elbe River in Germany^{3,6}. Another type of measure would be food advisories as have been developed, for example, for fish in PFOS or PCB contaminated areas^{6,10}. More research is also clearly needed here for reducing exposure to cattle and chickens and related management measures are needed.

Furthermore, the low PCDD/F and PCB levels in soil at which chicken/eggs can become contaminated above regulatory limits and health based limits highlights the need to strictly regulate and control industrial and other emissions. It is also of particular importance to ensure the safe treatment and disposal of ashes and other residues from waste incinerators, metal industries and even ashes from residential sources in particular where waste plastics such as PVC or contaminated wood are co-incinerated. Residual ashes with contamination levels as low as 50 ng TEQ/kg can be risk sources. Even if such ash is "diluted" on soils the PCDD/F can re-accumulate over time with repeated applications. In this respect 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.

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1. Weber R, Gaus C, Tysklind M, Johnston P, Forter M, et al. (2008). *Env Sci Pollut Res* 15, 363-393
- 2 US EPA (1994) Estimating exposure to dioxin-like compounds, vol 1-3. Office of Health and Environmental Assessment, Office of Research and Development, EPA/6006-88/005, Washington
- 3 Weber R, Albrecht M, Ballschmiter K, Berger J, Bruns-Weller E, Kamphues J, Körner W, Malisch R, Nöltner T, Schenkel H, Severin K, Vossler C, Wahl K (2014) *Organohalogen Compounds* 76, 815-818
- 4 Hoogenboom LA, Kan CA, Zeilmaker MJ, Van Eijkeren J, Traag WA. (2006) *Food Addit Contam.* 23, 518-527.
- 5 Kijlstra A, Traag WA, Hoogenboom LA. (2007) *Poult Sci.* 86, 2042-2048.
- 6 Weber R, Hollert H, Kamphues J, Ballschmiter K, Blepp M, Herold C (2015) R&D Report for German EPA, FKZ 371265407/01.
- 7 DiGangi J, Petrlík J (2005) The egg report – Keep the promise eliminate POPs Report. IPEN.
8. Weber R, Watson A, Petrlik J, Winski A, Schwedler O, Baitinger C, Behnisch P (2015). *Organohalogen Compounds* 77, 615-618.
9. Hoogenboom LAP, Dam G ten1, Bruggen M van, Zeilmaker MJ, Jeurissen SMF, Leeuwen SPJ van. *Organohalogen Compounds* 77, .
10. Brambilla G, D'Hollander W, Oliaei F, Stahl T, Weber R (2015). *Chemosphere* 129, 192-202.
11. Bussian B, Schmidt S, Utermann J (2013) Typische Gehalte von Dioxinen und dl-PCB in Böden, Fachgespräch „Dioxine und PCB: Bessere Daten – Schnellere Aufklärung“ Bonn 28.10.2013.
12. Libeti L (2014) *International Journal of Innovation and Scientific Research* 9 (2), 175-189.
13. Wimmerová S, Watson A, Drobná B, Šovčíková E, Weber R, Lancz K, Patayová H, Jurečková D, Jusko TA, Murínová L, Hertz-Picciotto I, Trnovec T (2015) *Environ Sci Pollut Res Int.* 22, 14405-14415
14. Labunska I, Harrad S, Wang M, Santillo D, Johnston P. (2014) *Environ Sci Technol.* 48, 5555-5564.