Chasing ppq – The challenge of analysing the super poison “Dioxin”

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Persistent organic pollutants (POPs) are an omnipresent threat in modern times. Within the so-called “dirty dozen” one major compound group are the dioxins, or precisely polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Although dioxins were never produced industrially on purpose, they have been widely spread in the environment and accumulate in the food chain, predominantly in the fatty tissue.

Discovered in Germany as byproduct for the pyrolysis of the disinfectant and pesticide pentachlorphenol (PCP), the prominent agent 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) was understood to be extremely hazardous already in 1957. Even 0.000001 g is enough to kill a small animal in short term and causes severe threats to human health. Despite this knowledge, big manufacturers, military and politics concealed and downplayed these facts wherever possible. An ideal chemical weapon was created and gained notoriety being an ingredient of agent orange in Vietnam War: Heavily destructible, easily inhalable and cheap to produce.

The mechanisms of dioxin contamination and human exposure have been best studied. Hence, we know that more than 90% of human exposure comes along with nutrition. Meat, dairy products, fish and shellfish are the key sources for dioxin uptake.

Due to the omnipresence of dioxins, there is a certain background exposure not being expected to affect human health. However, owing to the highly toxic potential, constant efforts need to be undertaken to reduce background exposure and keep the dietary uptake at a minimum.

Low concentrations causing toxic effects make it necessary to go for highly sophisticated analysis. Despite high resolution mass spectrometry are current state of the art, the sample itself, it’s treatment and analyte clean-up are crucial factors for serious assessment of dioxin concentration and subsequent threats. Consequently, POPs in general and dioxins in particular open wide discussion fields between daily routine analysis and scientific questions.