

Persistent Organic Pollutants

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Definition

POPs are stable **toxic manmade chemicals** that harmfully **affect human health and the environment** and that are **accumulated** in the environment.

Persistent = chemicals are stable and **persist for a long time in the environment** and can be **accumulated and pass** from one species to the next one (food chain)
-> **bioaccumulation**

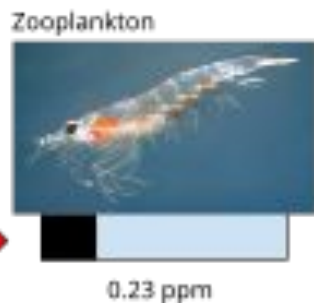
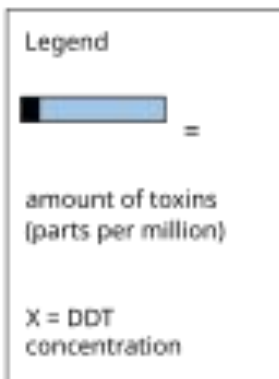
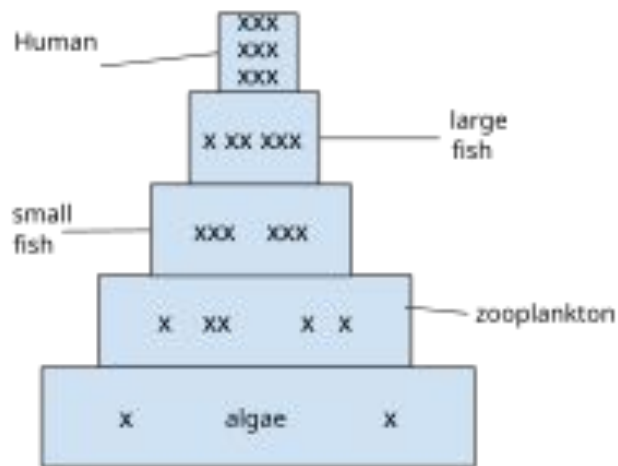
Organic = compounds with carbon-hydrogen bonds (C-H) or bonds between carbon atoms (C-C). Can be found in **living organisms/synthetic/naturally occurring**.

Pollutants = POPs can be **transported** by wind and water -> pollution can affect people and wildlife far **from the place of the POPs origin**

How does it work?

- 1) POPs are used in pest and disease control, crop production, industry, clothing industry, colours, cleaners,...
- 2) Human and animals touch contaminated surface or waste, consume food or water with toxic chemicals. Plants and fungi obtain nutrients and water from contaminated soil and are exposed to polluted environment.
- 3) POPs stay in our organism (accumulate in animal fat), usually they are resistant to photochemical, biological and chemical degradation.
- 4) We are in contact with POPs repeatedly -> chemicals are cumulated in our organism in small steps.
- 5) When there is a higher level of POP in our body, it will cause a serious health issue.

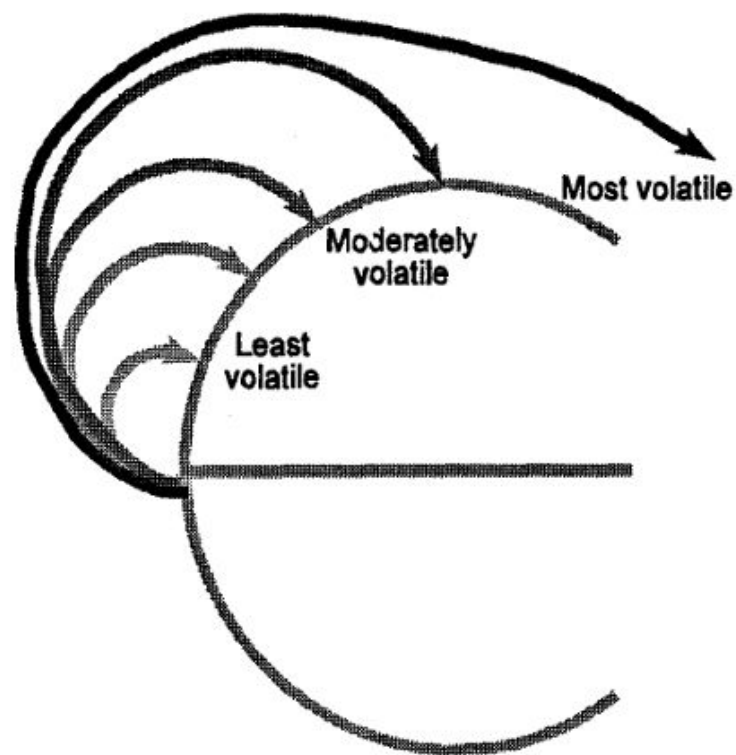
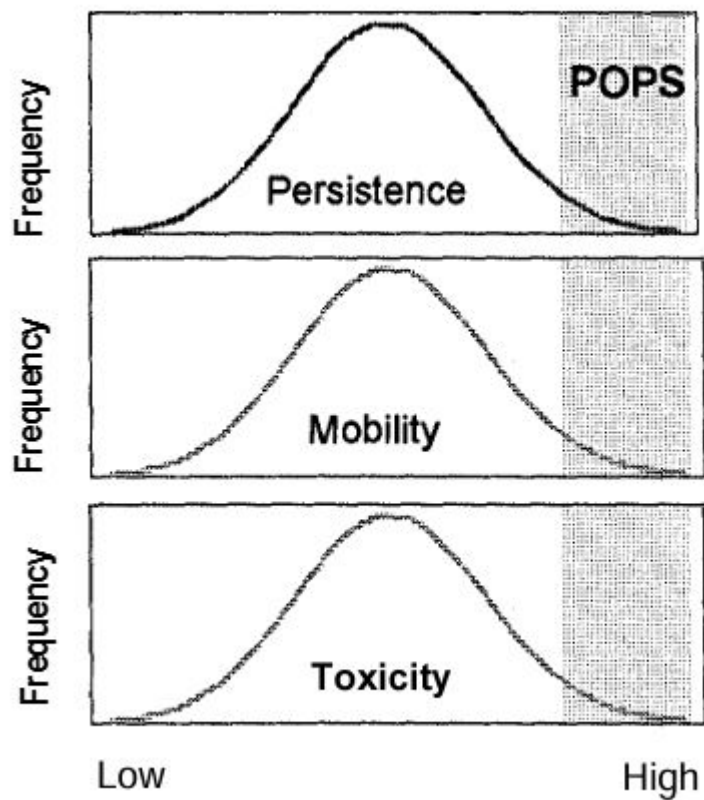
Higher amount of toxins as trophic level increases in the food chain





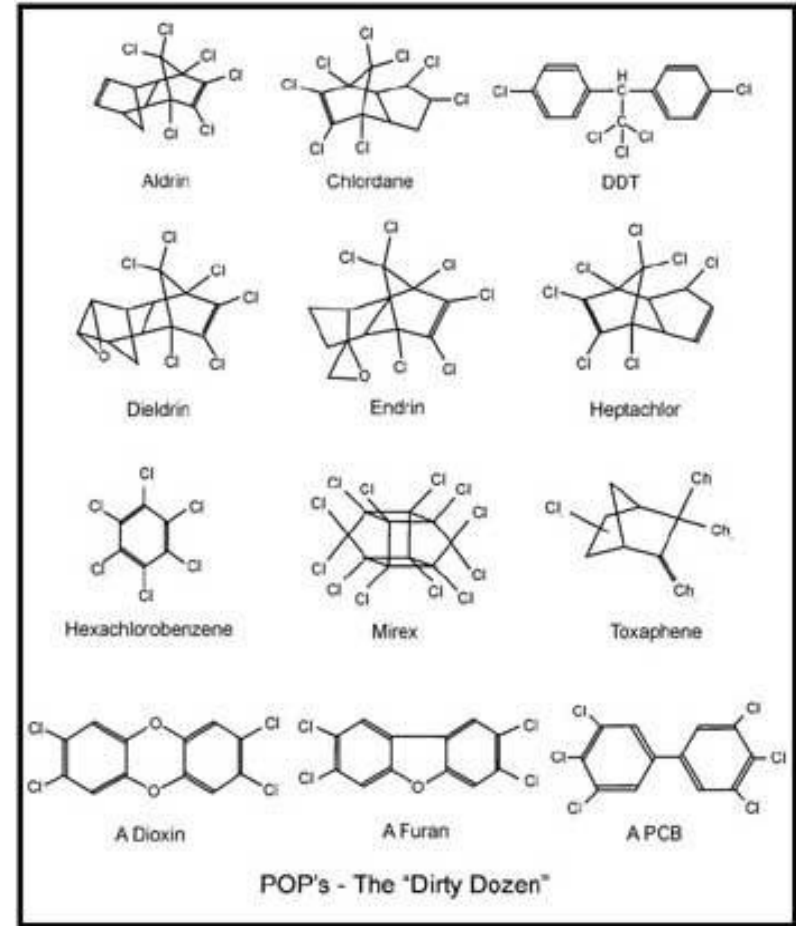
Characteristics

- Stability (halogenation, aromatic rings...)
- Lipophilic
- Semi volatility
- Long half-lives
- Ubiquitous



Examples of Pops

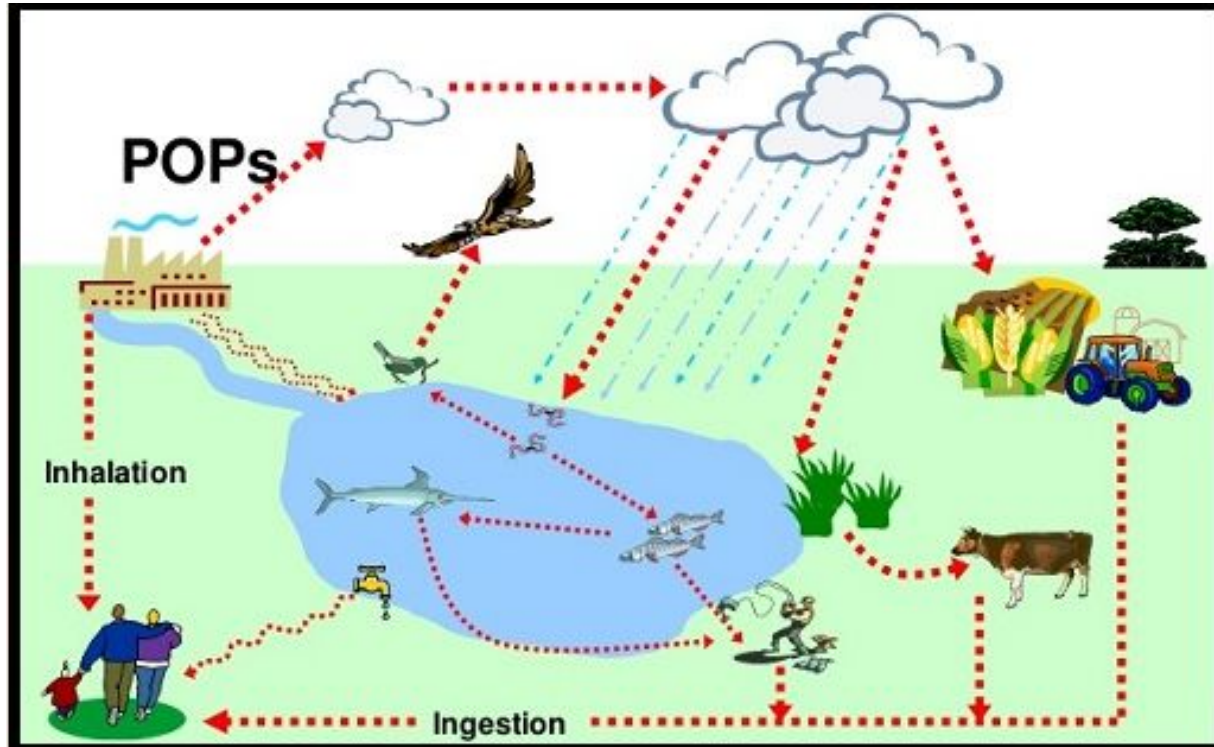
- DDT (Outdated pesticide)
- PCB (Plastic/Industrial applications)
- PAH (Incomplete combustion)
- Dioxins (Manufacturing byproducts)
- Pharmaceutical compounds



Problems associated

- **Cancer risk**
- **Reproductive and development disorders**
- **Immune problems**
- **Neurotoxicity**
- **Endocrine disruption**
- **Genotoxicity**
- **Ecological harm**
- **Threat to biodiversity (Epa)**

Transportation



Aarhus protocol

1998

Protocol to the 1979 Geneva Convention on Long-Range Transboundary Air Pollution

Aims to control, reduce, or eliminate discharges, emissions, and losses of persistent organic pollutants

Europe, some former Soviet Union countries and the United States

16 substances (11 pesticides, 2 industrial chemicals, 3 by-products)

Stockholm convention

May 22-23 2001 in Stockholm

United National Environment Programme (UNE)

185 countries worldwide

Included 12 substances and their groups at the time of signing

Currently covers 30 substances, with more under review due to their hazardous nature

Czech Republic

Ministry of the Environment

National Action Plan

Programs for the Removal of Old Pesticides

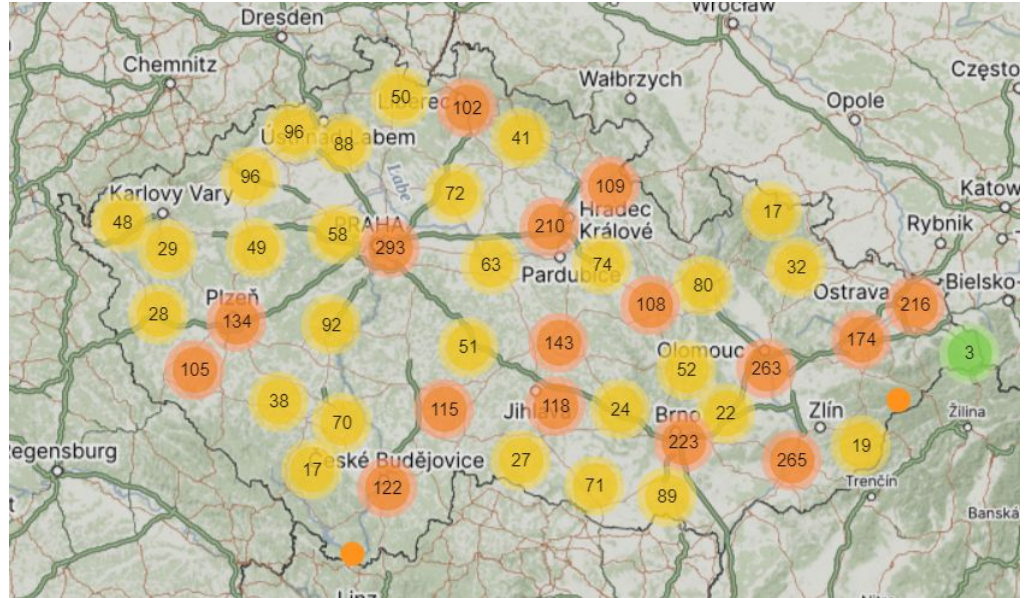
Education and Awareness Campaigns

Research and Monitoring

International Cooperation

Local cases

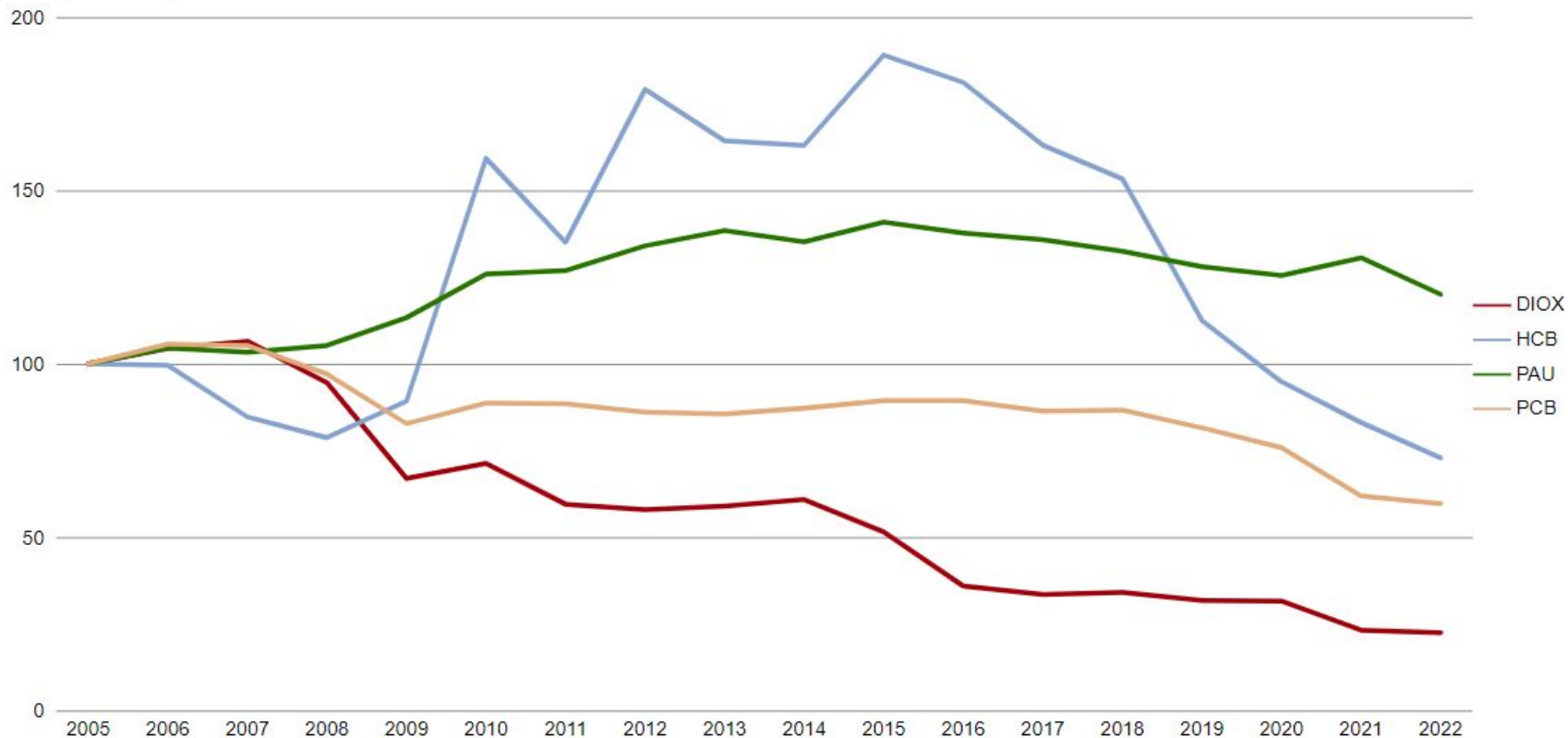
- we can monitor level of POPs in organism by blood or milk tests (POPs are located in fats mostly)
 - blood donors (18 - 61 y. o.)
 - breastfeeding mothers (2 - 8 weeks)
- **Czech Republic:** monitoring between 1996 - 2011 in human breast milk
 - results: the exposure to POPs is low but still significant, intake of these substances is decreasing



Vývoj emisí perzistentních organických látek (POPs) přepočítaných na index k roku 2005.

Vývoj emisí POPs v ČR [index, 2005 = 100], 2005–2022

index (2005 = 100)



Data pro rok 2023 nejsou k dispozici, budou nejdříve v dubnu 2025.

Zdroj dat: ČHMÚ

Toxic cube sold in the Czech Republic



Spolana Neratovice

- **Spolana chemical plant in Neratovice** - along the **Elbe River**
 - **260 ha large**
 - **products:** PVC, caprolactam, NaOH, HCl, H₂SO₄, fertilizer
 - **produce:** dioxins, mercury, and DDT
 - **floods** of August 2002 -> hazardous chemical spills occurred
-
- alarming levels of POPs in local soil and food products -> a ban on local consumption.
 - two contaminated sites were successfully remediated between 2005 and 2008 using non-incineration technologies
 - in 2016 - became a part of ORLEN Unipetrol

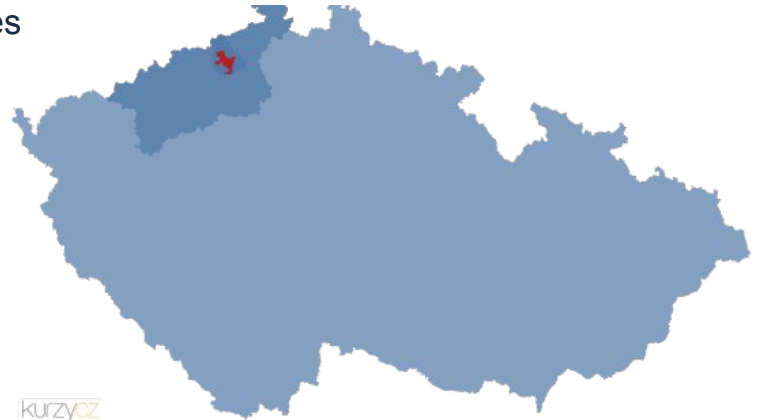


Spolana Neratovice



Hazardous Waste Incineration and POPs waste stockpile at Lysá nad Labem

- built in the 1990s in Lysá nad Labem to manage hazardous waste
 - POPs (PCBs, dioxins, DDT) found in soil, food, wildlife
- 2003: pollutants detected in poultry, fish and soil
- closed in 2007 after frequent emissions of toxic substances
- reopened in 2012 - yet pollution continued, occasionally released through an emergency chimney.
- 2013: dioxin filter issues led to **shutdown**

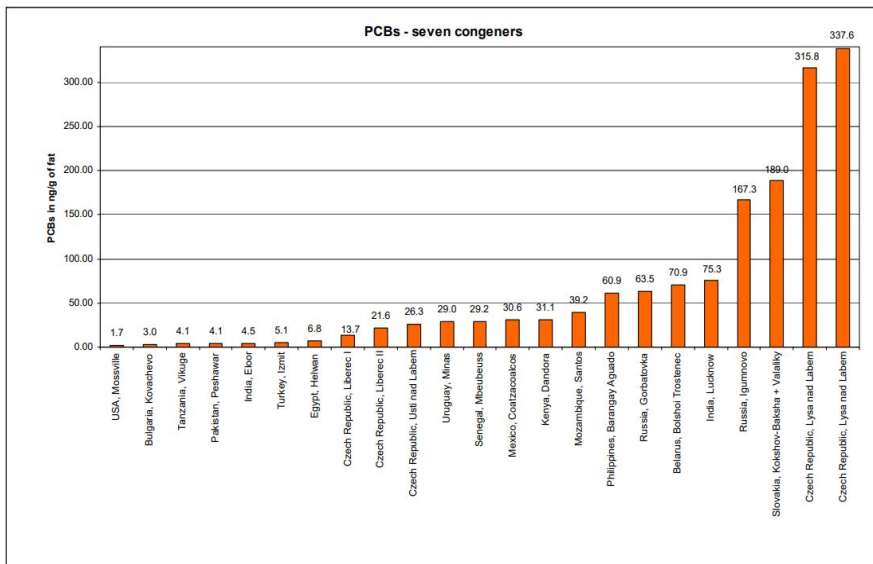


Hazardous Waste Incineration and POPs waste stockpile at Lysá nad Labem

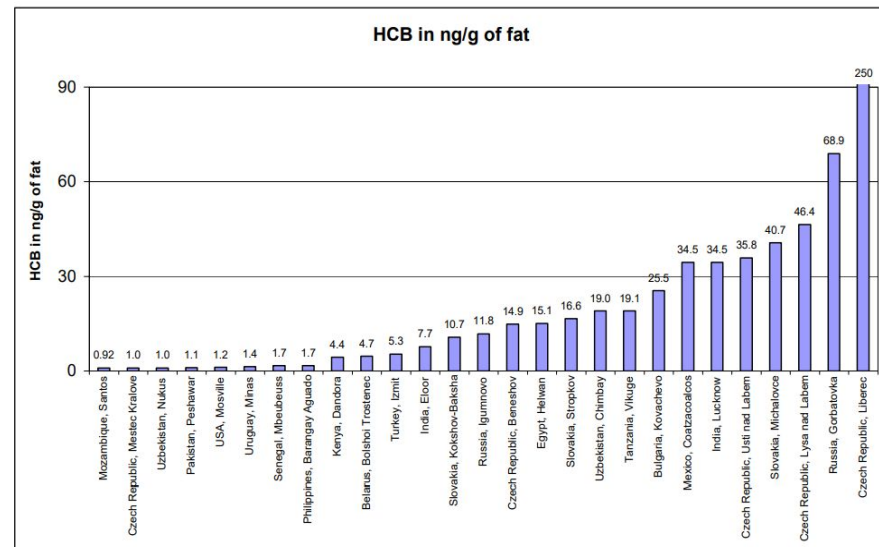


Hazardous Waste Incineration and POPs waste stockpile at Lysá nad Labem

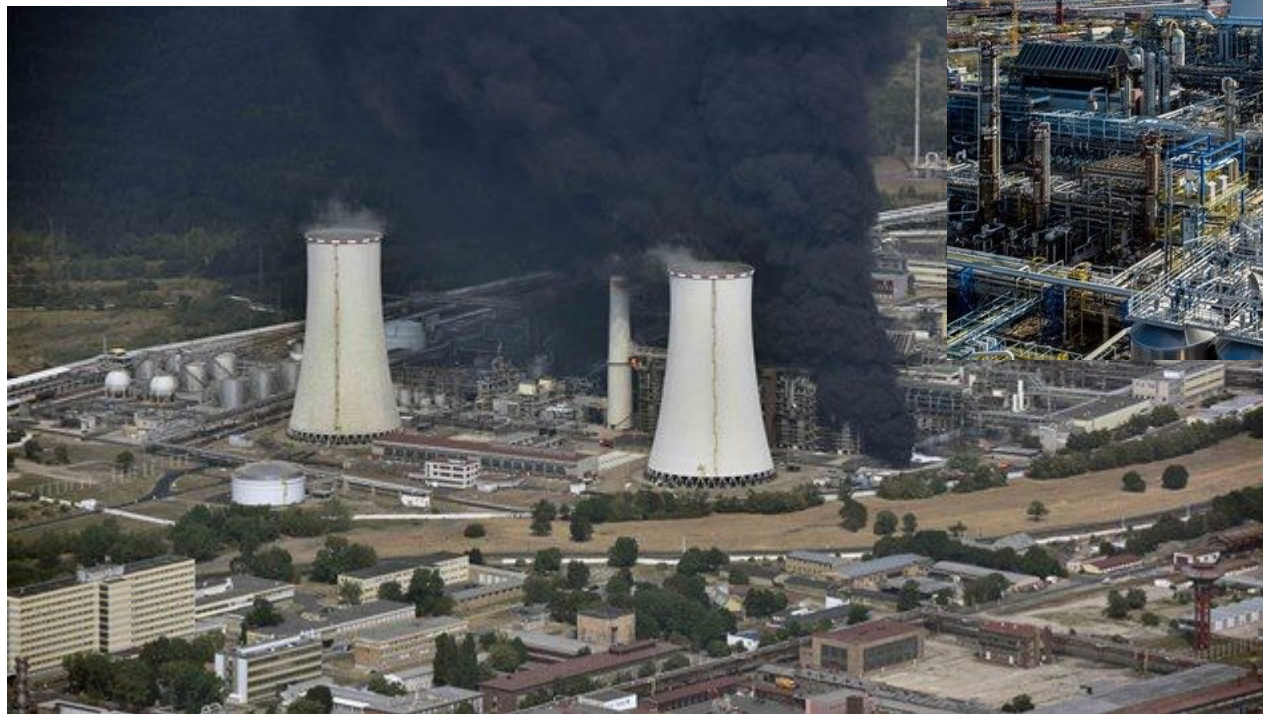
Picture III: Graph levels of seven PCB congeners in different free range chicken eggs samples according to data in Table VII.



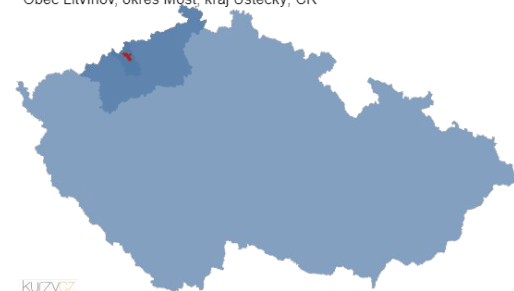
Picture IV: Graph levels of HCB in different free range chicken eggs samples according to data in Table VIII.



Unipetrol Litvínov



Obec Litvínov, okres Most, kraj Ústecký, ČR



POPs removal options

Thermal

Reductive

Bioremediation

QUIZZ - Question 1

What does bioaccumulation mean?

QUIZZ - Question 2

How do we call process when the concentration of persistant pollutants increse at higher levels of the food chain?

QUIZZ - Question 3

Wich one of these is **not** a characteristic of pops?

- a) High volatility
- b) Ubiquitous
- c) Hydrophobic
- d) Persistant

QUIZZ - Question 4

Which of the following is NOT classified as a persistent organic pollutant?

A) DDT

B) Mercury

C) PCB

D) Aldrin

QUIZZ - Question 5

What company is the biggest POPs pollutor in the Czech Republic?

QUIZZ - Question 6

How many substances were included in the Aarhus protocol?

A)37

B)48

C)12

D)16

Debriefing

POPs have ability to persist in environment, bioaccumulation in food chain and have toxic effect on health and ecosystem

Main sources: industrial processes, pesticides, waste burning

They can be spread by air, water or food chain

Health effect: hormonal disruption, reproductive issue, increase risk of cancer, effect on the nervous and immune system

Aarhus protocol and Stockholm convention

Resources

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Resources

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