POPs in Rustavi as an Example of Industrial Hot Spots

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IPEN expert on dioxins and waste

Arnika is a:

- ➔ Czech NGO
- ➔ Enviromental Association
- ➔ IPEN hub for CEWE
- ➔ International projects (e.g. Armenia, Georgia, Ghana, Indonesia, Kazakhstan, Thailand)

International Pollutants Elimination Network

- More than 620 CSOs in more than 125 countries

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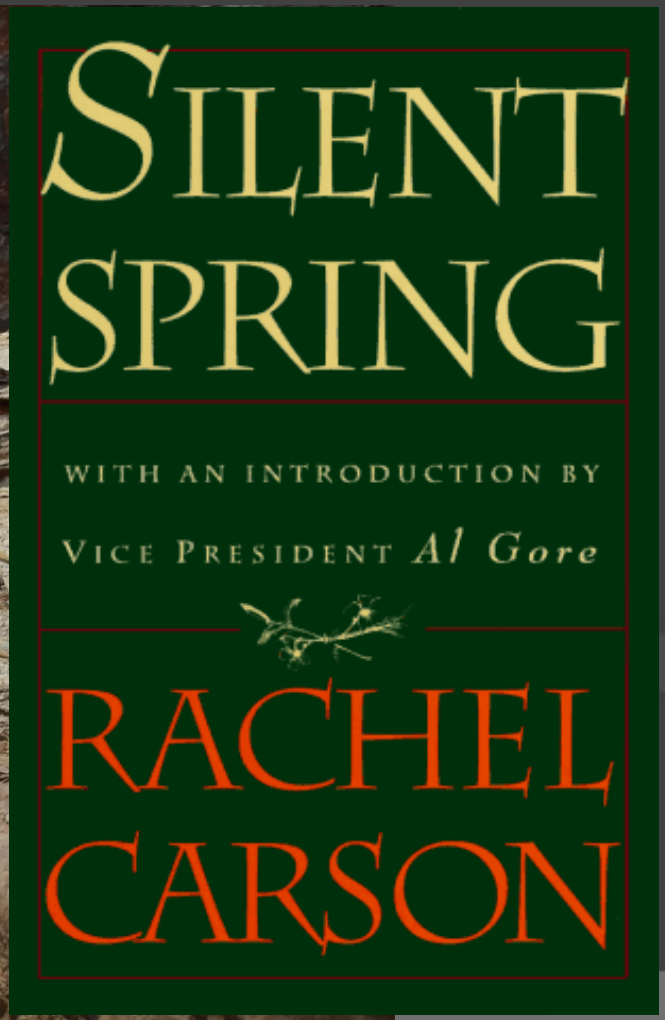
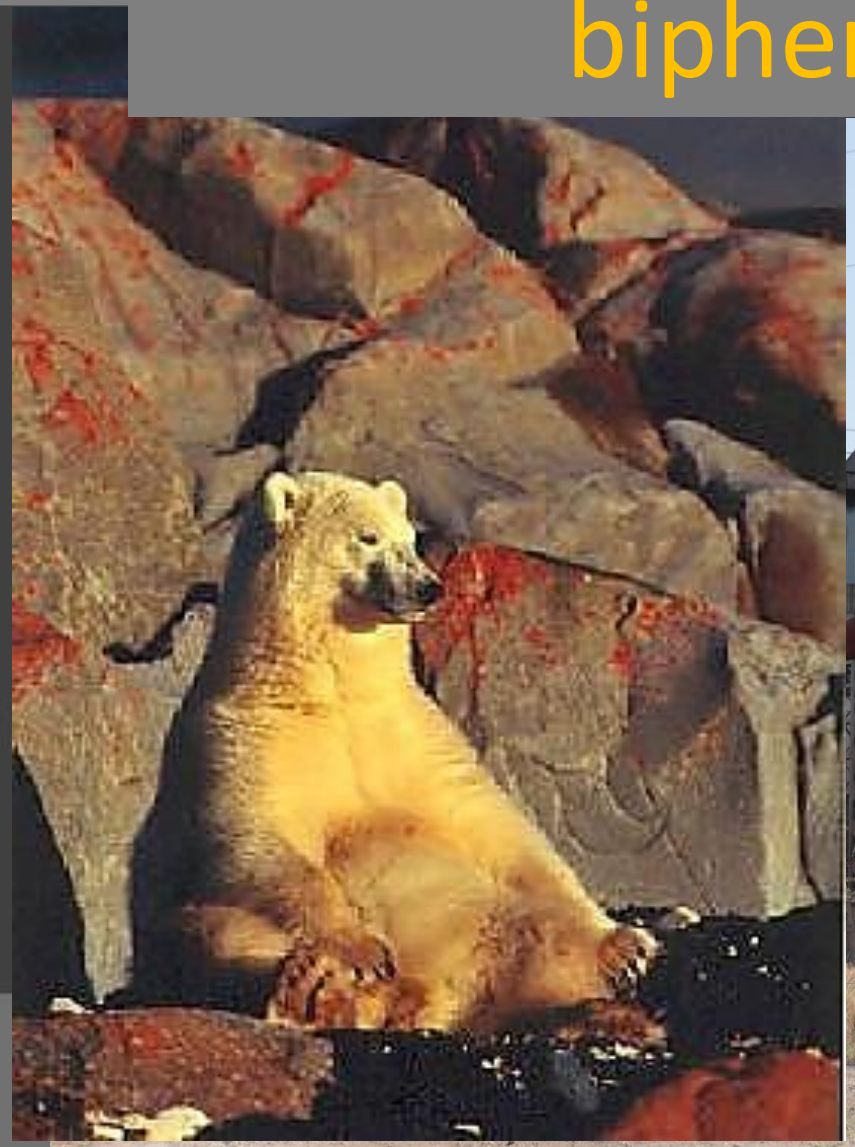
Persistent Organic Pollutants (POPs)

Sampling of DDT - Armenia



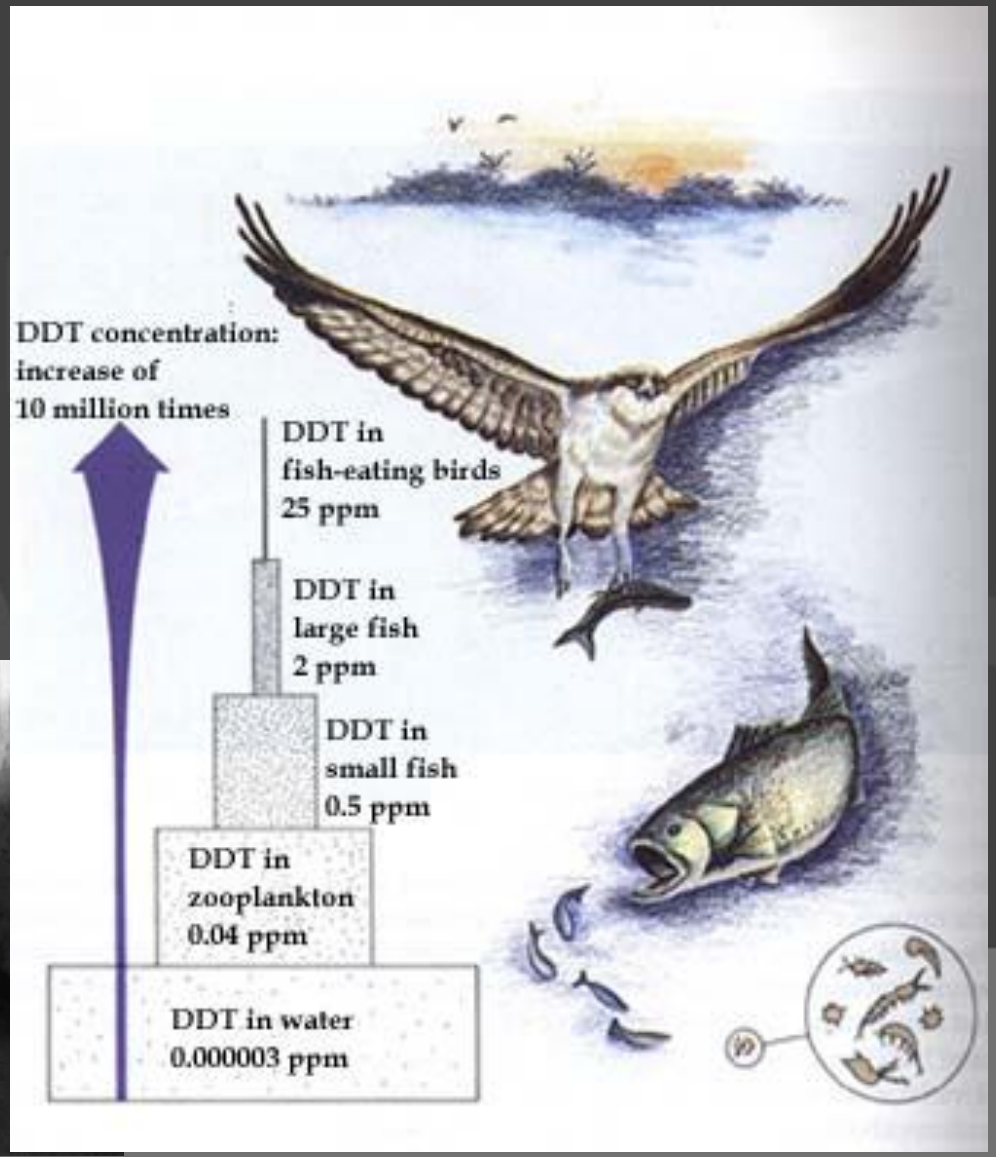
POPs – examples: Polychlorinated biphenyls (PCBs)



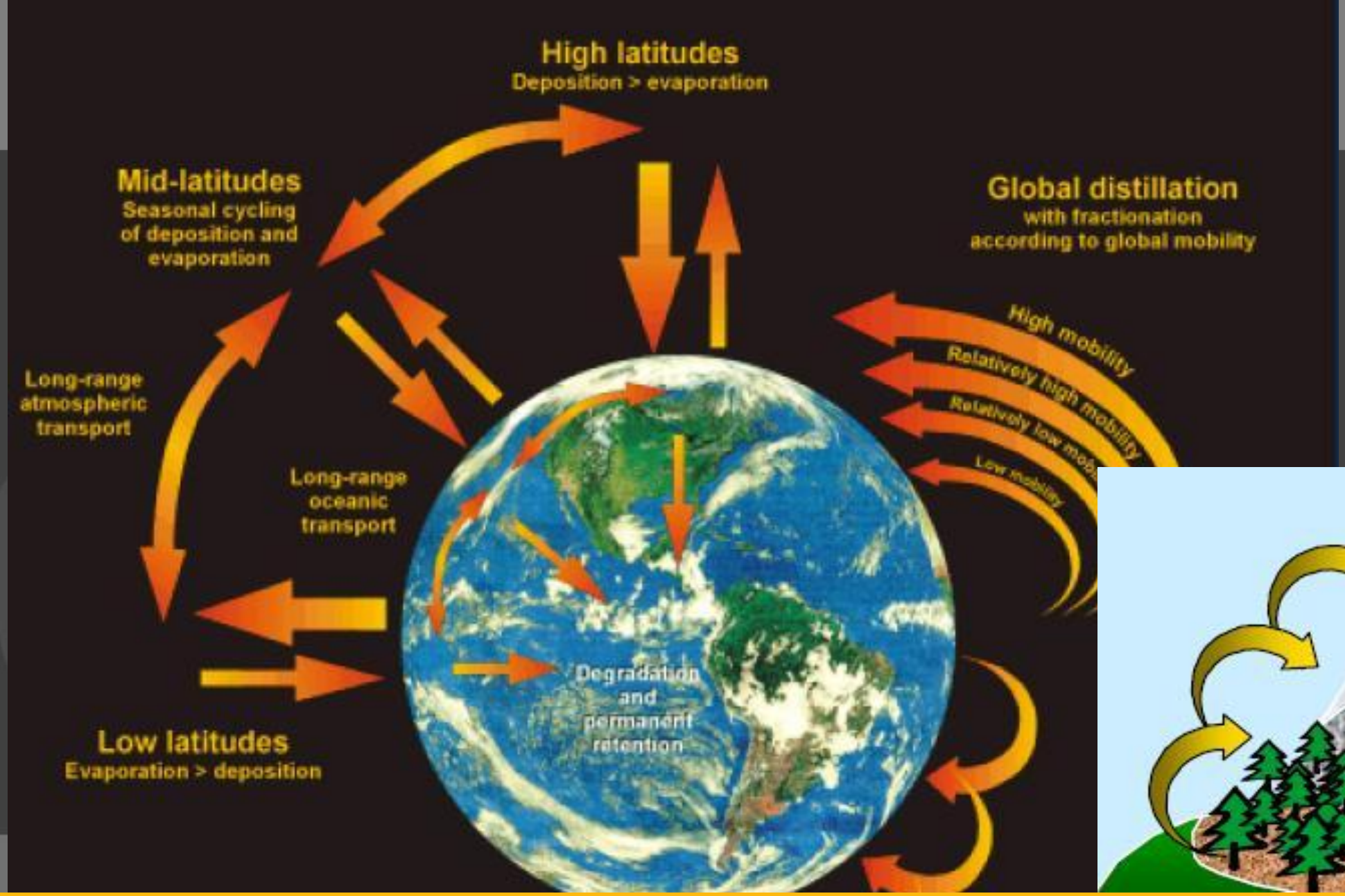
Bioaccumulation of POPs and their transfer(s)

fanaticcook.blogspot.com

www.fws.gov

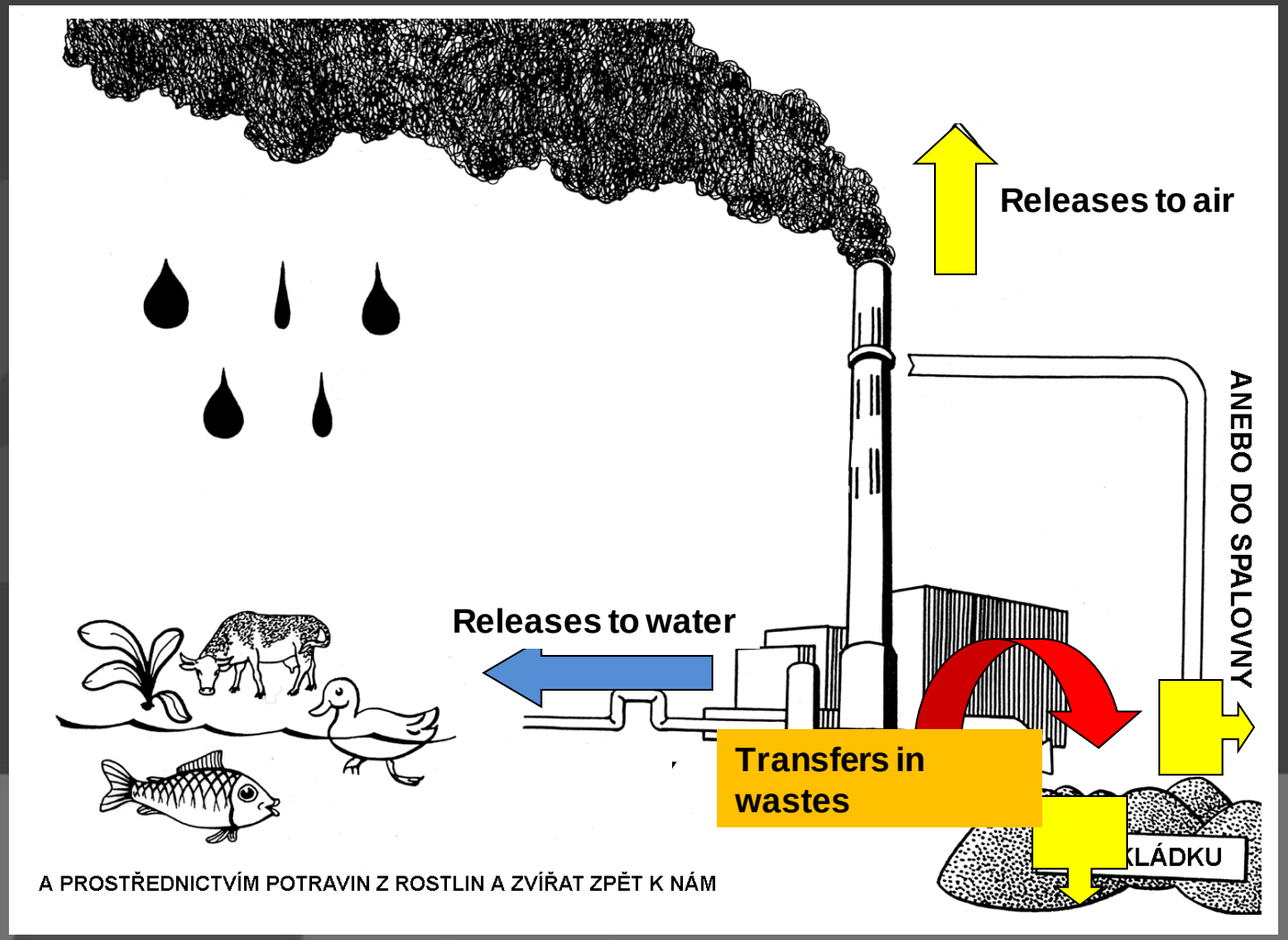


- Dioxins, PCBs, DDT and other POPs accumulate in animal fat



Bio-accumulation of POPs and their transfer

Purpose of sampling



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Dioxin sources

Dioxins (PCDD/Fs) - units

- **0,000 000 001 (air emissions gases) – ng**
- **0,000 000 000 001 (soils) – pg**
- **0,000 000 000 000 020 (outdoor air) - fg**

A sugar cube in a lake of one cubic kilometer

Dioxins (PCDD/Fs)

- 75 congeners of dioxins (PCDD)
- 135 congeners of furans (PCDF)
- 7 dioxin congeners, 10 furan congeners, and 12 dioxin-like PCB congeners → routinely measured in laboratories to evaluate dioxin toxicity, expressed as total TEQs (toxic equivalents)

POPs case study: Kazachstan 2012 - 2016

Kazakhstan 2012 - 2016

https://www.researchgate.net/publication/308948216_Toxic_pollutants_in_camel_milk_from_the_Mangystau_Region_of_Kazakhstan_Results_of_sampling_conducted_in_2015-2016

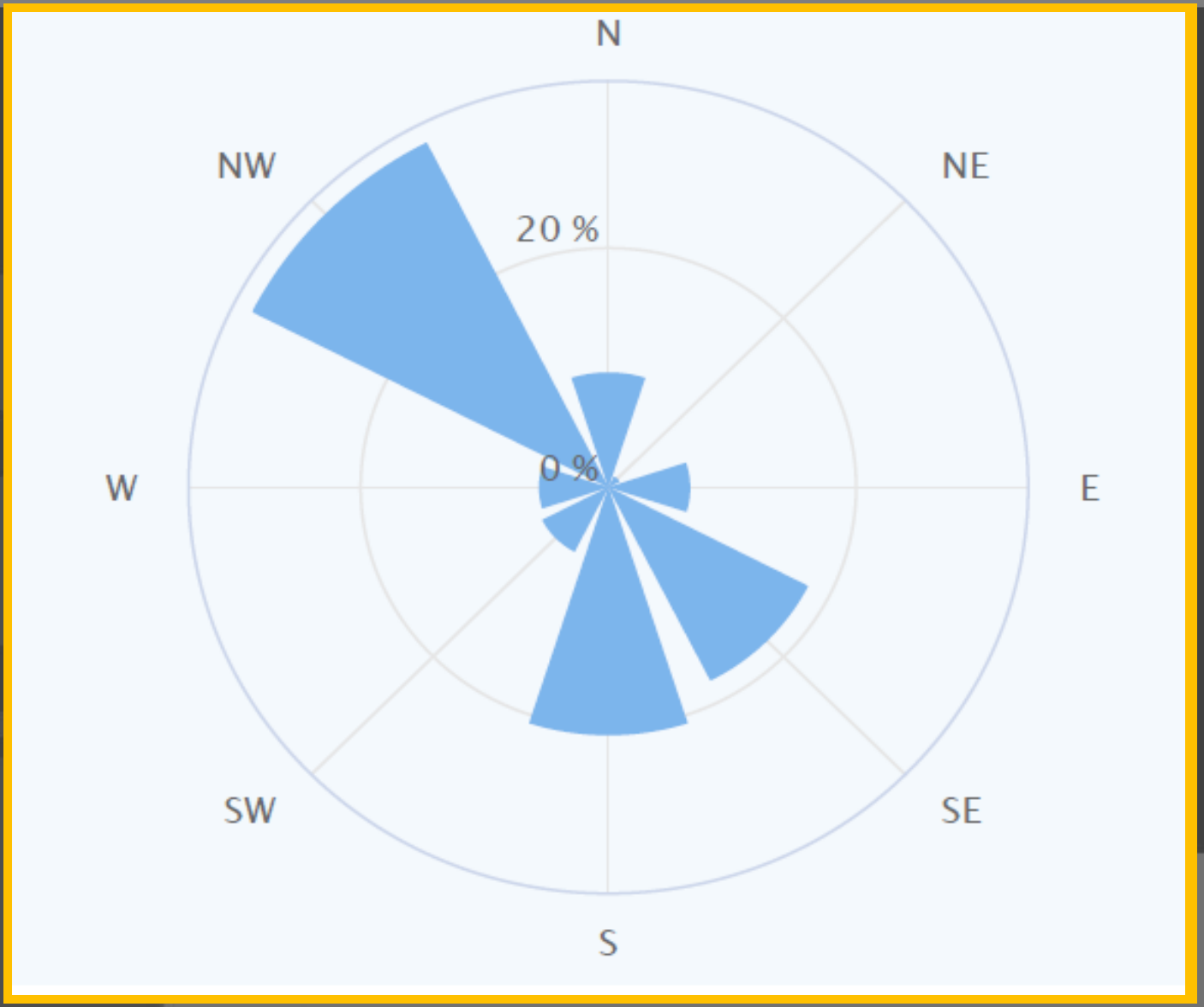
https://www.researchgate.net/publication/314389513_Toxic_Hot_Spots_in_Kazakhstan_Monitoring_Reports

https://www.researchgate.net/publication/314394820_Contaminated_sites_and_their_management_Case_studies_Kazakhstan_and_Armenia

Rustavi – sampling 2024

- In September 2024, a total of 44 environmental and food samples were collected in and around the city of Rustavi, including Tazakendi village
- 8 pooled egg samples (7 from free-range
- hens and 1 from a supermarket for reference),
- 12 fish samples (mostly pooled),
- 2 slag samples,
- 11 soil samples (including 7 collected at children's
- playgrounds)
- 4 sediment samples, and
- 5 road dust samples.

Rustavi - sampling



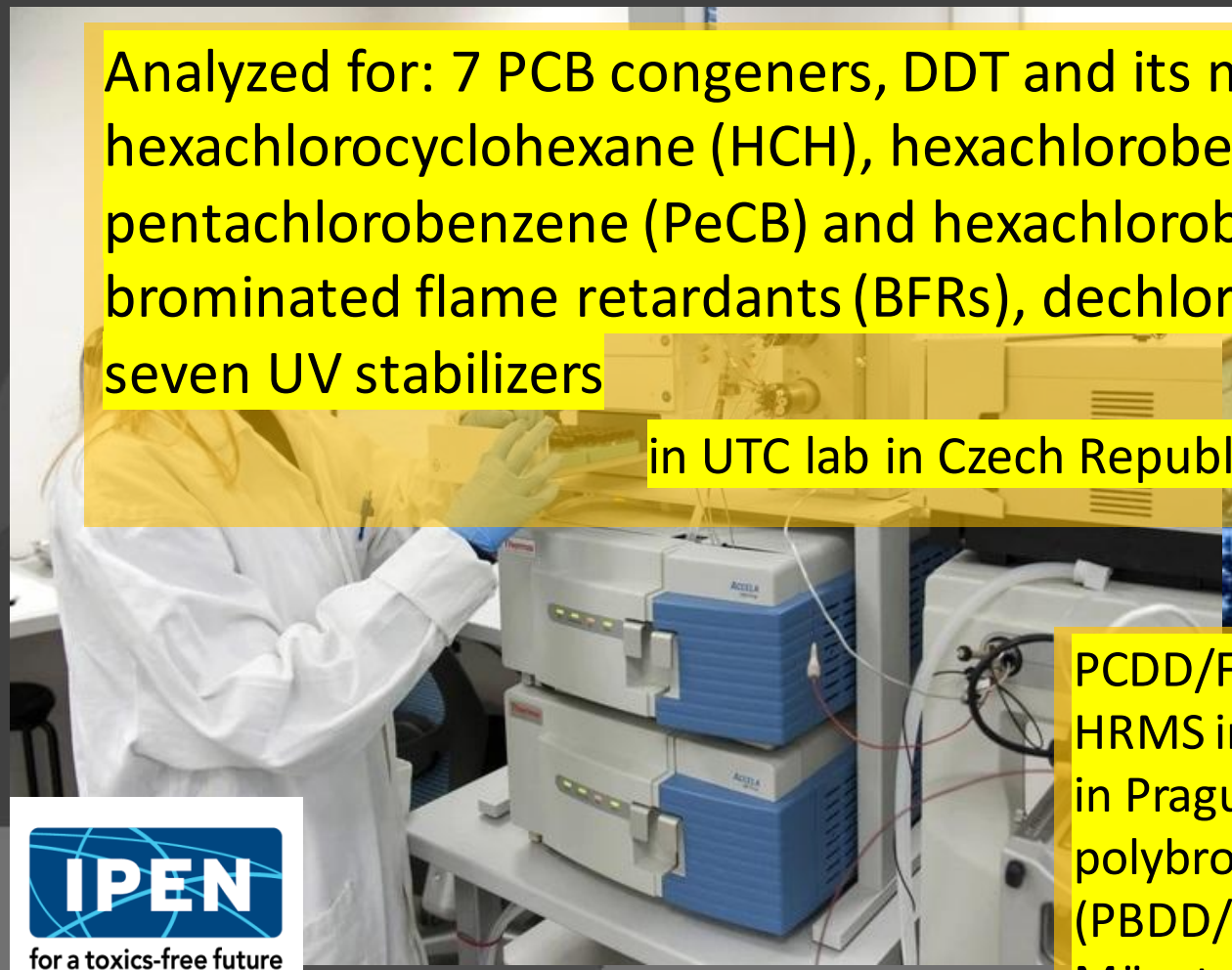
Rustavi - sampling

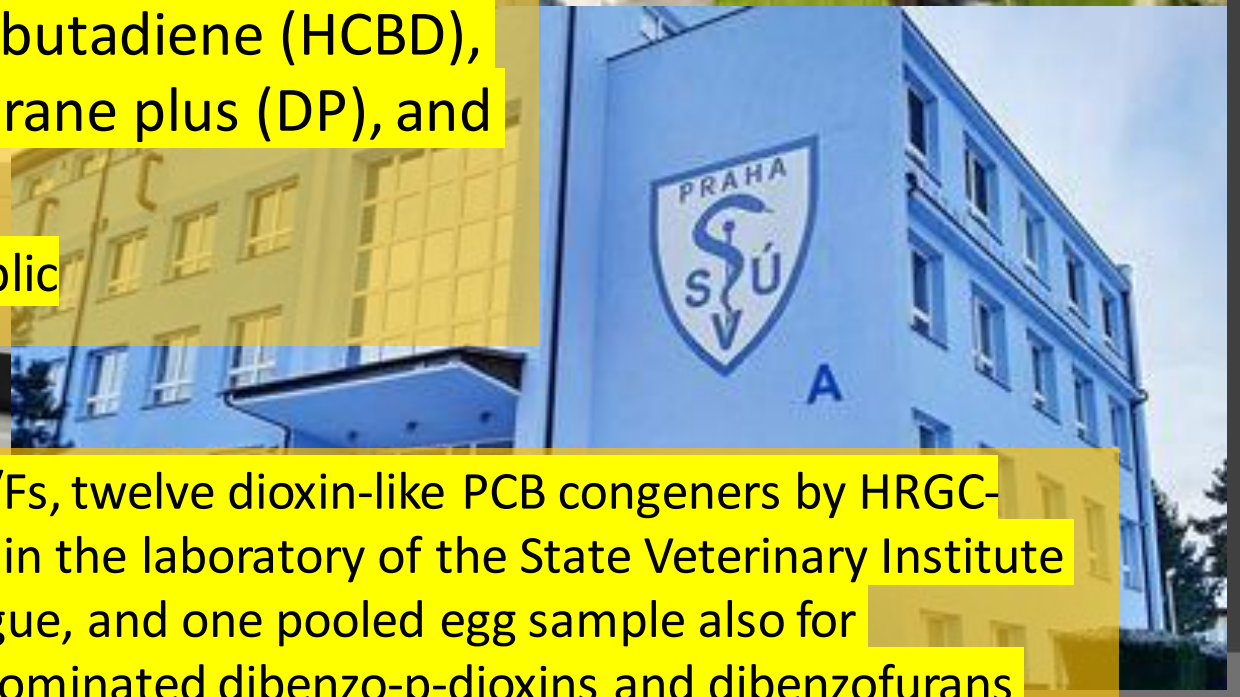
Udabno – reference (clean) site

Rustavi: POPs analyses

Analyzed for: 7 PCB congeners, DDT and its metabolites, hexachlorocyclohexane (HCH), hexachlorobenzene (HCB), pentachlorobenzene (PeCB) and hexachlorobutadiene (HCBD), brominated flame retardants (BFRs), dechlorane plus (DP), and seven UV stabilizers

in UTC lab in Czech Republic





PCDD/Fs, twelve dioxin-like PCB congeners by HRGC-HRMS in the laboratory of the State Veterinary Institute in Prague, and one pooled egg sample also for polybrominated dibenzo-p-dioxins and dibenzofurans (PBDD/Fs) by HRGC-HRMS in the MAS laboratory, Münster, Germany.

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POPs in Rustavi – results

TABLE 3.2: POPS IN SAMPLES OF SOIL FROM RUSTAVI'S PLAYGROUNDS (GE-RPG-1 – GE-RPG-6B) AND REFERENCE SITE IN UDABNO VILLAGE (GE-UPG-1). Levels are in ng/g dm. All samples had 100% od dry weight.

Sample ID	GE-RPG-1	GE-RPG-2	GE-RPG-3	GE-RPG-4	GE-RPG-5	GE-RPG-6A	GE-RPG-6B	GE-UPG-1
7 PCB	1.97	24.3	4.97	10.4	3.62	0.44	1.82	<0.02
PeCB	0.33	0.79	0.25	0.37	0.13	0.03	0.10	<0.02
HCB	0.31	0.22	0.15	0.28	0.48	0.08	0.13	0.02
HCBD	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Σ HCH	3.98	2.55	4.17	3.44	0.48	0.12	0.31	0.06
Σ DDT	1,087	280	776	265	340	3.85	9.67	0.31
p.p'-DDT/p.p'-DDE	0.86	0.28	0.46	0.65	0.49	NA	NA	0.17

POPs in Rustavi – results

TABLE 3.1: POPS IN SAMPLES OF SLAG AND SOIL FROM RUSTAVI AND TAZAKENDI, APPART FROM PLAYGROUNDS.
Levels are in ng/g dry matter (dm).

Sample ID	GE-RW-1	GE-RW-2	GE-RS-1	GE-RS-2	GE-RS-3	GE-RS-4
Location	Roadside slag heap	Slag heap withiin larger slag processing site	Area between metallurgi-cal facilities	Adjacent to apartment building with backyard poultry	Near the cement kiln	At the edge of Tazakendi
Sample type	slag	slag	soil	soil	soil	soil
Dry weight	100%	100%	100%	100%	100%	100%
7 PCB	9.4	45	459	11.3	9.2	510
6 PCB	7.1	43	345.18	8.83	6.8	500
PeCB	0.09	2.31	0.89	0.42	0.23	0.25
HCB	0.06	0.59	0.37	0.46	0.13	0.18
HCBD	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
∑ HCH	0.13	0.16	0.89	1.94	0.14	0.58
∑ DDT	0.91	1.5	7.6	235	1.2	3.3
p.p'-DDT/p.p'-DDE	0.75	0.03	0.04	3.47	0.38	0.36

POPs in Rustavi – results

LES OF SLAG AND SOIL FROM RUSTAVI AN
Levels are in ng/g dry matter (

GE-RW-2	GE-RS-1
Slag heap withiin larger slag processing site	Area between metallurgi-cal facilities
slag	soil
100%	100%
45	459

POPs in Rustavi

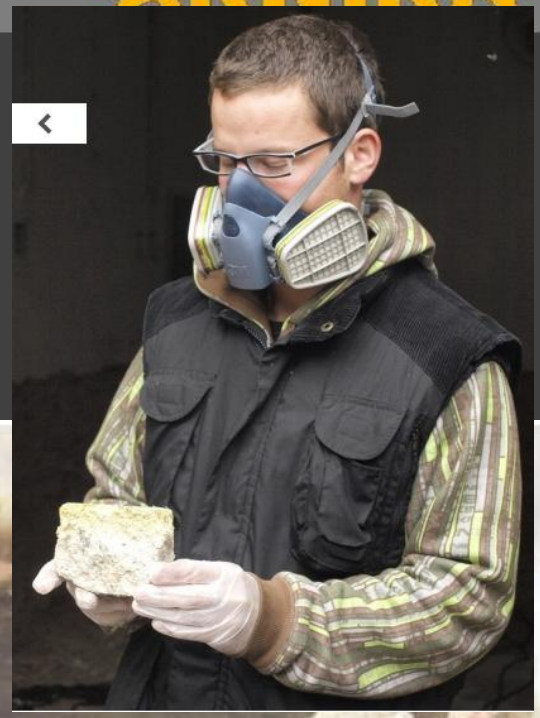
- **Environmental pollution hotspots identified:** Soil samples from playgrounds and other public spaces revealed dangerously high levels of DDT, PCBs and other pollutants, in some cases exceeding reference values by hundreds to thousands of times.
- **Industrial legacy and current sources impact multiple media:** The presence of multiple industrial chemicals in soil, eggs, and fish—including HCB, PCBs, and PCDD/Fs—confirms that both the industrial legacy and ongoing industrial activities in Rustavi continue to affect the environment and food chain.

POPs in Rustavi

- **Evidence of recent or ongoing use of DDT:** Elevated p,p'-DDT/p,p'-DDE ratios in both soil and biological samples suggest that illegal or uncontrolled use of DDT may still be occurring in the Rustavi area.

Klatovy, Czechia - Back and forth with justice

- 1994 – It is find out that the place is contaminated
- 1995 – Additional analysis shows high contamination by different pesticides
- 1996 – 2003: Lawsuit is filed against agrochemical enterprise and long fight for justice has started
- **2003** – Arnika made an **analysis of eggs** (high concentration of DDT, DDE),
- 2006 - Inger Schörling visited the farm
- **2007** – **Analysis of fish** from a close by river
  Comprehensive study by Arnika
  Petition



Klatovy, Czechia - Happy ending

- 2008 – Risk analysis and testing by Dekonta
- **2010** – Grant through the Ministry of Environment and DECONTAMINATION by Dekonta
  (total cost of 380 000 euro,
  266 000 euro covered by the EU grant)
- almost 16 years
  (7 years since Arnika joined)

Uruguay 2005

Picture 1: ANCAP Cement plant

KEEP THE PROMISE
ELIMINATE POPs

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http://www.redes.uy
http://www.chasque.net/rapaluy

Prepared by Dioxin, PCBs and Waste Working Group of the International POPs Elimination Network (IPEN) Secretariat, REDES-AT (Uruguay), RAPAL (Uruguay) and Arnika Association (Czech Republic)

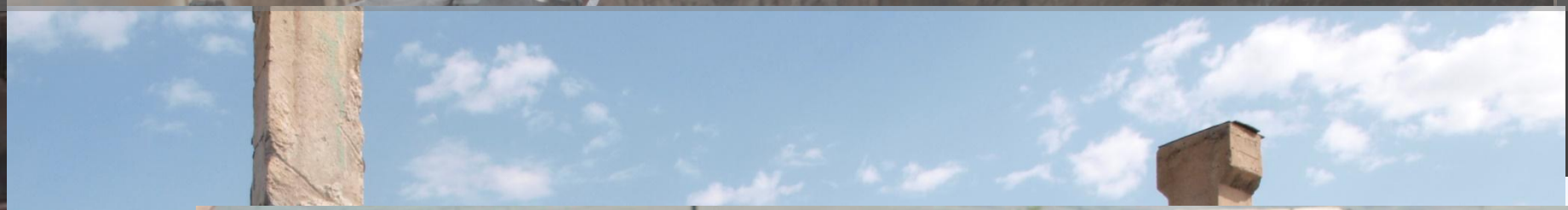
IPEN

Contamination of chicken eggs near the cement kilns in Minas, Uruguay by dioxins, PCBs and hexachlorobenzene

https://www.researchgate.net/publication/324132807_Contamination_of_chicken_eggs_near_the_cement_kilns_in_Minas_Uruguay_by_dioxins_PCBs_and_hexachlorobenzene

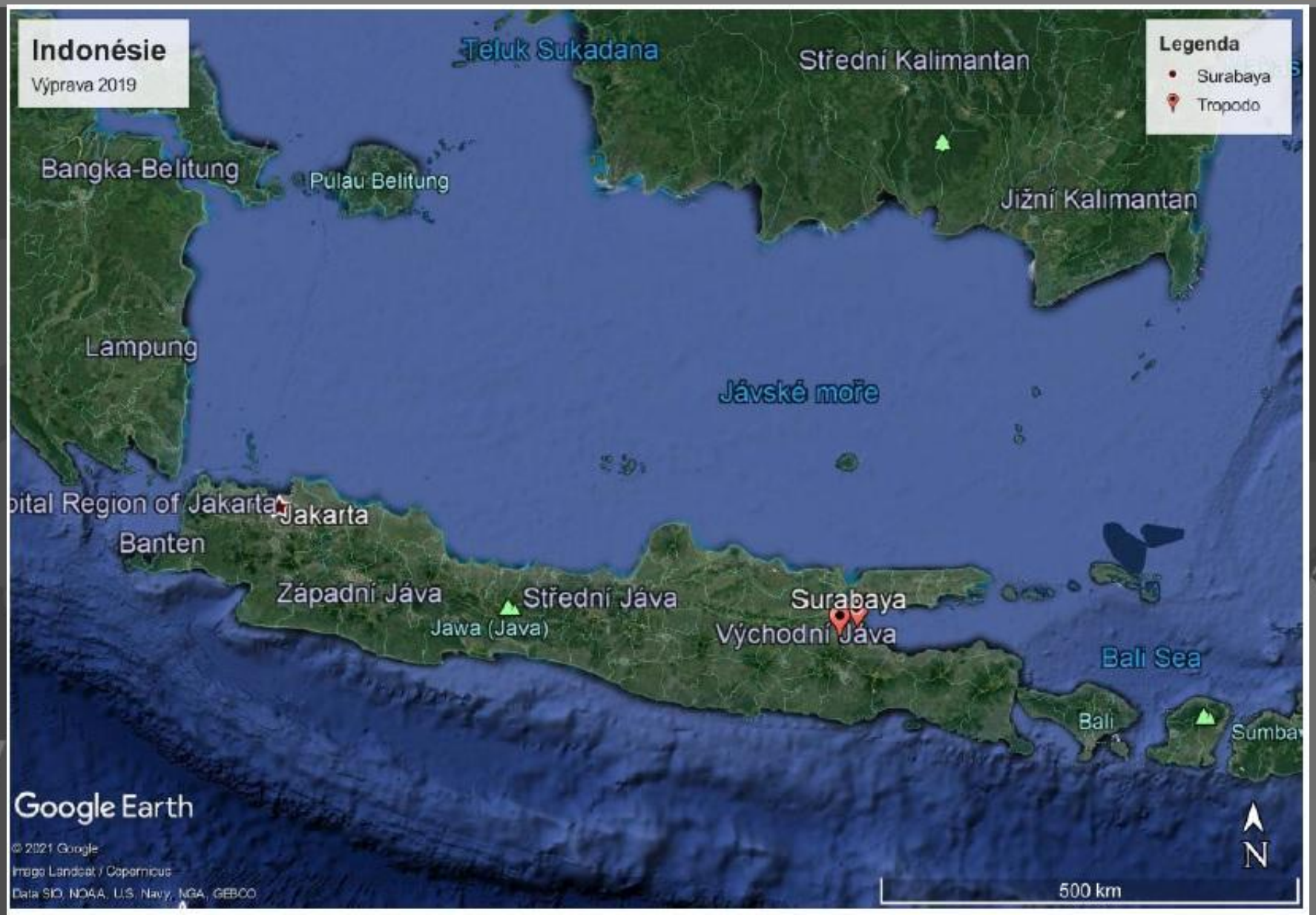
Armenia 2010 - 2011

Armenia 2018 - 2025

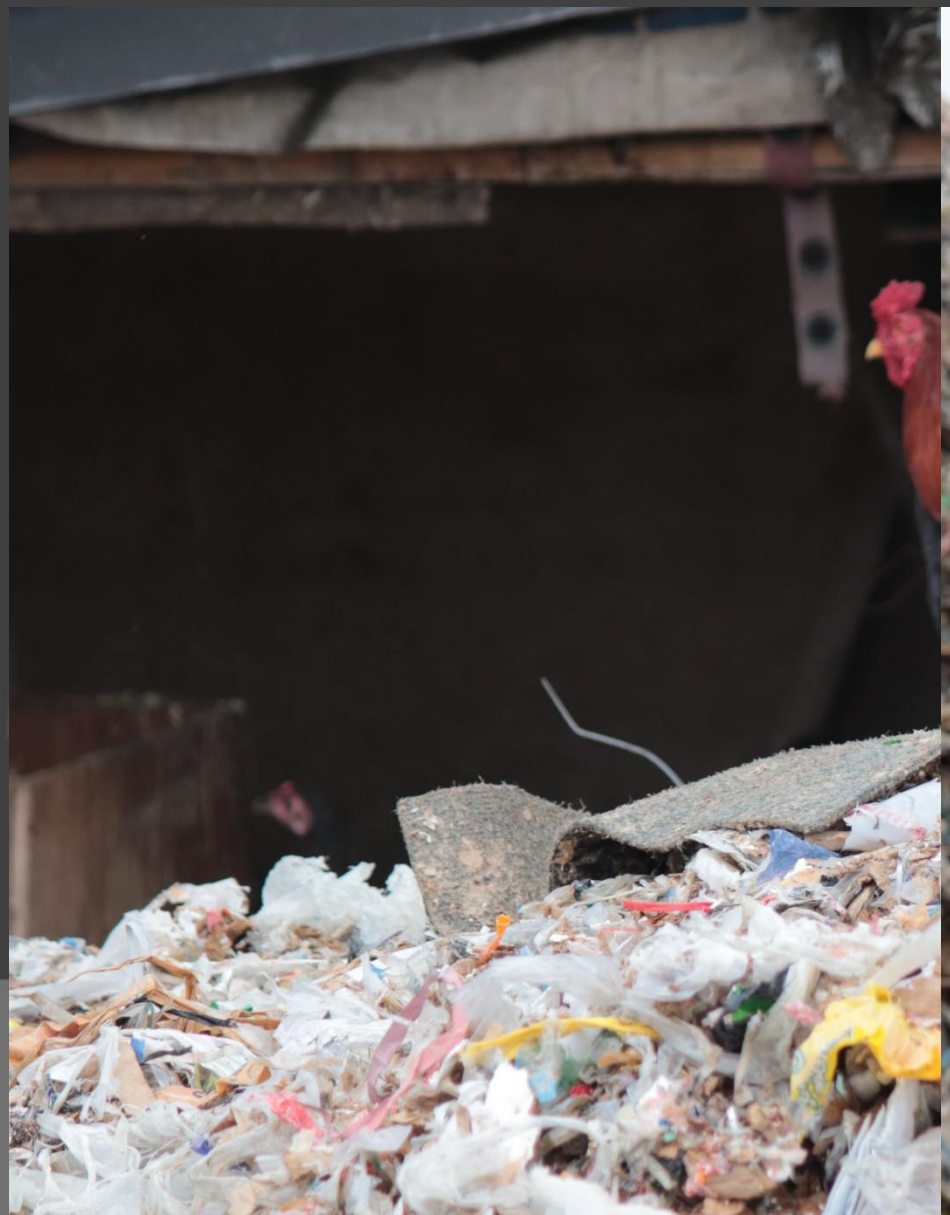


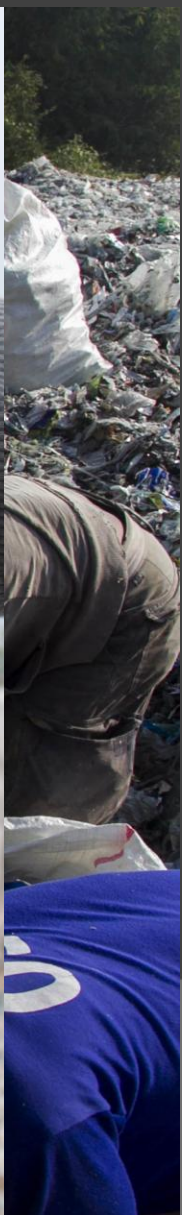
https://www.researchgate.net/publication/326369754_Toxic_Hot_Spots_in_Armenia

Indonesia 2019



Indonesia 2019





NIKA

https://www.researchgate.net/publication/348751747_Toxic_Hot_Spots_in_Java_and_Persistent_Organic_Pollutants_POPs_in_Eggs

Proposal for listing brominated dioxins (PBDD/Fs) under the Stockholm Convention

https://www.researchgate.net/publication/329178115_Toxic_Soup_Dioxins_in_Plastic_Toys

TOXICSOUP

Exemptions for PBDEs recycling in waste Limits for PBDEs in recycled products

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journal homepage: www.elsevier.com/locate/chemosphere

Detection of high PBDD/Fs levels and dioxin-like activity in toys using a combination of GC-HRMS, rat-based and human-based DR CALUX® reporter gene assays

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[e] IPEN, Gothenburg, Sweden

HIGHLIGHTS

- We determined DR CALUX and DR_{human} CALUX REP values for PBDD/Fs.
- In sampled plastic toys, we measured high levels of PBDD/Fs using GC-HRMS.
- GC-HRMS-based TEQ calculated using PCDD/F TEF were up to 3821 pg TEQ/g.
- Bioassay equivalents up to 2550 pg TEQ/g were measured by DR CALUX® bioassays.

https://www.researchgate.net/publication/348734545_The_map_Selected_POPs_waste_Hot_Spots_around_the_World_-_1_40_000_000

SCAN ME

2009

Selected POPs waste „Hot Spots" around the World

Solution(s) : Remediation technologies

Super Critical Water Oxidation

Gas Phase Chemical Reduction

Indirect Thermal Desorption

Thank you

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