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# HUMAN EXPOSURE AND RISK ASSESSMENT OF PESTICIDES

KATARÍNA ŘIHÁČKOVÁ, PAVEL ČUPR  
HAZMAT PROTECT 2018

## **PESTICIDES - DEFINITION**

„The term “pesticides” is commonly used as a synonym for plant protection products. However, pesticides is a **broader term** that **also covers products such as biocides**, which are intended for non-plant uses to control pests and disease carriers such as insects, rats and mice...“ ([EFSA](#))

**Pesticides** (plant protection products): Chemical compounds used to protect crops by killing or controlling pests or weeds.

**Active substances**: such as chemicals or micro-organisms, are the essential ingredients in the pesticide that cause the effect of the product.

## PESTICIDES EU

- Almost 1400 chemical compounds (active substances), bacteria strains and viruses
- Out of which almost 500 currently approved for use ([Regulation \(EC\) No 1107/2009](#))
- [EFSA](#) (European Food Safety Authority): Advisory function
- [EU COMMISSION](#) (see [EU pesticides database](#)): Decisive function

## ACTIVE SUBSTANCES APPROVAL IN THE EU

Rapourter member state assesses the Dossier and prepares Draft assessment report (DAR) or Renewal Assessment Report

EC and member states decide about approval of the active substance

Company submits application (Dossier) for a new active substance or an active substance that needs to be re-evaluated (Regulation (EU) 544/2011 – data requirements)

EFSA peer reviews the DAR/RARand submits the Review report to the European Commission (EC)

More details of the process

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## PESTICIDES APPROVAL IN THE EU

EU member state assess the application, proposes maximum residue level (MRL)\*.

Company applies to put the product containing the approved active substance on the market.

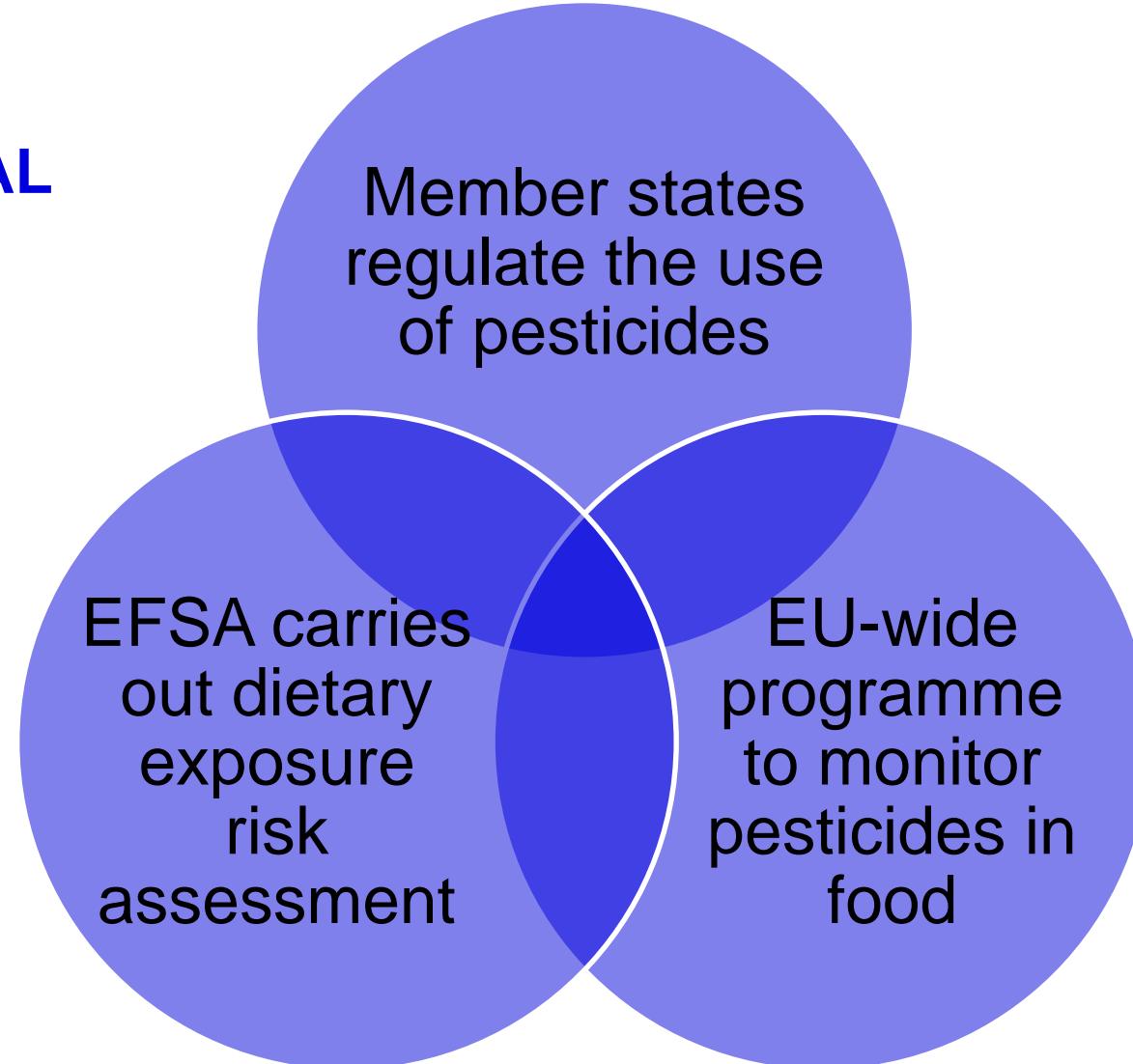
If MRL not covered by legislation – EFSA assesses the proposed MRL.

EC decides and if approved, company brings the product on the market.

\* Upper level of a pesticide residue allowed in food/feed

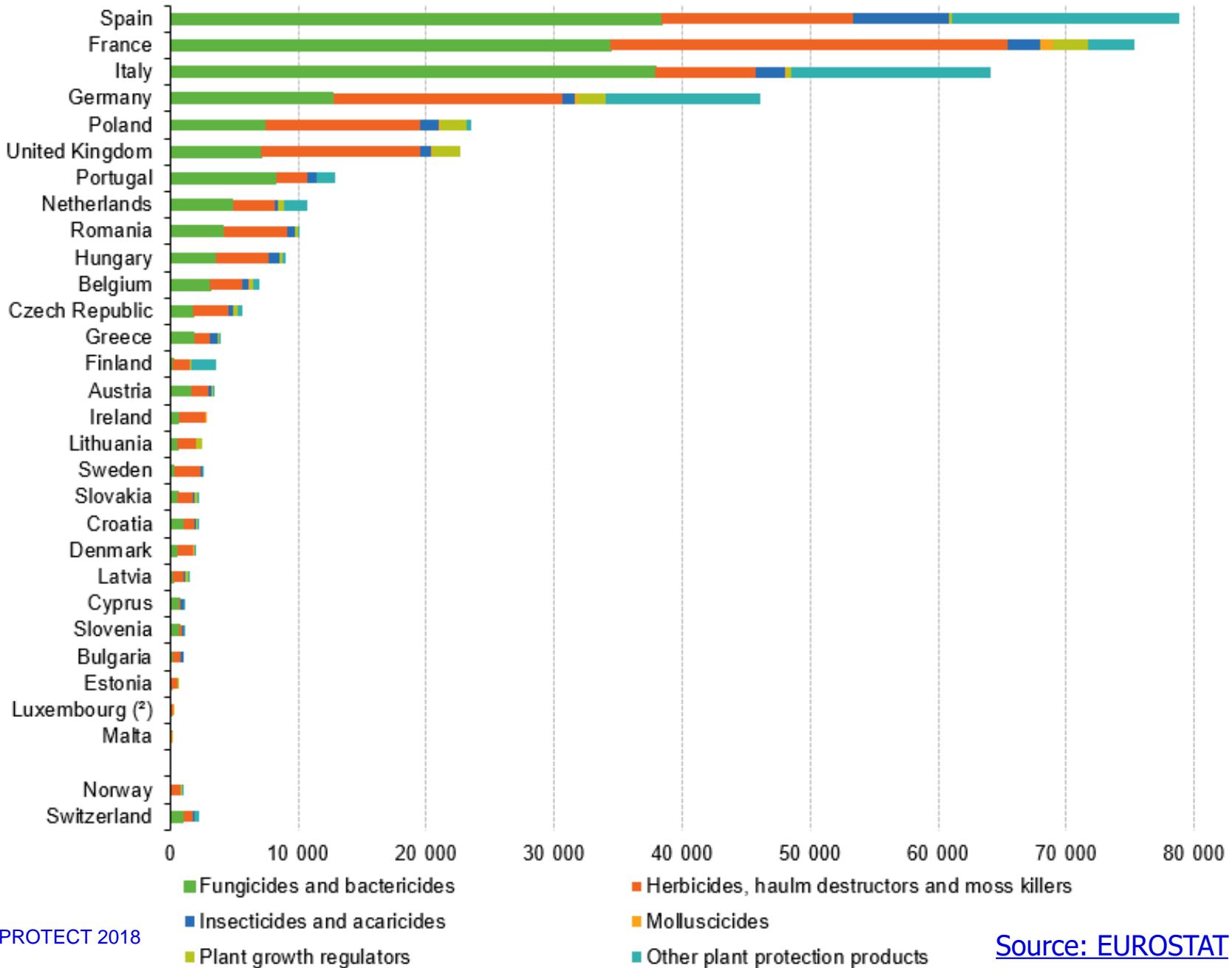
**Regulation (EC) No 396/2005 on MRLs** <sup>5</sup>

## AFTER APPROVAL



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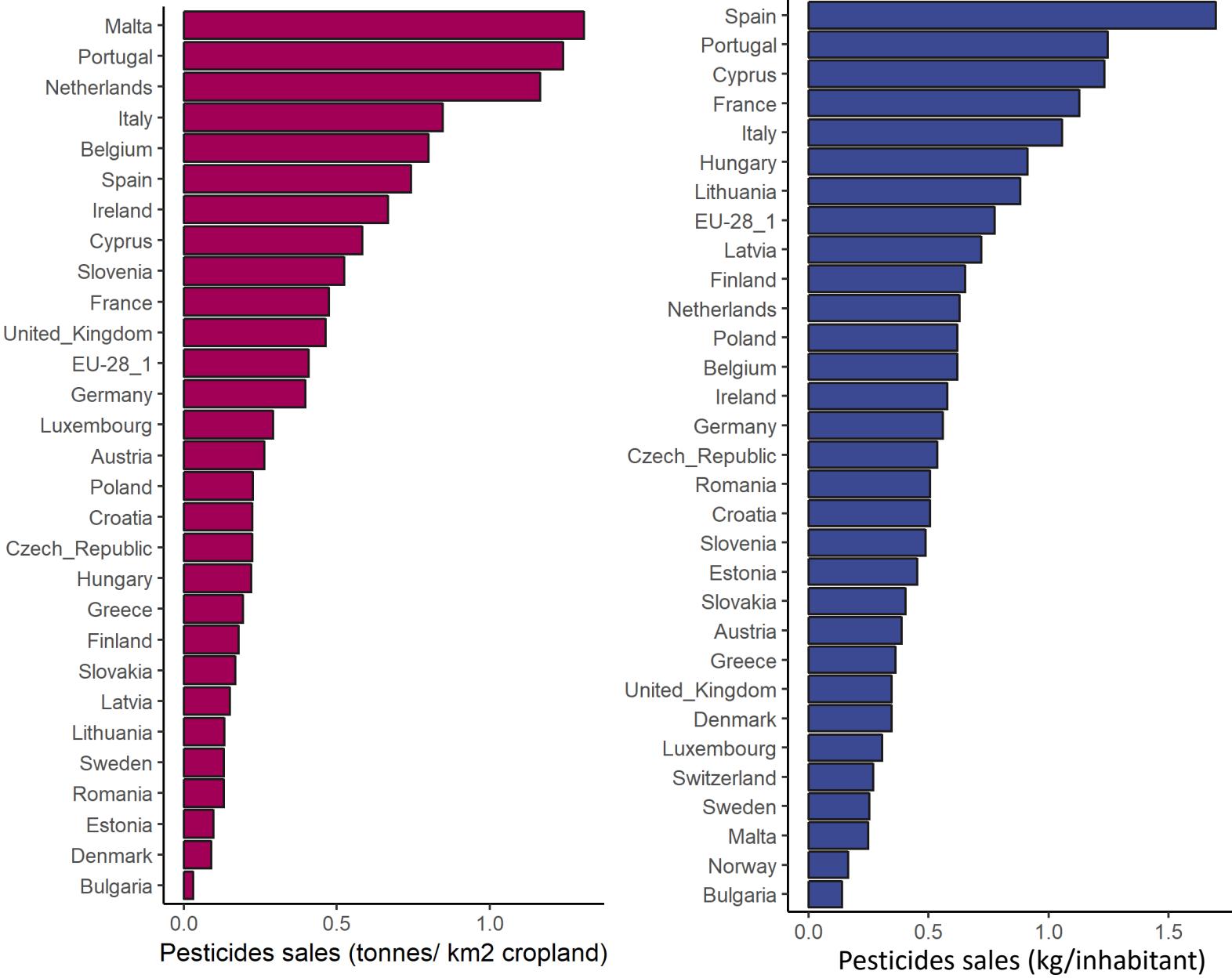
## PESTICIDES SALES 2014 (Tonnes of active substances)



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## PESTICIDES SALES Amount of active substances)

EU 28 +  
Switzerland  
Norway



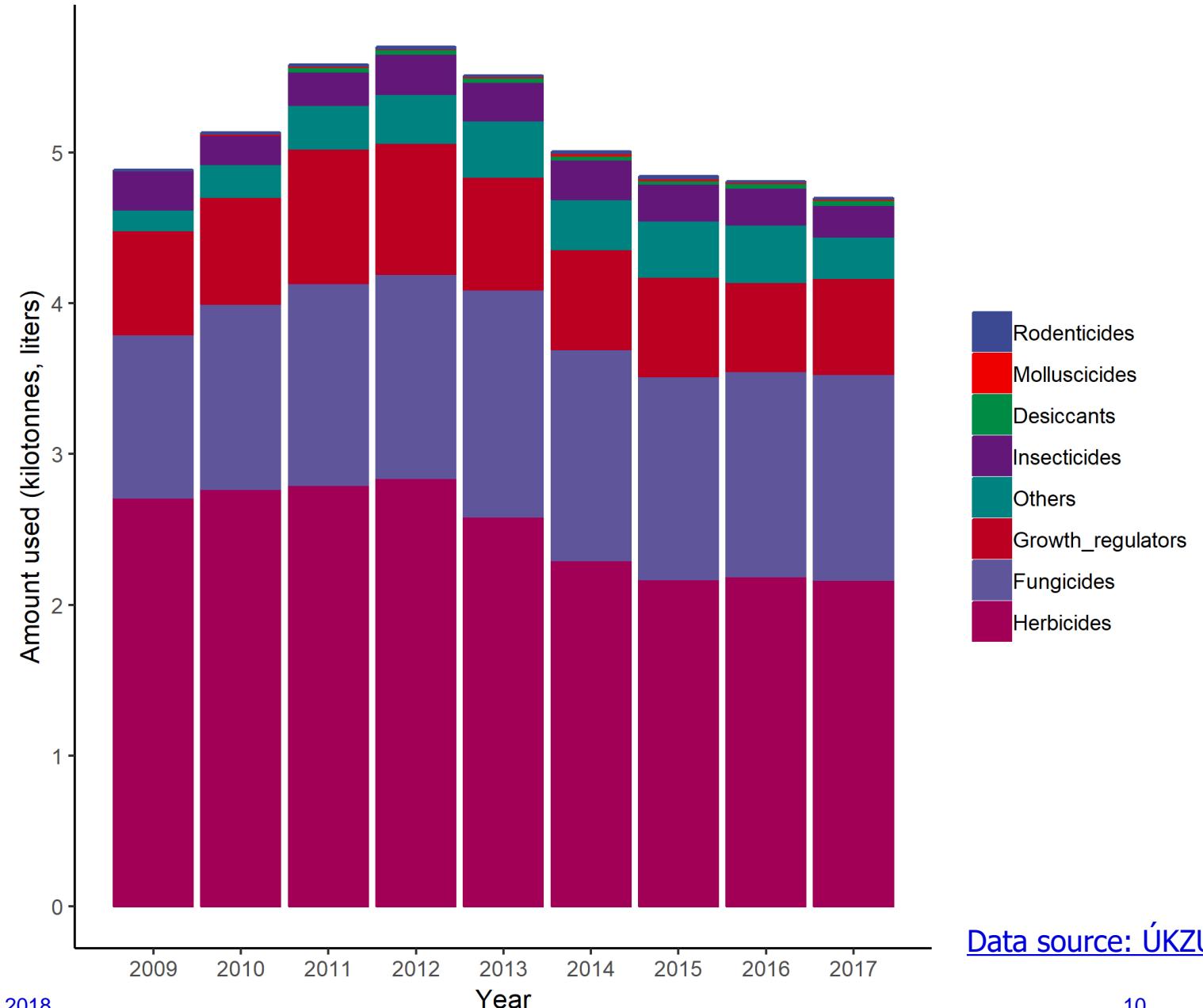
## PESTICIDES IN THE CZECH REPUBLIC

- Ústřední kontrolní a zkušební ústav zemědělský  
(ÚKZÚZ, Central Institute for Supervising and Testing in Agriculture)
  - Record on the use (1997 – now)
  - List of registered plant protection products (PPPs)
  - Evaluation of Environmental Fate, Ecotoxicology, Physico-chemical properties
- Státní zdravotní ústav (SZÚ, The National Institute of Public Health (NIPH))
  - Evaluation of human exposure, reference values and health risks

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## USE IN THE CZECH REPUBLIC IN 2009 - 2017

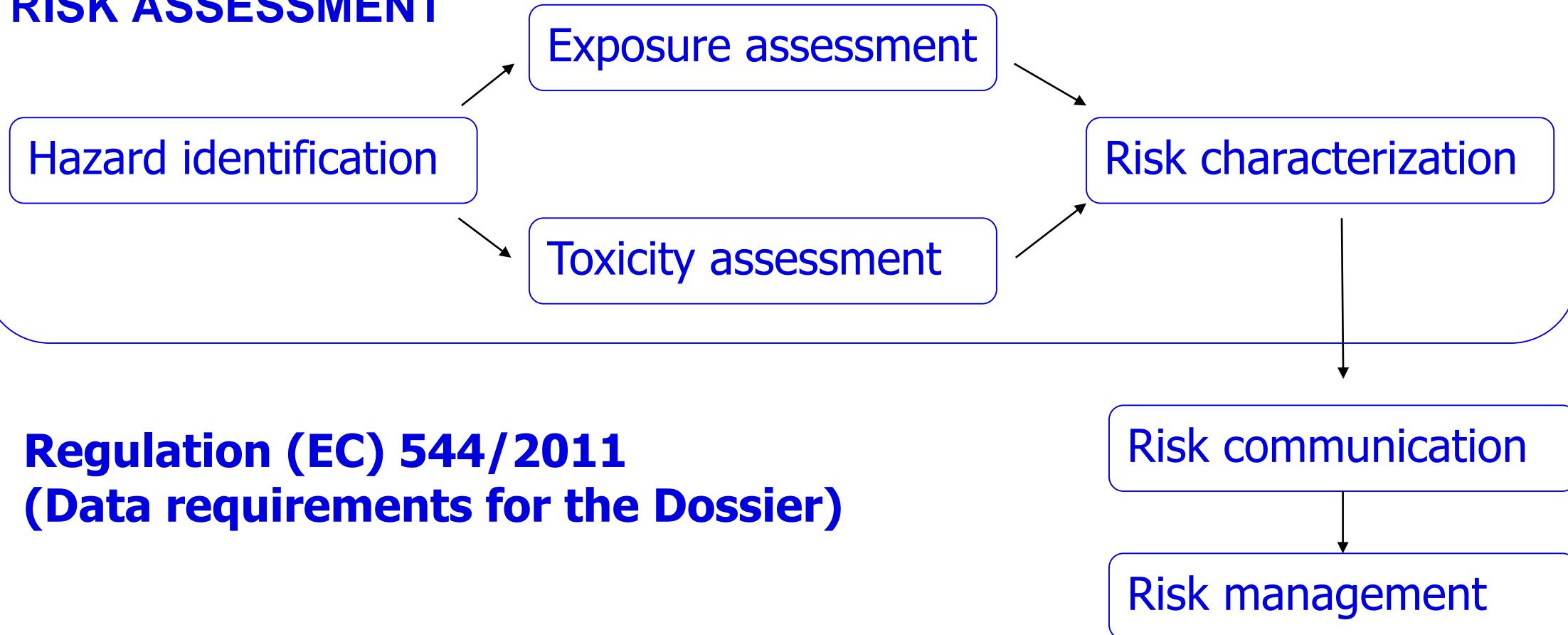
**Kilotonnes,  
kiloliters  
of active substances**



## **PESTICIDES – DEFINITION BY THE PURPOSE OF THEIR USE**

- Pesticides – the compounds belong to this group because of the purpose of their use. But there is great variety of physico-chemical properties, effects, application, fate
- Assessment of individual compounds vs. mixtures in the environment

## RISK ASSESSMENT



**Regulation (EC) 544/2011  
(Data requirements for the Dossier)**

## PESTICIDES EVALUATION –

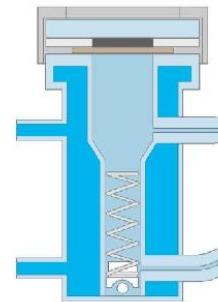
- EFSA TOOLS
  - PRIMo – Pesticide Residue Intake Model
  - FOCUS simulation models and FOCUS scenarios
  - Calculation tool annexed to the guidance document on non-dietary exposure to pesticides
  - Calculation tool annexed to the guidance on dermal absorption
  - Calculation tool annexed to the guidance on risk assessment of plant protection products on bees
- Merlin Expo (exposure assessment software)
- RECETOX: Combination of in vitro/ ex vivo studies + PBPK modelling

## BUT WHAT ABOUT

- Exposure to mixtures
- Exposure via contaminated environmental matrices
- New forms of pesticides (nanopesticides?)
- Internal levels in populations and related health outcomes
- Effects of long-term chronic exposure
- Development of new protective equipments, application tools, etc.

**Bányiová et al. 2016:** New experimental data  
on the human dermal absorption of Simazine and Carbendazim  
help to refine the assessment of human exposure

Human skin ex vivo  
+  
Aqueous solution  
of pesticides  
in donor chamber  
+  
PBS with BSA  
in receptor chamber

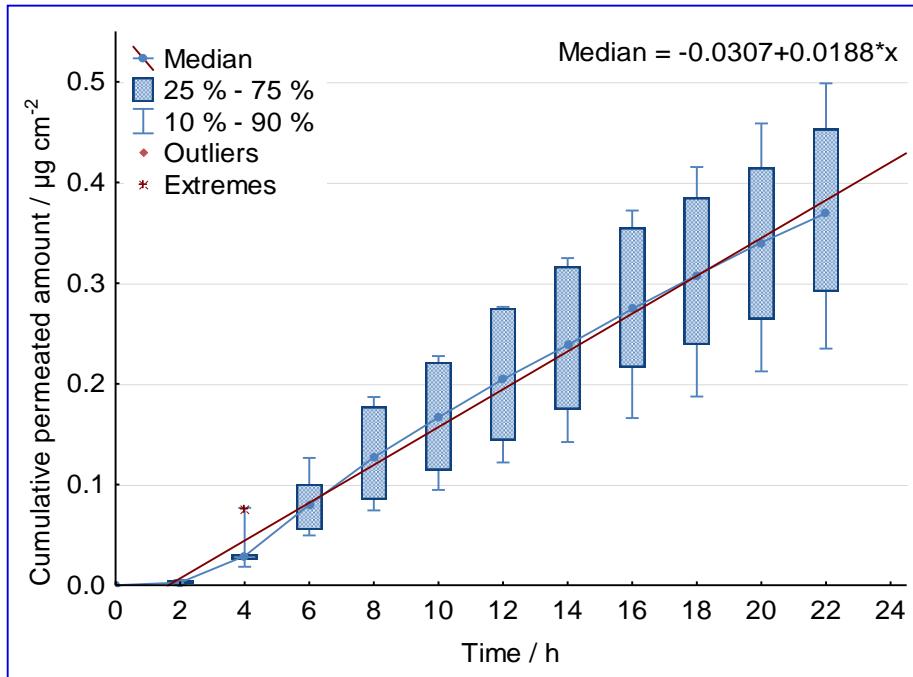


Automatic system  
of diffusion cells  
by Hanson Research

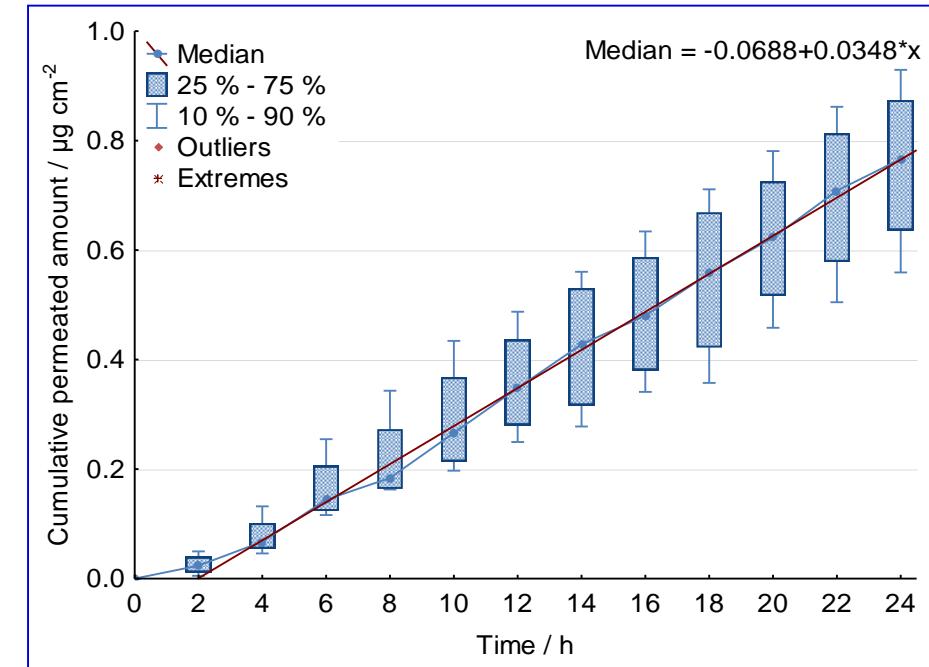


Determination  
of absorption  
kinetic parameters:  
 $K_p$   
 $\text{lagT}$   
 $J_{ss}$

## Carbendazim



## Simazine



## EXPOSURE WHEN SWIMMING IN CONTAMINATED WATER

CONCENTRATIONS  
IN CZECH WATERS  
(IS ARROW)

+

EXPERIMENTALLY  
DEFINED PARAMETERS  
ON DERMAL ABSORPTION

### US EPA (2011) EXPOSURE EQUATIONS

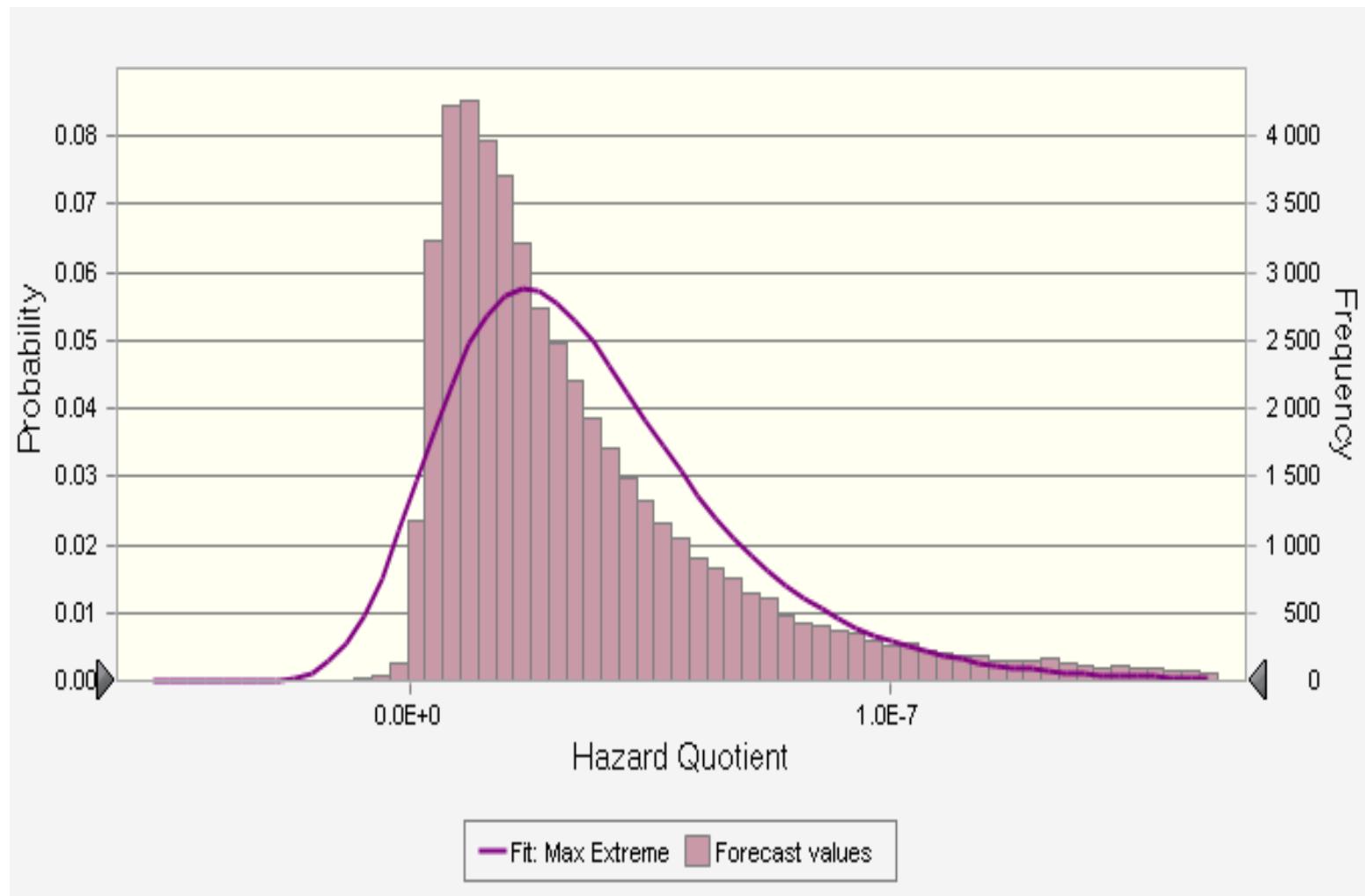
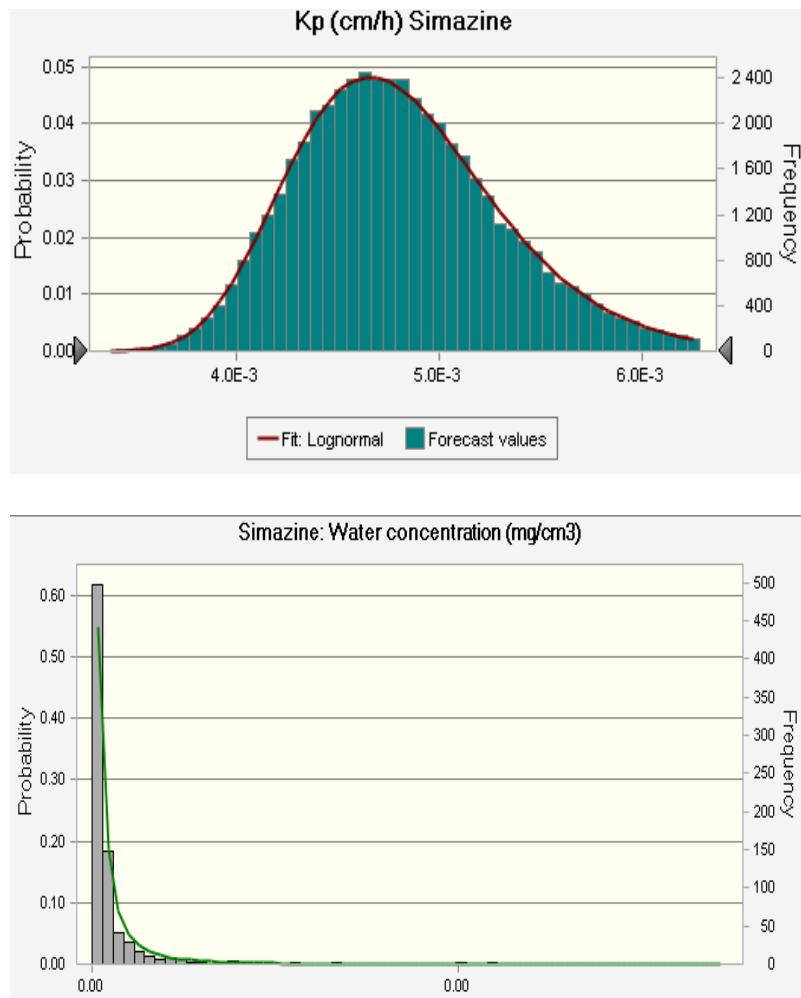
$$DAD = \frac{DA_{event} \times EV \times ED \times EF \times SA}{BW \times AT}$$

Here the Kp &  
lagT are used

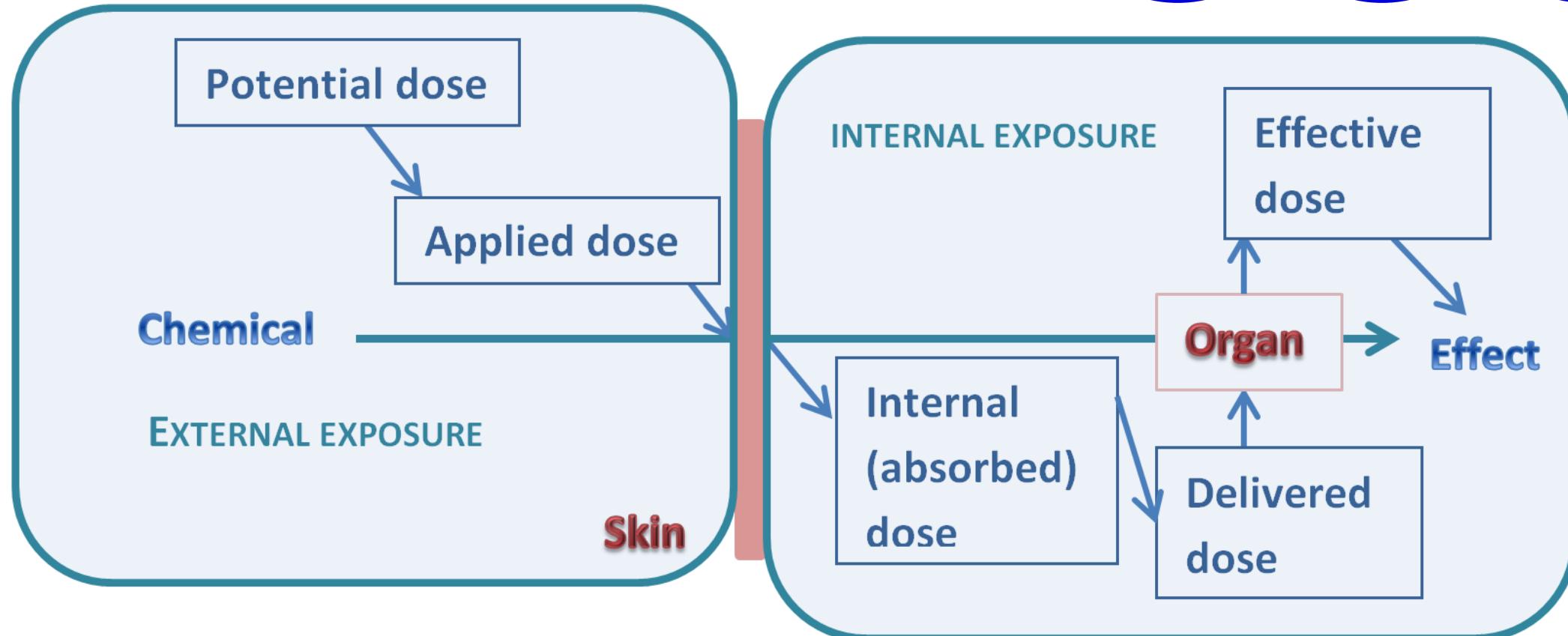
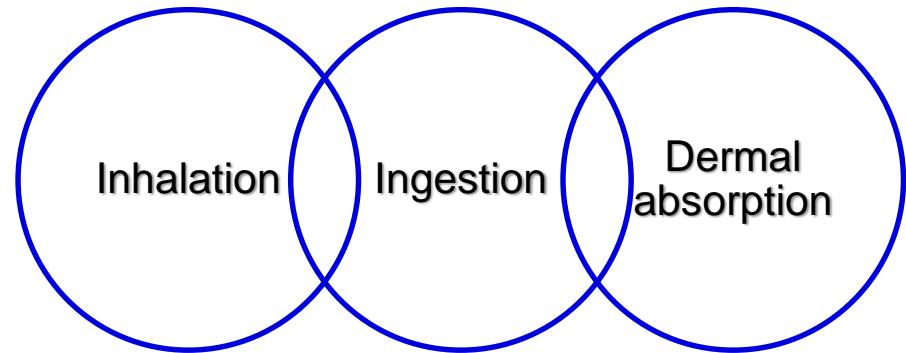
CALCULATION OF  
HAZARD QUOTIENTS FOR  
WORST-CASE  
EXPOSURE SCENARIOS:  
HQ = DAD/RfD

PROBABILISTIC  
APPROACH

## SIMAZINE

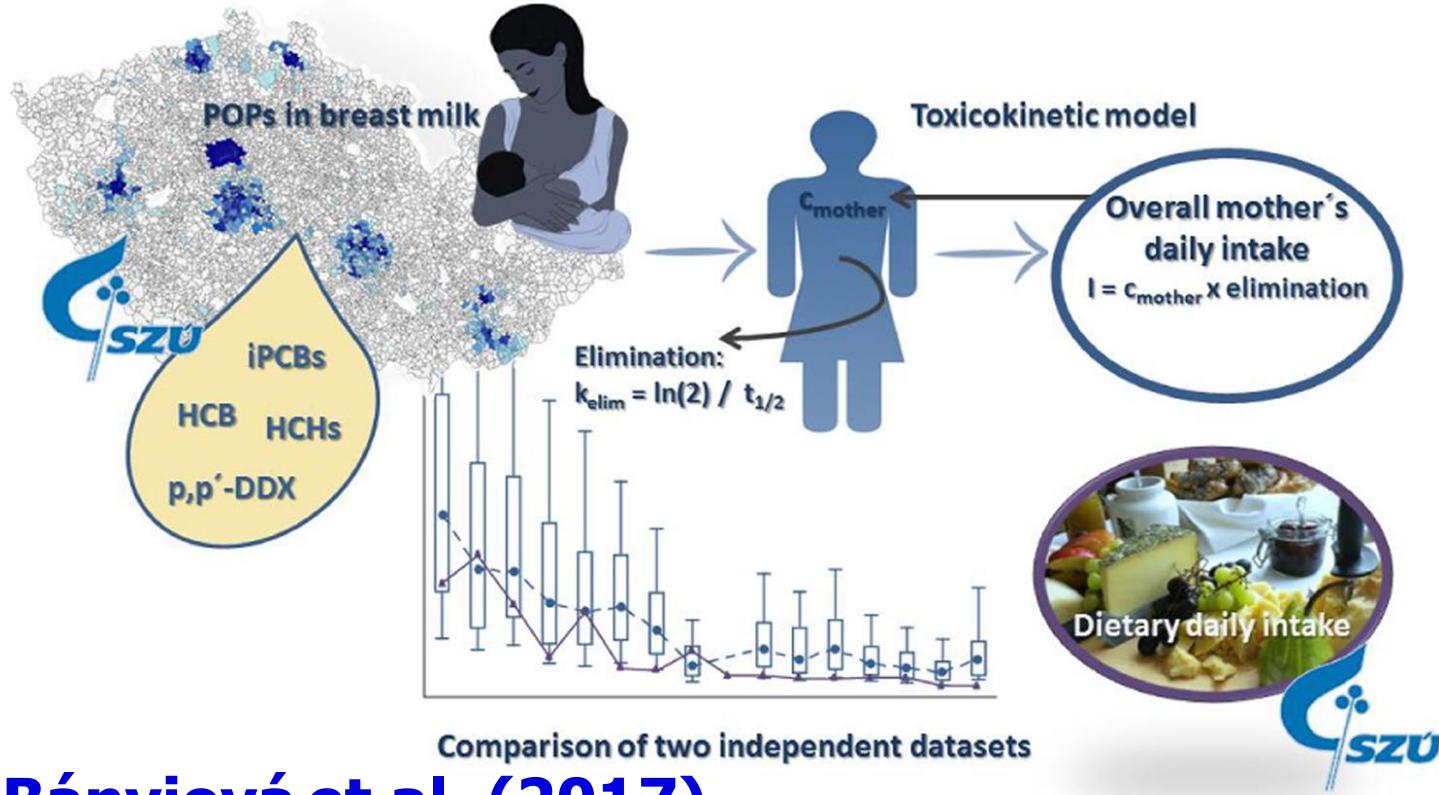


## EXTERNAL AND INTERNAL EXPOSURE

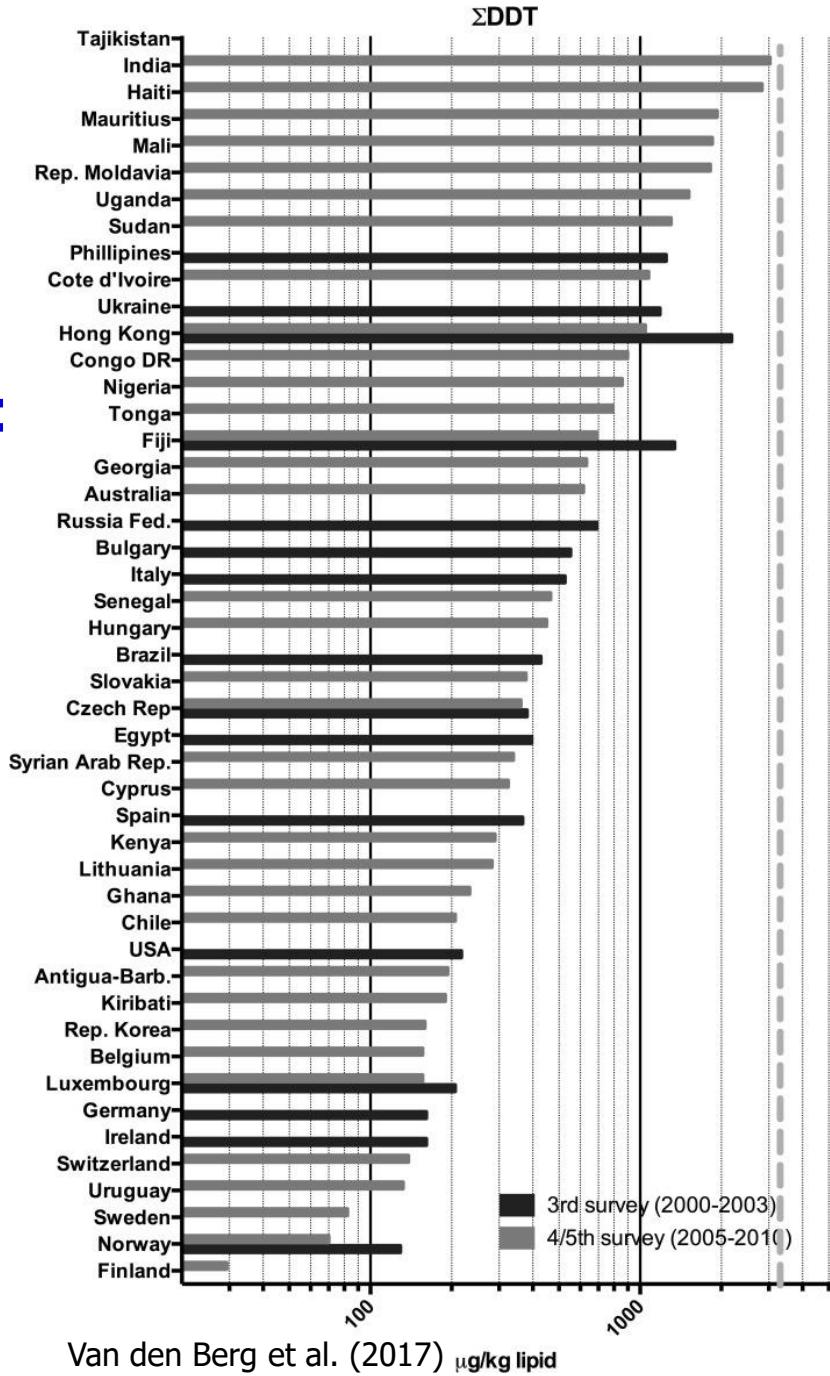


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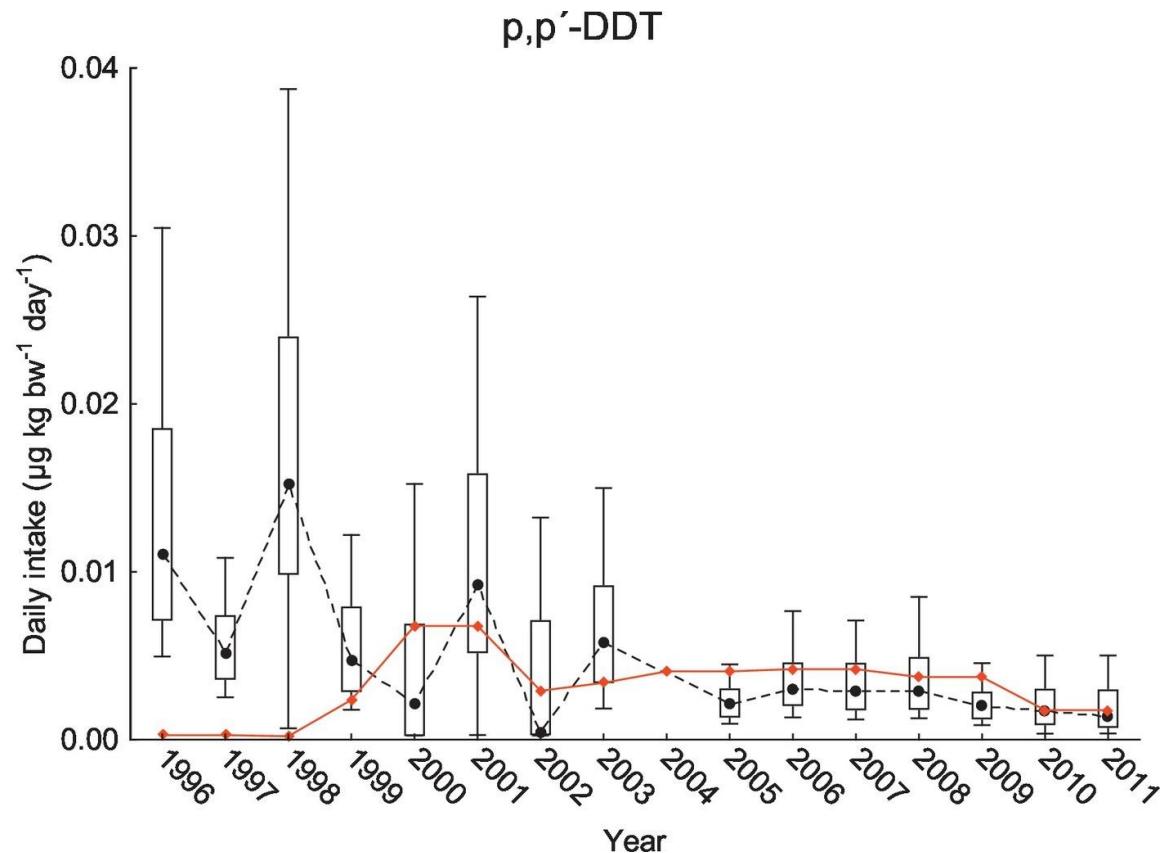
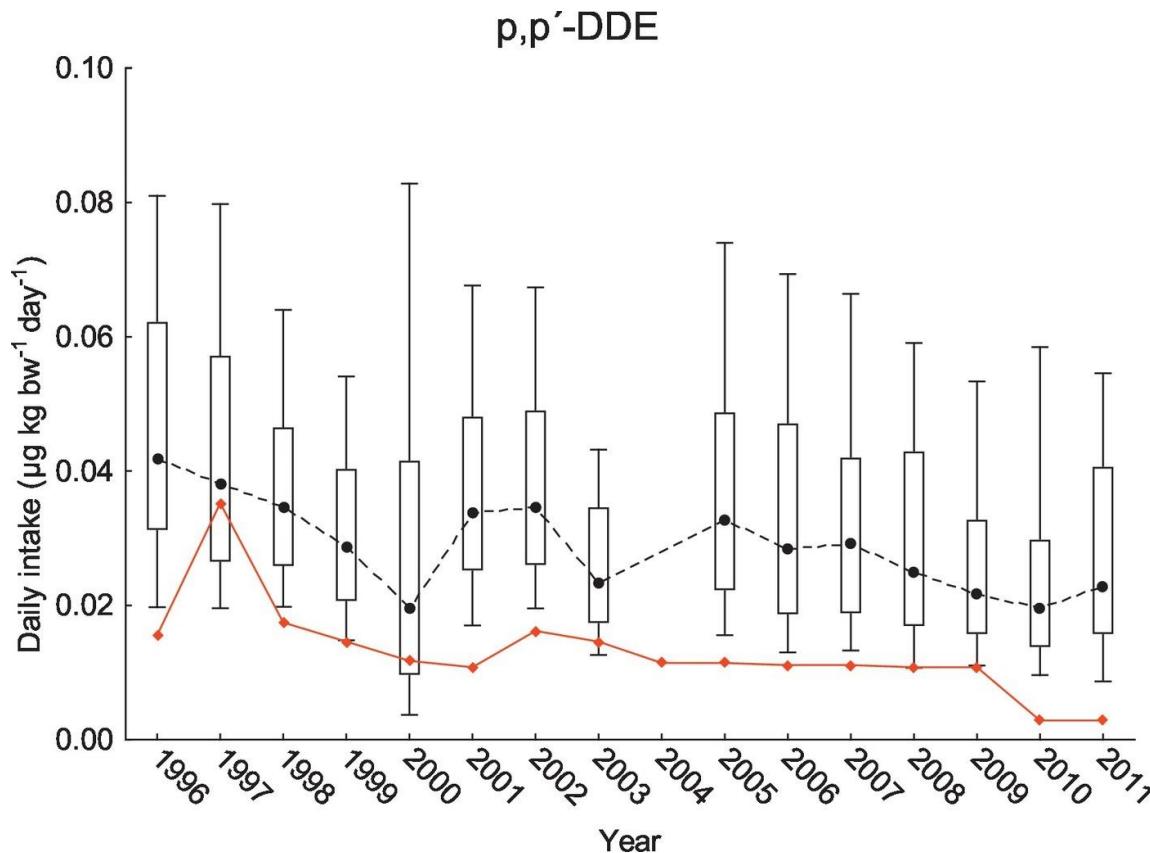
## MODELLING OF INTAKE OF POPs (INCL. OCPs) FROM THE DATA OF BREAST MILK MONITORING:



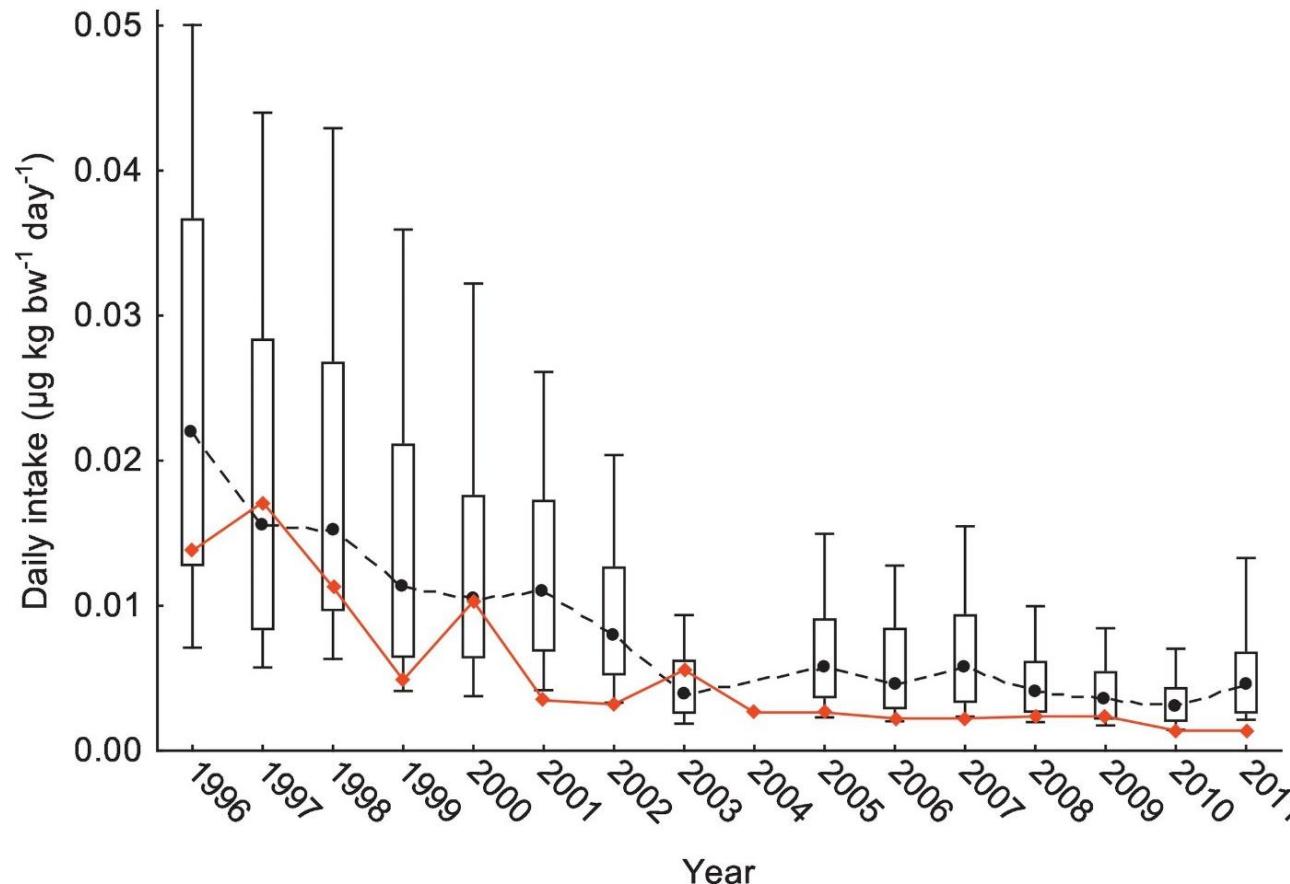
**Bányiová et al. (2017)**



- - - - Intake calculated from breast milk levels using TK model  
— Intake from food



- - - - Intake calculated from breast milk levels using TK model  
— Intake from food



## HUMAN BIOMONITORING

### - A USEFUL TOOL TO EXPOSURE BIOMARKERS MONITORING

- Measurement of internal exposure biomarkers in human serum, urine, etc.
- Monitoring of mixtures



- HBM4EU: Pesticides are on the list of project priority substances
- Possible assessment of mixtures, comparison among countries, population subgroups.

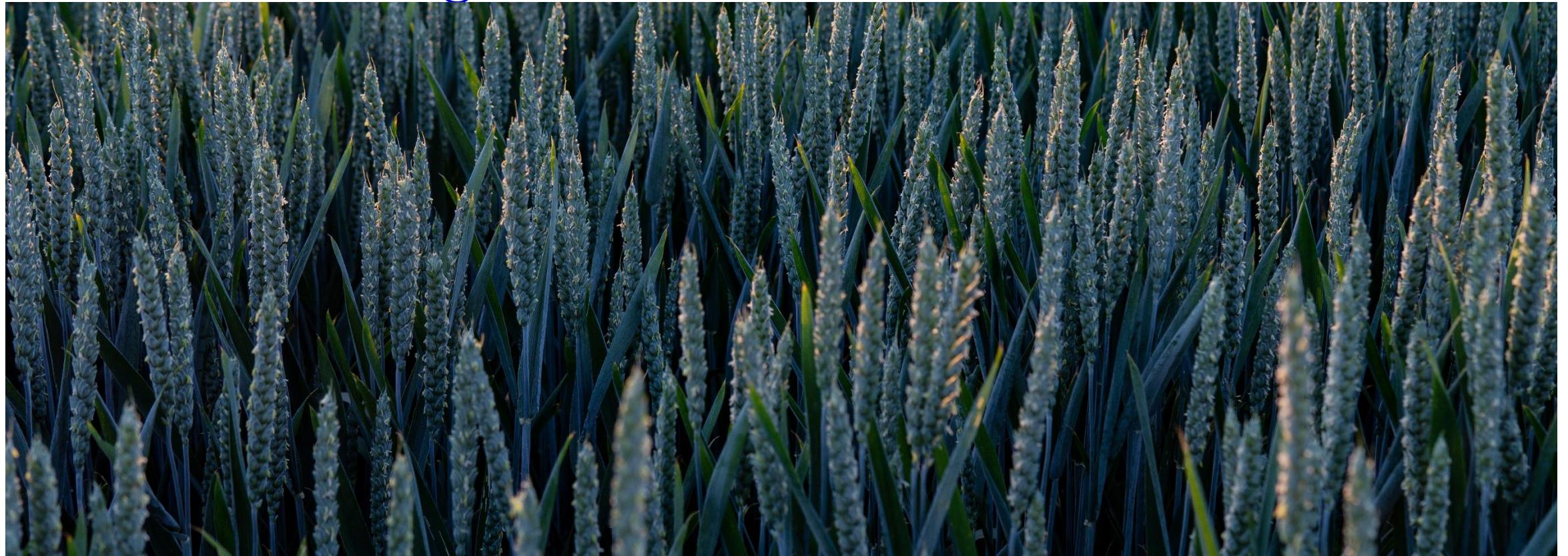
## CONCLUSIONS

- Pesticides is group of compounds that vary in their properties and effect
- Almost 500 active substances are approved for the use in the EU
- In EU, complex approval process (EFSA and EC) but some issues are not addressed (like exposure to mixtures of pesticides)
- Human biomonitoring seems to be promising tool to assess the mixtures of pesticides, their effects, differences among countries, population subgroups, etc.

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**THANK YOU**

Katarína Řiháčková: [rihackova@recetox.muni.cz](mailto:rihackova@recetox.muni.cz)



## OTHER USEFULL SOURCES OF INFORMATION

- [Scientific risk assessment of pesticides in the European Union \(EU\):EFSA contribution to on-going reflections by the EC](#)
- [Pesticides properties database: PPDB](#)
- [Stockholm Convention](#): more information about restrictions of organochlorine pesticides, endosulfane etc.