NEW SYSTEM OF LIMIT VALUES FOR THE ASSESSMENT OF SOIL POLLUTION IN THE CZECH REPUBLIC

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SK EU2016

1994 - First legislative measure for assessment of soil pollution – Decree No. 13/1994 S.B.
- simple limit values
- not effect based
- no linkage to measures
- in organic pollutants sometimes inadequate to real contents

Need for new system based on principles:
- effect based limits
- reflecting basic exposition routes
- differentiated limits
- bound to measures
- feasible for administration
- providing reliable level of assessment

2016 – new Decree No. 153/2016 S.B setting detalis for agricultural soil protection

METHODS FOR ASSESSMENT OF SOIL POLLUTION

level of uncertainity

A.   <u>COMPARATIVE METHODS</u>

-evaluation of information about inputs of substances

-comparison with „background" values of risk substances contents

B.   <u>LIMIT VALUES</u>
SIMPLE LIMITS (FIXED)
DIFFERENCIATED LIMITS

chemical extractant
soil properties
land use
receptor

SITE SPECIFIC

C.   <u>RISK ASSESSMENT</u>
ECOLOGICAL RISK ASSESSMENT   PEC/PNEC
HEALTH RISK ASSESMENT
NONCARCINOGENIC RISKS
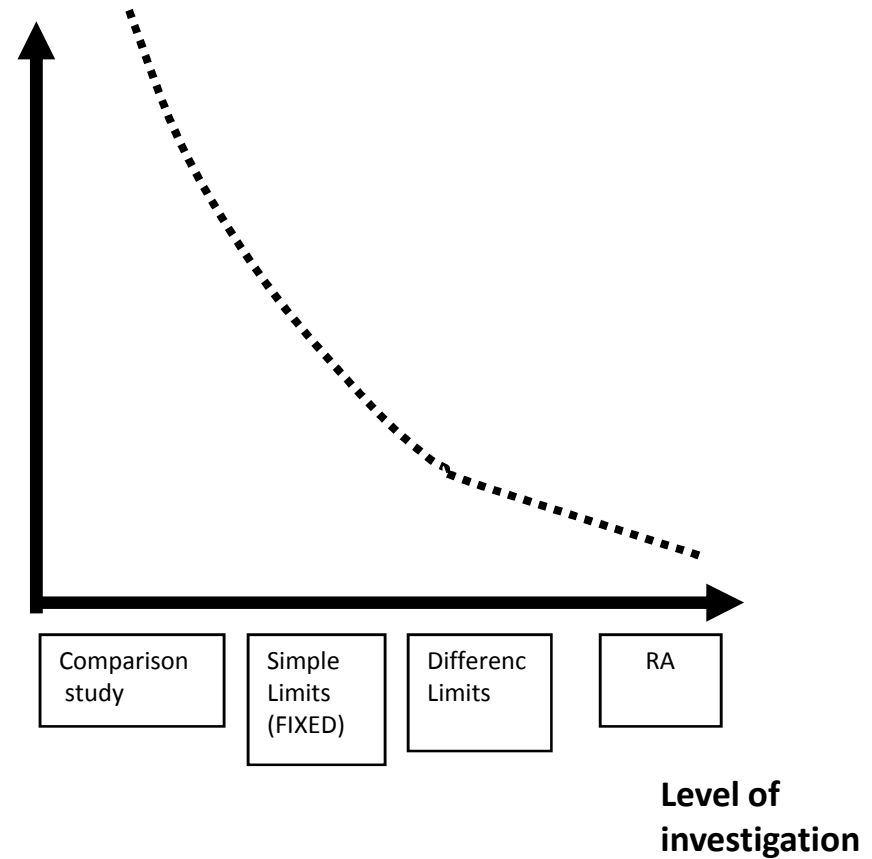**CARCINOGENIC RISKS**

ORAL

DERMAL

INHALATION

EXPOSITION PARAMETERS
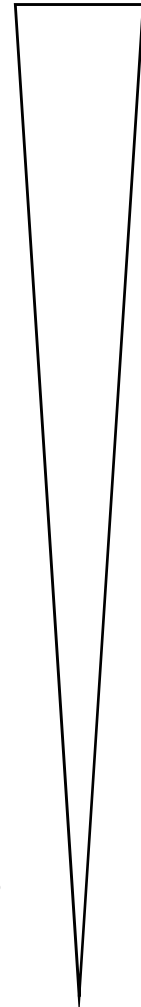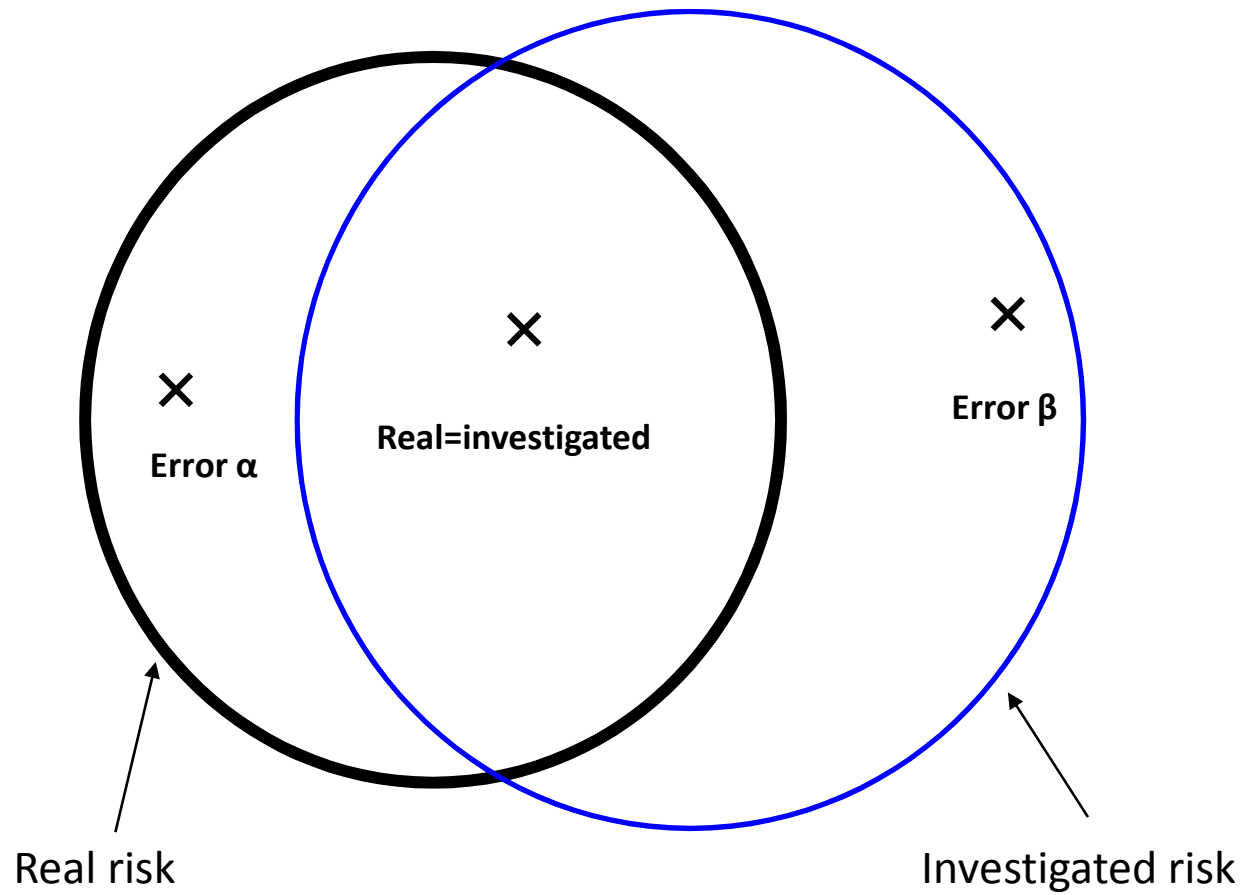
DEVELOPMENT OF REASONABLE METHOD
FOR ROUTINE ASSESSMENT OF SOIL POLLUTION
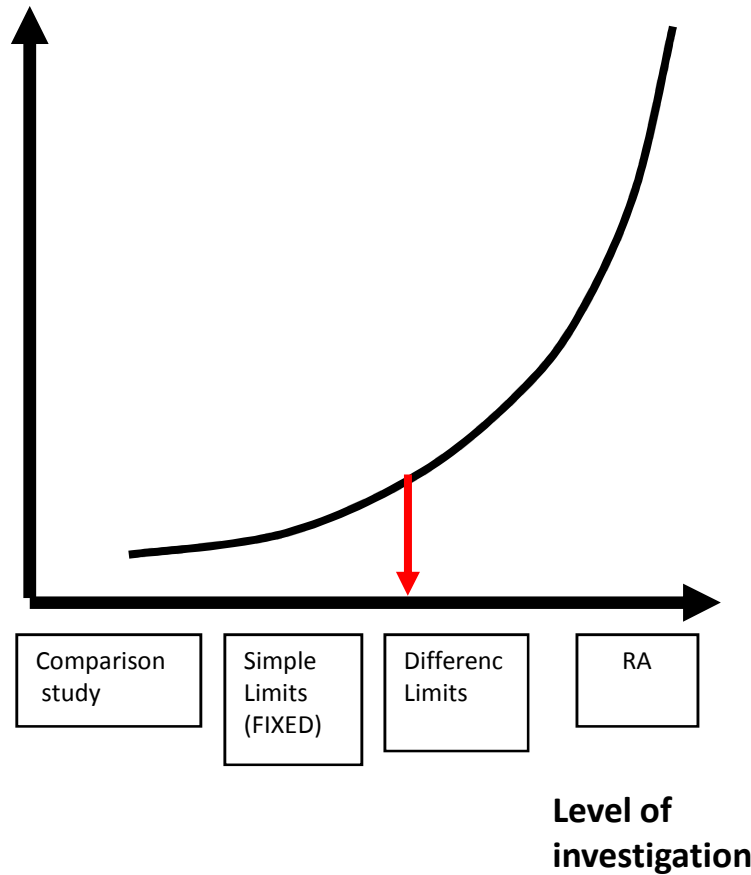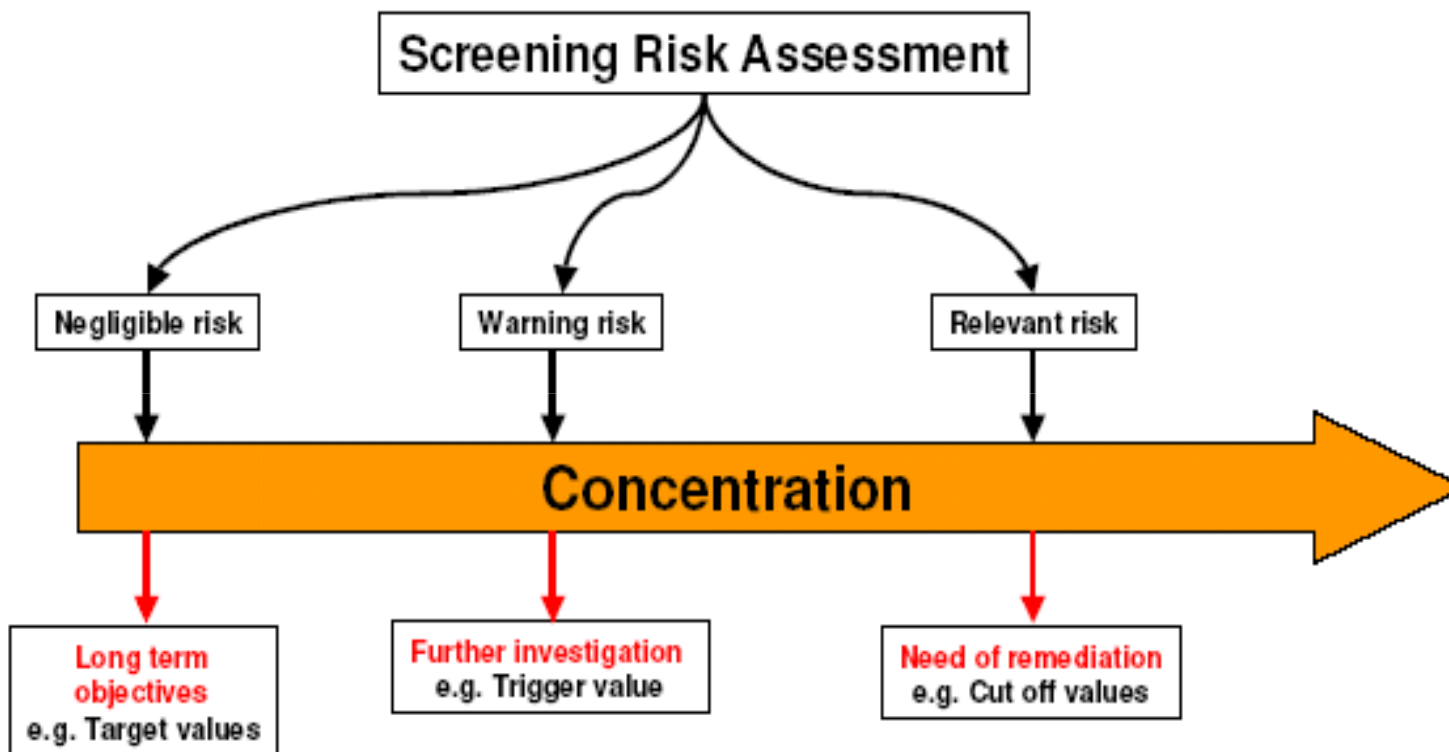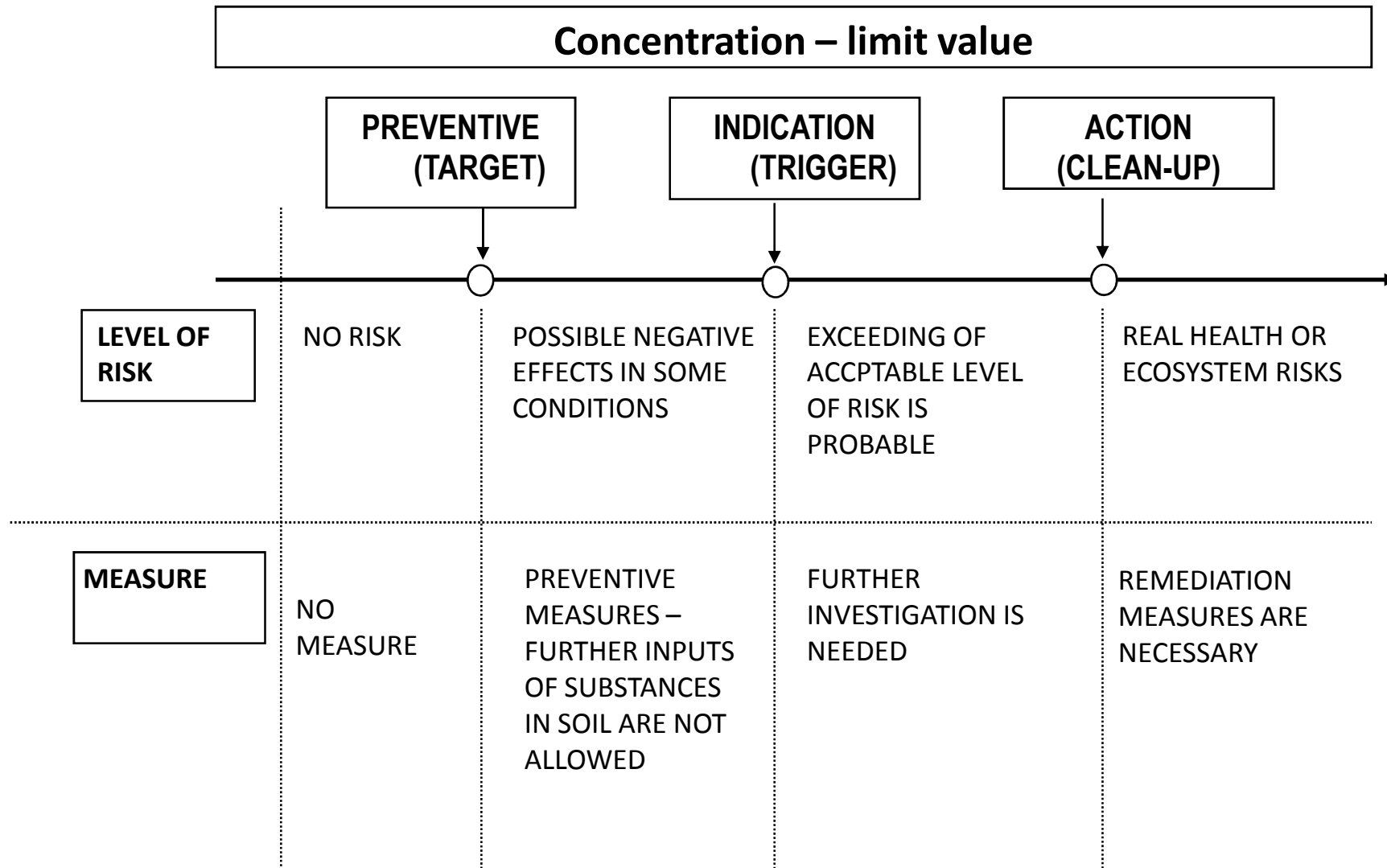
POSSIBLE ERRORS IN RISK ASSESSMENT

STEPS TO MERGE REAL AND INVESTIGATED RISKS TO MINIMISE ERRORS

- Investigation of all historical data
- DQO
- Sampling plan and analyses
- Setting of exposition parameters
- Reference values
- Methodology of calculation
- Minimalization of uncertainities

Types of screening values associated to different levels of environmental protection

Concentration – limit value

	PREVENTIVE (TARGET)	INDICATION (TRIGGER)	ACTION (CLEAN-UP)

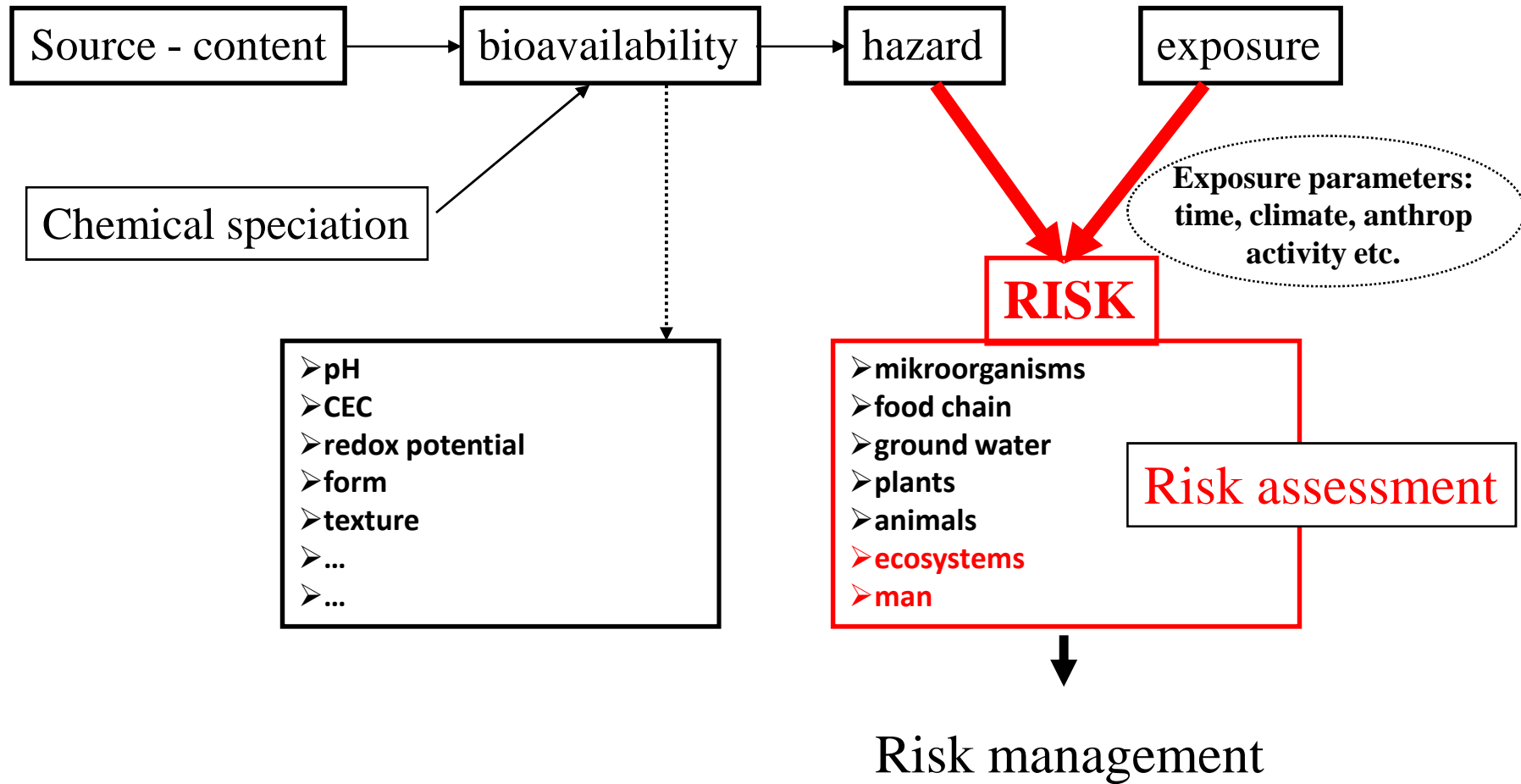| **LEVEL OF RISK**	NO RISK	POSSIBLE NEGATIVE EFFECTS IN SOME CONDITIONS	EXCEEDING OF ACCPTABLE LEVEL OF RISK IS PROBABLE	REAL HEALTH OR ECOSYSTEM RISKS
MEASURE	NO MEASURE	PREVENTIVE MEASURES – FURTHER INPUTS OF SUBSTANCES IN SOIL ARE NOT ALLOWED	FURTHER INVESTIGATION IS NEEDED	REMEDIATION MEASURES ARE NECESSARY

SYSTEM OF LIMIT VALUES – LEVELS OF DFFERENTIATION

LEVEL OF LIMIT VALUE (RISK)	SUBSTANCES	EXPOSITION PATHWAY	ANALYTICAL METHOD	SOIL PROPERTIES
PREVENTION	RISK ELEMENTS AND ORGANIC SUBSTANCES	general prevention for humans and environment	aqua regia, total for Hg and POPs	two classes of soil texture for all elements
INDICATION	RISK ELEMENTS	food chain contamination	aqua regia, total for Hg	two classes of soil texture for Cd
				three classes of pH for Cd and Ni
			$1mol/L\ NH_4NO_3$	two classes of soil texture for Cd
				two classes of pH for Cd
		plant growth inhibition	aqua regia, total for Hg	three classes of pH for Cu and two classes for Ni
			$1mol/L\ NH_4NO_3$	-
		human health protection	aqua regia, total for Hg	-
	ORGANIC SUBSTANCES	human health protection	total content	-
ACTION	-	-	-	-

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SOIL POLLUTION RELATION OF SOURCE AND HAZARD

Source - content → bioavailability → hazard   exposure

Chemical speciation → bioavailability

Exposure parameters: time, climate, anthrop activity etc.

RISK

➢pH
➢CEC
➢redox potential
➢form
➢texture
➢...
➢...

➢**mikroorganisms**
➢**food chain**
➢**ground water**
➢**plants**
➢**animals**
➢**ecosystems**
➢**man**

Risk assessment

Risk management

PREVENTION LIMIT VALUES FOR RISK ELEMENTS

Soil Category	Prevention value (mg/kg of d.m.)										
	As	Be	Cd	Co	Cr	Cu	Hg	Ni	Pb	V	Zn
Standard texture soils[1]	20	2,0	0,5	30	90	60	0,3	50	60	130	120
Light texture soils [2]	15	1,5	0,4	20	55	45	0,3	45	55	120	105

[1]Soils except light texture soils
[2]Sandy soils, loamy-sandy soils, gravel-sandy soils

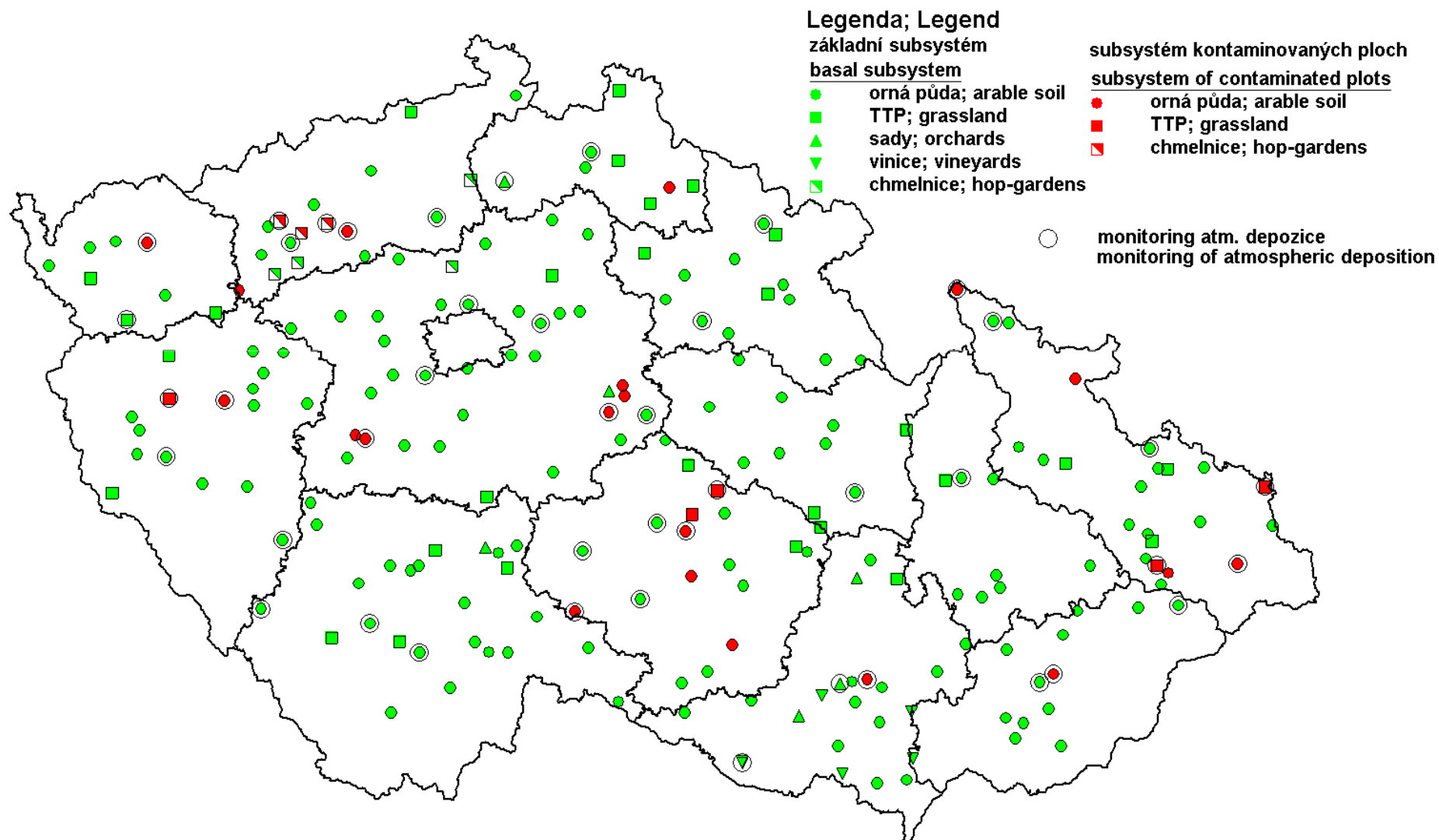# PREVENTION LIMIT VALUES FOR ORGANIC SUBSTAN

POPs	Prevention value (mg/kg of d.m.)
Polycyclic aromatic hydrocarbons	
Σ PAHs[1]	1.0
Chlorinated hydrocarbons	
Σ PCB [2]	0,02
Σ DDT [3]	0,075
HCB[4]	0,02
HCH[4] (Σ α+β+γ)	0,01
PCDDs/Fs[5]	5,0
Petroleum hydrocarbons	
Hydrocarbons C10 – C40	100

Registr kontaminovaných ploch ÚKZÚZ
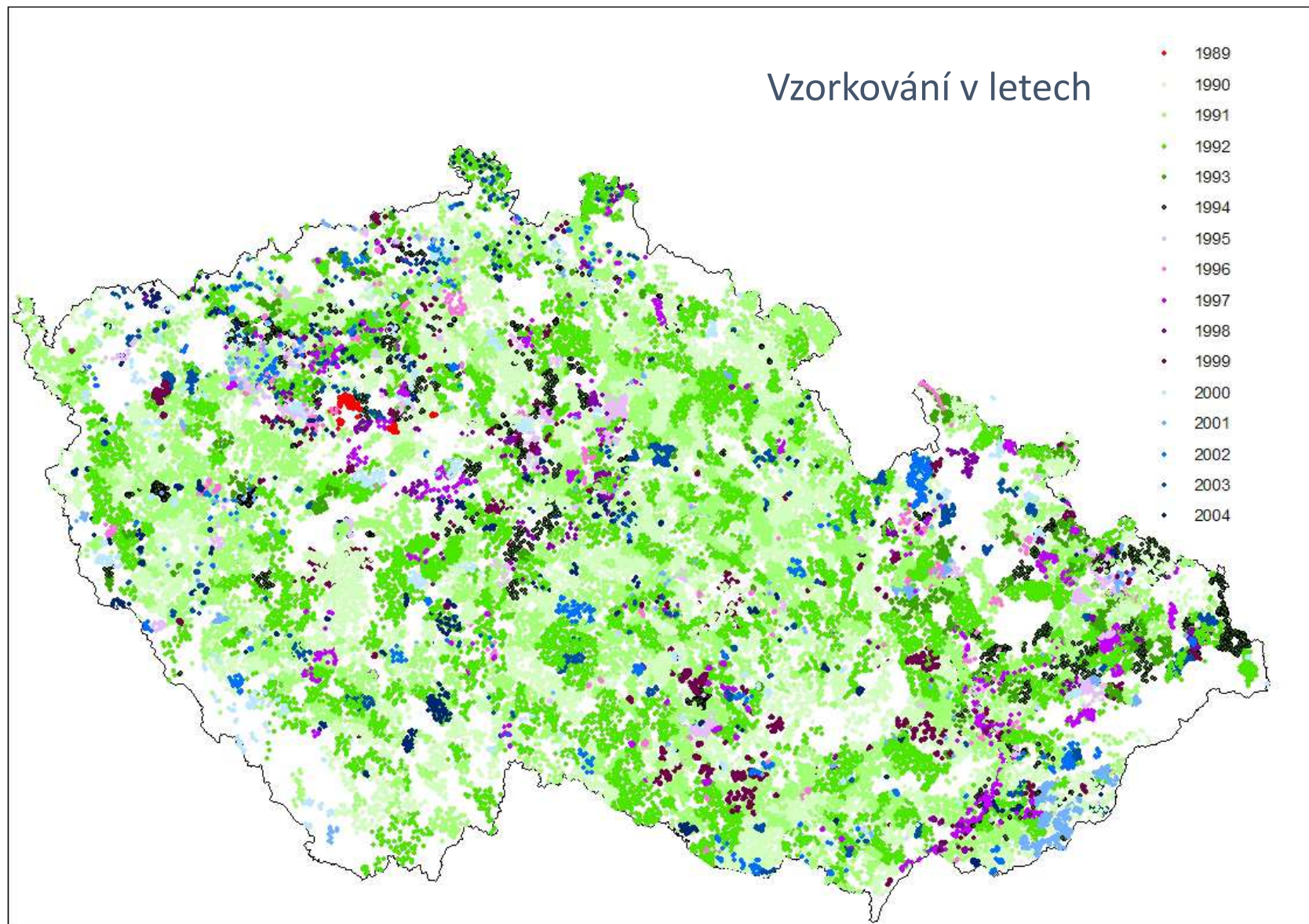
Lokalizace pozorovacích ploch bazálního monitoringu zemědělských půd

Location of basal soil monitoring plots

Legenda; Legend

základní subsystém
basal subsystem

- orná půda; arable soil
- TTP; grassland
- sady; orchards
- vinice; vineyards
- chmelnice; hop-gardens

subsystém kontaminovaných ploch
subsystem of contaminated plots

- orná půda; arable soil
- TTP; grassland
- chmelnice; hop-gardens

○ monitoring atm. depozice
monitoring of atmospheric deposition

INDICATION LIMITS FOR FOOD CHAIN CONTAMINATION

Element	Soil texture	pH/CaCl$_2$	Indication value (mg/kg of d.m.)	
			Aqua regia	1mol/L NH$_4$NO$_3$
As	-	-	40,0	1.0
Cd	-	$\leq$ 6.5	1.5	-
	standard texture	> 6,5	2.0	0.1
	light texture	> 6,5	2.0	0.04
Ni		$\leq$ 6.5	150	-
		> 6,5	200	-
		-	-	1.0
Pb		-	300	1.5
Hg*		-	1.5	-

INDICATION LIMITS FOR PLANT GROWT H INHIBITION

| Element	pH/CaCl$_2$	Indication value (mg/kg of d.m.)	
		Aqua regia	1mol/L NH$_4$NO$_3$
Cu	<5	150	-
	5 – 6.5	200	-
	> 6,5	300	-
	-	-	1.0
Ni	≤ 6.5	150	-
	> 6,5	200	-
	-	-	1.0
Zn		400	-
		-	20

INDICATION LIMITS FOR HUMAN HEALTH PROTECTION RISK ELEMENTS

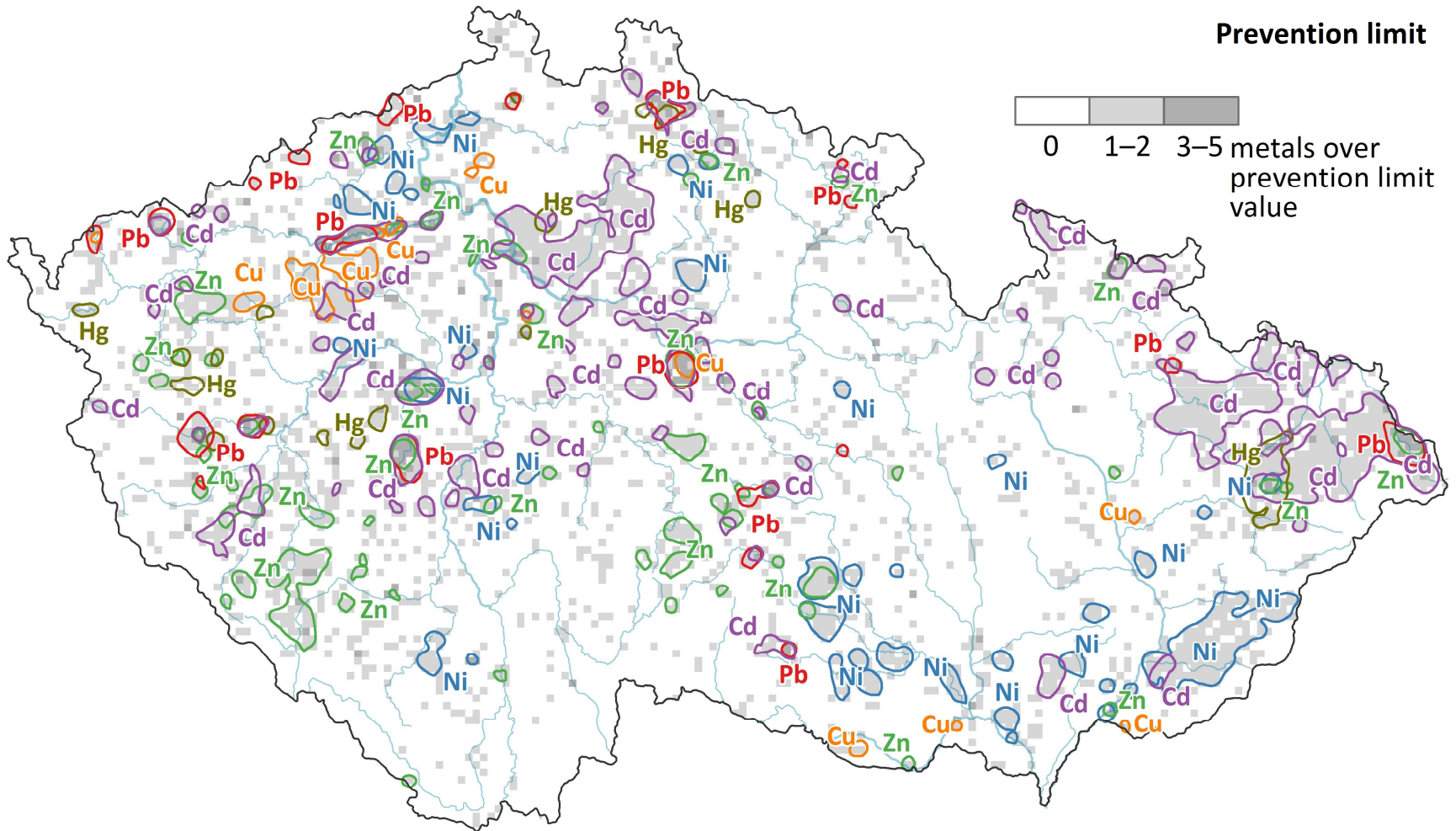| Element	Indication value (mg/kg of d.m.)
As[1]	40
Cd[1]	20
Hg[2]	20
Pb[1]	400

INDICATION LIMITS FOR HUMAN HEALTH PROTECTION
- PERSISTENT ORGANIC POLLUTANTS

Substance	Indication value (mg/kg of d.m.)
Σ PAHs[1]	30
Benzo(a)pyrene	0,5
Σ PCB[2]	1,5
Σ DDT[3]	8,0
HCB[4]	1
HCH[4] (Σ α+β+γ)	1
PCDDs/Fs[5]	100

Maps of metal concentrations in topsoil interpolated using ordinary kriging
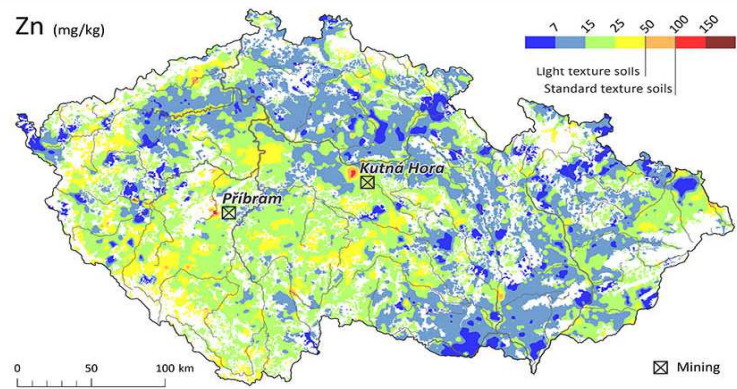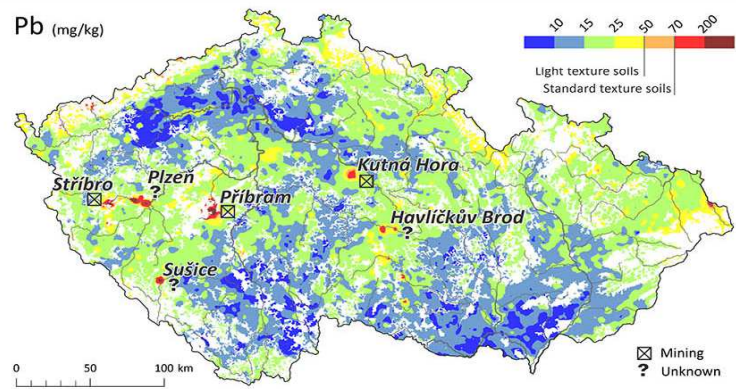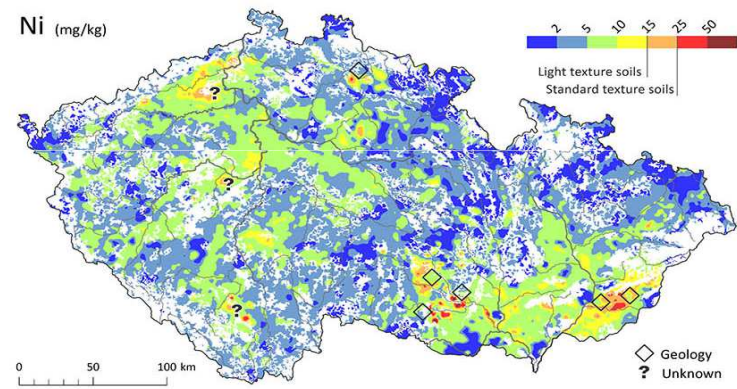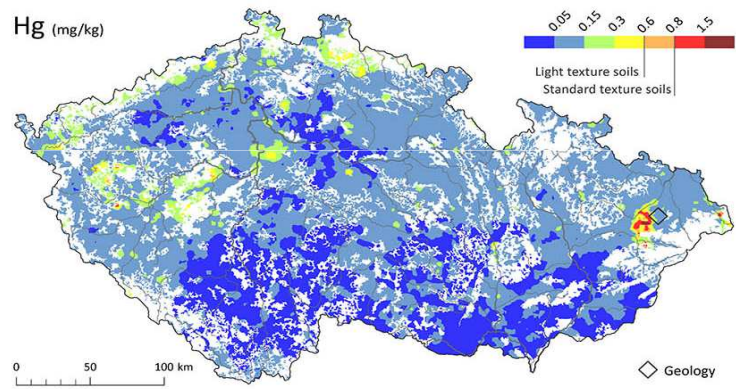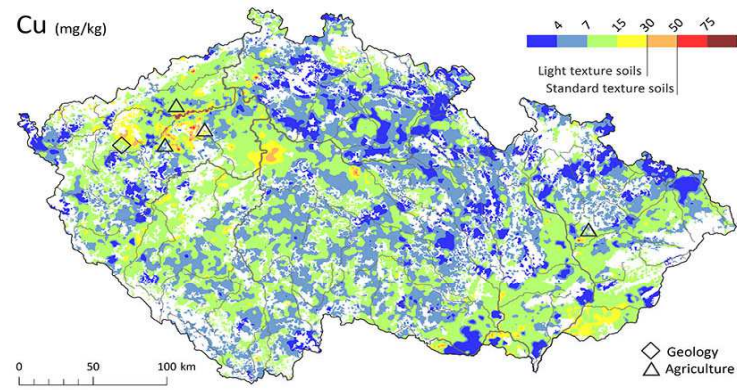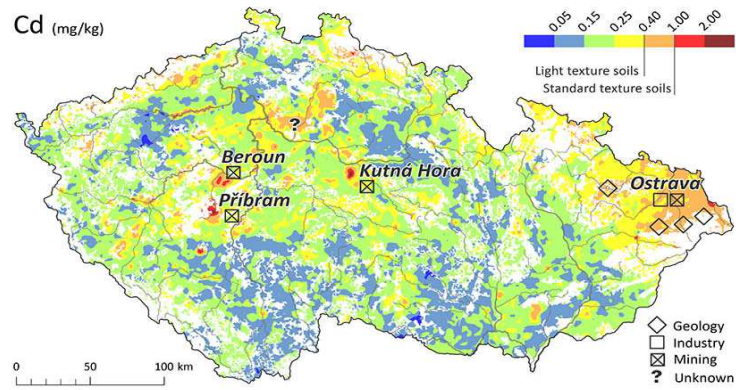
Areas with exceeding of prevention limit values of risk elements on agricultural soil

Prevention limit

0	1–2	3–5 metals over

prevention limit value

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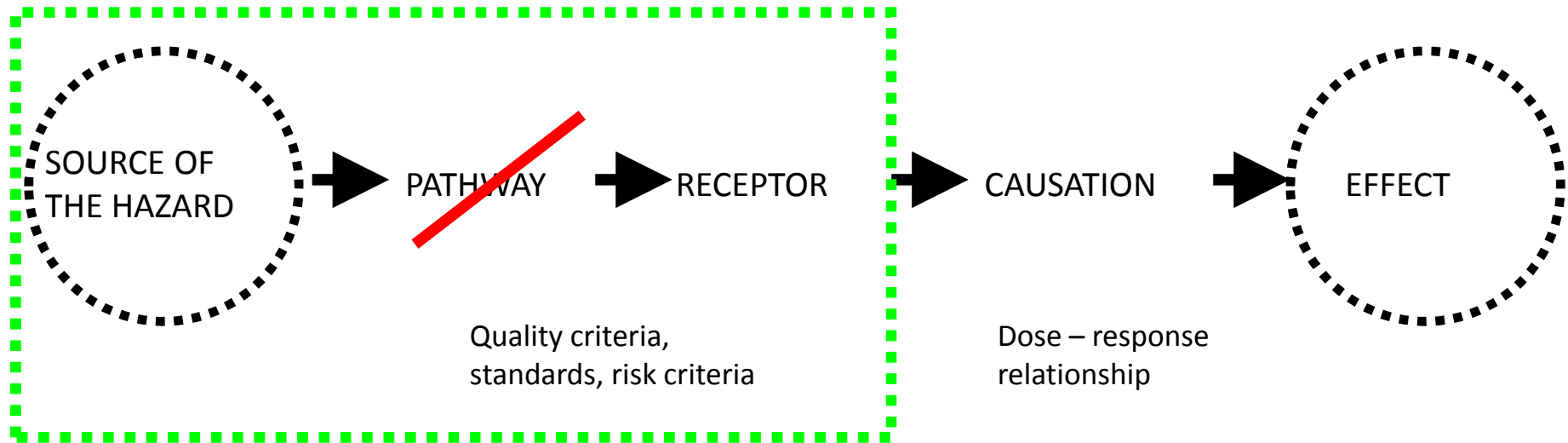# Sites with exceeding of indication limit values of risk elements for food chain contamination and plant growth inhibition on agricultural soil

Indication limit for food chain contamination and plant growth inhibition

- Cd
- Cu
- Hg
- Ni
- Pb
- Zn

- 1 site
- 2–5 sites
- > 5 sites

0   50   100 km

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RISK REDUCTION

SOURCE OF THE HAZARD → PATHWAY → RECEPTOR → CAUSATION → EFFECT

Quality criteria, standards, risk criteria

Dose – response relationship
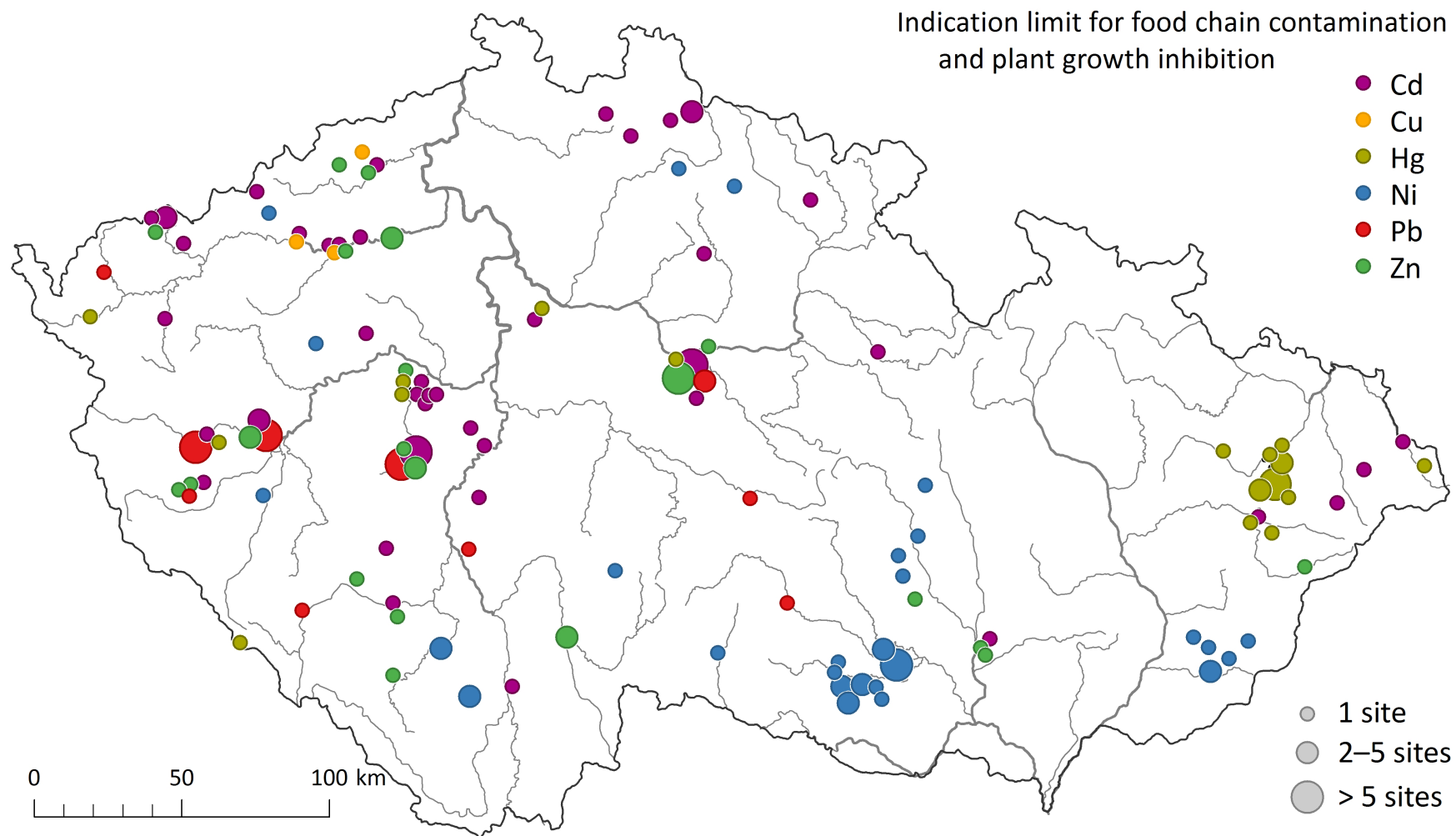
REMOVING THE SOURCE
-**REMEDIATION**
-**DECOMTAMINATION**

BREAKING THE PATHWAY
-**SOLIDIFICATION**
-**SOFT REMEDIATION**
-**CHANGE OF USE**

REMOVING THE RECEPTORS
CHANGE OF USE (MOVING)

THANK YOU FOR YOUR ATTENTION

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