



# Chemie životního prostředí II – Znečištění složek prostředí

## Atmosféra

(12)

### Vlivy znečištění ovzduší na zdraví

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# Toxicological relevant chemicals



Pesticides



Products of  
combustion processes



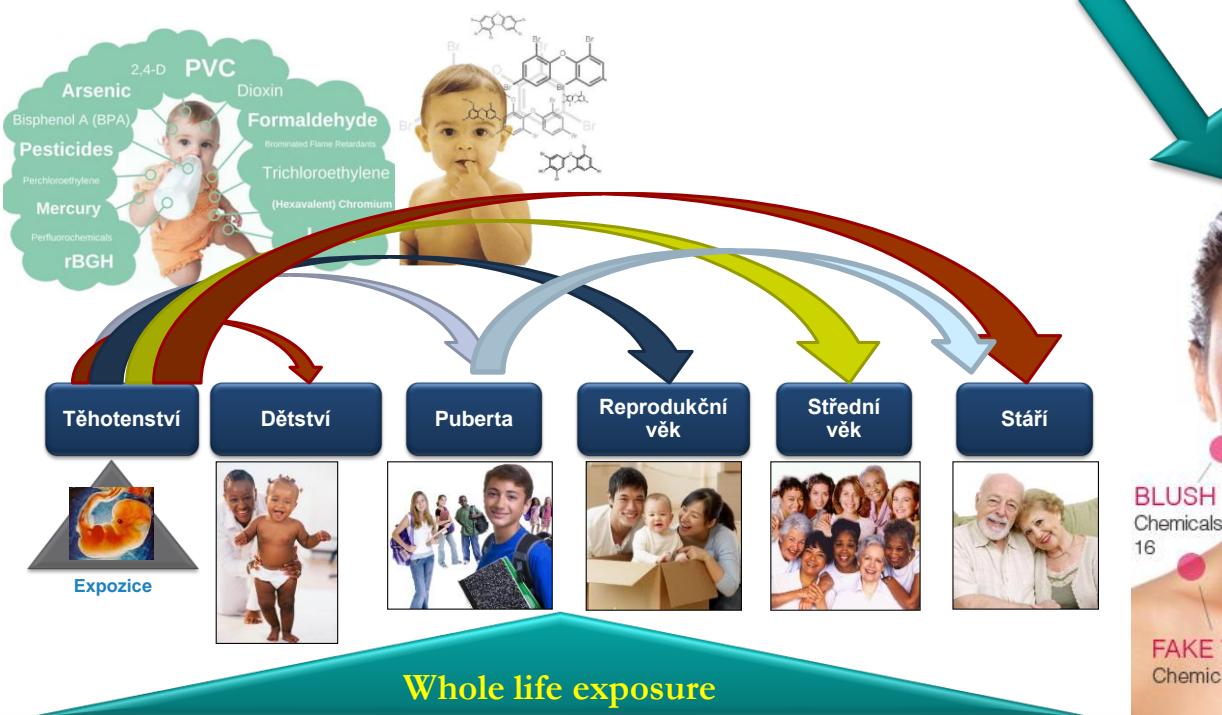
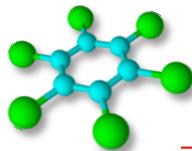
Personnal care  
products (PCP)



Food packages

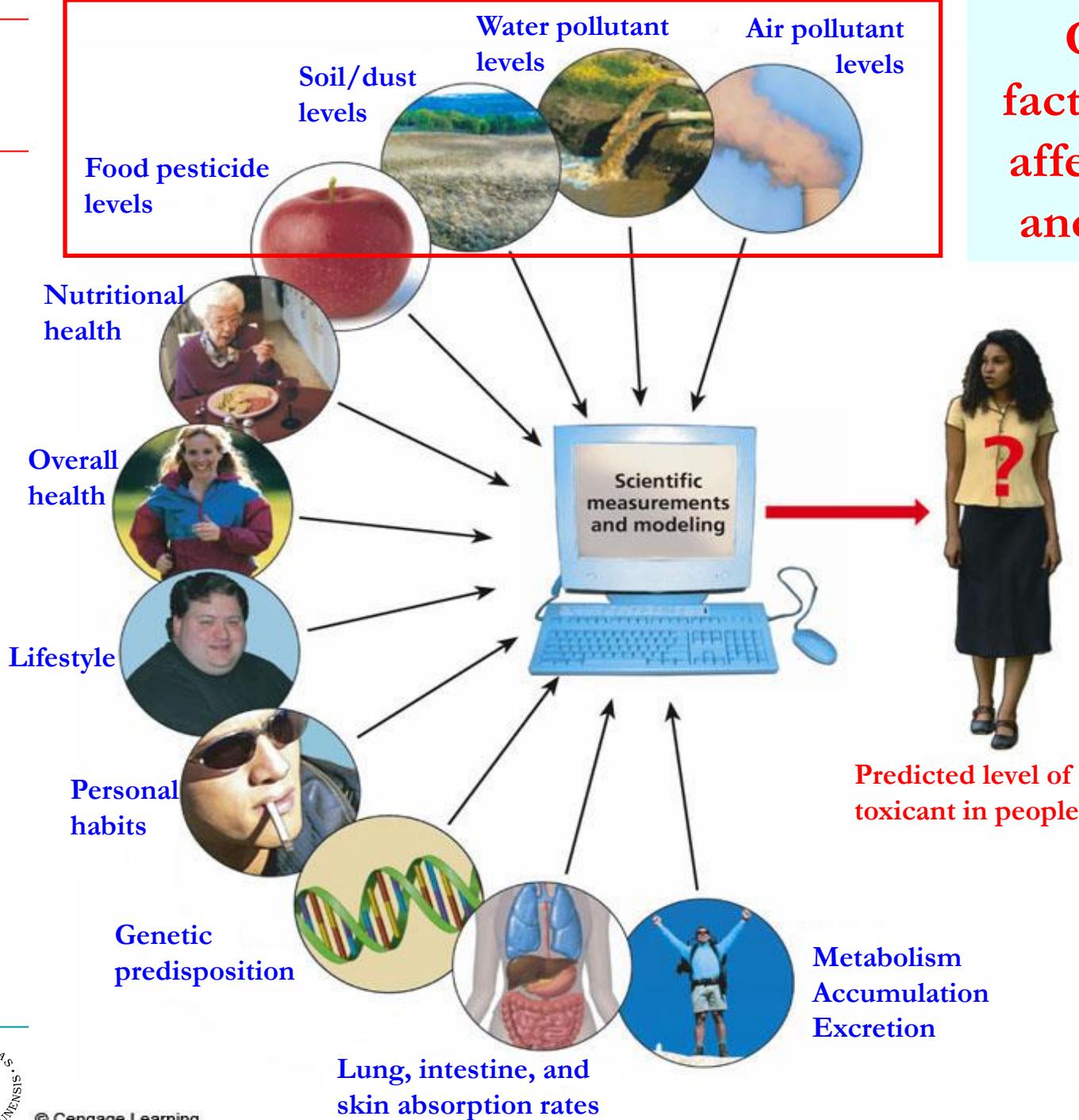


Wastes



Environmental occurrence = potential possibility of transfer to human organisms  
We have to determine the level of exposure in all age categories including prenatal period  
Health effects may be delayed until later in life

# Overview of factors, which can affect exposure and human risks



# Toxic interactions

**IPCS**  
International Programme on Chemical Safety  
 WHO  
IPCS Assessment Project

**Assessment of Combined Exposures to Multiple Chemicals: Report of a WHO/IPCS International Workshop**

**IOMC**  
INTERNATIONAL MULIT-POLLUTANT ASSESSMENT CENTER  
INTERAGGREGATE RISK ASSESSMENT FOR POLY-EXPOSURE

 World Health Organization

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## Risk assessment of combined exposure to multiple chemicals: A WHO/IPCS framework<sup>☆</sup>

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Screening level assessment  
Tiered approach  
Threshold of toxicological concern

### ABSTRACT

This paper describes a framework for the risk assessment of combined exposure to multiple chemicals based on and developed subsequent to the World Health Organization/International Programme on Chemical Safety Workshop on Aggregate/Cumulative Risk Assessment (Combined Exposures to Multiple Chemicals) held in 2007. The framework is designed to aid risk assessors in identifying priorities for risk management for a wide range of applications where co-exposures to multiple chemicals are expected. It is based on a hierarchical ('phased') approach that involves integrated and iterative consideration of exposure and hazard at all phases, with each tier being more refined (i.e., less cautious and more certain) than the previous one, but more labor and data intensive. It includes reference to predictive and probabilistic methodology in various tiers in addition to tiered consideration of uncertainty. The paper also addresses two case studies that have been developed to test and refine the framework.

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### 1. Introduction

A World Health Organization (WHO)/International Programme on Chemical Safety (IPCS) Workshop on Aggregate/Cumulative Risk Assessment (Combined Exposures to Multiple Chemicals) was held in Washington, DC, USA, on 19–21 March 2007. The principal objectives of the workshop, which involved experts from agencies worldwide, were to consider the state of the art in this area and delineate next steps. The workshop report, which comprises an overview and a series of extended abstracts, serves as a resource to identify existing methodologies in this area [IPCS, 2009].

Workshop participants recommended additional consideration of terminology in order to facilitate communication internationally in this area and development of an international framework for the risk assessment of combined exposures to multiple chemicals. This

paper describes the framework based on and developed by a drafting group subsequent to the WHO/IPCS workshop and references associated case studies, included at the end of this paper and elsewhere [EHA, 2009], developed to test and refine the framework. The draft framework was revised based on feedback received during a public comment period from May to October 2009 and a WHO review meeting (see Acknowledgments).

The framework is designed to aid risk assessors in identifying priorities for risk management for a wide range of applications where co-exposures to multiple chemicals are expected. Application of the framework is not confined to any particular type of chemical or effect. The framework builds on previously published guidance for priority setting and assessment of combined exposures (see, for example, Meek and Armstrong, 2007; US EPA, 2007). It is intentionally concise, based on the recognition that more extensive guidance on specific technical aspects, including data quality, is available [ATSDR, 2004; US EPA, 2009; ICHIC, 2009]. The framework is designed to be additionally developed through pragmatic application in specific case studies.

The case studies annexed to this paper were developed to illustrate application of the framework. They are considered to be only examples of a much broader range of potential applications, which

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# Cesty expozice bioty EDCs ve vzdálených oblastech

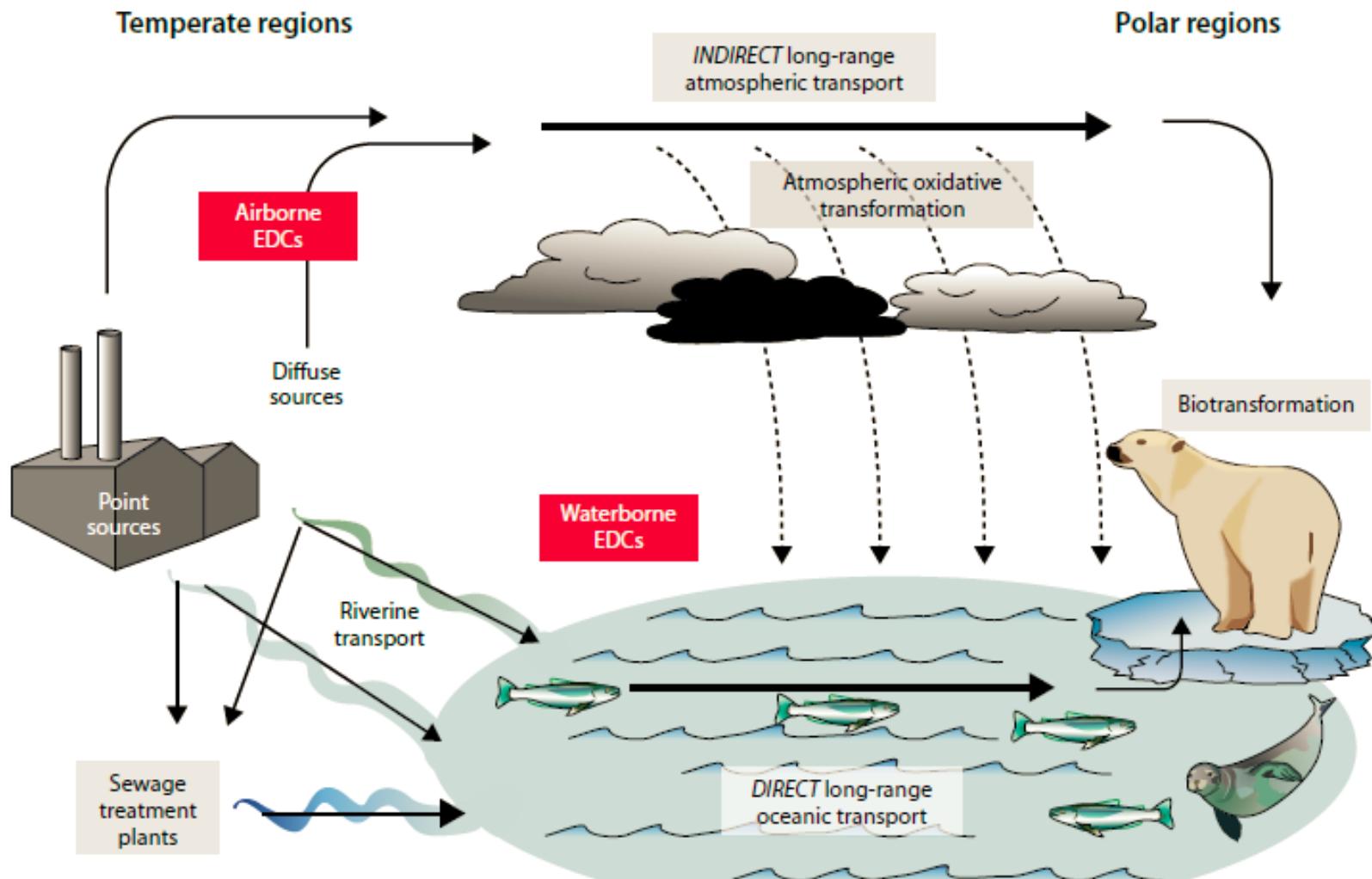
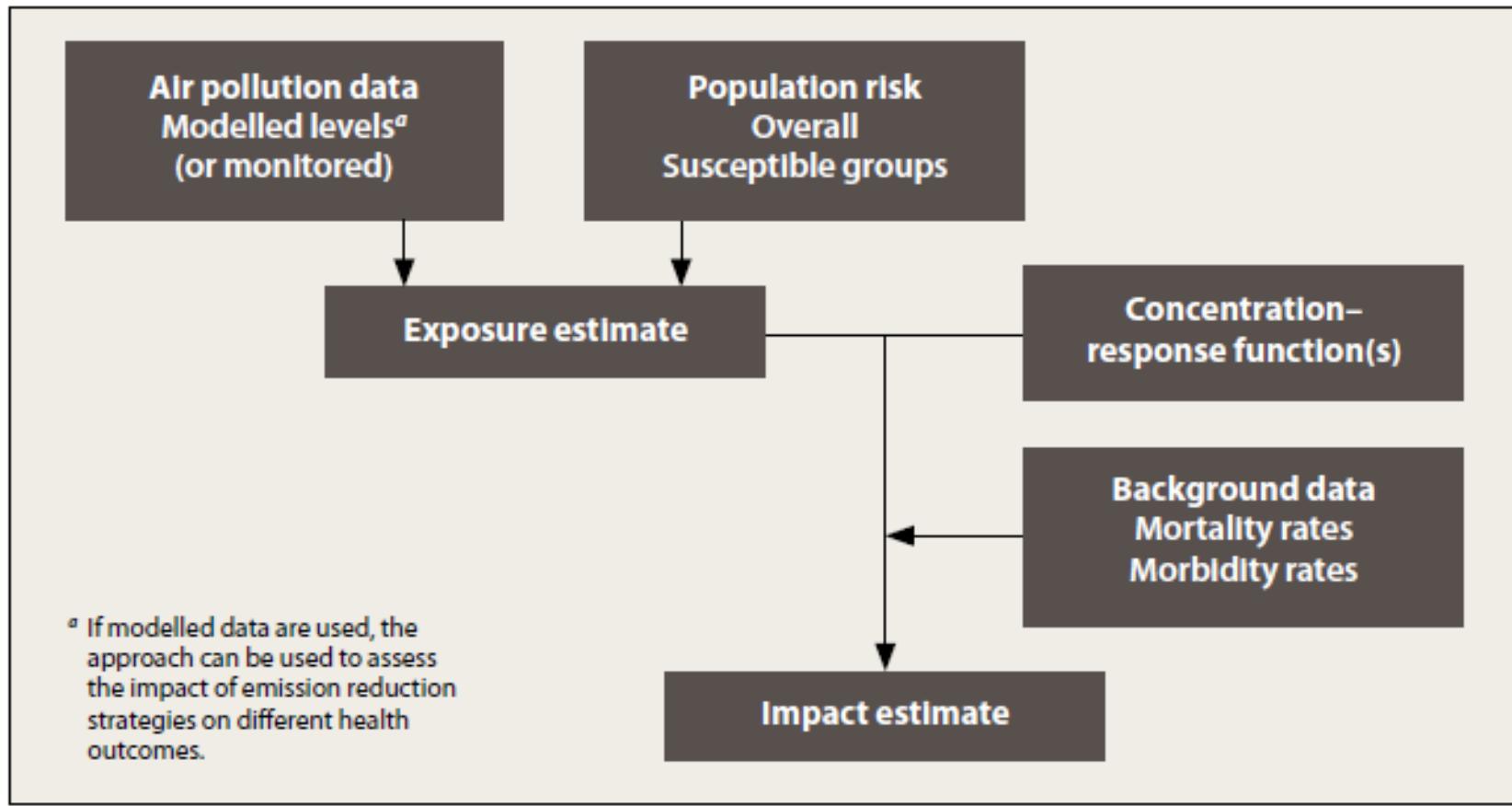


Figure 3.6. Routes of EDC exposure for biota in remote environments, illustrating the importance of long-range transport pathways for wildlife. Based on AMAP (2009).

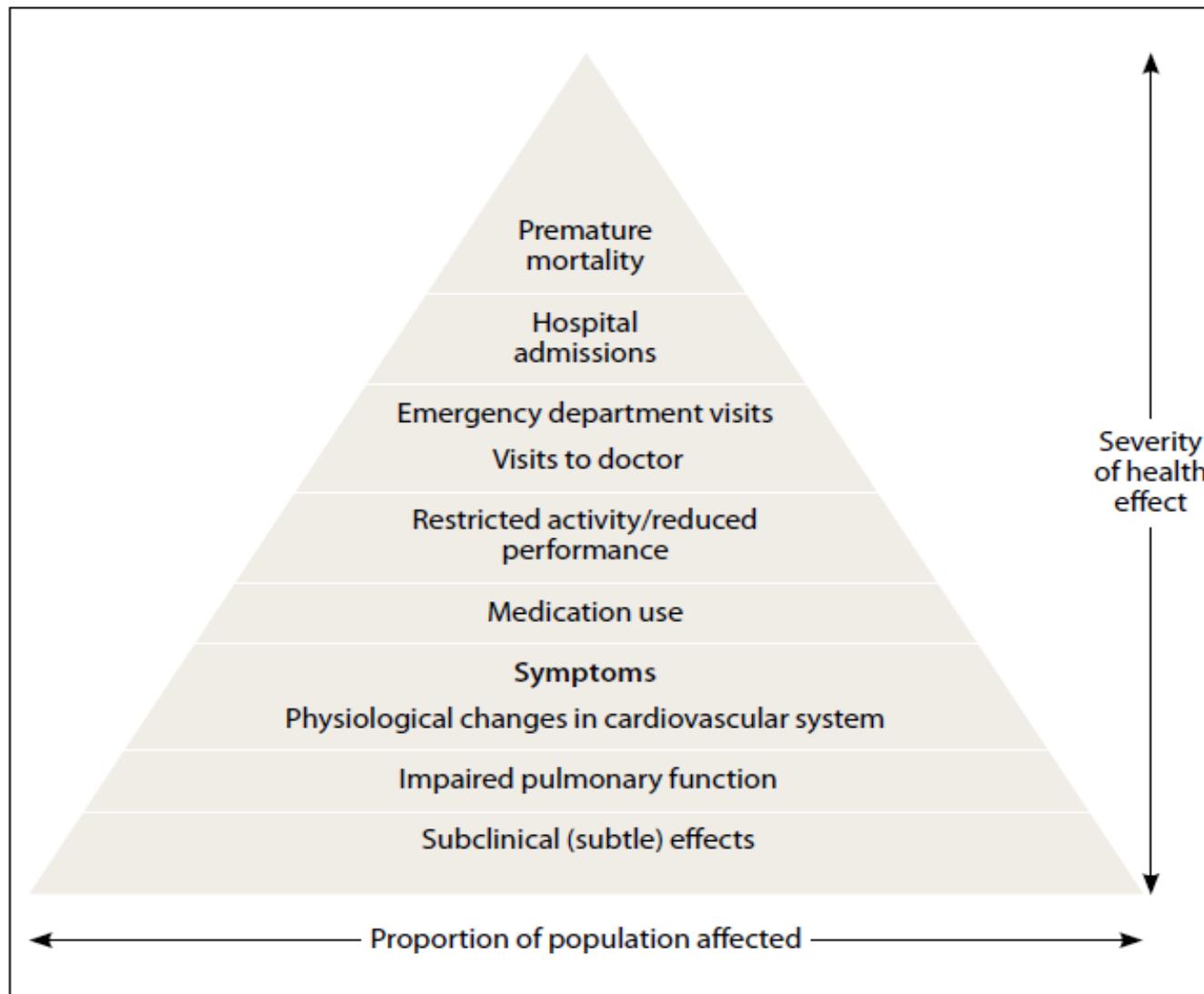
# Hlavní kroky hodnocení zdravotních dopadů

Fig. 1. Schematic presentation of the main steps of health impact assessment



# Pyramida účinků na zdraví spojených se znečištěním ovzduší

Fig. 1. Pyramid of health effects associated with air pollution



Source: American Thoracic Society (6).

# Zdravotní účinky znečištěného ovzduší

Table 1. Health effects of air pollution

*Effects attributed to short-term exposure*

- Daily mortality
- Respiratory and cardiovascular hospital admissions
- Respiratory and cardiovascular emergency department visits
- Respiratory and cardiovascular primary care visits
- Use of respiratory and cardiovascular medications
- Days of restricted activity
- Work absenteeism
- School absenteeism
- Acute symptoms (wheezing, coughing, phlegm production, respiratory infections)
- Physiological changes (e.g. lung function)

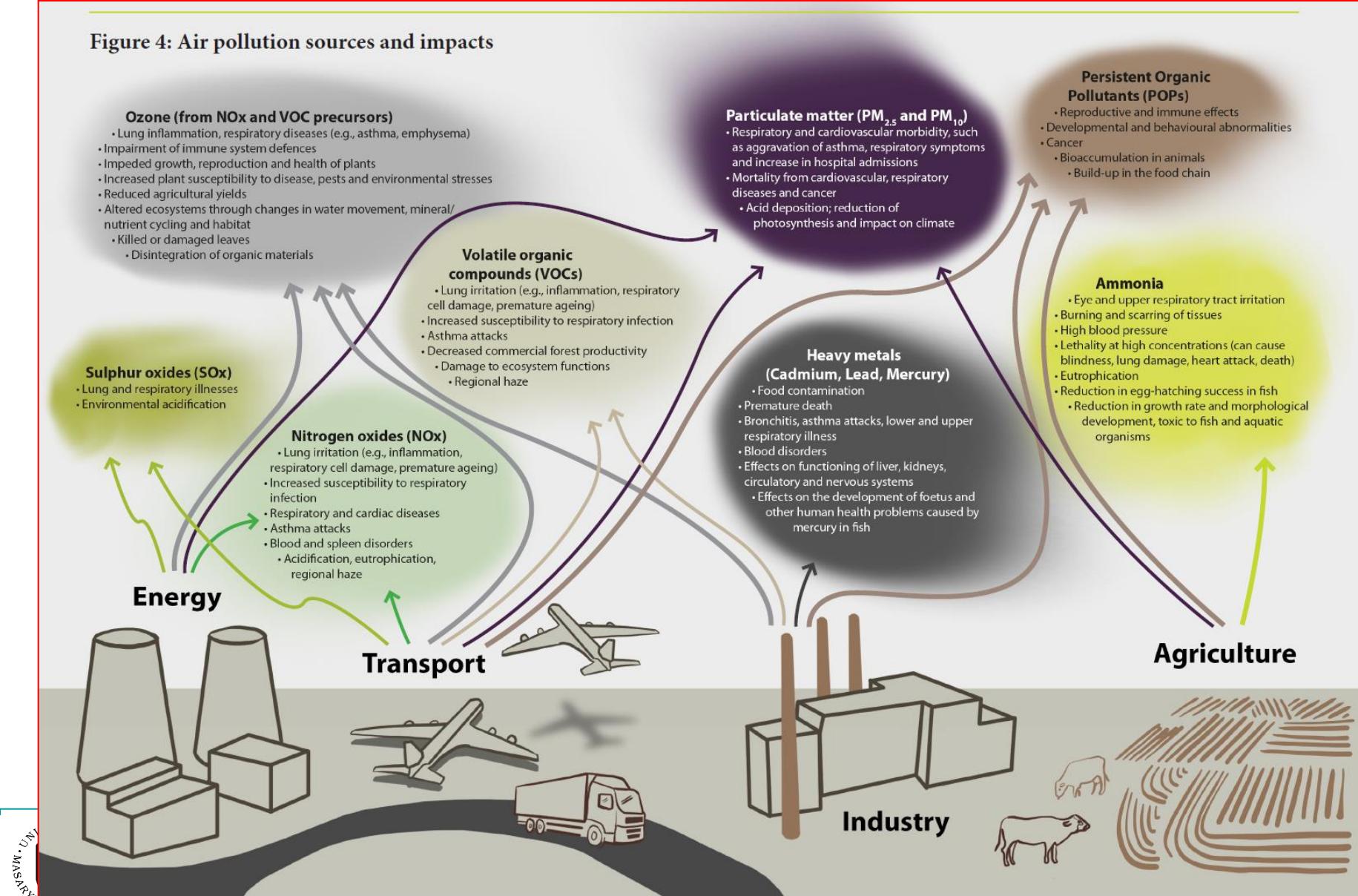
*Effects attributed to long-term exposure*

- Mortality due to cardiovascular and respiratory disease
- Chronic respiratory disease incidence and prevalence (asthma, COPD, chronic pathological changes)
- Chronic changes in physiologic functions
- Lung cancer
- Chronic cardiovascular disease
- Intrauterine growth restriction (low birth weight at term, intrauterine growth retardation, small for gestational age)

Source: World Health Organization (25).

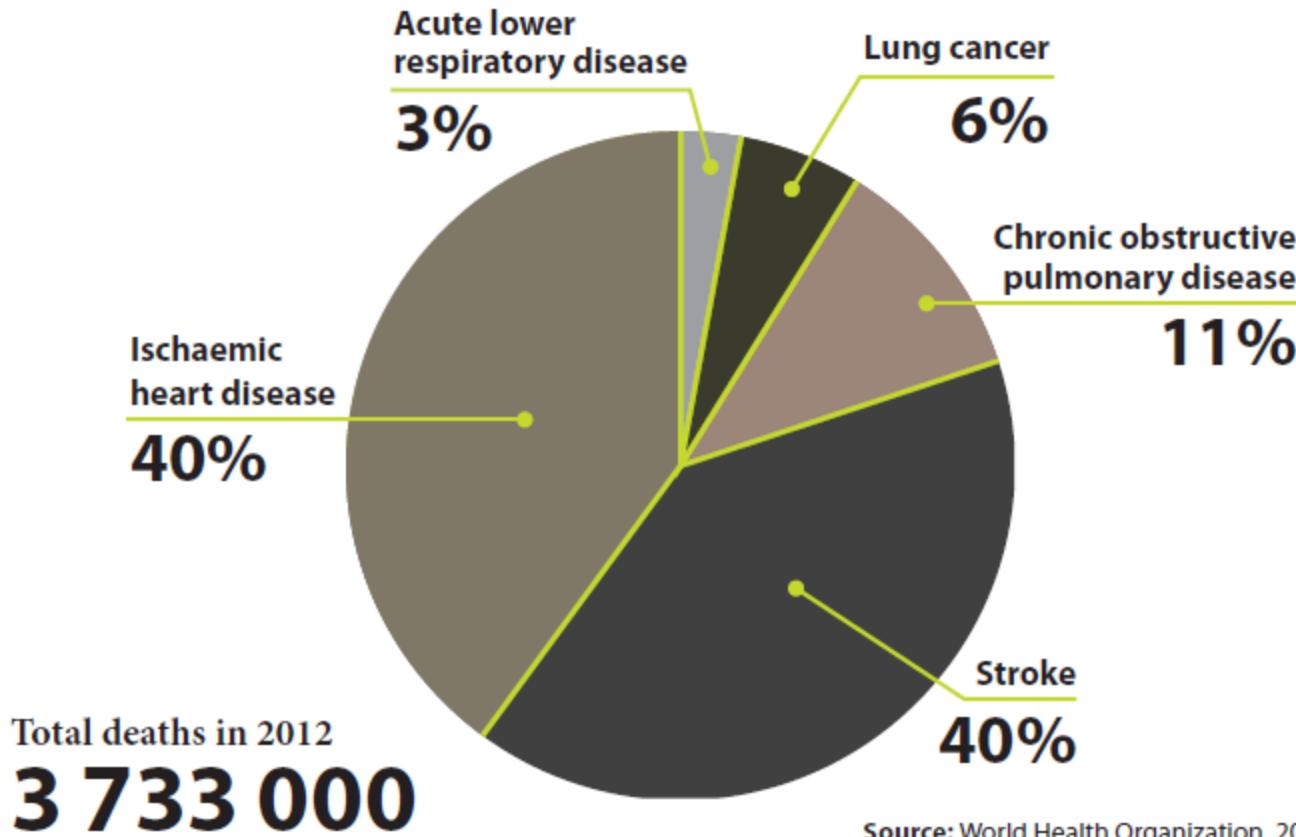
# Zdroje znečištění ovzduší a dopady

Figure 4: Air pollution sources and impacts



# Úmrtí spojovaná se znečištěním ovzduší

Figure 5: Deaths attributable to ambient air pollution



# Počet obyvatel žijících v regionech s překročeným limitem BaP

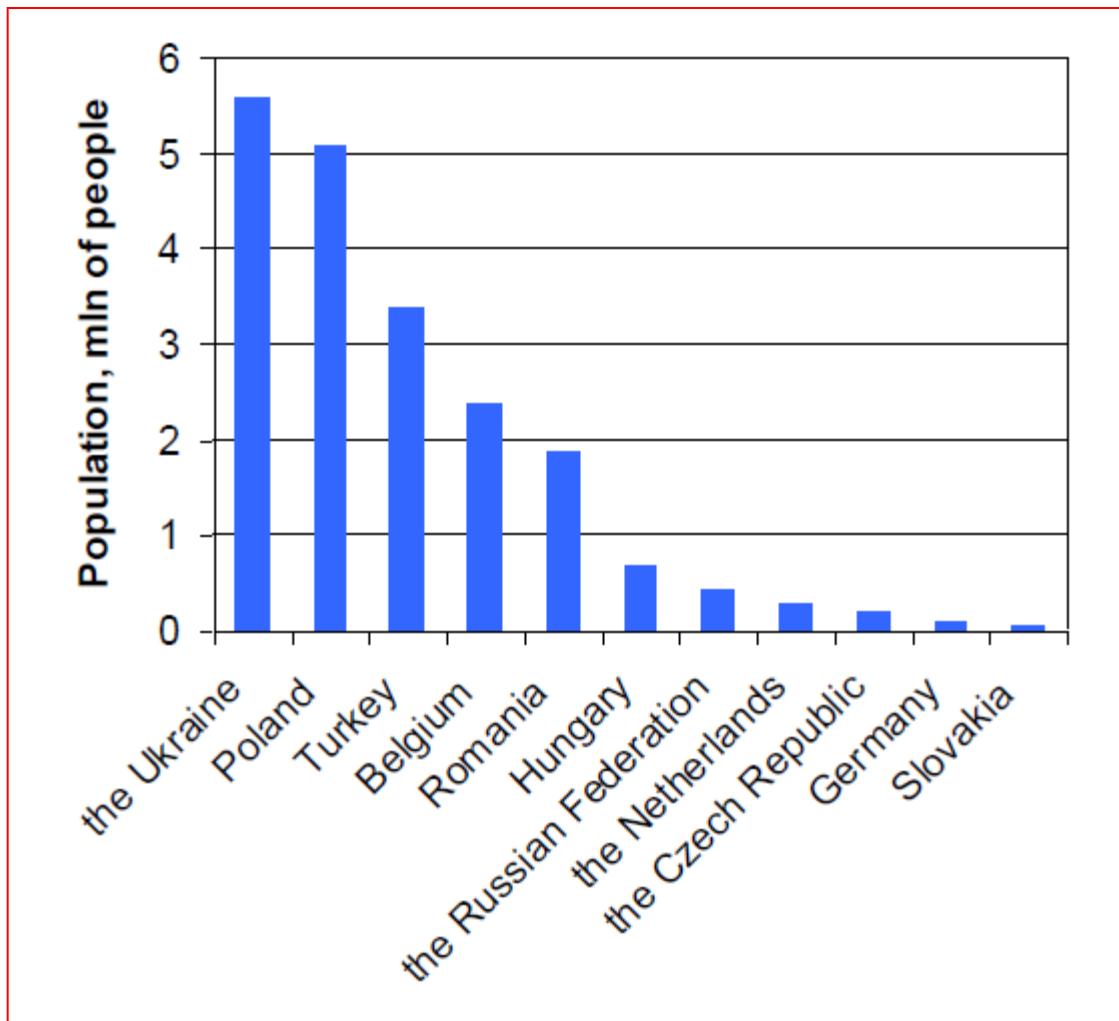
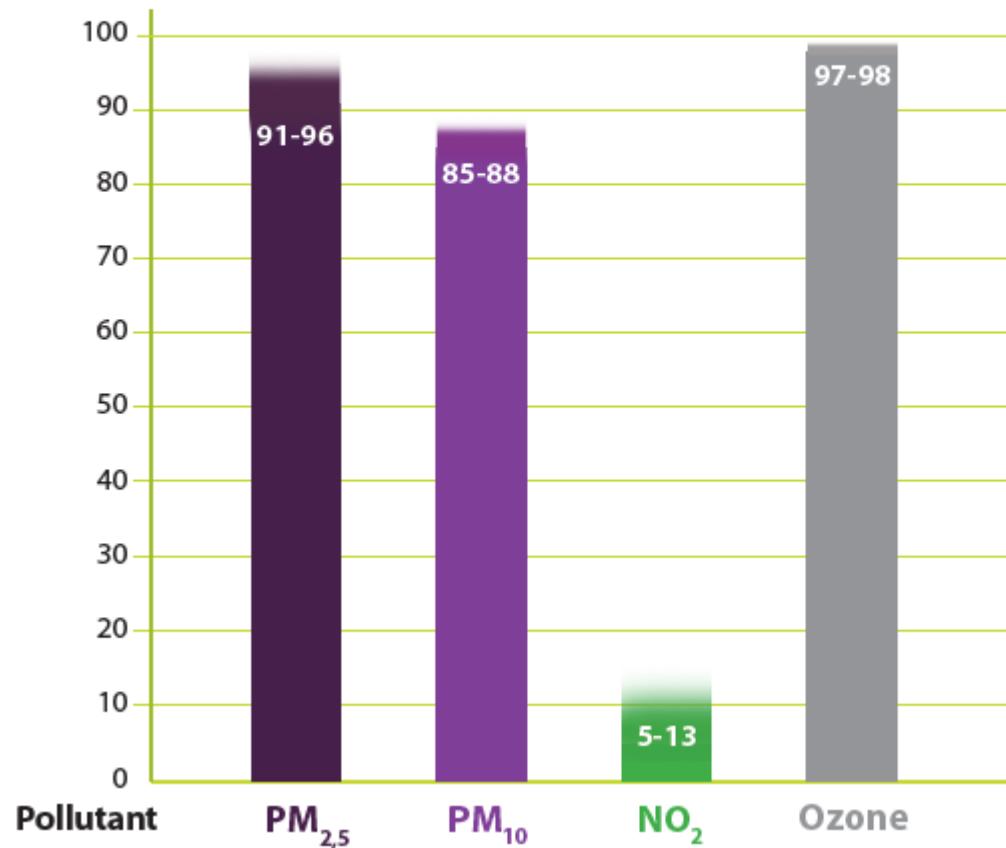


Figure 4.14: Number of people living in regions where B[a]P air concentrations exceed EU target value of 1 ng/m<sup>3</sup> in EMEP countries in 2012 according to modelling results.

# Procenta překročení WHO limitů

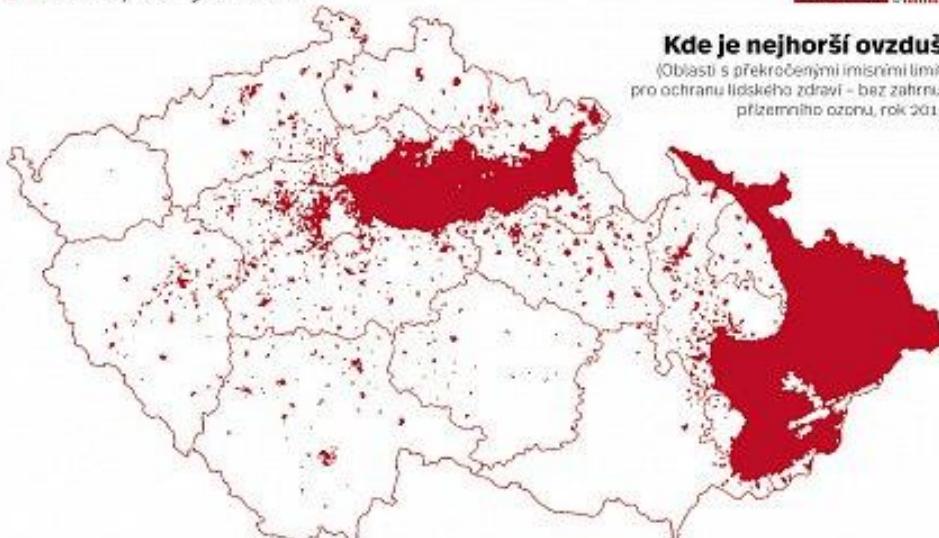
Figure 6: Percentage of the urban population in the EU exposed to air pollutant concentrations above WHO reference levels

Exposure above reference levels estimate (%)



### Kde je nejhorší ovzduší

(Oblasti s překročenými imisními limity pro ochranu lidského zdraví – bez zahrnutí přízemního opisu, rok 2015)



### Kolik lidí umře navíc

(Navýšení celkové roční úmrtnosti o „předčasná úmrtí“ kvůli PM10)

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
6528	9878	3192	3408	4515	6417	5531	5253	5184	4800

**Kde je to letos nejnebezpečnější?**

Počet překročení imisních limitů u jemného prachu, 2016



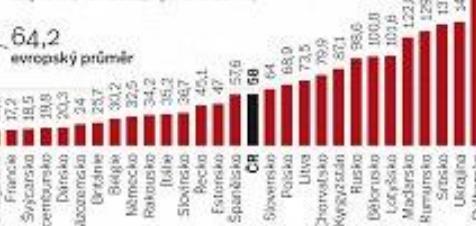
#### Copächne neivic

(Zdroje emisí PM<sub>10</sub> v ČR, v %, 2014)



#### Kolik lidí umírá v Evropě

(Úmrtnost na znečištěném ovzduší, na 100 tisíc obyvatel, rok 2012, vybrané země)



## Compounds in the Environment

# Vnitřní prostředí

## SOURCES OF INDOOR POLLUTANTS

