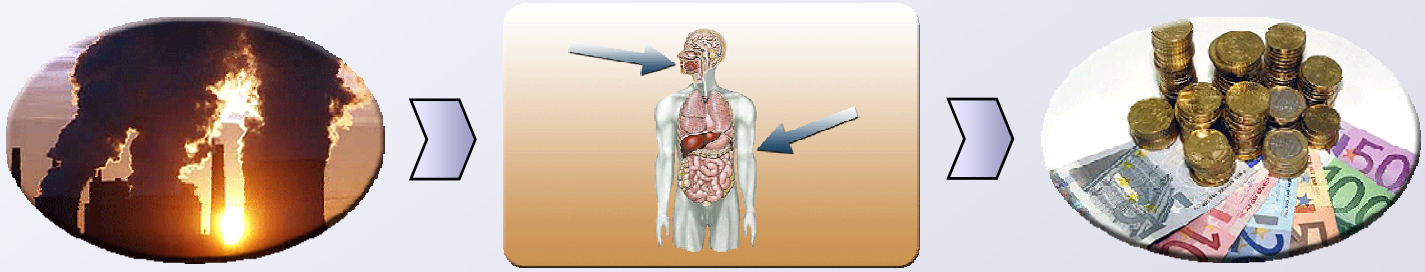
External Cost Assessment of Organic Chemicals for Evaluating Environmental Policies



P. Fantke[1], T. Geftler[1], R. Friedrich[1]

[1]Institute for Energy Economics and the Rational Use of Energy, University of Stuttgart

3rd Network Conference on Persistent Organic Pollutants

22nd/23rd April 2009 (Birmingham/UK)

Content

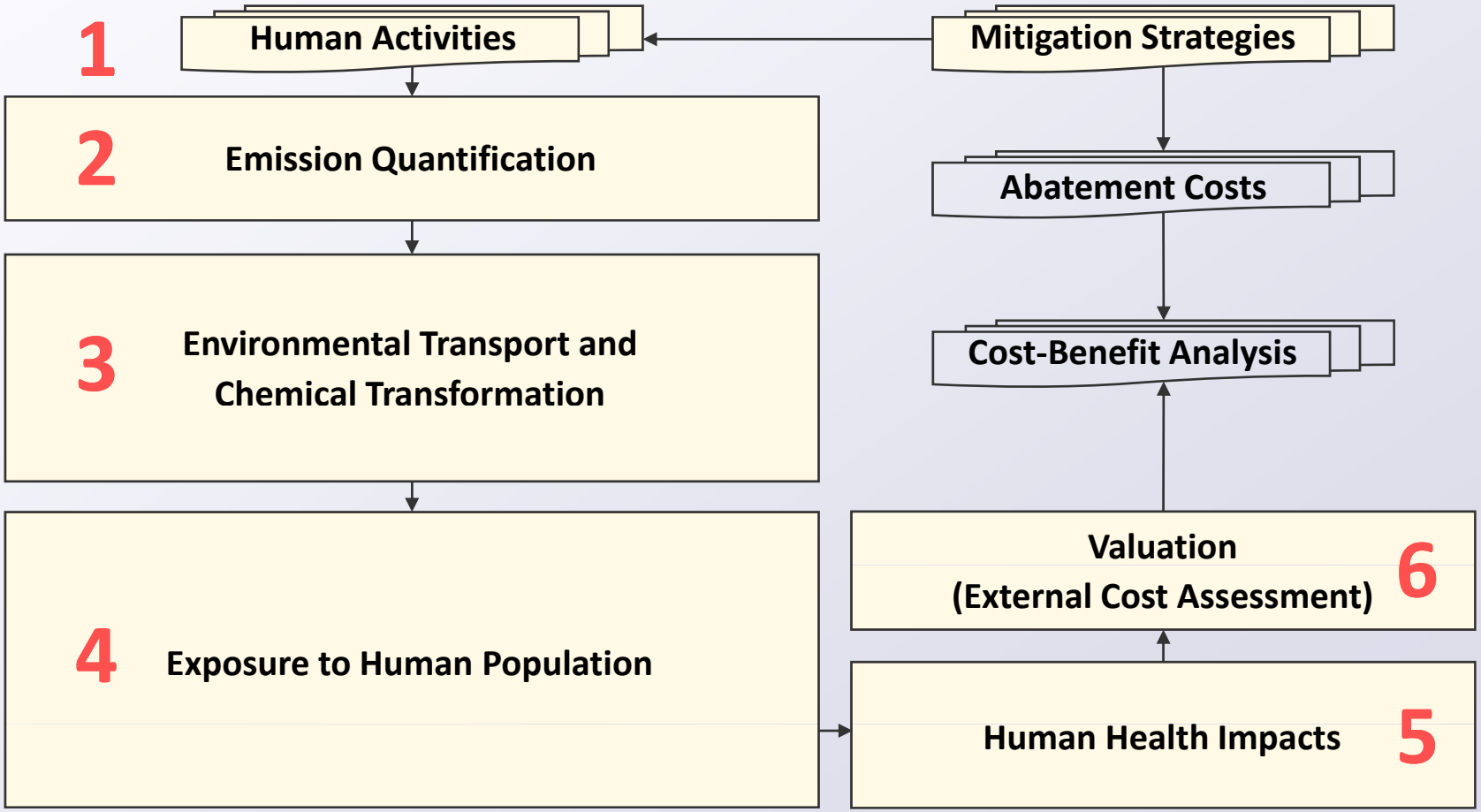
- Outline
- Integrated Health Impact Assessment of Organic Chemicals
- Human Activities and Mitigation Strategies
- Emission Quantification
- Environmental Transport & Chemical Transformation
- Exposure to Humans
- Human Health Impacts
- Valuation – External Cost Assessment
- Outlook

Outline

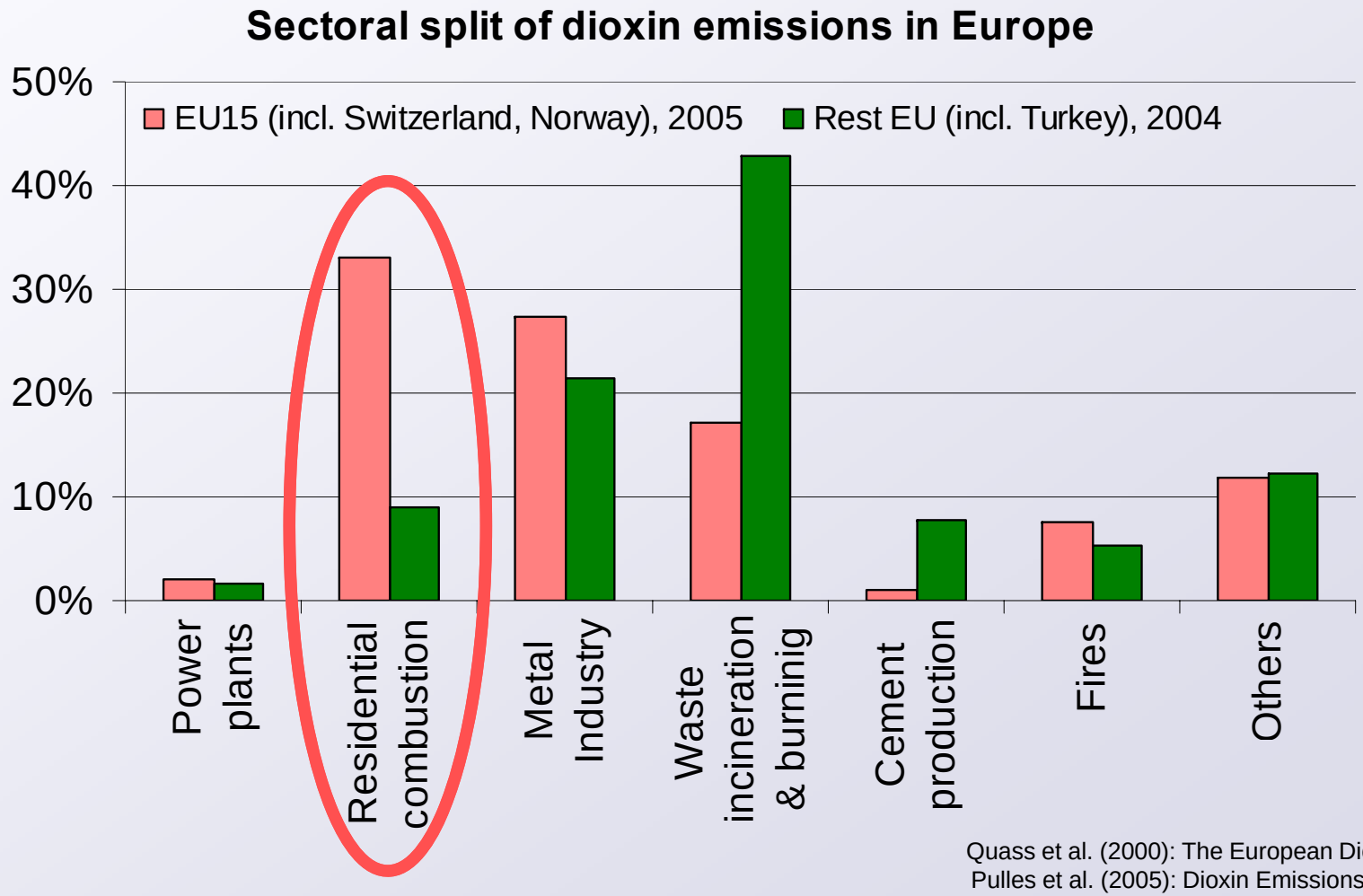
- **Question:** What is the reduction potential of an environmental policy with respect to human health impacts?
  - **Pollutant:** e.g. dioxins/furans (in TEQ of 2,3,7,8-TCDD)
  - **Sector:** e.g. residential combustion (burning of various synthetic constituents → formation of dioxins/furans)
  - **Scope:** Europe, spatially explicit (EMEP grid, river basins and administrative units
  - **Method:** Impact Pathway Approach (IPA)

Integrated Assessment Method

Simplified Impact Pathway Approach: 6 Steps



1 of 6: Identification of Emission Source Sectors



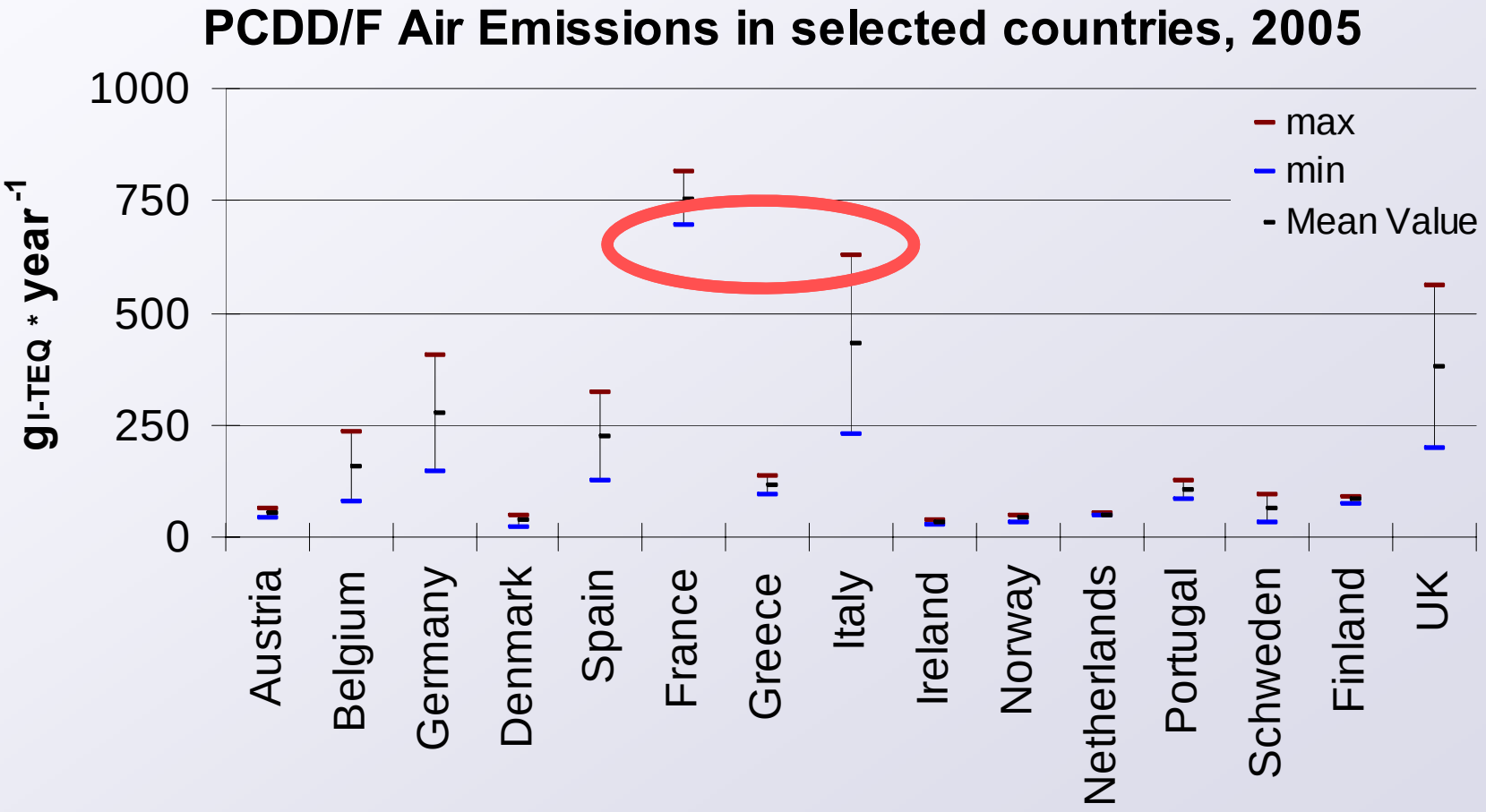
Source:
Quass et al. (2000): The European Dioxin Emission Inventory.
Pulles et al. (2005): Dioxin Emissions in Candidate Countries.

1 of 6: Identification of Mitigation Measures

Example: 2005/32/EC (Energy using products Directive)
→ *revision*

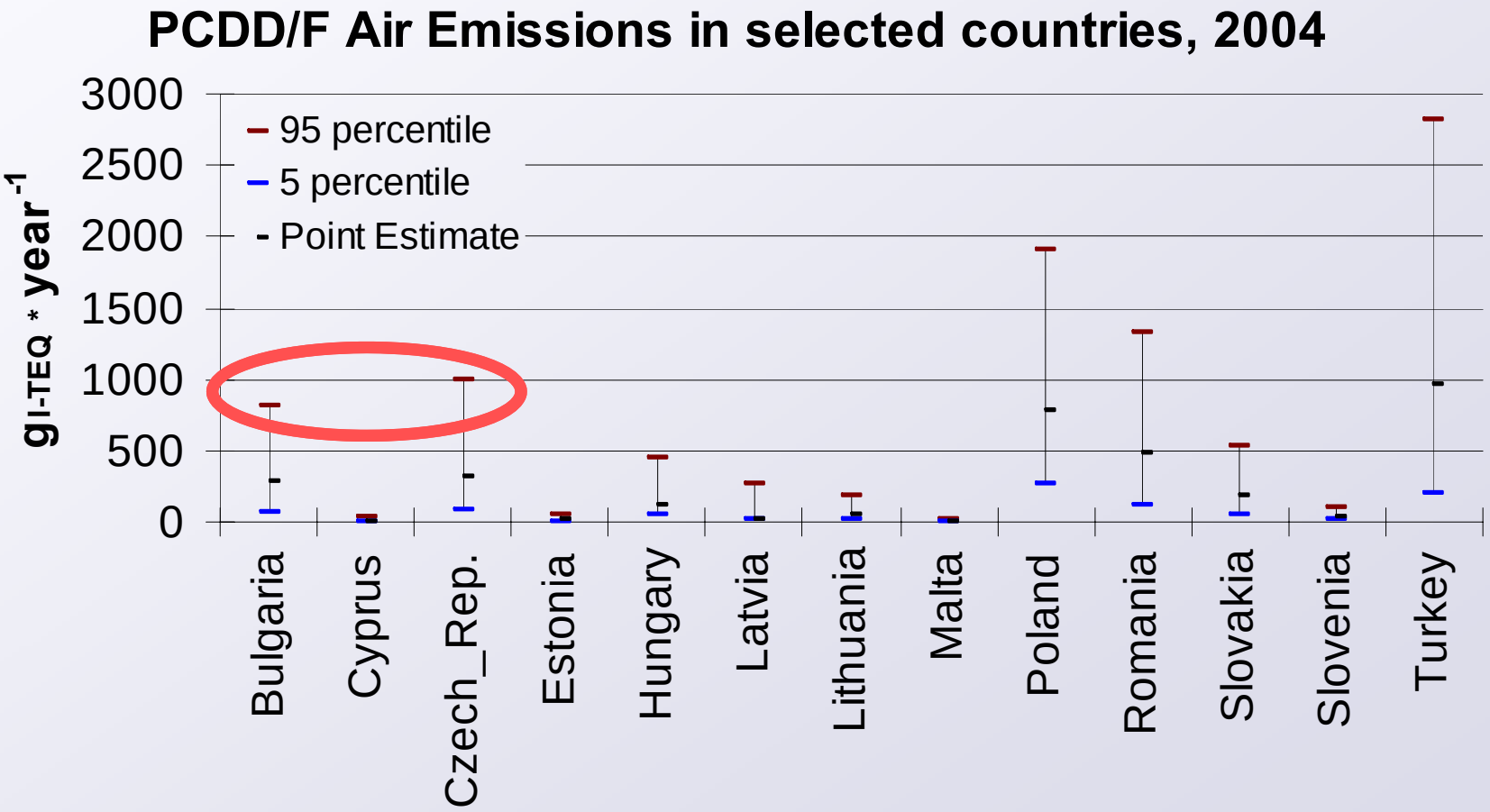
- **Implementation of emission thresholds for combustion processes in small-scale furnaces most likely until end of 2009 via**
- **Non-technical measures (e.g. no impregnated wood combustion without emission control technologies)**
- **Technical measures (e.g. improvement of biomass boiler combustion technologies to reduce incomplete combustion products)**

2 of 6: Emission quantification: EU15 countries



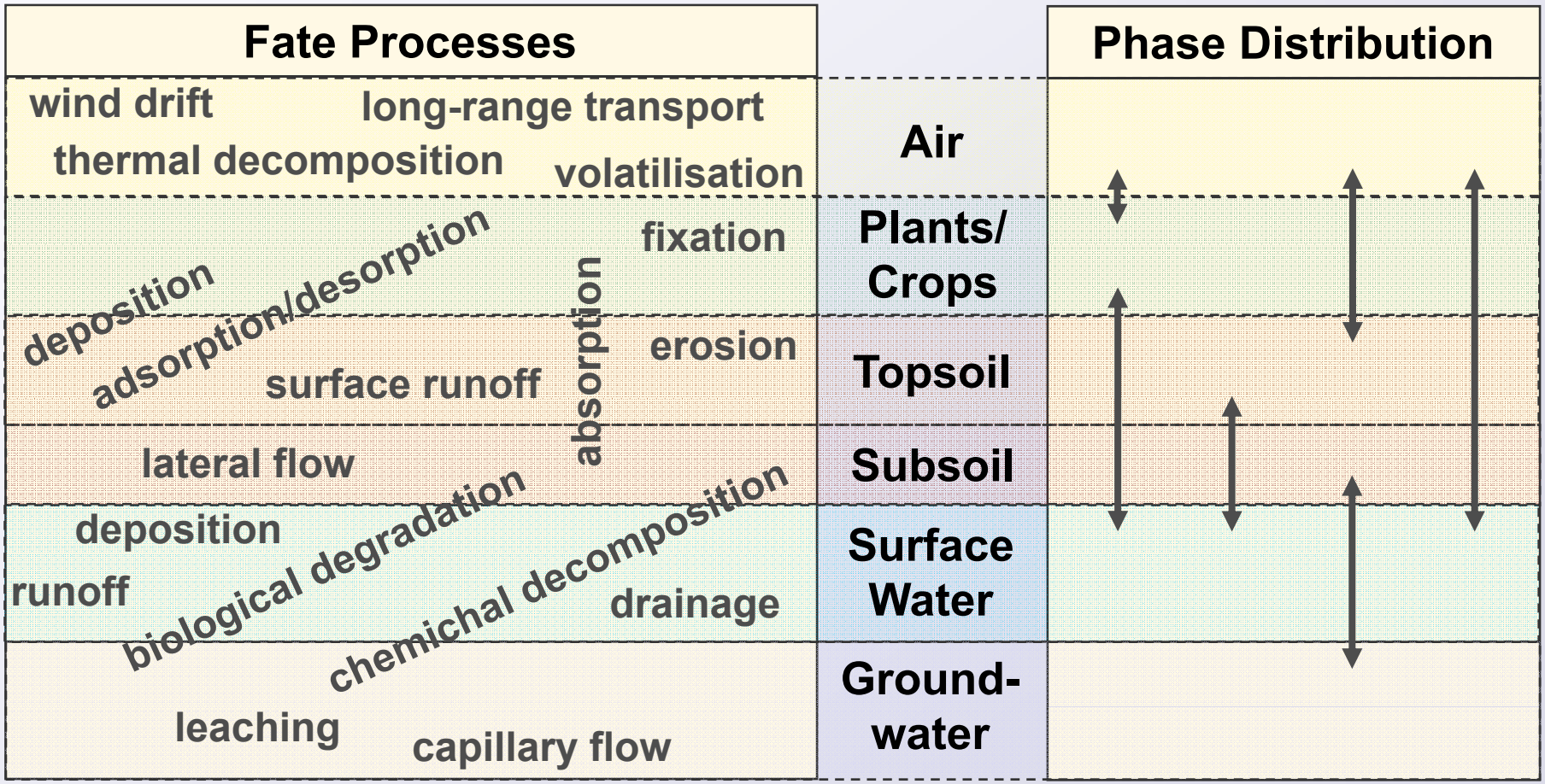
Source: Quass et al. (2000): The European Dioxin Emission Inventory.

2 of 6: Emission quantification: other EU countries

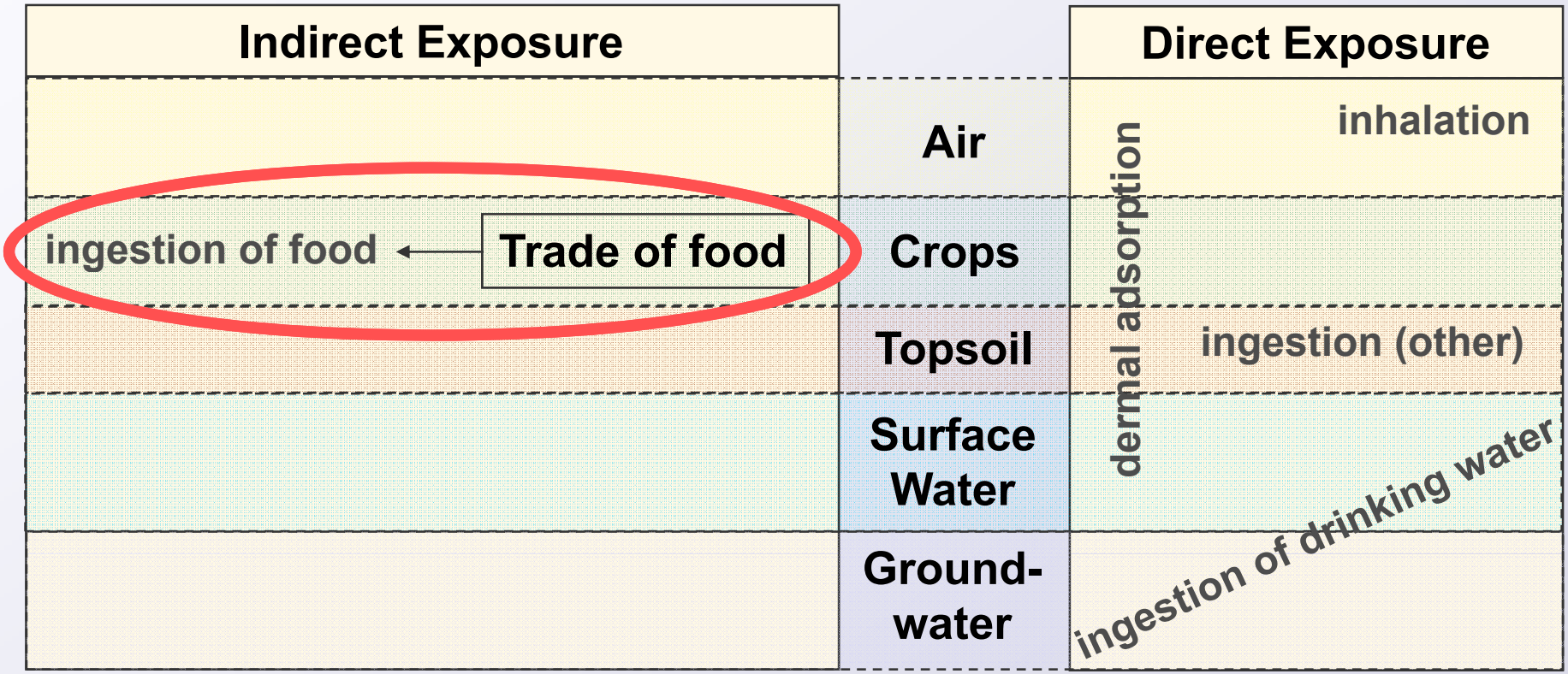


Source: Pulles et al. (2005): Dioxin Emissions in Candidate Countries.

3 of 6: Environmental Fate Modelling



4 of 6: Human Exposure Assessment



Population, activity, production, consumption and other data required!

5 of 6: Environmental Health Impact Assessment

⇨ Relation between (unspecified) cancer mortality and time-dependent cumulative exposure to dioxins:

Slope factor[a] = $0.2 \cdot 10^6$ [life time cancer risk per person due to ingestion during 70 years of 1 mg per $kg_{body\ weight}$ per day]

[a] Per TEQ of 2,3,7,8-TCDD.
Reduced by factor 1/5 from US EAP value, in view of IOM report by A. Searl.
Slope factor based on Cheng et al. (2006). doi:10.1111/j.1539-6924.2006.00800.x

⇨ Further relations between dioxin exposure and health risks required!

6 of 6: External Cost Assessment

	Severity Measures		Monetary Values
External Costs =	Σ YOLL, Σ YLD } Σ DALY Σ IQ Point loss Σ others	Cancer (inhalation, Ingestion, dermal)	40,000 €$_{2000}$ per YOLL 40,000 €$_{2000}$ per YLD 8,600 €$_{2000}$ per lost IQ Point others
		x	
	Σ YOLL, Σ YLD } Σ DALY Σ IQ Point loss Σ others	Non-cancer (inhalation, Ingestion, dermal)	40,000 €$_{2000}$ per YOLL 40,000 €$_{2000}$ per YLD 8,600 €$_{2000}$ per lost IQ Point others

6 of 6: External Cost Assessment

- **Problem:** How to address future damages?
- **Discounting** = comparing future with present damages (declining discount rate depending on increasing uncertainty of predicting future interest rates)

Calculated discount factor W_t	Valid for time t
$W_t = (1+0.035)^{-t}$	$0 < t \leq 25$
$W_t = (1+0.035)^{-25} \cdot (1+0.02)^{-(t-25)}$	$25 < t \leq 75$
$W_t = (1+0.035)^{-25} \cdot (1+0.02)^{-50} \cdot (1+0.01)^{-(t-75)}$	$75 < t \leq 300$
$W_t = (1+0.035)^{-25} \cdot (1+0.02)^{-50} \cdot (1+0.01)^{-225} \cdot 1$	$t > 300$

Outlook

- Expected health effects? — yes
- Expected reduction potential of current and future policies? — yes (variable)
- Comparison between policies (ranking) possible? — yes
- Results expected? — end of 2009

Thank you !