

3rd INTERNATIONAL SCIENTIFIC MEUSE SYMPOSIUM

***THE MEUSE DISTRICT : CHALLENGES FOR TOMORROW***

LIEGE, April 22 – 23, 2010

# Strategy to manage emerging pollutant issues

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# INTRODUCTION

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## EMERGING POLLUTANTS:

Anthropogenic chemical compounds analysed in drinking water, water bodies and in waste water.

e.g. 15 years ago **pesticides** → drinking water standard of 0,1µg/l (at that time below limit of quantitation)

current: artificial sweeteners, pharmaceuticals, heavy metals

## THE TWO BASIC LAWS OF THERMODYNAMICS :

All the anthropogenic compounds **ever produced or newly developed** and applied will be distributed all over the globe.

## PROGRESS IN THE SENSITIVITY OF CHEMICAL ANALYSIS:

**increasing number of pollutants** which can and will be detected in water(s) even at very low concentrations

# CONCERN

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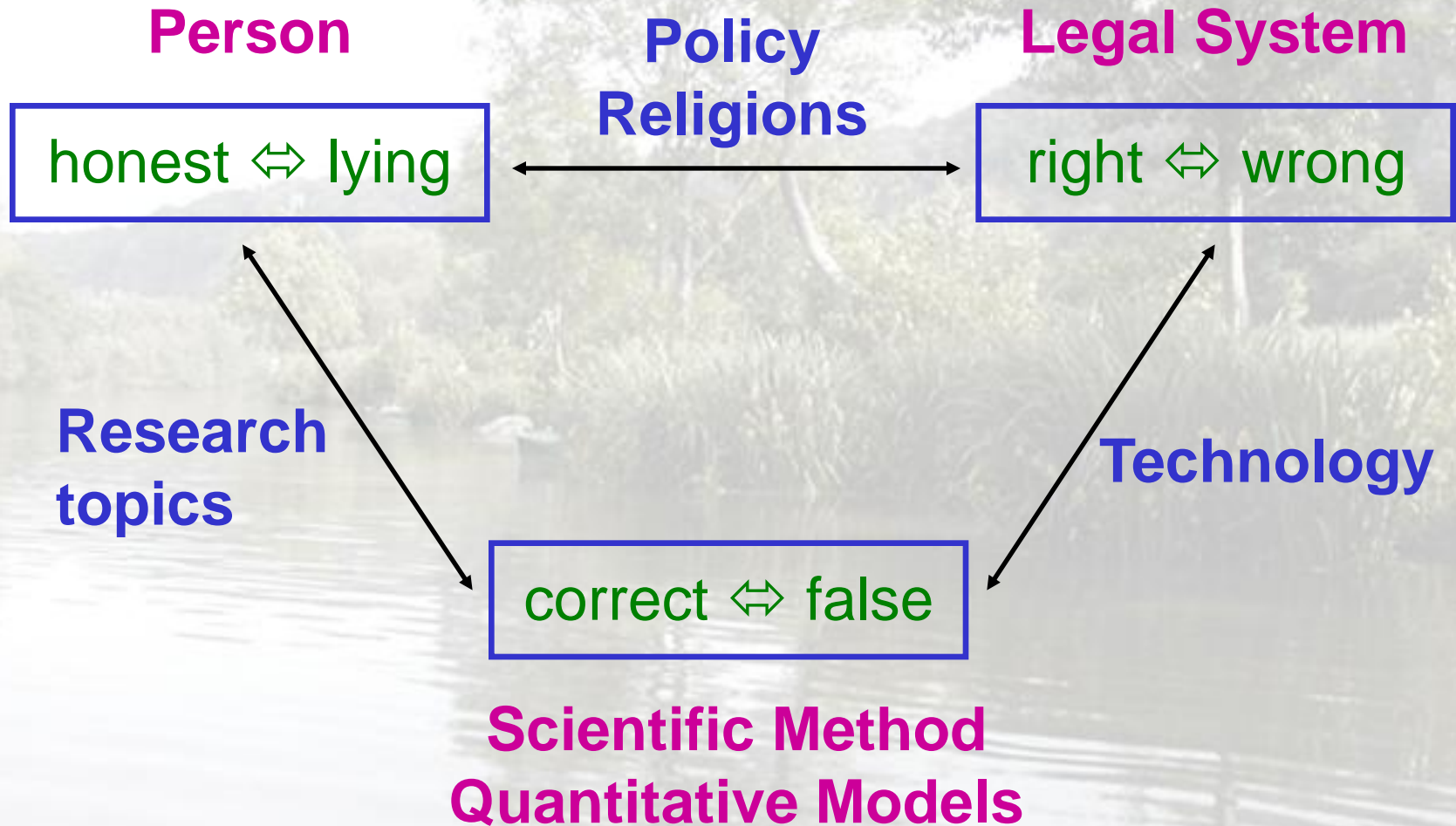
**Basic questions:**            **What can and do we know?**  
   **What can we hope?**  
   **What should we do?**

**What can we hope:**        **Dosis facit venenum (homeopathy? )**  
   **Natural development of higher organisms**  
   **and ecosystems is “protected” from micro-**  
   **pollutants by the degradation capacity of micro-**  
   **organisms**

**Concern:**                    **Does this also apply to man made chemical**  
   **compounds ? (NOEC tests?)**  
   **Is the rate of innovation much higher than adaptation?**  
   **Is self-organisation capacity high enough ?**  
   **Lack of scientific knowledge**

# POLLUTION MANAGEMENT

## Dynamic Control and Adaptation System



# POLLUTION MANAGEMENT

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- Anthropogenic activity and natural processes result in risks.  
→No Zero Risk for drinking water consumption and water protection.
- Production and use of chemicals, pharmaceuticals, synthetic material etc. are driving forces for economic development but are also associated with risks which have to be managed.
- Complete absence of chemical compounds (pollutants) in waters and drinking water can only be achieved (claimed) for chemicals never produced and globally banned.
- Scientific consensus: risk or hazard caused by chemicals is bound to their concentration and/or dose (EU-REACH).

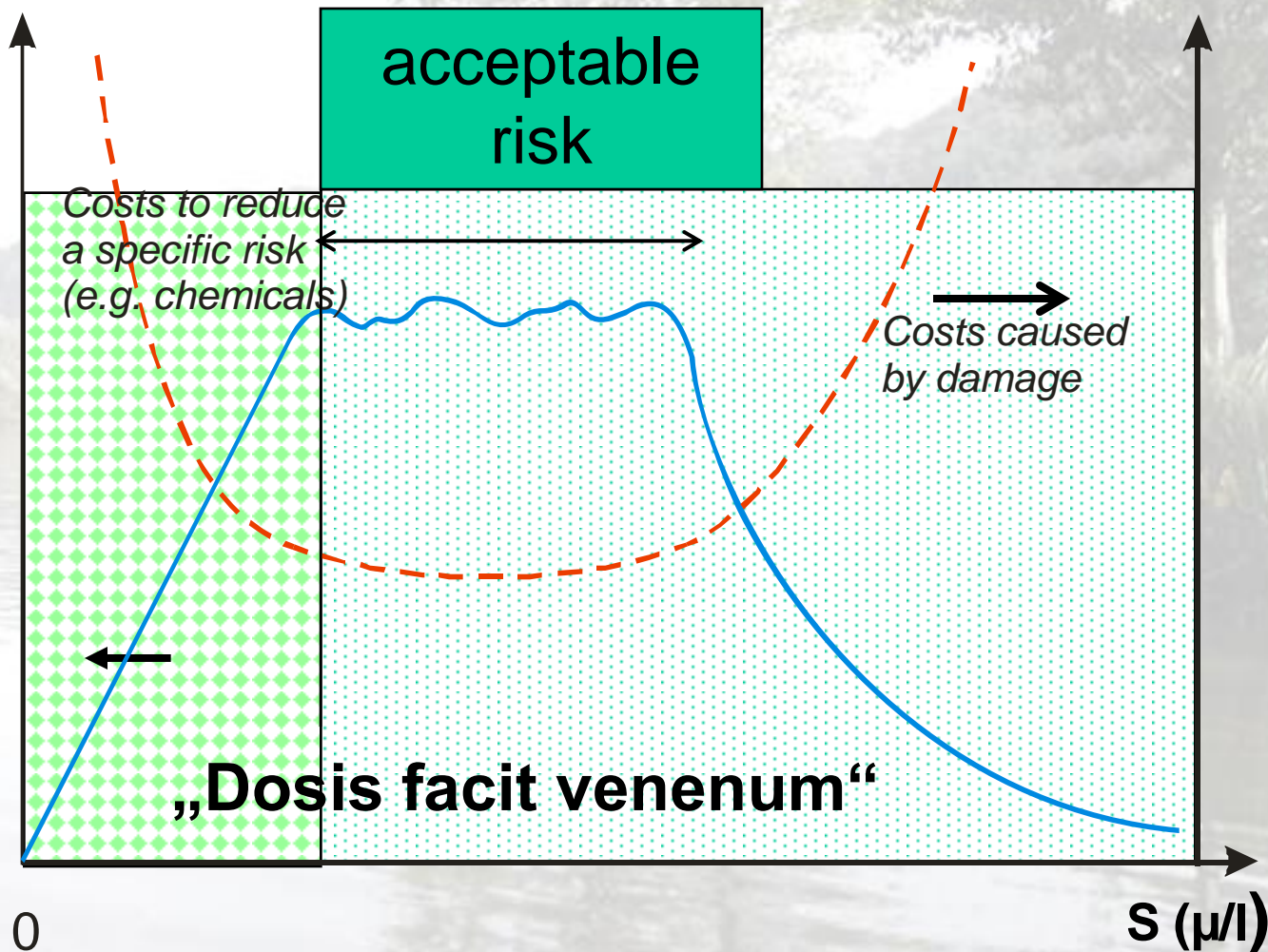
# POLLUTION MANAGEMENT

- Chemical compounds must not be classified as dangerous or hazardous without a clear criterion.
- Decomposition processes in natural systems:
  - ⇒ associated with the production of unknown intermediate chemical compounds,
  - ⇒ bound to the presence of a great variety of trace nutrients
- Well established scientific methods to determine maximum threshold values for concentrations (doses) in drinking water; similar methods for aquatic ecosystems are in development.
- The number of emerging pollutants will increase:
  - ⇒ Need for a political, science based strategy to cope with.

## Sustainability, risks and costs

Sustainability

”Costs (risk?)“



# STRATEGIES

Different strategies to cope with emerging pollutants are under development (NRW, Switzerland, Baden Württemberg)

The strategy developed in NRW in the context of the political programme “**Reine Ruhr**”:

The Ruhr river

- ⇒ **waste water discharge of ~2,5 Mio inh.**
- ⇒ **source of drinking water for ~ 5. Mio inh.**
- ⇒ Ruhrverband example of **multipurpose water management** organisation

The Ruhr river basin is still a highly industrialised area with dominating SME structure

# OVERALL « REINE RUHR » PROGRAMME

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1. Analysis and description of the actual situation
2. Development of a new monitoring concept
3. Upgrading of emission inventory
4. New source control strategy
5. Evaluation and implementation of additional waste water treatment steps
6. Evaluation and implementation of additional drinking water treatment steps
7. Information and consulting of stakeholders

# STRATEGY «REINE RUHR»

- Implementation of WHO Water Safety Plans for the Ruhr catchment based on a risk regulation
  - Linking drinking water quality and water protection in the whole catchment of the of raw water source.
- Strategic decision to apply
  - the same parameters and
  - the same standards for quality assessment of drinking water and raw water sources (river), only the probability of compliance and the limits for exceedance of the standards will be different
  - Standards based on well established methods:
    - $GOW_x$  : health related indication value;
    - LW : guide value.

# STRATEGY «REINE RUHR», DECISION TOOL

- Decision values  $PW_x$  for emerging pollutants:
  - ⇒  $PW_{ak} > 50 \mu\text{g}/\text{l}$ : (acute toxicity possible)  
**immediate action required: information and remedial action for drinking water supply**, consumer information, start of risk assessment, action for pollution abatement
  - ⇒  $50 \mu\text{g}/\text{l} > PW_{ct} > 0,1 \mu\text{g}/\text{l}$ : (chronic toxicity possible)  
**no immediate action at drinking water supply** as only life long consumption causes risk (chronic risk): **Start** of consumer information, risk assessment for standard value development and action for pollution reduction.
  - ⇒  $PW_{ch} < 0,1 \mu\text{g}/\text{l}$  (chronic toxicity only in the case of compounds with strong gene-toxicity → **no action**.  
  
for compounds with strong gene-toxicity concentrations  $< 0,01 \text{ mg}/\text{l}$  ( $GOW_2$ ): **no action**

# STRATEGY «REINE RUHR», DECISION PAD

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VWs

# GOW<sub>x</sub> CONCEPT

Depending on the existing knowledge, and the characteristics of emerging pollutants GOW<sub>x</sub> values  $\leq$  LW are developed

Denotation	Value [ $\mu\text{g/l}$ ]	Explanation
GOW <sub>1</sub>	$\leq 0,1$	For low gene-toxic compounds without sufficient scientific expertise and relevant experimental data
GOW <sub>2</sub>	0,01	<i>For strongly gene-toxic compounds only</i>
GOW <sub>3</sub>	0,3	For verifiably non gene-toxic compounds if significant experimental-toxicological data are absent
GOW <sub>4</sub>	1	As GOW <sub>3</sub> , <i>Additional data for oral neuro-toxicity Immuno-toxicity and for genetic hazard potential of the compound do not result in a value <math>\leq</math> GOW<sub>3</sub></i>

**If LW for a compound has been determined GOW<sub>x</sub> lose relevance**

# GOW<sub>x</sub> CONCEPT

Depending on current knowledge, and the characteristics of emerging pollutants GOW<sub>x</sub> values are developed (UBA Berlin)

Denotation	Value [ $\mu\text{g/l}$ ]	Explanation
GOW <sub>5</sub>	3	As GOW <sub>4</sub> , <i>in addition</i> , data from a significant study on subchronical – oral toxicity of the compound do not lead to a value $\leq$ GOW <sub>4</sub>
GOW <sub>QSAR</sub>	0,1 to 3	Analogy -and „(Qualitative) <b>Structure Activity Relationship</b> “ Existing databases allow to derive maximum concentrations according to molecular structure and classes of compounds e.g. Threshold of Toxicological Concern according to Cramer-classification.
GOW <sub>6</sub>	> 3	As GOW <sub>5</sub> , <i>in addition</i> , data from a significant study on subchronical-oral toxicity do not lead to a value $\leq$ GOW <sub>5</sub>

# STRATEGY «REINE RUHR»

- Risk assessment and standard value development using the GOW and LW (guide value) investigation method developed by German EPA, 2003  
<http://umweltbundesamt.de/wasser/themen/downloads/trinkwasser/Empfehlung-Nicht-bewertbare-Stoffe.pdf>
- For all organic micro-pollutants with a  $GOW_x$  or  $LW > 10\mu\text{g/l}$  a special precautionary standard  $VW_s$  (spezieller Vorsorgewert)  $=10\mu\text{g/l}$  is defined as a goal if economically compatible.
- A new monitoring system, a central data management system and a detailed emission inventory have been developed.
- The adaptation of the whole administrative structure to the action plan “Reine Ruhr” is on the way.

# STRATEGY «REINE RUHR»

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- Micro-pollutant reduction technologies are investigated for DW and WW treatment.
- Based on the results a combined approach i.e. a combination of minimum standards for micro-pollutants (ALARA principle) at specific point sources (waste water treatment plants) and the application of an environmental standard principle (GOW and LW) for specific pollutants will be developed taking into account cost effectiveness.
- This strategy aims to be applicable to all waters used for drinking water abstraction (in EU?).
- For many micro-pollutants, the standards for aquatic ecosystems might be lower than for human consumption.

A serene landscape featuring a calm river in the foreground, lush green trees along the banks, and misty mountains in the background. The scene is captured in a soft, slightly desaturated light, creating a peaceful and natural atmosphere.

**Thank you for your  
attention**