Gerhard Winkelmann-Oei
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Threshold: criteria and philosophy for setting the thresholds value for water pollution

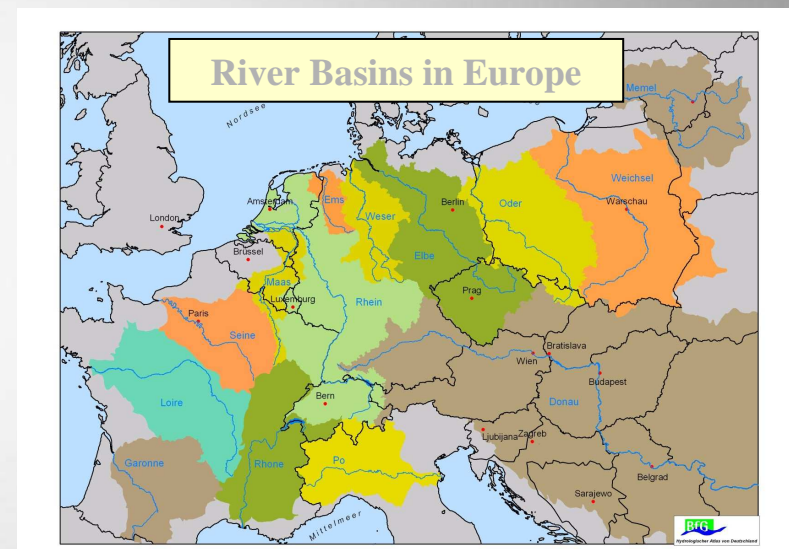In the context auf transboundary cooperation!

Why we need criterias and threshold values for transboundary water pollution ?

Reasons: Accidents can effect i.e.
- **Drinking water supply**
- **Economic Use (i.e. cooling water)**
- **Ecological Purposes (Aquatic Ecosystem)**

The perception of Upstream Countries can vary significantly from Downstream Countries

→ Harmonized Criterias and Threshold Values

River Basins in Europe

Threshold: criteria and philosophy for setting the thresholds value for water pollution

In the context auf transboundary cooperation!

In especially criterias and threshold values are needed for:

1. **International Alert-Systems**
   - **Hazardous Substances**
   - **Thresholds**
2. **Notification of Hazardous Activities**
   - **UNECE Industrial Accident Convention**
   - **River Commissions**
3. **Inventories and Statistical Analysis**
   - **Accidental Risk Sites**
   - **Accidents**
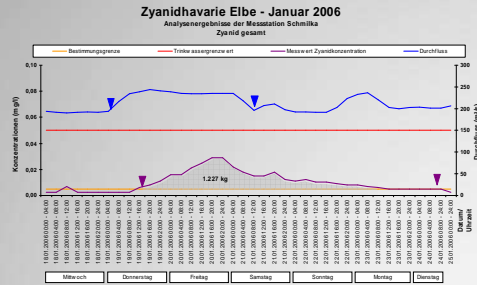
Example
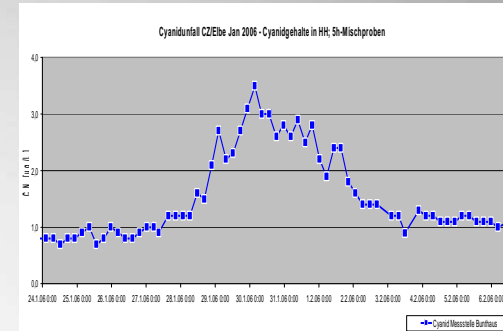## Cyanide-Accident, January 2006

Press-Headlines:

➢ **Wave of Poison Is Rolling towards Saxonia!**

➢ **Cyanide in the Elbe is endangering Drinking Water Supply in Germany**

Transboundary?

German-Czech Border
~ 1,2 t
(250 Km downstream)

Hamburg
~ 1 -1,5 t
(700 Km downstream)

Conclusion:　Every water contamination will become transboundary.
It is only up to the sensitivity of the monitoring systems,
whether it will be detected
Transboundary = F (Sensitivity of Mon.-Device)

Problem :　What is a **„serious"** transboundary Pollution or a
contamination causing a transboundary **"effect"**?

EU-Seveso II

ANNEX VI

CRITERIA FOR THE NOTIFICATION OF AN ACCIDENT TO THE COMMISSION AS PROVIDED FOR IN ARTICLE 15 (1)

Cross-border damage

Any accident directly involving a dangerous substance giving rise to

Effects outside the territory of the Member State concerned.

Effects:

Immediate damage* to the environment

— *significant or long-term damage to freshwater*

— 10 km or more of river or canal,

— 1 ha or more of a lake or pond,

— 2 ha or more of delta,

* …the Lethal Concentration (LC) for 50 % of the species representative of the environment …

Assessment of the Pollution

Cyanide: 0,2 mg/l (Threshold Sewage Water (Germany))

Elbe (Dresden):   150 m (Breite) x 2 m (Tiefe) x 10.000 m = 3.000.000 m³

Assumption: homogenous Mixture

Toxic Amount: 3.000.000 m³ x 0,2 g/m³= 600.000 g = **600 Kg**

Measurement: 1200 Kg

→ **Effect according to EU Seveso II Directive**

The calculation of different high water endangering substances shows a range between 1 – 1000 Kg

Problems

➢ 100.000 different chemicals are at use

➢ Toxicity of different substances varies over several (~7) powers

→ **Water Risk Class (WRC)**

Hazardous Substance Properties
Water

WRC

R-Phrases
(EC 67/548/EEC)

H-Statements
(EC) 1907/2006

Acute Toxicity:
→ Human-, Fish-, Crustacae-, Algae-, Bacteria-, Toxicity

Longterm-Impact:
→ Cancerogenity, Mutagenity, Teratogenity
→ Bioaccumulation
→ Biodegradability

Water Risk Classes (WRC)

Searching for WRC´s: UBA – Database (> 7000 Substances)

→ http://webrigoletto.uba.de/rigoletto/public/searchRequest.do?event=request

Number Substances

→ **WRC "0"**   → **WRC 1**   → **WRC 2**   → **WRC 3**

Cyanide Accident

Integrated water endangering properties

(i.e. Toxicity (aqua., mam.), Bioaccumulation, Degradation)
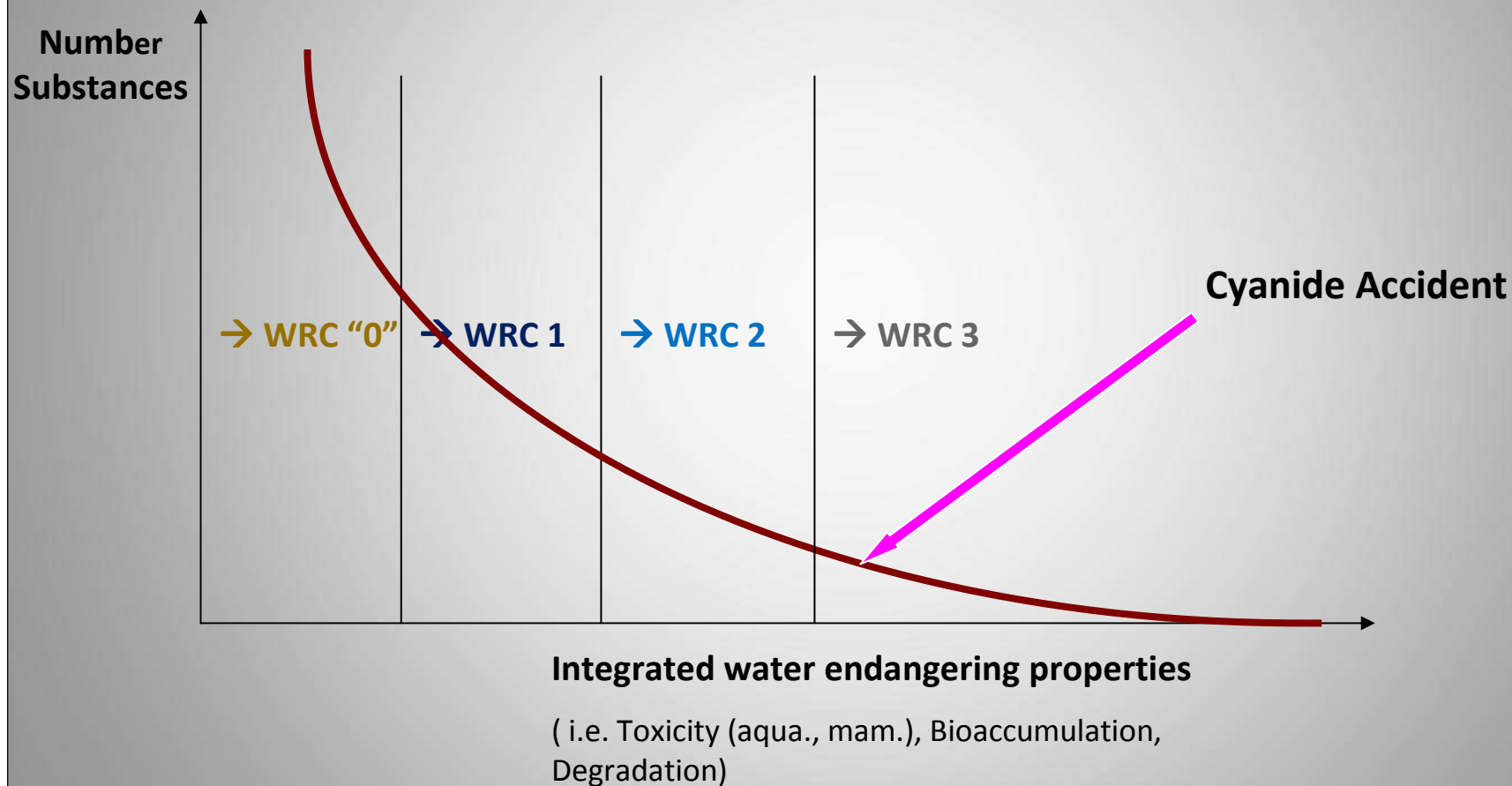
Guidance for Alarm-Thresholds
River Elbe

Substance Classification	Alarm Thresholds		
WRC	[kg] / [l]	[kg] / [l]	[kg] / [l] for n>2
„0"	≥ 10.000	≥ 100.000	$\geq 10^{n+3}$
1	≥ 1.000	≥ 10.000	$\geq 10^{n+2}$
2	≥ 100	≥ 1.000	$\geq 10^{n+1}$
3	≥ 10	≥ 100	$\geq 10^{n}$
Water-Risk-Index (WRI) WRI = log (WRC 3eq.)	≥ 1	≥ 2	$\geq n$

Water Risk Index

WRC-Equivalent Mass (M):

WRC	"0"	M x 1000
WRC	1	M x 100
WRC	2	M x 10
WRC	3	M

→ **WRI = Log (WRC 3 – equivalent** (kg or l))

Guidance for Alarm-Thresholds
River Elbe

Mixture Classification	Alarm Thresholds		
WRC	**[kg] / [l]**	**[kg] / [l]**	**[kg] / [l] for n>2**
- Oil (not specificated)	≥ 100	≥ 1.000	$\geq 10^{n+1}$
- Fire Retention Waters	≥ 1.000	≥ 10.000	$\geq 10^{n+2}$
- Slurry	≥ 1000	≥ 10.000	$\geq 10^{n+2}$
- Ash-Suspensions	≥ 10.000	≥ 100.000	$\geq 10^{n+3}$
WRI	≥ 1	≥ 2	$\geq n$

Guidance for Alarm-Thresholds
River Danube
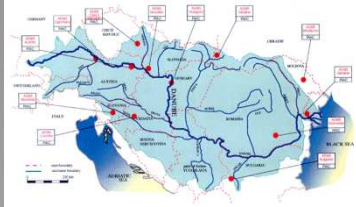
Alarm-Thresholds		
Spilled Substances	**Thresholds**	
WRC	**Average Flow** **< 1000 m³/s** [kg] or [l]	**Average Flow** **≥ 1000 m³/s** [kg] or [l]
"0"	≥ 100 000	≥ 1 000 000
1	≥ 10 000	≥ 100 000
2	≥ 1 000	≥ 10 000
3	≥ 100	≥ 1 000
Water Risk Index (WRI)	≥ 2	≥ 3

Guidance for Alarm-Thresholds
River Odra

Substance Classification		Alarm-Thresholds		
R-Phrases [1]	WRC[2]			
		[kg] / [l]	[kg] / [l]	[kg] / [l]
25 or 52, 53, 52/53	1 Low Water endangering	≥ 1000	≥ 10.000	$\geq 10^{n+2}$
28 or 45, 50, 51/53 and 22 or 25	2 Water endagering	≥ 100	≥ 1.000	$\geq 10^{n+1}$
50 or 52, 53, 50/53, 51/53, 52/53 and 28 or 45, 45 and 28	3 Highly Water endangering	≥ 10	≥ 100	$\geq 10^{n}$
Water Risk Index		≥ 1	≥ 2	$\geq n$

Mixture	Alarm-Thresholds		
	[kg] / [l]	[kg] / [l]	[kg] / [l]
Oil (not specified)	≥ 100	≥ 1.000	$\geq 10^{n+1}$
Fire Retention Water	≥ 1.000	≥ 10.000	$\geq 10^{n+2}$
Slurry	≥ 1.000	≥ 10.000	$\geq 10^{n+2}$
Water Risk Index	≥ 1	≥ 2	$\geq n$

Alarm Criteria Dniester River
## *- Draft Proposal -*

Russian WRC

Пороговые значения объявления тревоги для бассейна		Смесь веществ, высвободившаяся в результате аварии	Уведомлени об опасности [kg] или [l]
Классификация веществ l	**Пороговы е значения**		
Water Risk Class **Класса риска для водных объектов (WRC)**	Уведомлени об опасности [kg] или [l]	**Нефть и нефтепродукты**	≥ 1 000
		Вода, примененная для пожаротушения	≥ 10 000
"0" / 4	≥ 100 000	**Водные взвеси и сточные воды** (животноводство)	≥ 10 000
1 / 3	≥ 10 000		
2 / 2	≥ 1 000		
3 / 1	≥ 100	**Суспендированная зола**	≥ 100.000
Степень риска для водных объектов **Water Risk Index (WRI)**	≥ 2		

Drawing up Inventories
WRI > 5 (10 tons WRC 3 equ.)
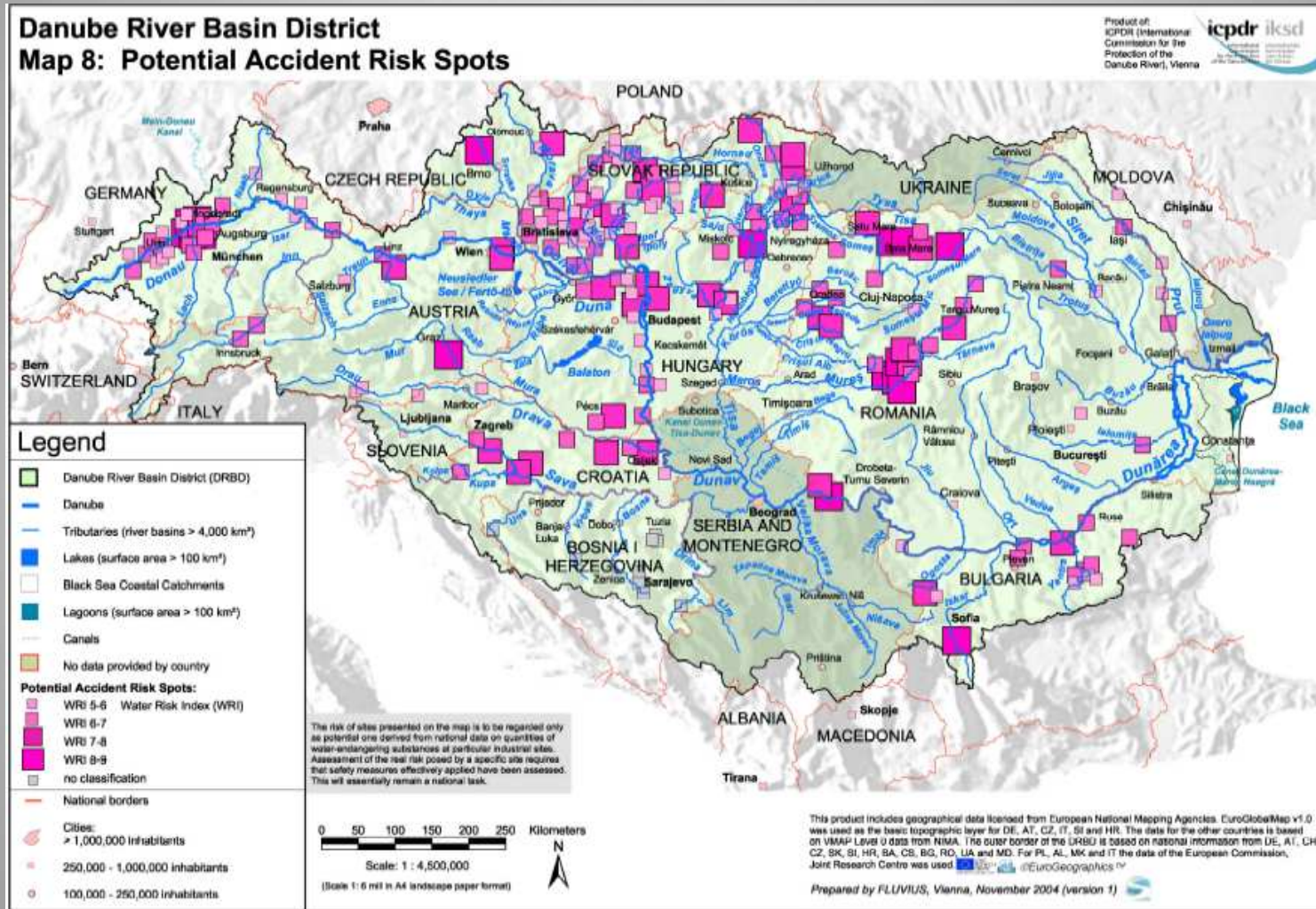
ARS-Inventory

Table 2   The number of ARSs and their total hazard potential

Country	Reported ARS	Evaluable ARS	Total quantity (WRC 3 – Equivalents) [Kg]	Total WRI
Bulgaria	29	28	370,000,000	8.6
Germany	56	56	2,293,874,000	9.4
Croatia	30	26	135,734,760	8.1
Moldova	27	14	3,634,610	6.6
Romania	67	59	2,076,893,274	9.3
Slowak. Rep.	148	145	250,877,521	8.4
Slovenia	2	2	980,000	6.0
Czech Rep.	9	8	144,617,790	8.2
Hungary	243	242	706,603,002	8.8
Total	611	580	5,982,720,034	9.8

Industrial Sites

Mining Sites

Prepared by the ARS-ad-hoc Expert Panel of the AEPWS EG, 2001

Notification of Hazardous Activities

UNECE Location Criteria: Water Path

Along or within catchment areas * of transboundary and border rivers, transboundary or international lakes, or within the catchment areas of transboundary groundwaters, for activities involving substances that fall under category 3, 4, 5 or 8 of part I of annex I to the Convention and that may be released into watercourses in the event of an accident.

Whether or not such an activity is capable of causing a transboundary effect in such an event should be decided by the competent authority of the Party of origin, preferably in consultation with joint bodies**. The decision should depend, among other things, on the existence of river warning and alarm systems and the distance ***between the location of the hazardous activity and the border.

Notes

*   A catchment area of a transboundary river or lake is defined as the whole drainage area of this river or lake with a common outlet.
**   Joint body means any bilateral or multilateral commission or other appropriate institutional arrangements for cooperation between Riparian Parties.
*** The joint ad hoc expert group on water and industrial accidents recommended that this distance should correspond to approximately a flowing period of **two days of average flow** velocity.

→ ECE/CP.TEIA/12, Page 21, Annex II

UNECE: Location-Criteria

Rhine Flow rate: 1-2m/s

48 H x 2 m/s = ~ 200-350 Km
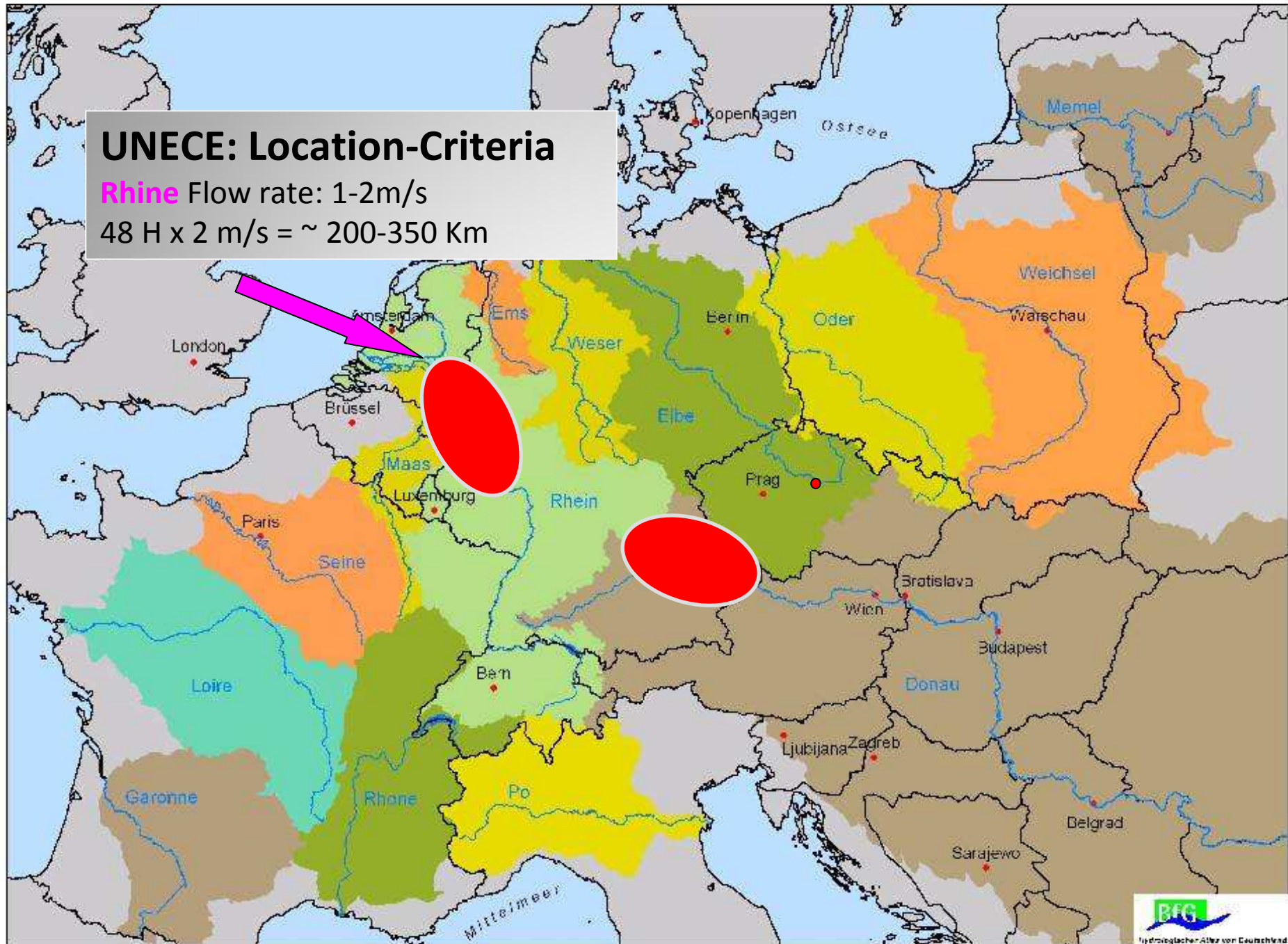
Comparison of Hazards

Hazardous Incident Index	**Water Risk**
➤ Sandoz (1986)	6
➤ Baia Mare (2000)	6
➤ Harpin (2005)	5
➤ Elbe-Cyanide (2006)	3
➤ Ayka/Kolontar (2010)	7 - 8

River Rhine

Joint Monitoring Station

Bimmen /Lobith

The Netherlands

Belgium

Luxembourg

Germany

France

Switzerland

Austria

Elevation [m a.s.l.]
- <0 - 200
- 200 - 400
- 400 - 600
- 600 - 800
- 800 - 1000
- 1000 - 1500
- 1500 - 2000
- 2000 - 2500
- 2500 - 3821

© BfG
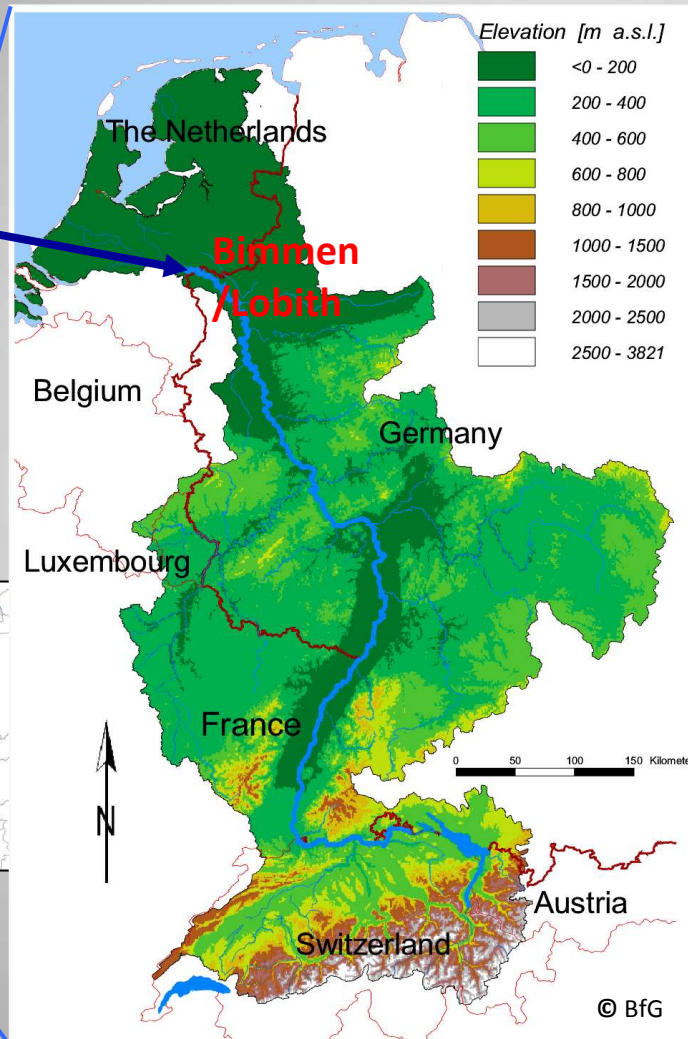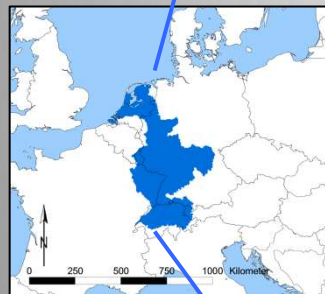
length:	1,320 km
catchment area:	185,000 km²
draining off:	2,290 m³/s
inhabitants in c. a.:	ca. 50 Mio.
political structure:	9 countries
drinking water for:	5.5 Mio inhab.
shipping:	ca. 11,000 ships
	ca. 175 Mio. tons
	30 % dangerous goods

50 % of Europe's chemical industry is located in the catchment area

Rhine water is used for
- drinking water supply
- hydropower
- waste water
- cooling water
- tourism ...

© Dr. P. Diehl

Guidance for Alarm-Thresholds
River Rhine

Guidance for Alarm-Thresholds

Parameter	Daily mean concentration	Discharged loads
pH-Wert	< 6,5 > 9,5	
Conductivity	1000 µS/cm	
Oxygen	< 5 mg/l	
Heavy metals		
Arsenic	10 µg/l	0,5 t
Lead	20 µg/l	1 t
Cadmium	3 µg/l	0,15 t
Chromium total	50 µg/l	2,5 t
Copper	20 µg/l	1 t
Nickel	20 µg/l	1 t
Mercury	1 µg/l	50 kg
Zinc	500 µg/l	
Further inorganic parameters		
Cyanide	5 µg/l	250 kg
Chloride	300 mg/l	-
Sum parameters		
TOC	15 mg/l	750 t
AOX	25 µg/l	1,5 t

Guidance for Alarm-Thresholds

Parameter	Daily mean concentration	Discharged loads
Organic Micro-pollutants		
PAH (individual substances)	0,1 µg/l	5 kg
Sum of PAH	0,5 µg/l	25 kg
Biocides (individual substances)	0,3 µg/l	15 kg
PCB (individual substances)	0,1 µg/l	5 kg
Plant protective agents (individual substances)	0,3 µg/l	15 kg
Pharmaceutical substances (individual substances)	0,3 µg/l	15 kg
Other organic micro-pollutants (individual substances)	3 µg/l	150 kg
Radioactivity		
Parameter	Activity	Activity
Total-γ (total-Gamma)	25 Bq/L above ≥ 2 h	1,250 GBq
Tritium	100 Bq/L	5.000 GBq

--> **Concentration guidance values concern to 5 (new!) monitoring stations along the Rhine**
--> **Discharged loads apply to indications of the polluter**

Gerhard Winkelmann-Oei
Umweltbundesamt

Alarm-Thresholds

1. <u>Emission-Thresholds</u>

Advantages:
- Simple and fast
- Rapid comparabilty to other accidents
- Supporting comparable safety standards

Disadvantages:
- Frequently no information to the discharge
- Non-reported accidents won`t be detected

2. <u>Immission-Thresholds</u>

Advantages:
- Direct warnings to protected goods are possible
- Non-reported accidents can be detected
- „radar trap"- effect possible!

Disadvantages:
- Dependent to Location and Equipment of monitoring station
- Only specific substances or substance groups can be detected
- Complicated evaluation (plausibilization and validation of the datas)
- Costly

Theses

- For international warning- and alert-systems fixed Thresholds are not appropriate, better Guidance levels

- In the long run Emission and Immission Guidance levels have to be developed

- Guidance levels are best for the first rough evaluation of the contamination, specific analysis have to follow

- The Water Risk Index (WRI) is very useful in

  - classification of accidents,

  - statistical analysis and

  - drawing up inventories.

Thank You for your Attention