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POTENTIAL MEASURES TO IMPROVE THE WATER QUALITY OF THE RIVER MEUSE WITH RESPECT TO EMERGING SUBSTANCES

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Focus of this presentation

- Background
- Sampling campaign aimed at the presence of emerging substances
- Which emerging substances are relevant to the Meuse river?
- Sources of emerging substances
- Inventarisation of potential measures
- Scales of measures



Why are emerging substances relevant?

- Unknown (long term) effects on aquatic environment and human health (bathing water, drinking water)
- Persistent in the aquatic environment
- Difficult to remove from the water without advanced treatment methods
- Infiltration in the dunes, effects on nature development



River Meuse: different views, different users, different wishes



Which emerging substances have been studied?

- (new) pesticides (e.g. nicosulfuron, dimethenamide-p)
- Pharmaceuticals
- X-ray contrast media
- Endocrine disruptive agents (bisfenol-a)
- MTBE/ETBE
- Perfluoralkylated compounds (PFOA, PFOS)
- Biocides
- Chelating agents (EDTA, NTA)
- other

Which emerging substances are relevant to the Meuse river?

Our measuring campaign at water quality measuring stations and intake points for drinking water production reveals the presence of many emerging substances in the river Meuse, amongst which

- *Plant protection products (mainly herbicides)*
- *Pharmaceuticals (incl. X-ray contrast media)*
- *Industrial chemicals*

at different locations in the river basin



(max) concentrations of plant protection products (2003-2008)

substance		Max conc. ($\mu\text{g/l}$)	Measuring station
Chloridazon	H	0,35	Luik (B)
2,4-D	H	0,29	Keizersveer (NL)
<i>AMPA</i>	<i>M</i>	<i>5,0</i>	<i>Heel (NL)</i>
Chlorotoluron	H	0,21	Luik (B)
Glyfosaat	H	2,4	Brakel (NL)
MCPA	H	0,42	Brakel (NL)
Mecoprop-p	H	0,38	Brakel (NL)
S-Metolachlor	H	0,22	Nameche (B)
Nicosulfuron	H	0,68	Keizersveer (NL)
<i>and many others</i>			

(max) concentrations of pharmaceuticals (and X-ray products)

substance		Max conc. (µg/l)	Measuring station
Carbamazepine	AE	0,21	Brakel (NL)
Diclofenac	PK	0,14	Keizersveer (NL)
Amidotrizoic acid	XR	0,47	Luik (B)
Iohexol	XR	0,18	Heel (NL)
Iomeprol	XR	0,35	Luik (B)
Iopamidol	XR	0,26	Brakel (NL)
Iopromide	XR	0,37	Luik (B)
Ibuprofen	PK	0,17	Keizersveer (NL)
Metoprolol	BB	0,13	Keizersveer (NL)
sulfamethoxazole	AB	0,16	Brakel (NL)
<i>and many others</i>			

(max) concentrations of other (emerging) substances

substance		Max conc. ($\mu\text{g/l}$)	Measuring station
MTBE		11	Heel (NL)
DIPE		16	Eijsden (NL)
Fluoride		2,44	Luik (B)
ETBE		0,7	Keizersveer (NL)
Tributylphosphate		48	Eijsden (NL)
p,p-sulfonyldiphenole		8,7	Eijsden (NL)
Urotropine		1,1	Brakel (NL)
EDTA		66	Keizersveer (NL)

What relevant sources are distinguished?

- Plant protection products (herbicides)
 - Diffusive via agricultural use
 - Diffusive via non agricultural use
- Pharmaceuticals (incl. X-ray contrast media)
 - WWTP effluents
 - Sewer overflows
 - Industrial effluents
- Industrial chemicals
 - Industrial effluents
 - Diffusive emission from traffic and roads (e.g. MTBE)
 - Calamities, shipping accidents



Potential for removal of emerging substances (treatment)

	simple treatment*					advanced treatment*				
	aer.	coag.	RF	UV ¹	ozone ²	PAC/ACF	O ₃ /H ₂ O ₂	UV/H ₂ O ₂	NF/RO	IEX
Chloridazon	-					0			+	
2,4-D	-				0/+	+	0/+		+	
Carbendazim	-	. ³	-	+	+	+		0	+	
Chlortoluron	-	-	-		+	0	+		+	
MCPA	-				0/+	+	0/+		+	
s-Metolachlor	-	-		-	+	0/+	+	+	+	
Nicosulfuron	-					-/0				
Amidotrizoic acid		-	-		-	-/0	0	+	+	
Iomeprol		-	-		-	0			+	
Iopamidol		-	-	0	-	-/0	0/+	+	+	
Iopromide		-	-	-	-/0	-/0	0	0	+	
Bezafibrate		-	-		0/+	0/+	+	0/+	+	
Carbamazepine		-	-	-	+	+	+	+	- NF/ + RO	
Diclofenac		-	-	0	+	0	+	+	+	0/+
MTBE	0	-	-	-	-	-/0	0	-	0/+	
ETBE		-	-		-	0		-/0	0/+	
DIPE		-	-		-	0		-/0	0/+	
Diglyme	-	-	-		-	-/0	0	0	0	
DTPA		-			-	0			+	
Fluoride	-	-	-						-/0	0

Glyphosate in the river Meuse and tributaries

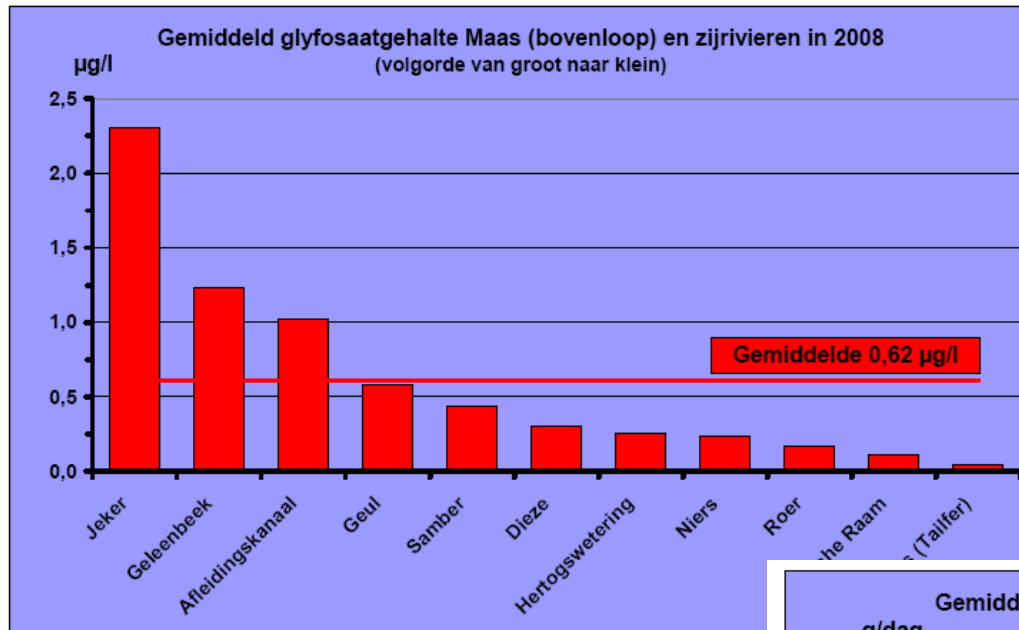


Fig. 4.1.2 Teneur moyenne en glyphosate / Mittlerer Glyphosatgehalt / Average glyphosate conc

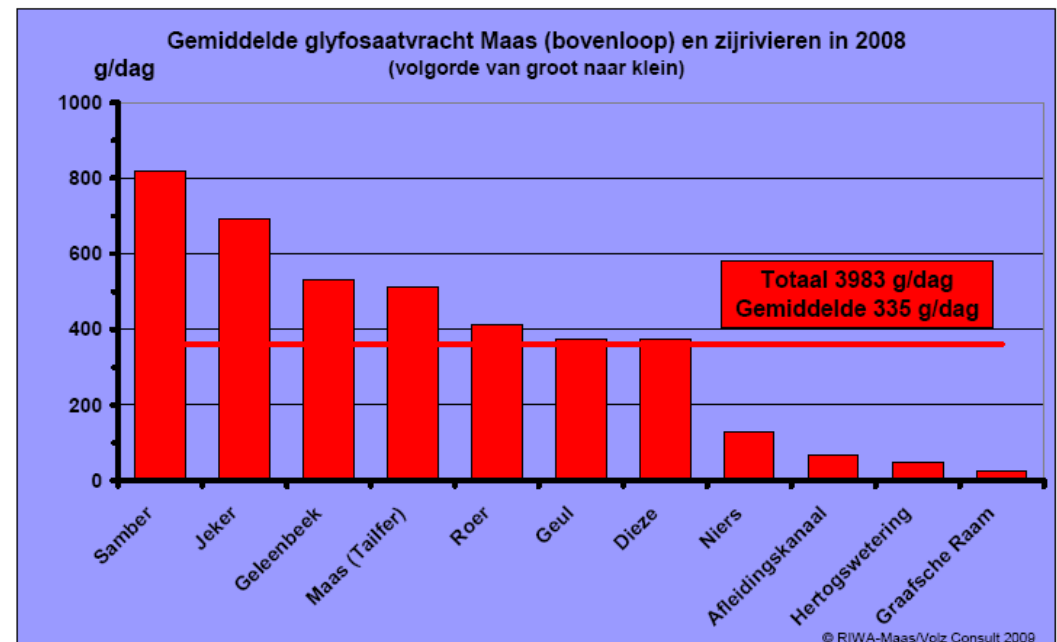


Fig. 4.1.4 Charge moyenne en glyphosate / Mittlere Glyphosatvracht / Average glyphosate load 2008

From Volz, 2009

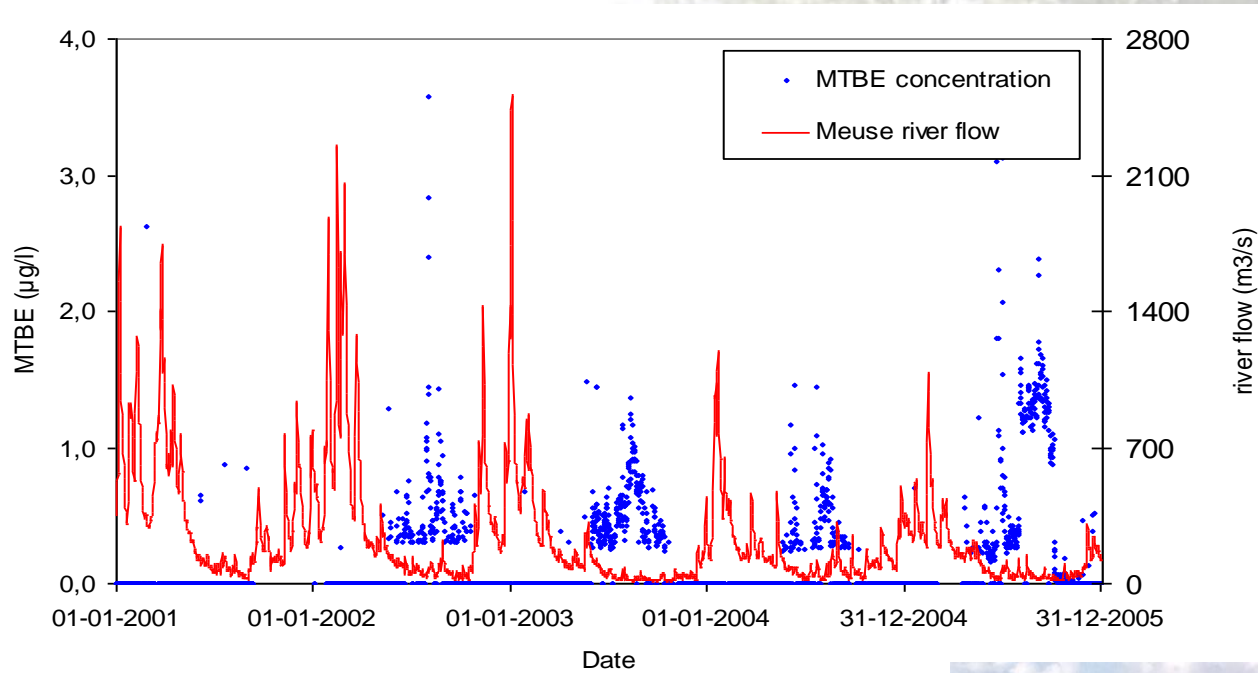
Effective measures at source

- Introduce a registration procedure for new (emerging) substances
 - cf assessment methodology for plant protection products (incl post registration monitoring)
- Reduce the use of (emerging) substances
- Promote development and sustainable use of less harmful substances
 - Spray free zones along waterways (reduction of drift)
 - Constricted regulations on the use of pollutants
 - Sustainable site management of pavements

Effective measures in the water system

- Introduce water quality standards for emerging substances that protect the (ecological) environment and functions of the river Meuse (bathing water, drinking water)
 - Pharmaceuticals and many other reluctant emerging substances (e.g. MTBE) do not have (ecological) quality standards for aquatic environments
- Decrease the number of sewer overflows and frequency of overflow
- Improvement of WWTPs
- Renewal of effluent discharge permits
 - Decrease number of untreated discharges
 - Relate permits to discharge waste water and industrial effluents to low river flows

Changing river flow patterns may result in concentration peaks



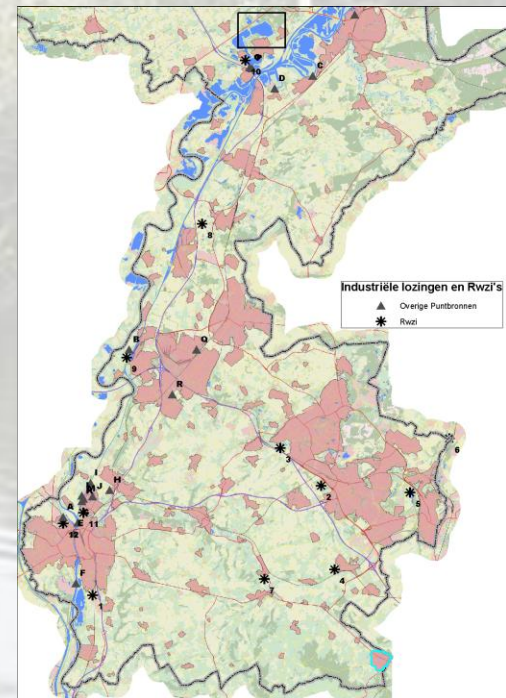
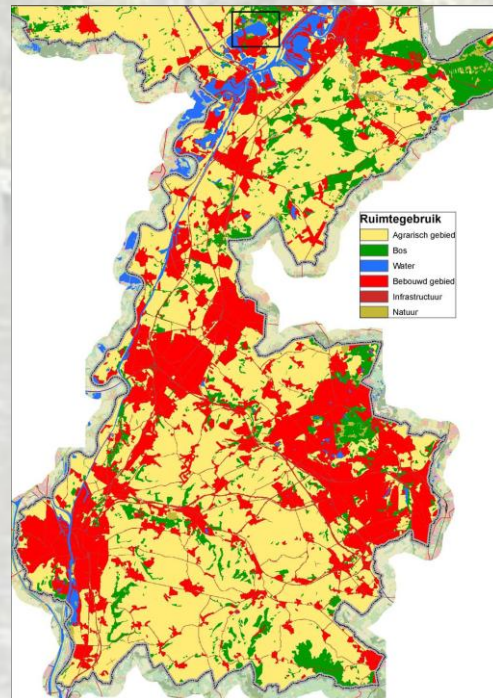
Discharge of the river Meuse, statistics

Q statistics	50-%	10-%	5-%	2-%	min
1950-1959	171	39	30	21	7
1960-1969	171	45	30	17	7
1970-1979	115	25	17	6	0
1980-1989	204	57	44	34	16
1990-1999	124	30	21	14	1
2000-2007	147	34	25	19	9
<i>average</i>	<i>155</i>	<i>38</i>	<i>28</i>	<i>19</i>	<i>7</i>

Discharge in m³/s at Eijsden

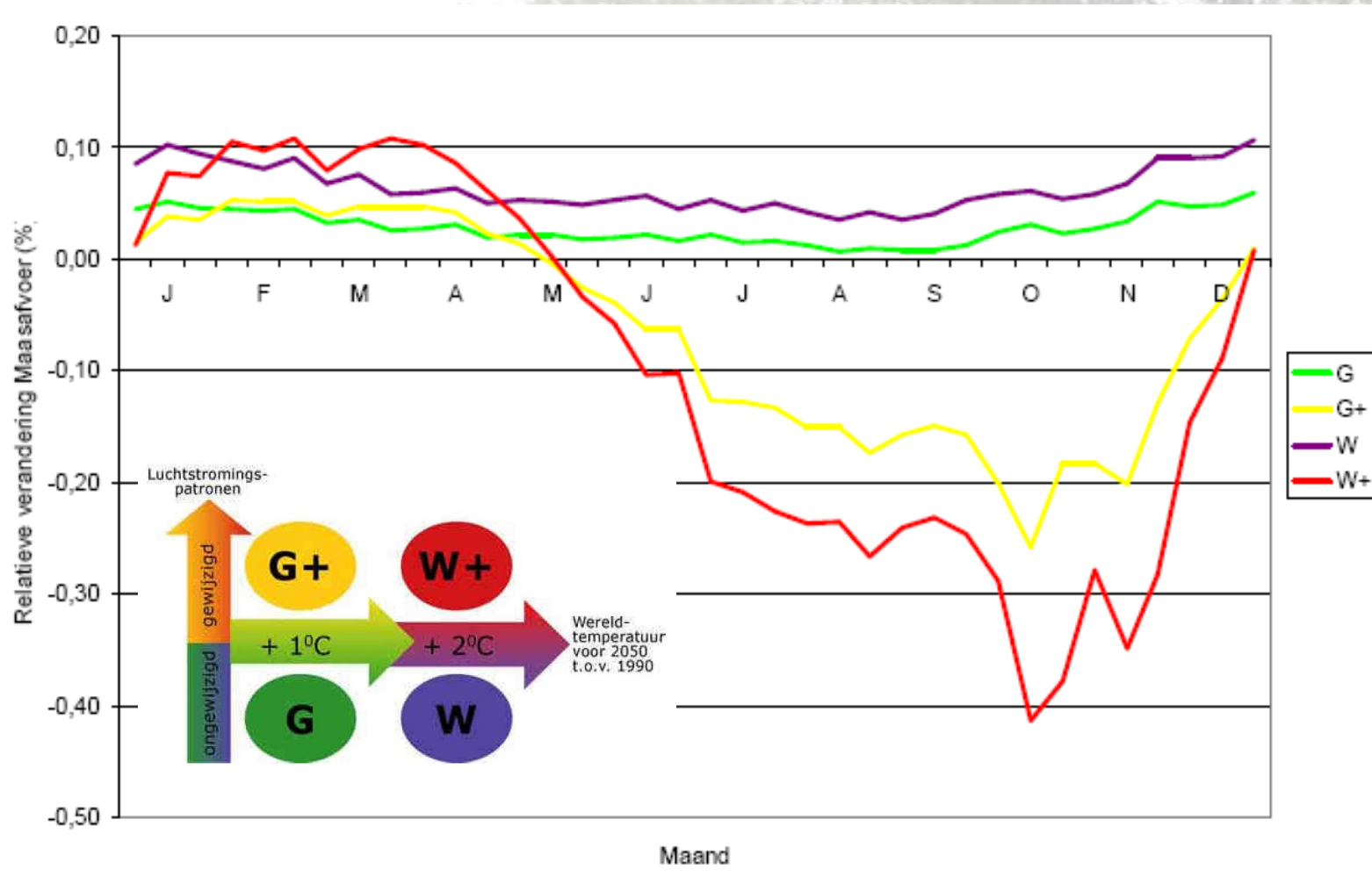
Effective measures in the water system

- Prevent pollution transfer to downstream areas
 - Improve collaboration between water management agencies upstream and downstream
- Apply protective measures for surface water intake areas
 - Introduce protection areas and information mapping of potential sources of (emerging) substances



RIVM, 2008

What about climate change?



Incorporate effects of autonomous developments

Increase the capacity of the water system to cope with the autonomous effects of climate change

- Direct effects of climate change on water quality (related to higher temperatures and low flows)
- Indirect effects of climate change on water quality, interaction with existing human pressures (changing their impacts)
- Risks for realisation of ecological goals and opportunities for (commercial) use of Meuse water

Scales of measures

Scale of measure	Measures
Regional/Provincial	<ul style="list-style-type: none">• Decrease # overflows• Improvement of WWTPs• Reduce # untreated waste discharges
National/Federal	<ul style="list-style-type: none">• Decrease diffuse pollution• New system for discharge permits• Reduction in the use of pesticides• Introduce specific protection areas
River basin	<ul style="list-style-type: none">• Measures to cope with CC changes• Introduce water quality standards (Meuse relevant substances)
European	<ul style="list-style-type: none">• Introduce water quality standards (Priority substances)• Promote the development and sustainable use of less harmful substances

Conclusions

- Emerging substances are present throughout the Meuse river basin and should be monitored on a regular basis
- Sources of emerging substances are diverse (household, agriculture, industry, WWTPs, etc.) and often diffusive
- This requires implementation of measures at regional, national and river basin scale



Je vous remercie de votre attention
Vielen Dank für Ihre Aufmerksamkeit
Dank voor uw aandacht

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