

– Vorkommen und Verhalten der Röntgenkontrastmittel im Berliner Wasserkreislauf

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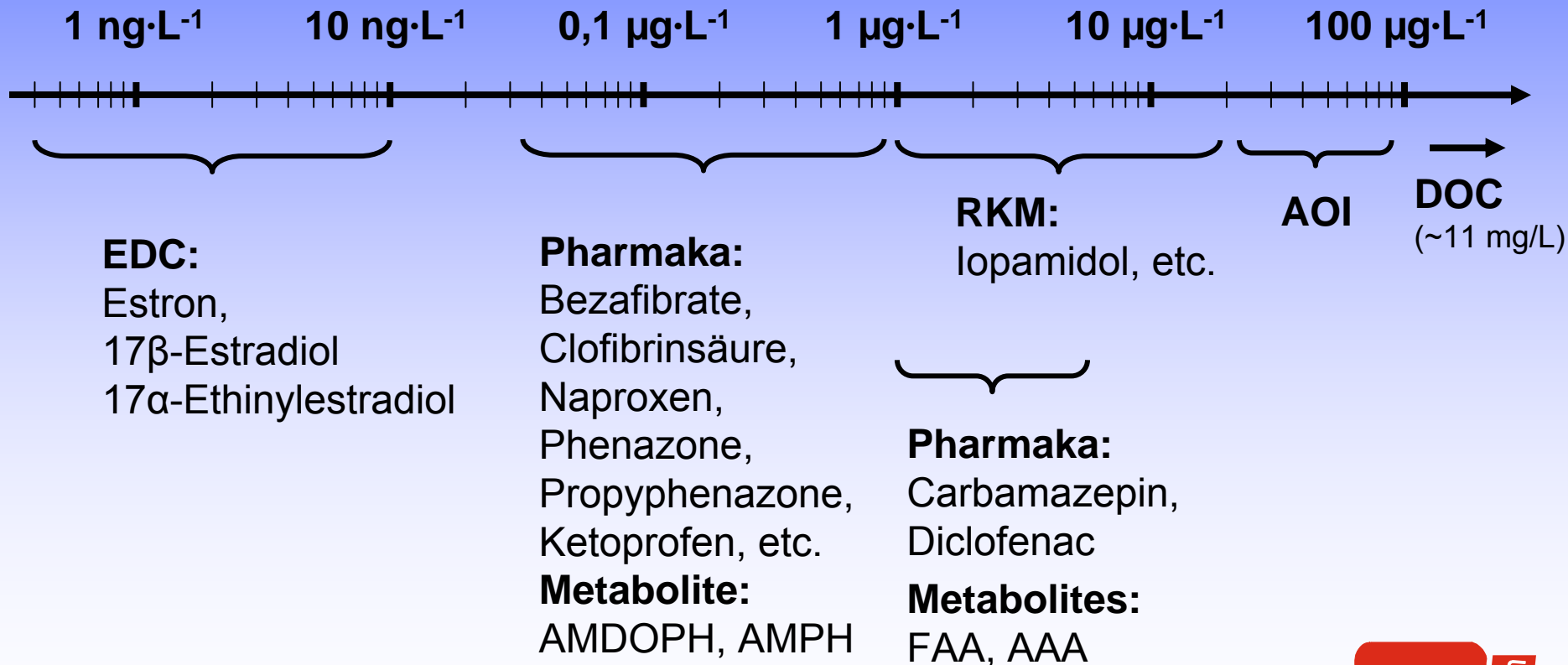
RKM Workshop des KWB

27. 3. 2006

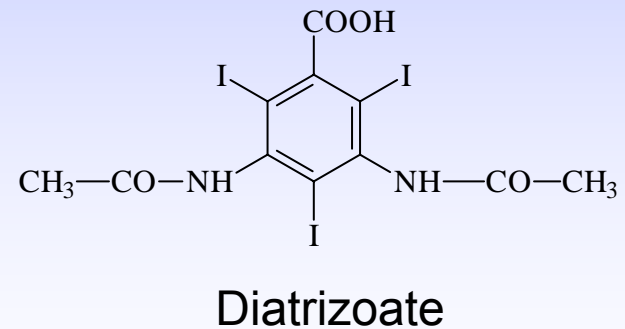
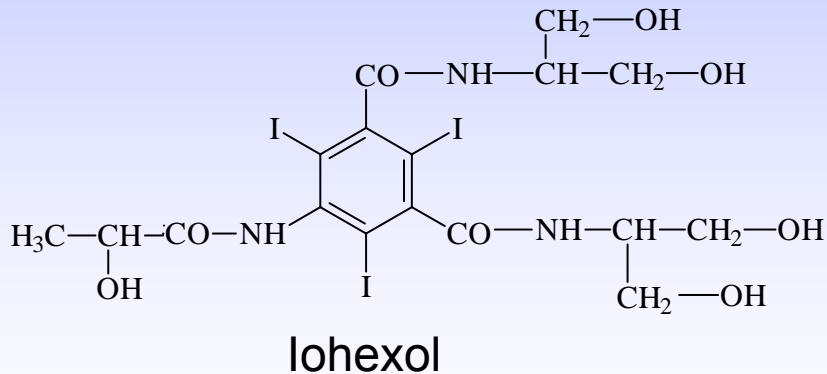
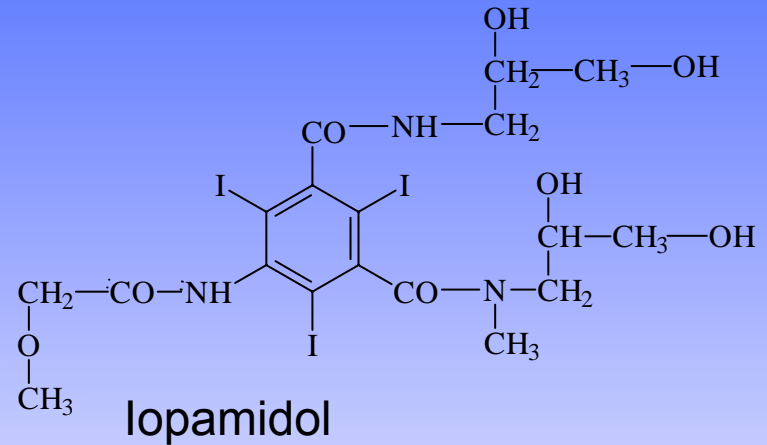
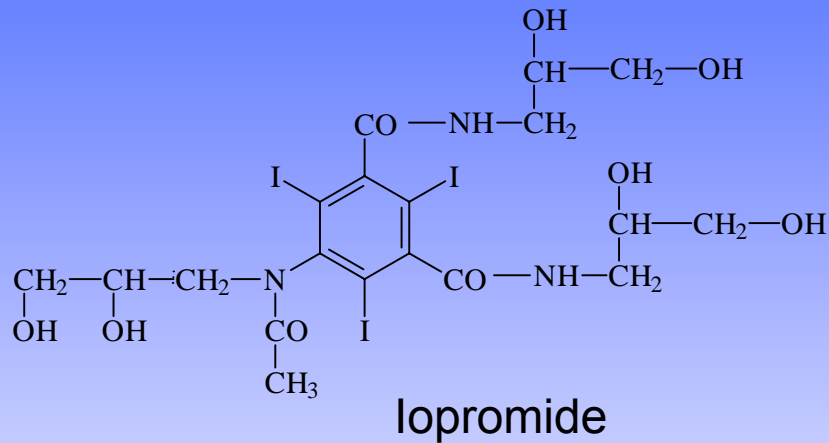
Vorkommen von Medikamentenrückständen im Klarlauf

Mittelwerte, KW Ruhleben

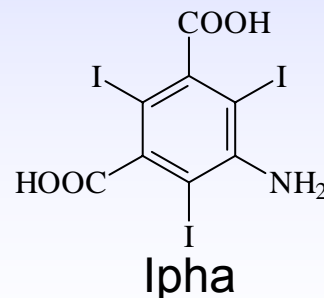
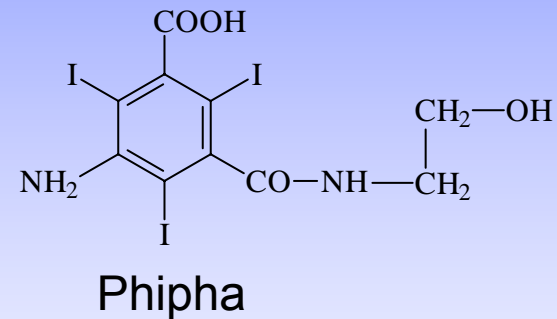
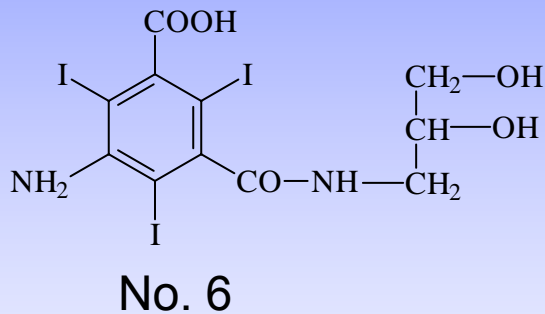
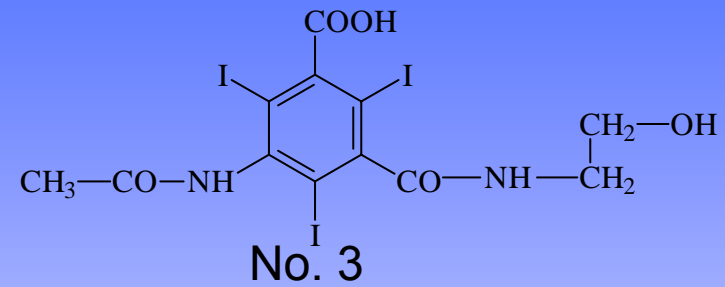
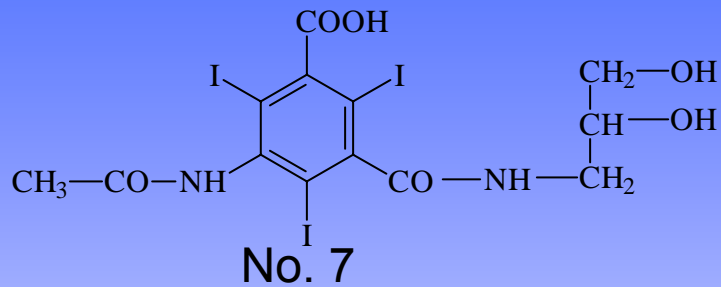
(12 Stichproben, Nov. 2004 - Jun. 2005)



Strukturen der RKM's



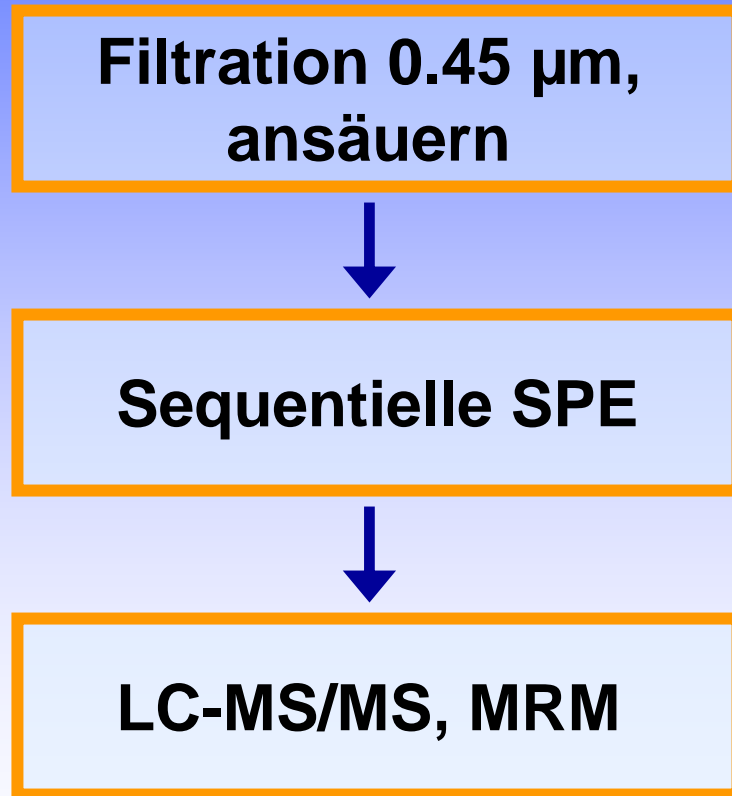
Strukturen von möglichen Metaboliten



Analytische Methoden

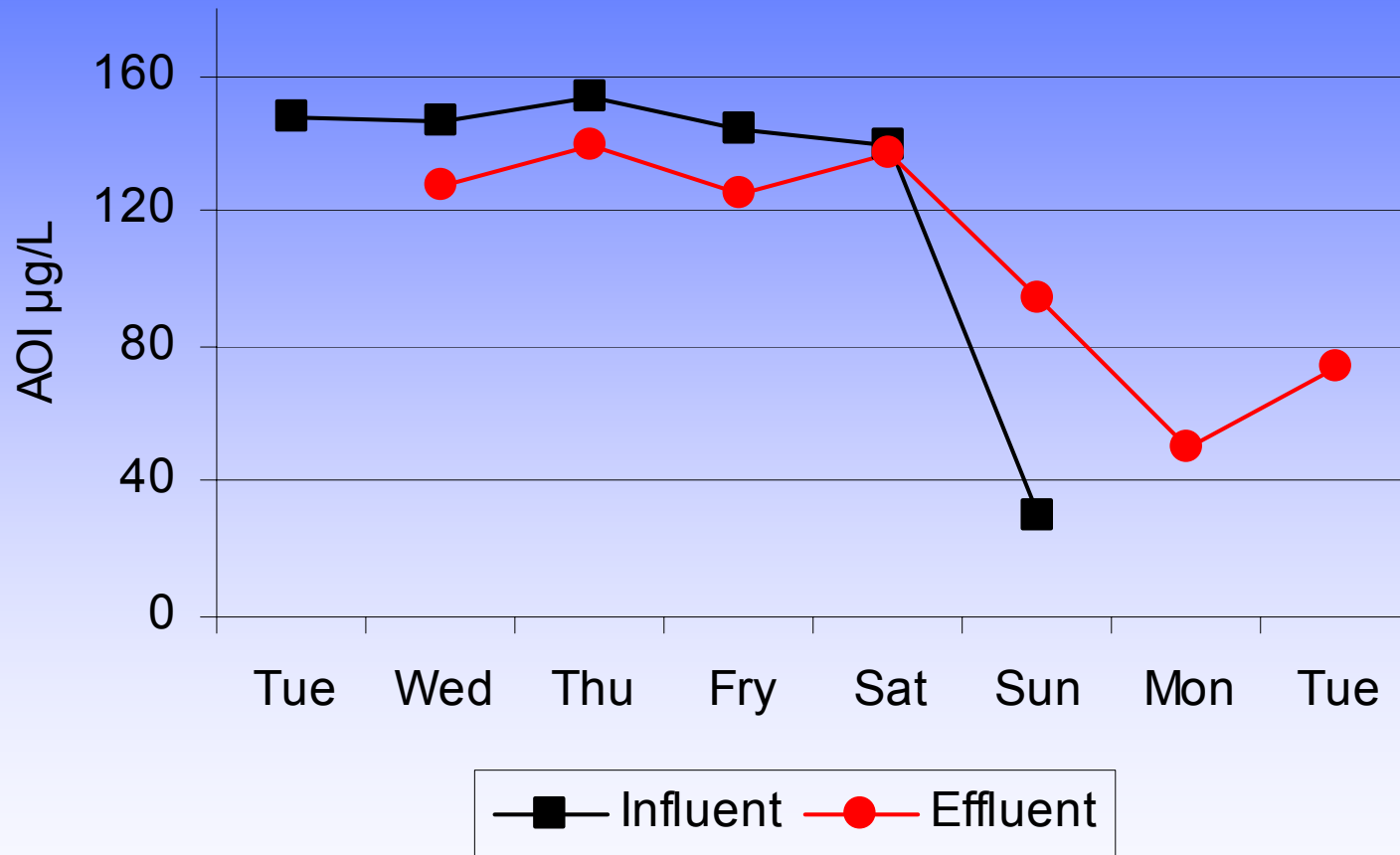
AOI: Als Teil des AOX, summiert über alle RKMs und Metaboliten

Einzelstoffe:



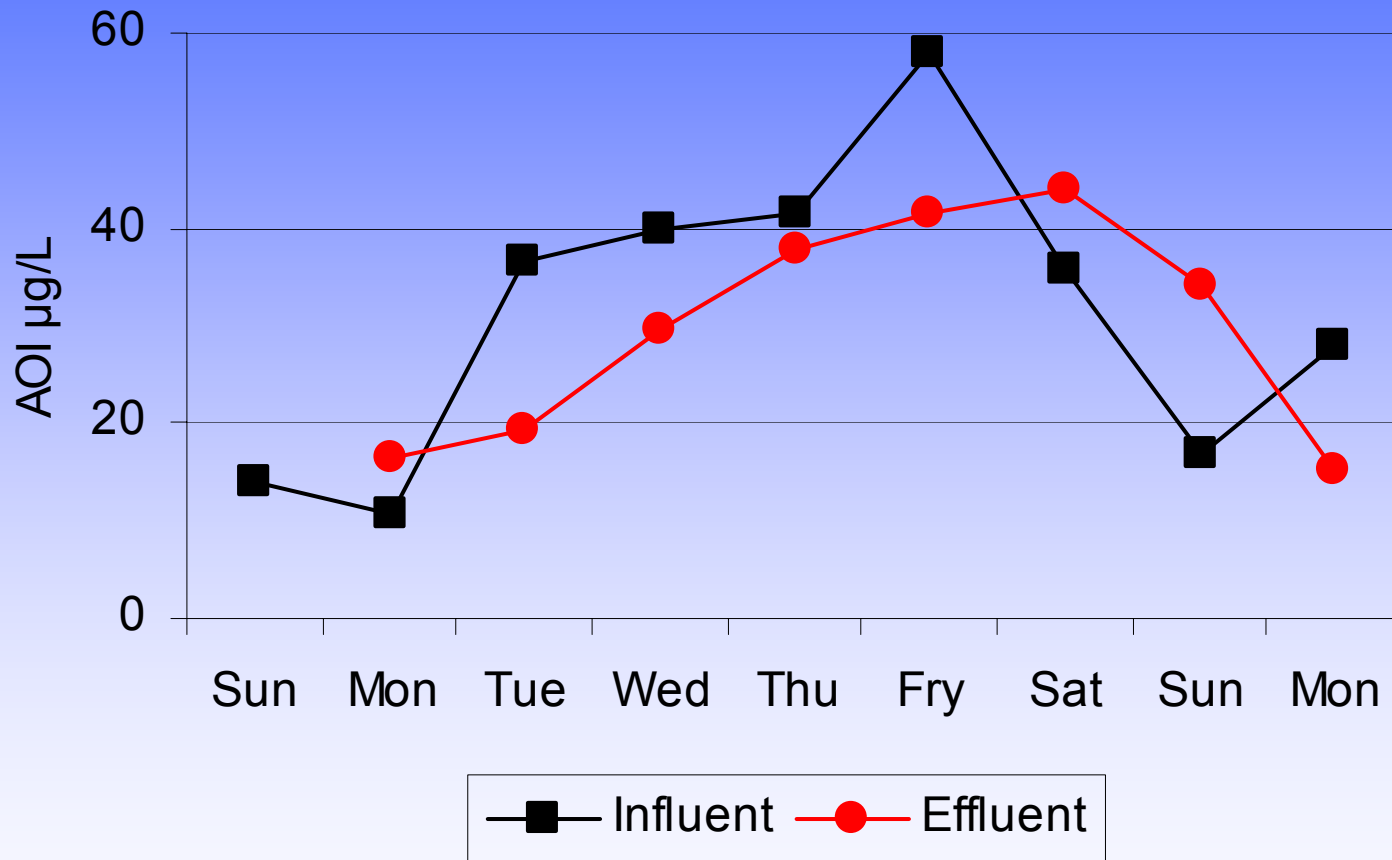
	LOQ [ng/L]
lopamidol	20
lopromide	20
lohexol	20
Diatrizoate	50

AOI: Kläranlage Ruhleben

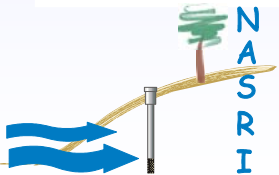
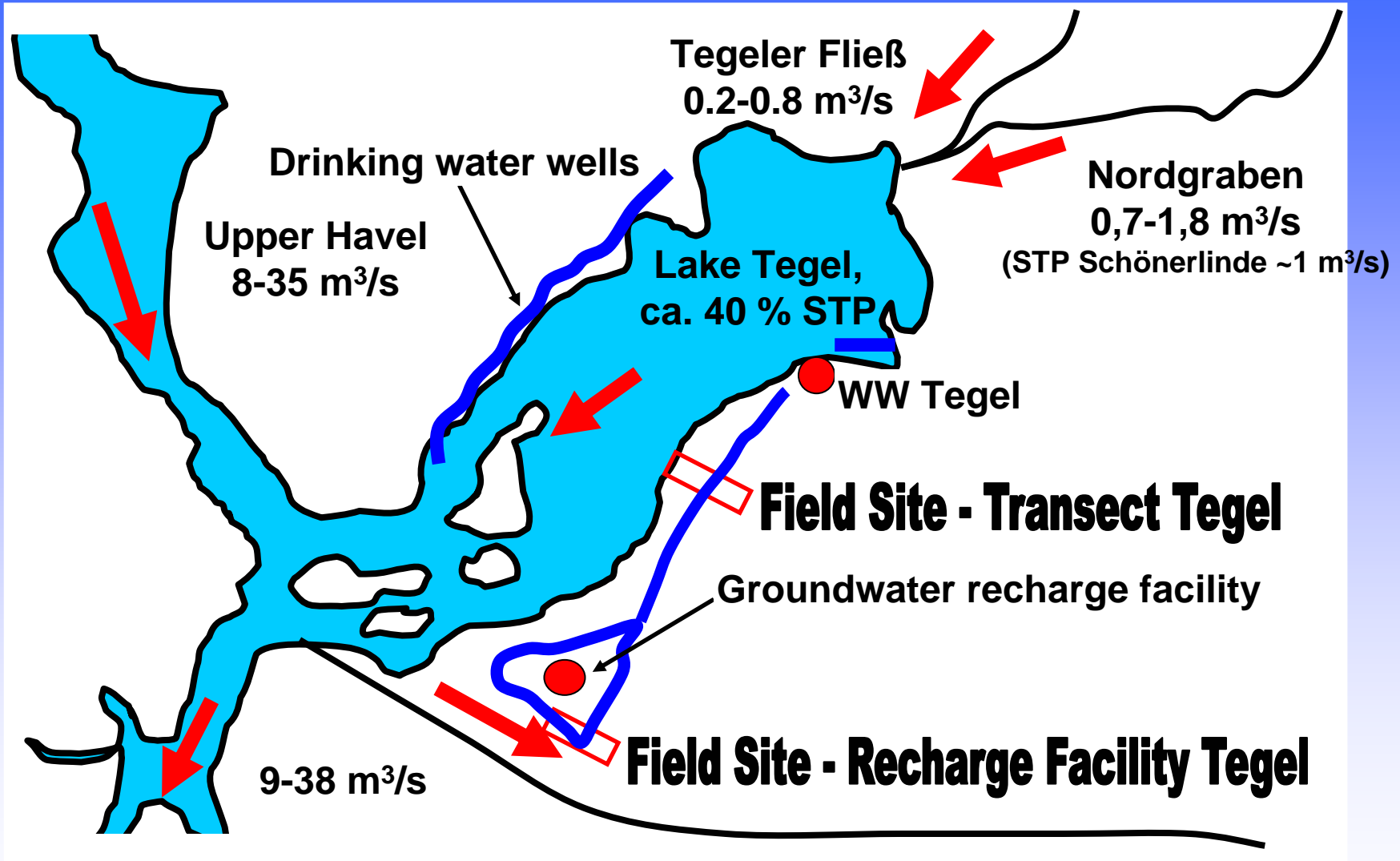


24 h Mischproben (Ruhleben)

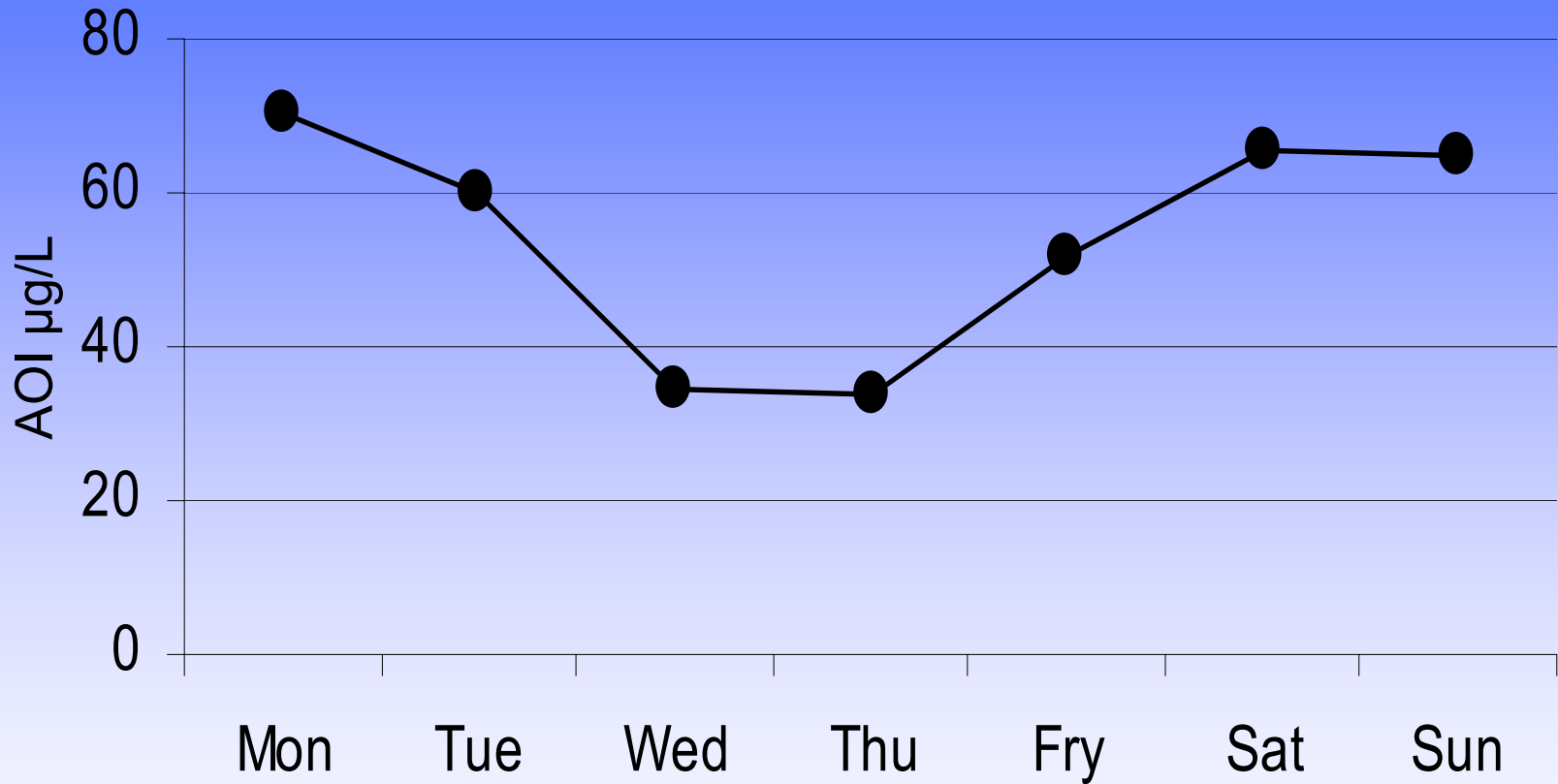
AOI: Kläranlage Falkenberg



Situation in Berlin at Lake Tegel



Nordgraben: AOI



Konzentration der RKM

	Iopromide µg/L	min/ max	Diatrizoate µg/L	min/ max	Iohexol µg/L	min/ max	Iopamidol µg/L	min/ max
Effluent WWTP*	20		13		7		n.a.	
Receiving Channel**	10	4 24	14	9 25	7	1 21	13	6 20
Receiving lake	1	0.9 1.2	1	0.5 1.4	0.08	0.06 0.1	0.5	0.2 0.8

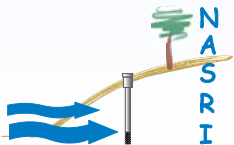
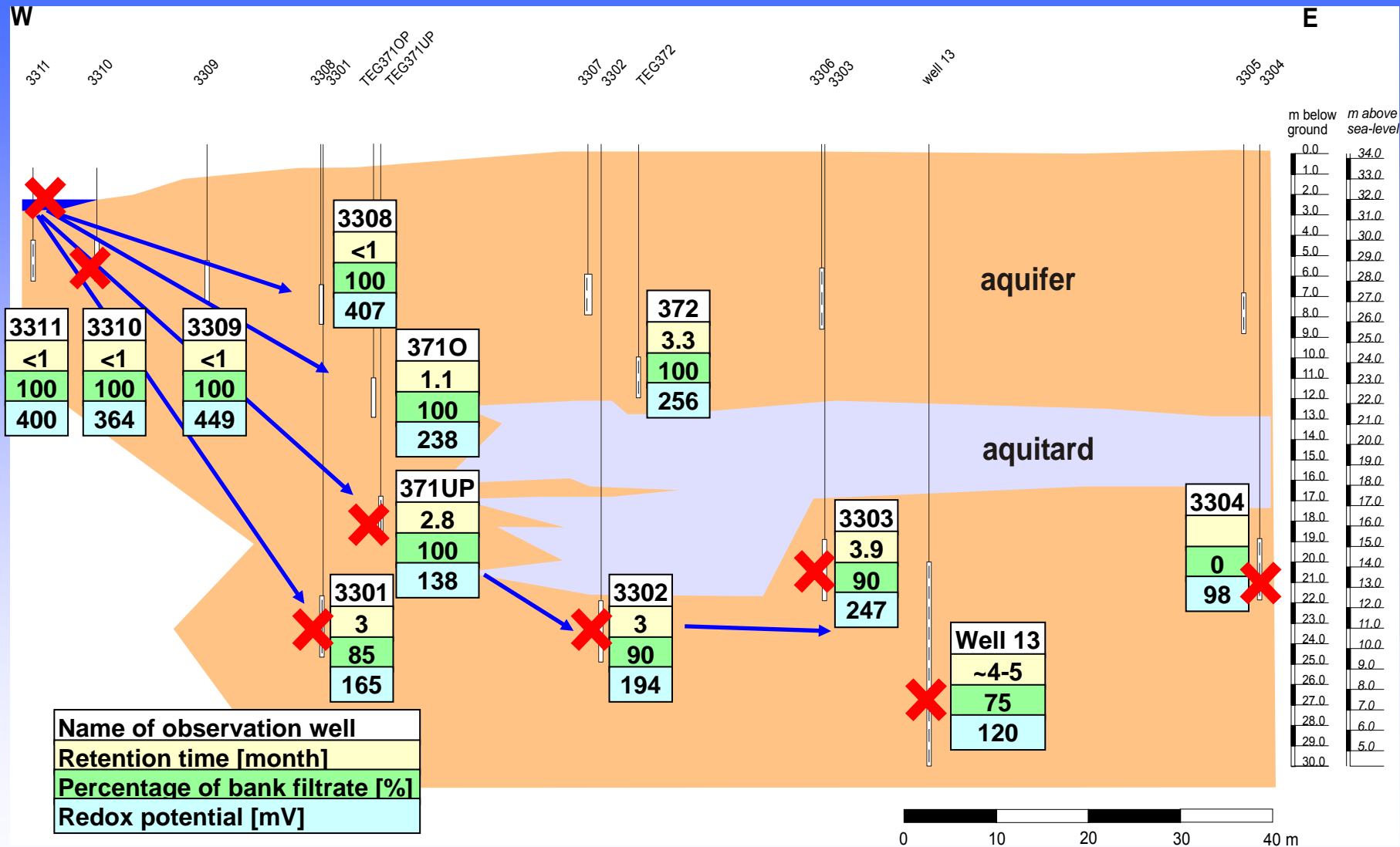
* 24 h mixed sample, ** grab sample: sampled each day over one week, *** grab sample: sampled each month over one year

RKM in anderen Gewässern

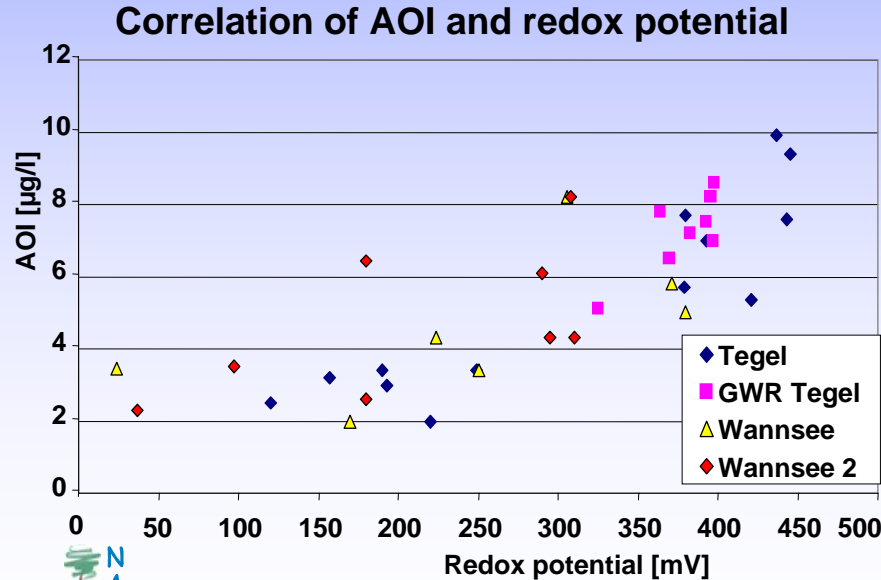
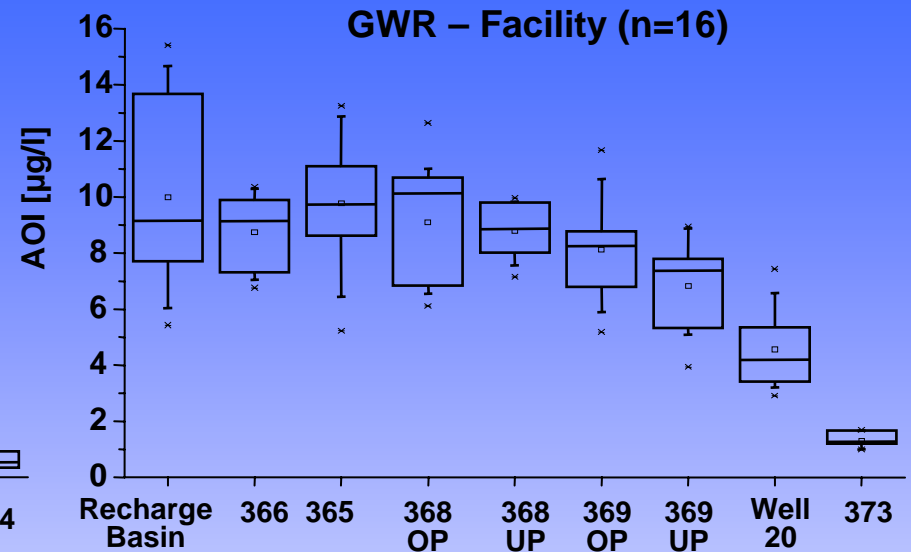
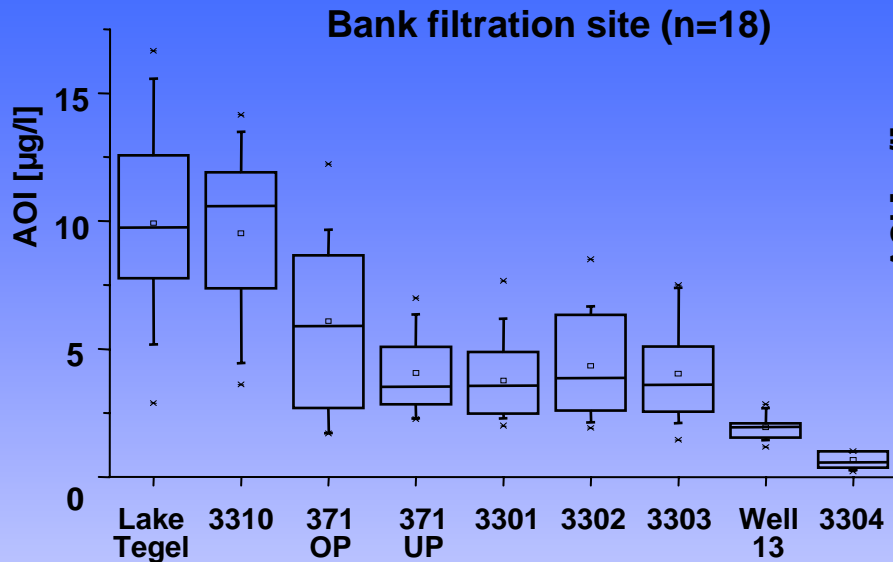
	Iopromid (min/max)	Iopamidol (min/max)
Donau	40 ng/L (10-75)	50 ng/L (10-200)
Rhein	60 ng/L (25-70)	100 ng/L (70-200)
Neckar	140 ng/L (80-160)	225 ng/L (175-600)
Körsch (ca. 70 % waste water)	125 ng/L (10-380)	800 ng/L (50-1400)

Daten aus: Brauch et al., 2002, „Vorkommen von Pharmaka und Hormonen in Grund-, Oberflächenwässern und Böden in Baden-Württemberg“

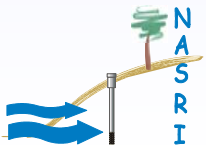
Bank filtration transect Tegel



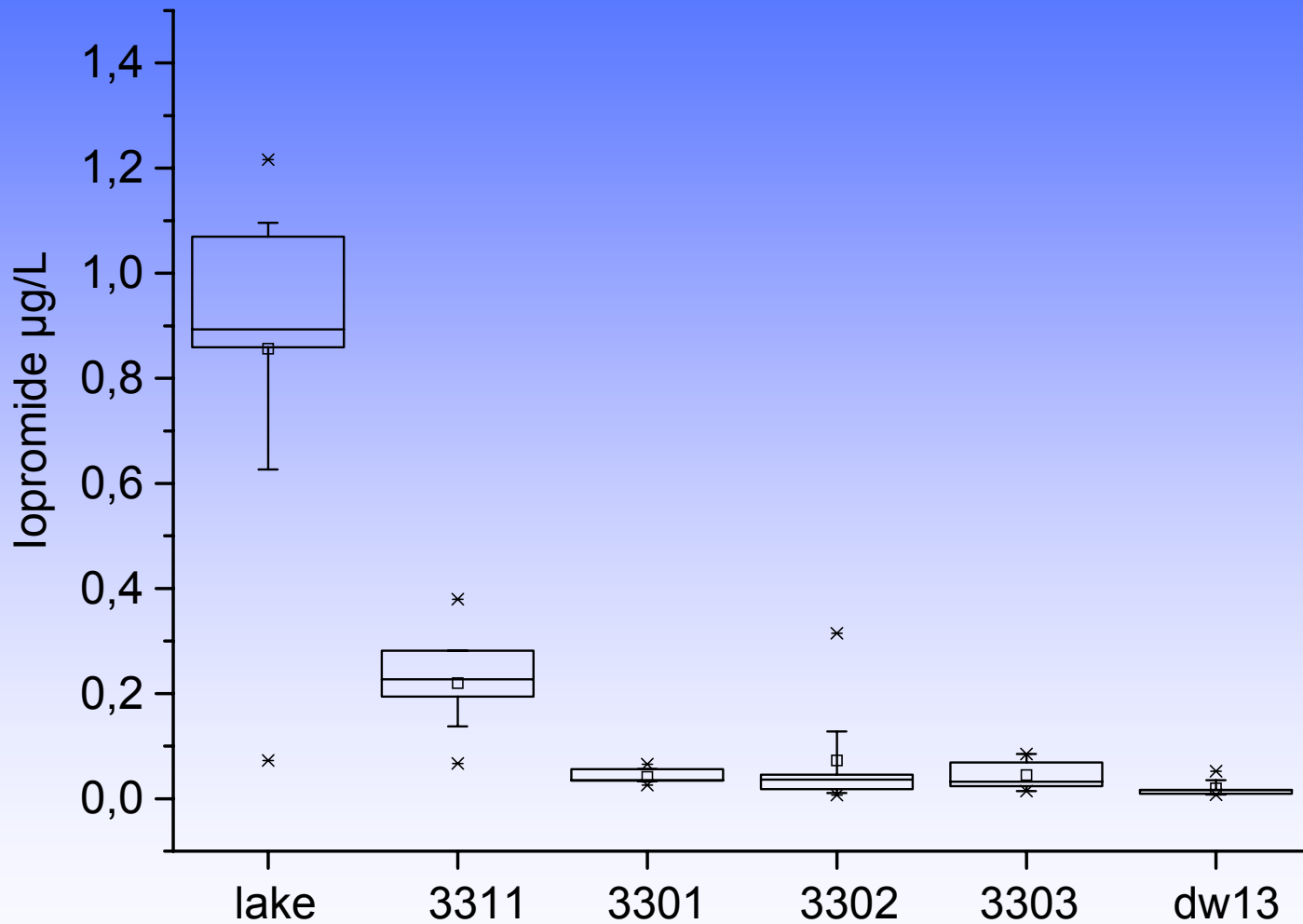
Resultate - AOI Konzentrationen



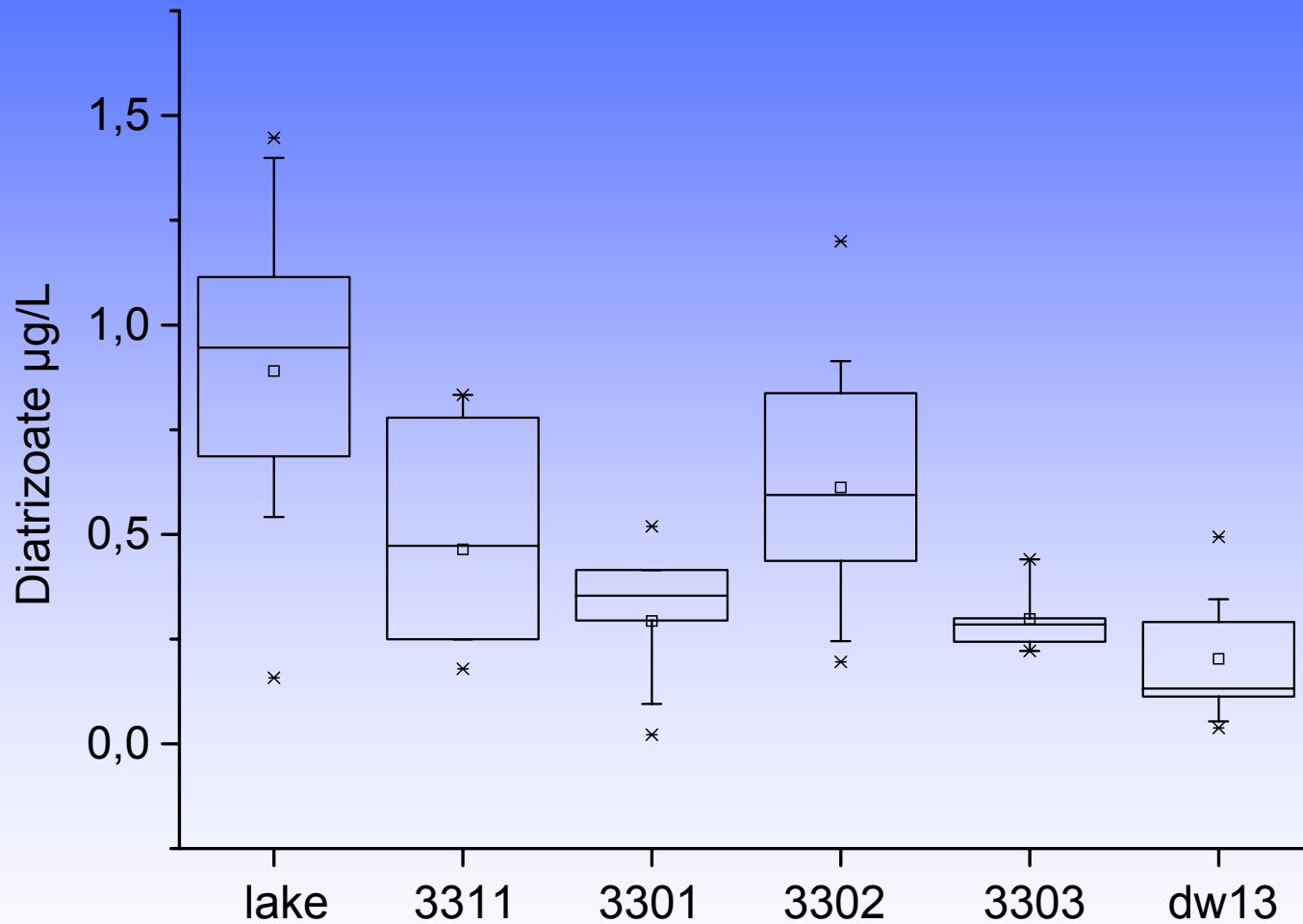
- Less removal of AOI at the aerobic GWR compared to the anoxic bank filtration site
- Relationship between redox potential due to reductive deiodination



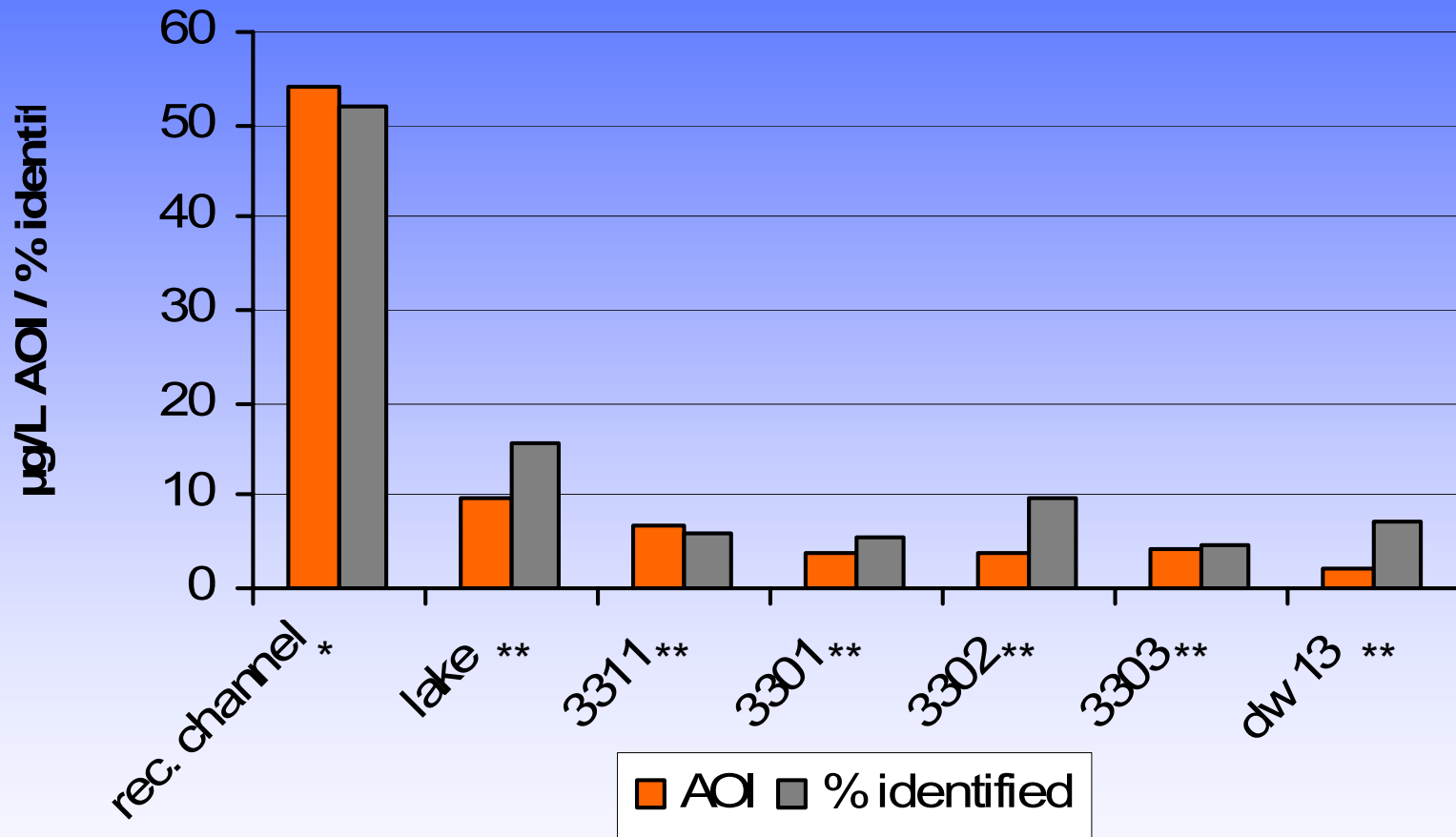
Iopromide in der Uferfiltration



Diatrizoate

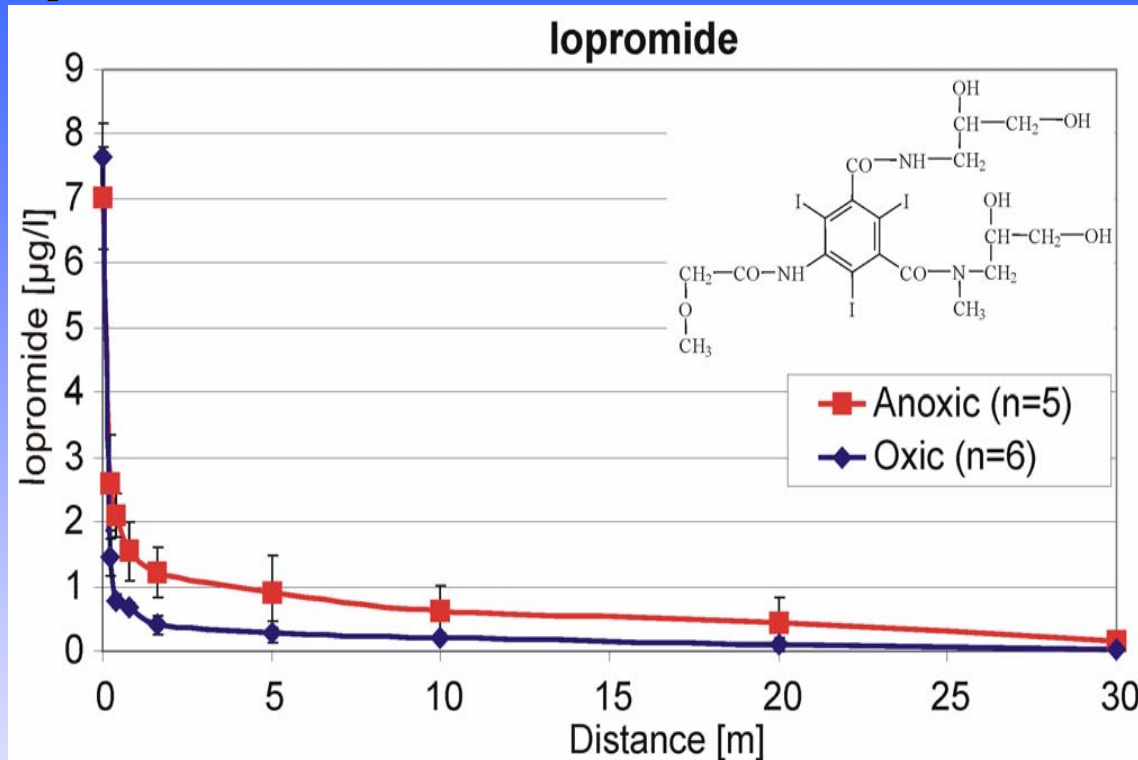


AOI and identifizierter AOI



* sampled each day over one week; **sampled form Mar. to Sept. 2002 once each month

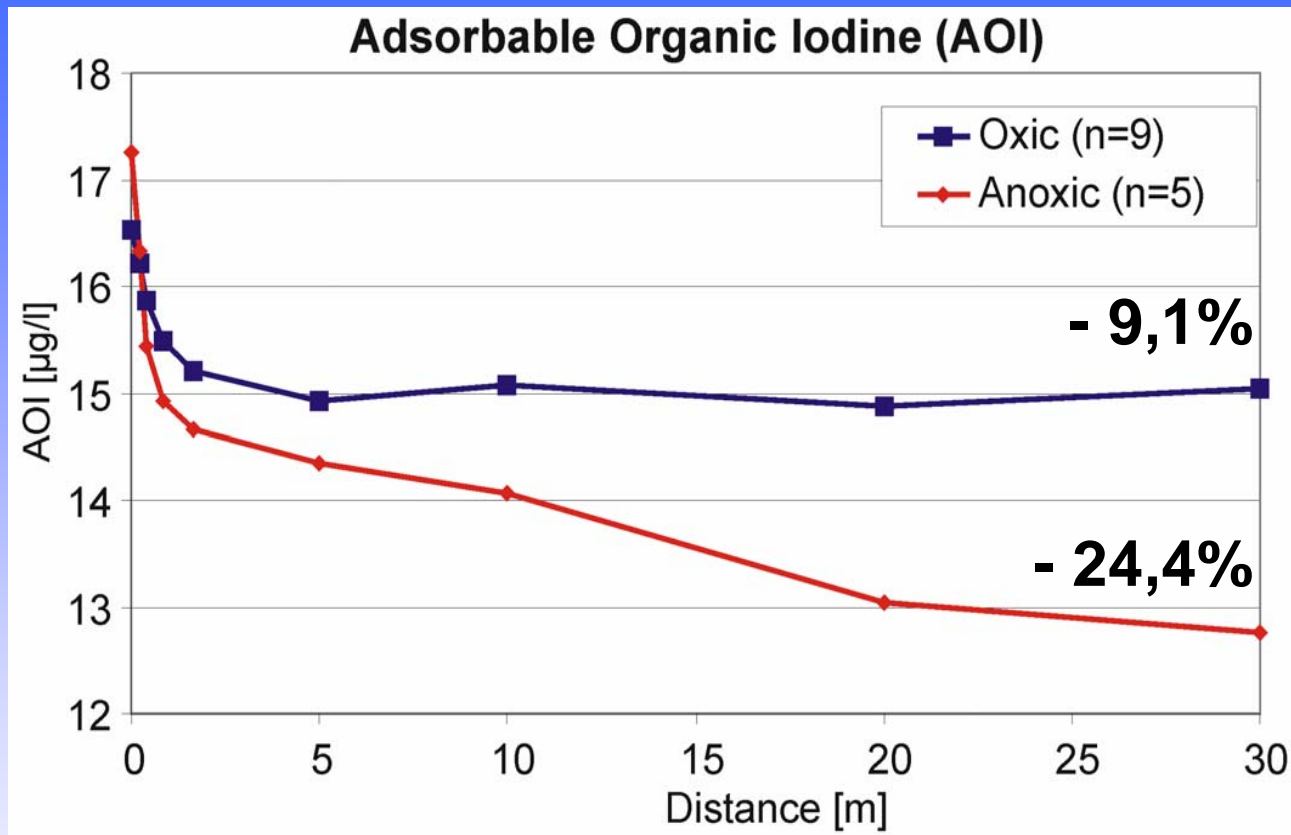
Iopromide in aerober und anoxischer Säule



- Very good removal of Iopromide under both redox conditions
- Consistent with findings of the field monitoring
- Oxic: Iopromide appears to be only metabolized, no effective dehalogenation was found, AOI concentration remains nearly stable along the columns

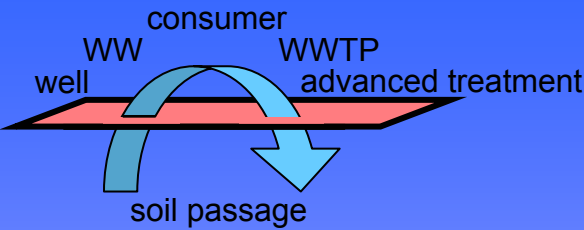


AOI in aerober und anoxischer Säule

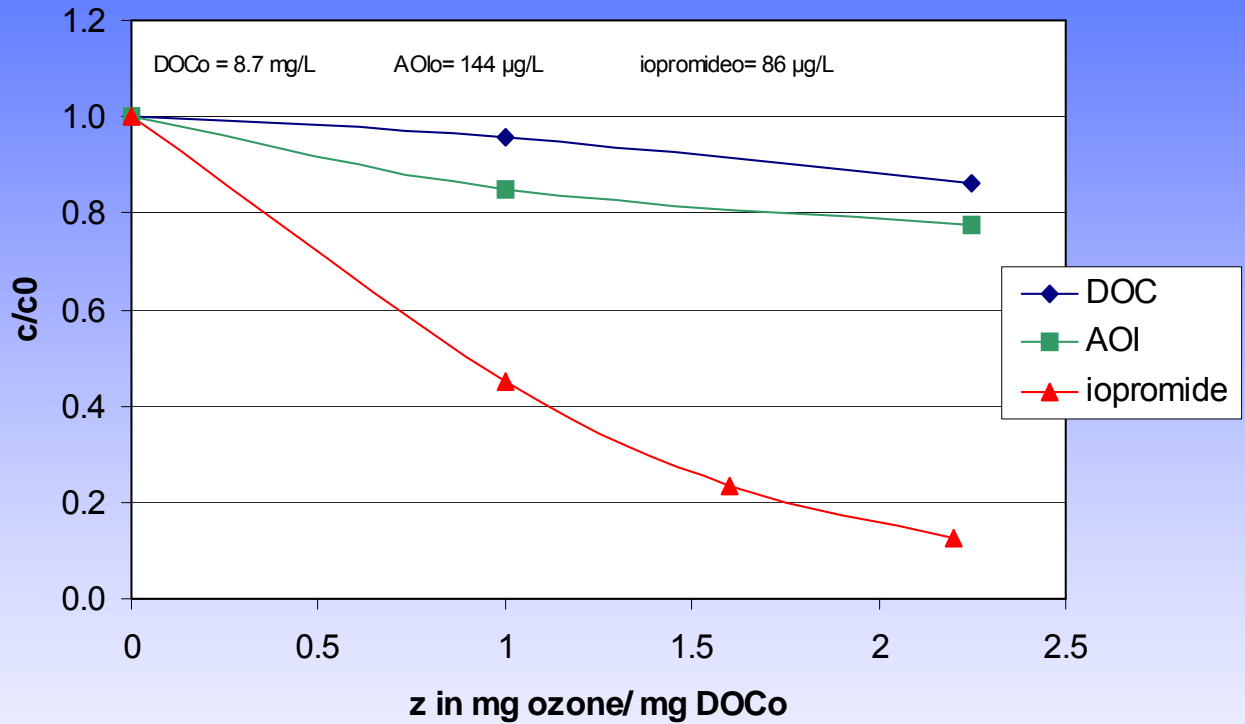
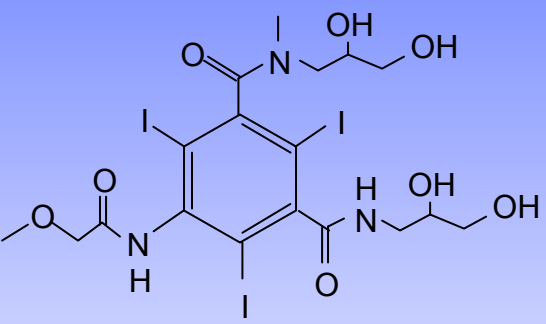


- Oxic: no efficient removal of AOI (~9% in the infiltration zone)
- Anoxic: 25% removal of AOI during infiltration (reductive dehalogenation in anaerobic parts of the column)





Ozonation of selected single compounds: x-ray contrast compound iopromide

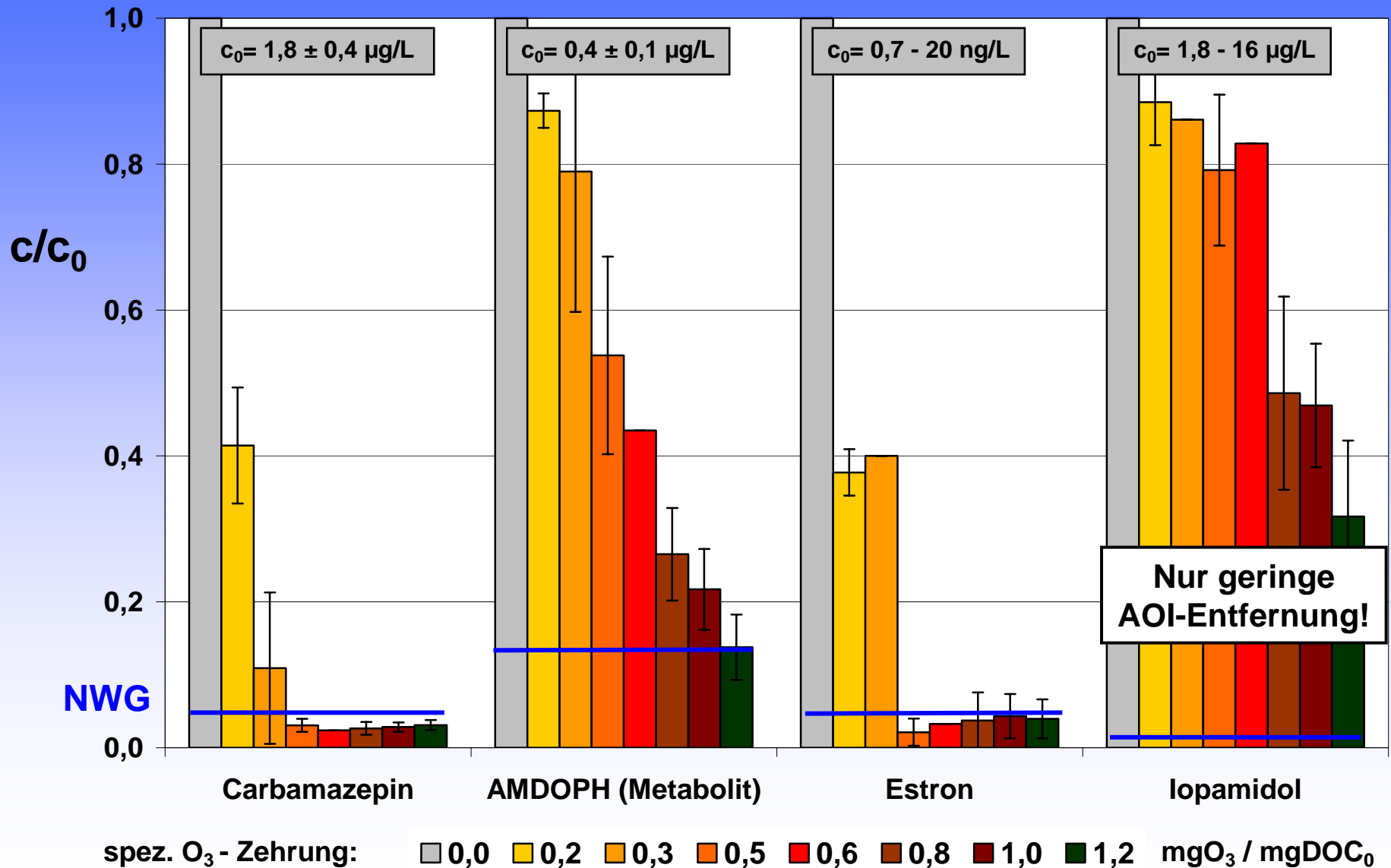


Iopromid lässt sich mit hohen Ozondosierungen anoxidieren, aber nicht mineralisieren. Der AOI nimmt kaum ab



Ozonung: Neutrale Pharmaka, EDC und RKM

DOC₀ = 10-12 mg/L



Schlussfolgerungen

- RKM's sind Indikatoren für kommunales Abwasser.
- Ihre hohe Polarität und Persistenz führt zu Gewässerbelastungen.
- Typisch sind biologische Transformationen an Seitengruppen unter aeroben Bedingungen ohne Iodidfreisetzung.
- Bei anoxischen und anaeroben Milieus im Untergrund ist eine Deiodierung bis 70 % möglich, jedoch sind Metabolite unbekannt, wie deren Verhalten
- Die Reaktivität mit Ozon und OH-Radikalen ist relativ gering (nur Primärangriff), mit Aktivkohlefiltern ist ihre Entfernung teilweise möglich.
- Die human- und ökotoxikologische Bedeutung der RKM und ihrer Metabolite ist vermutlich gering