

Grauwasser-Recycling im Hotel-, Gaststättengewerbe und Wohnungsbau - langjährige Betriebserfahrungen

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Warum Wasserrecycling?

Welche Anforderungen sind notwendig?

Entwicklung des Grauwasser-Recyclings in Deutschland

Untersuchungen und Ergebnisse

Wohin geht die Entwicklung, was hemmt die Entwicklung?

Why (Grey-) Water Recycling?

- A small or weak-receiving stream for (treated) wastewater (VW in Wolfsburg, Germany > 75% water recycling)
- Water shortage (arid or semi-arid regions)
- Save the scarce high-quality water resources (for drinking water purposes only)
- Reduce the individual or public water costs
- Reuse of greywater or blackwater?
 - **Water recycling** with the less loaded **greywater**
 - **Nutrient recycling** with the high loaded **blackwater**

Applications for “Decentralised” Greywater



Preferred sources:

Shower, bath tub, wash-basin,
washing machine

Preferred applications:



Toilet
flushing



House
cleaning



Irrigation



Laundry
wash

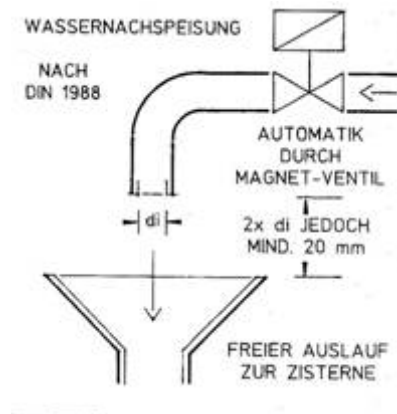
Which Requirements are necessary?

1. Hygienic safety

- Register plants at the local health authorities

Safe and controlled water installation system:

- Coloured/clearly designated water pipes to prevent cross-connection and back-flow to the drinking water system (free discharge)



- Use labels for proper identification of the water taps

Which Requirements are necessary?

1. Hygienic Safety

Microbiological parameters in accordance with the EU-Guidelines for Recreational Waters (76/160/EWG):

Total coliforms: < 100/ml

E. coli: < 10/ ml = < 1,000 /100 ml

P. aeruginosa: < 1/ml

Limit values in comparison to the quality of recycled water :

- E. coli in drinking water: 0/100 ml
- **E. coli (typical in recycled greywater): 0 -10/100 ml**
- E. coli in minced meat: 50,000/100 g
- E. coli in cheese from past. milk: 100,000/100 g
- E. coli in cheese from unpast. Milk: 10,000,000/100 g

Which Requirements are necessary?

2. No loss of comfort

Physical and chemical parameters to ensure an effective cleaning process and storage with no odour or clogging problems:

BOD₇: < 5 mg/l

O₂-Saturation: > 50%

UV-Transmission 1 cm cuvette 254 nm: > 60%

other Requirements

3. Environmental Tolerance

No addition of chemicals

- UV disinfection instead of chlorination

Low energy demand

- Typical total consumption: 1.5 kWh/m³

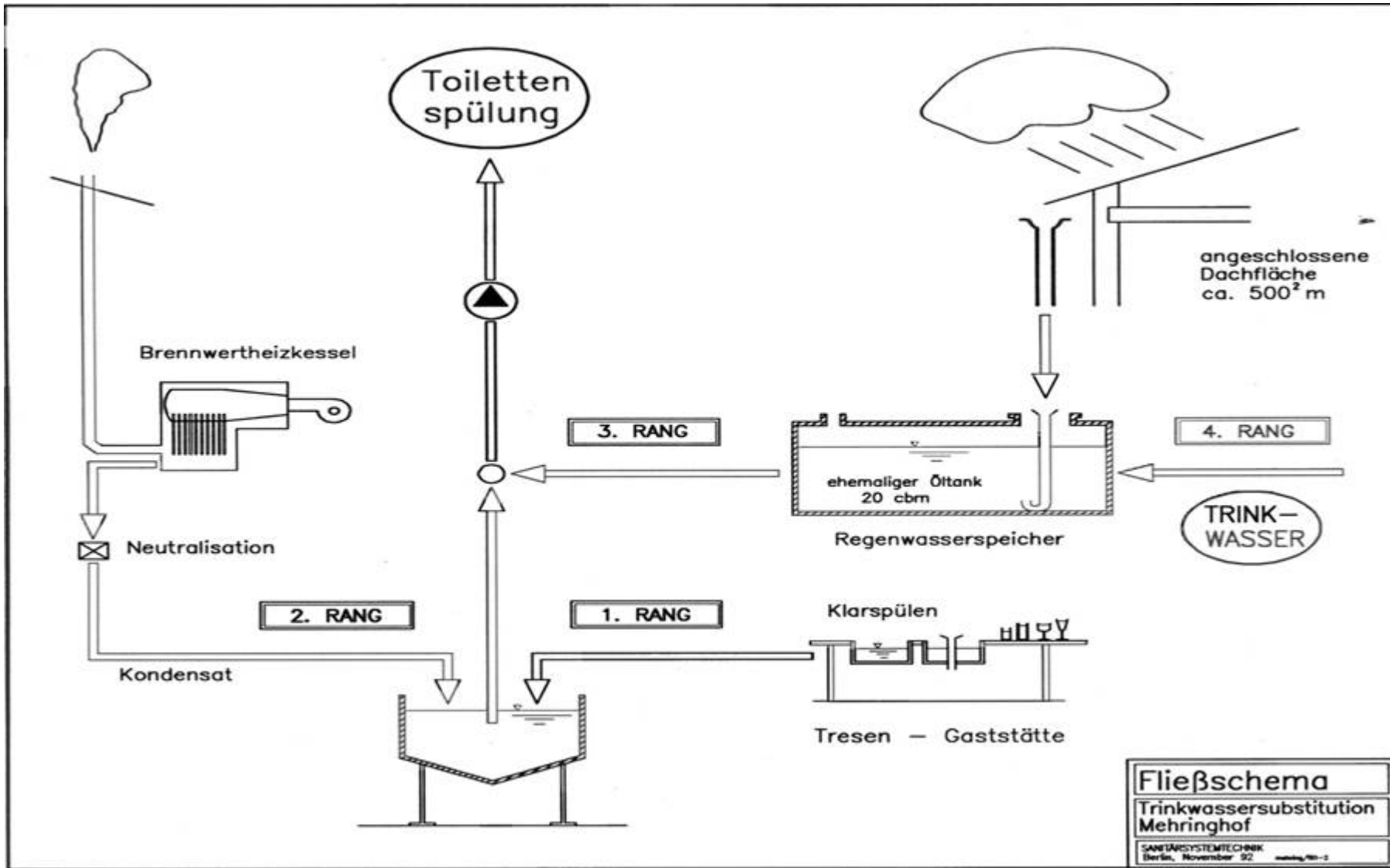
4. Inexpensive and Easy-to-Operate Technology

- Investment including all operational costs should pay off within an acceptable amortisation period.
- The cost of the recycling technology used should not exceed that of the conventional ones.

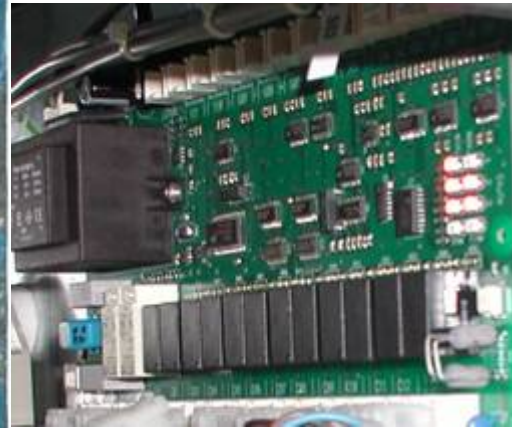
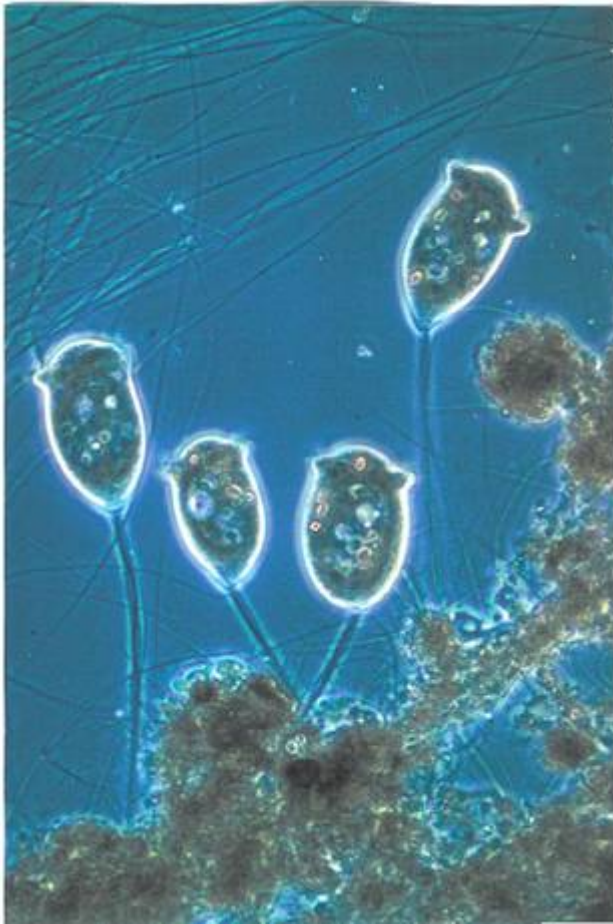
Wohnungsbau / Einfamilienhaus



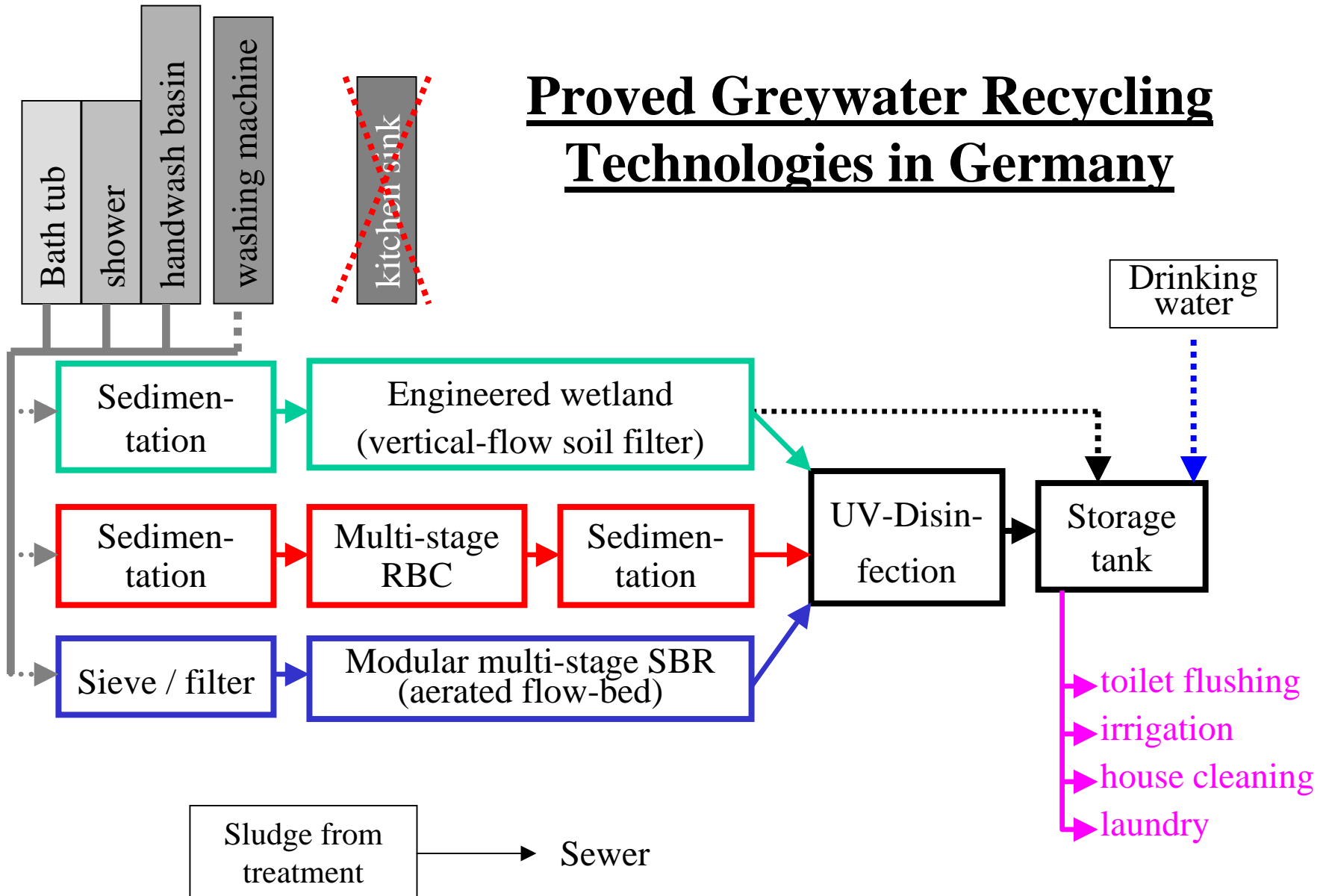
Gaststätte in Berlin



“No Greywater Recycling Without Advanced Treatment”!



Proved Greywater Recycling Technologies in Germany



Proved Technology in Germany (1)

Planted engineered soil filter (vertical not horizontal flow)



Because of algae formation without a stabilisation pond

Area requirements:
1- 2 m²/P

Consider
Evaporation!!

Proved Technology in Germany (2)

RBC for greywater recycling plants > 70 Persons (2-3 m³/d)



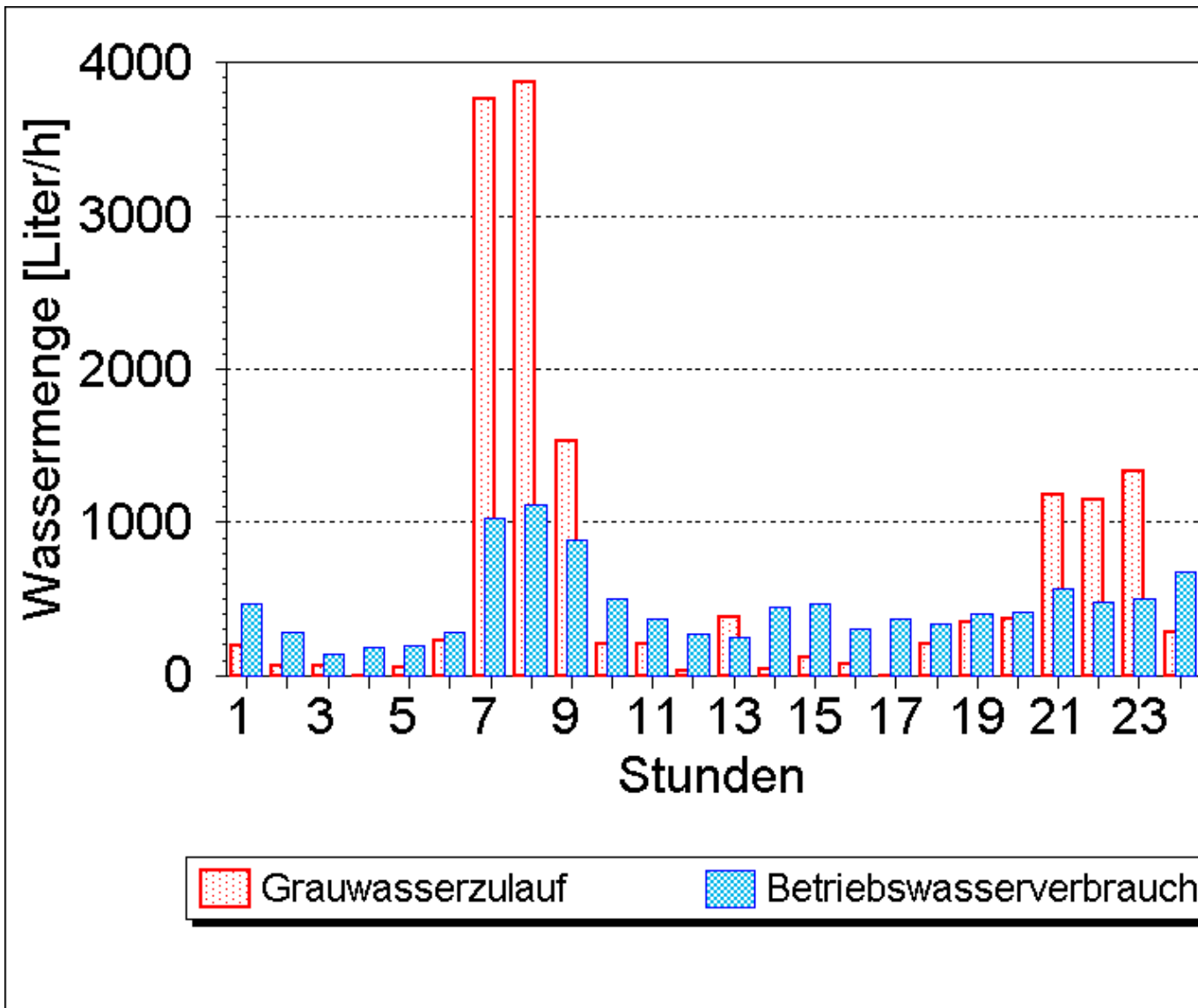
Area requirement: 0.1- 0.2 m²/Person

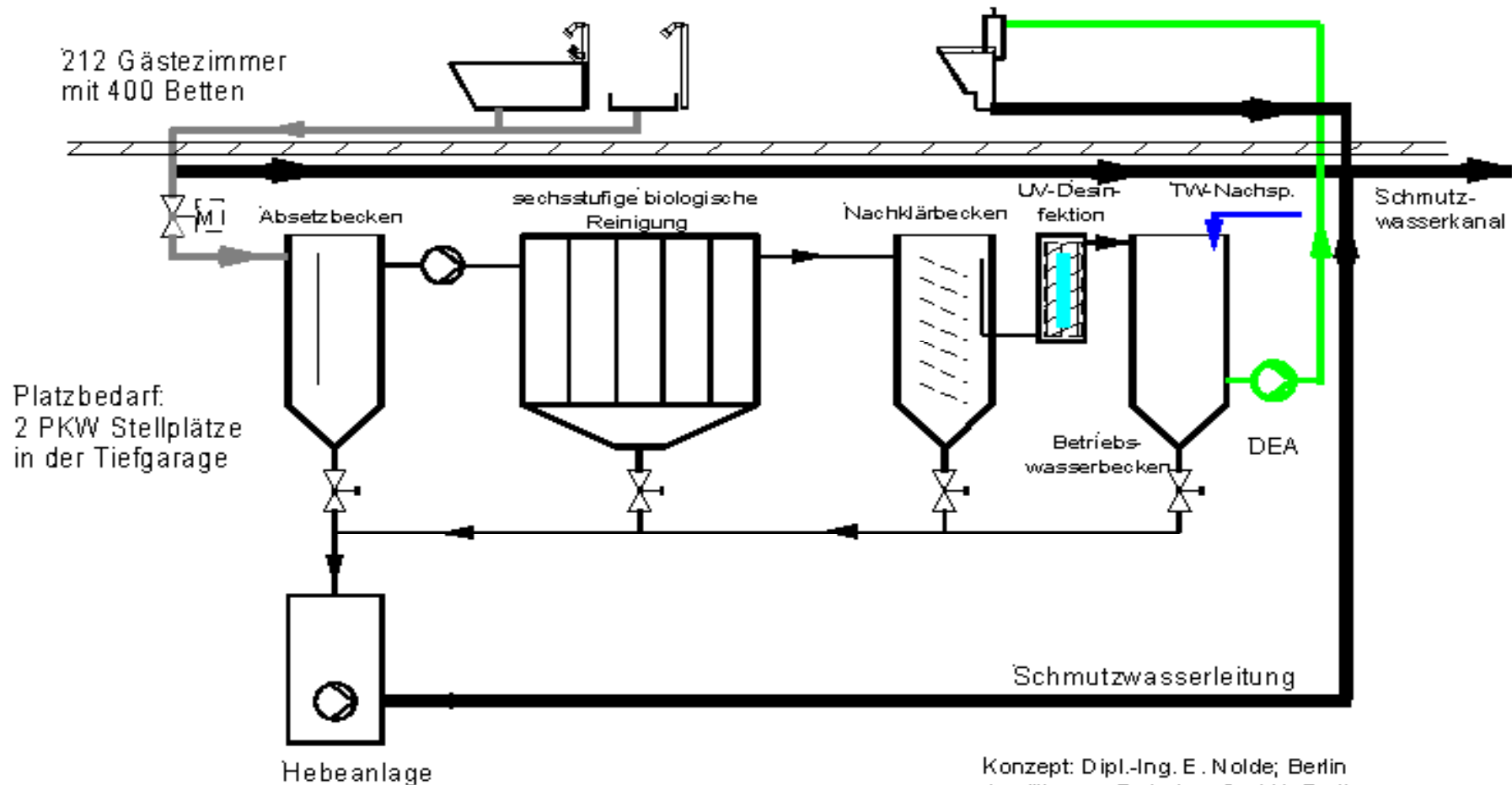
Energy demand: < 2 kWh/m³

Ventilation in installation area required

RBC for a greywater recycling plant in a 400-bed Hotel (15 -20 m³/d)



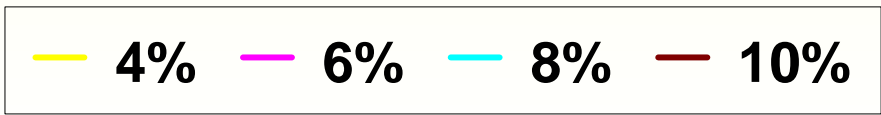
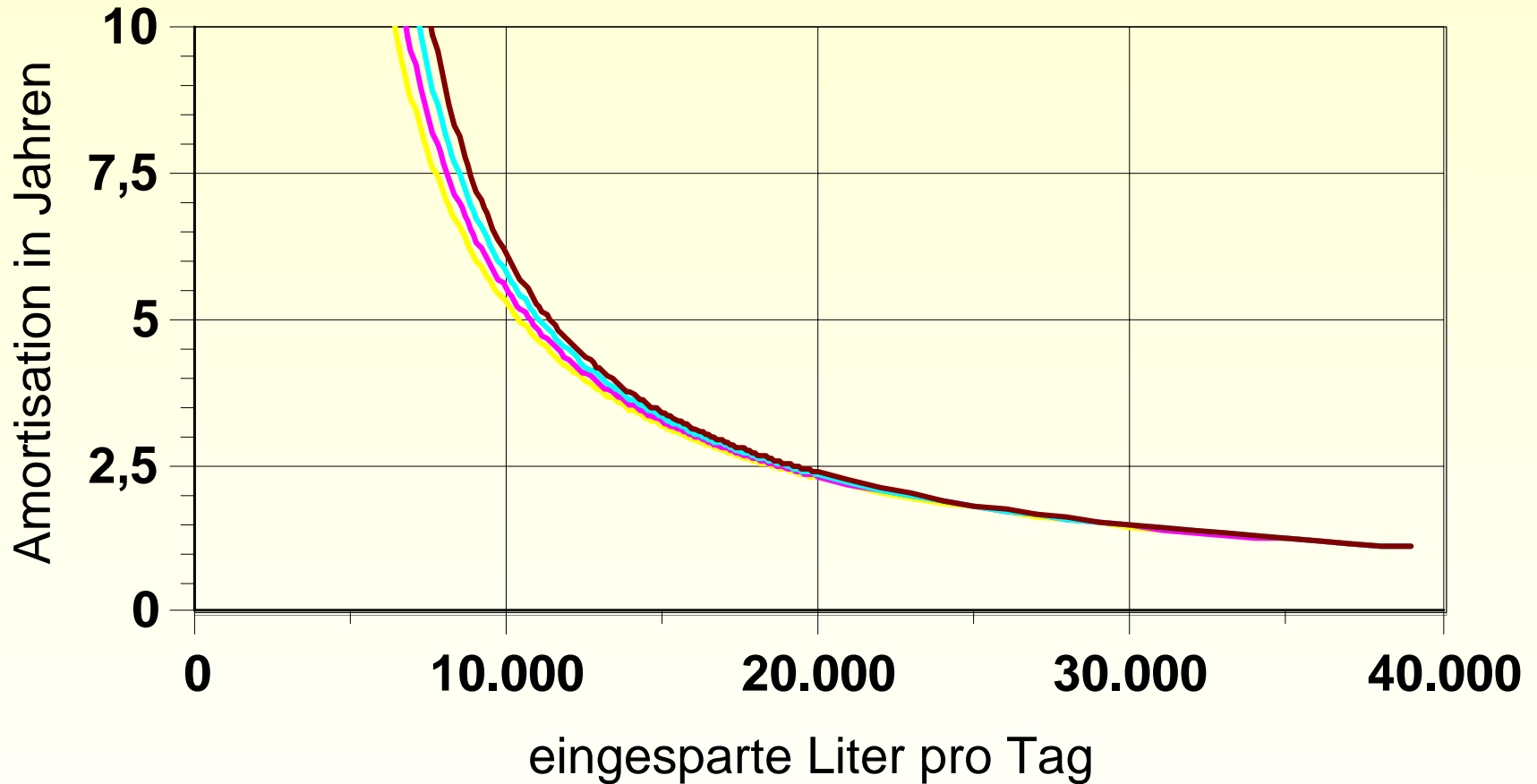




BSB ₇ :	< 3 mg/l	<i>E. coli</i> :	< 0,03 / ml
TOC:	1,5 – 2,0 mg/l	Gesamtcoliforme Bakterien:	< 0,1 /ml
O ₂ -Sättigung:	> 70%,	<i>P. aeruginosa</i> :	< 0,1/ml

Wirtschaftlichkeitsbetrachtung

Grauwasseranlage



Proved Technology in Germany (3)

Closed SBR: 0.2 up to 3 m³/d



Area requirement: 0.1 m²/Person

Energy demand: 1.5 kWh/m³

Ventilation not required

New Technology in Germany

Closed SBR: 3 up 30 m³/d



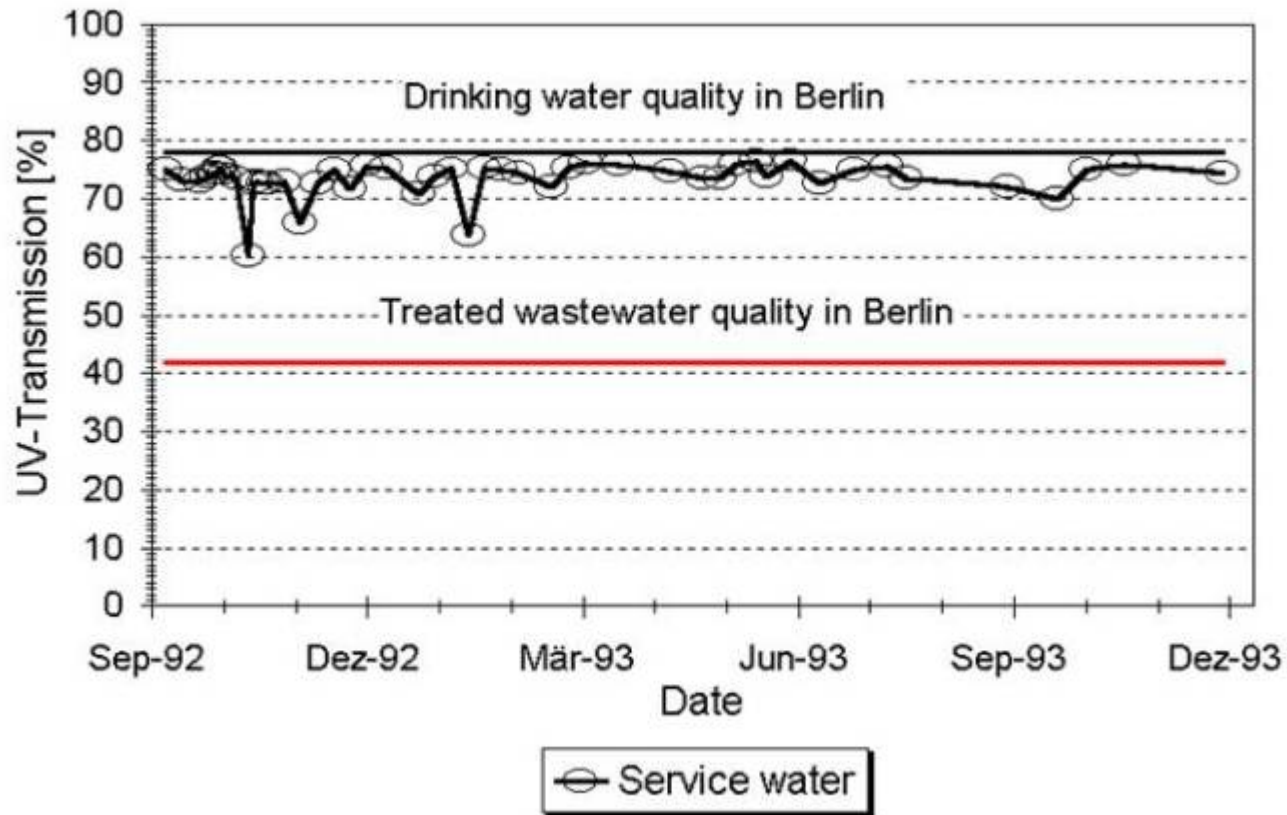
Area requirement: 0.1 m²/Person

Energy demand: < 1.5 kWh/m³

Moisture emissions in installation area

Results

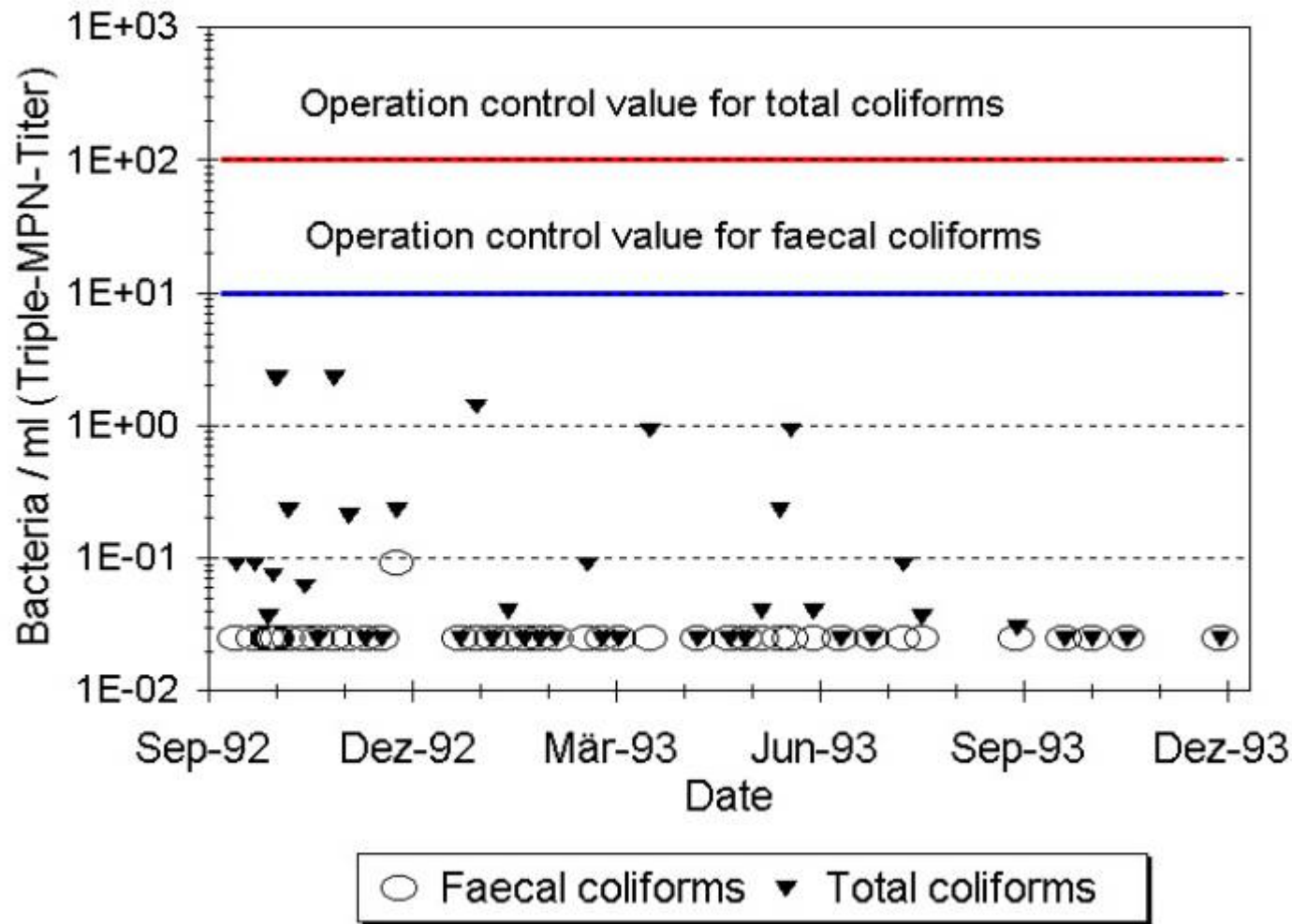
The water quality from the 3 different systems is



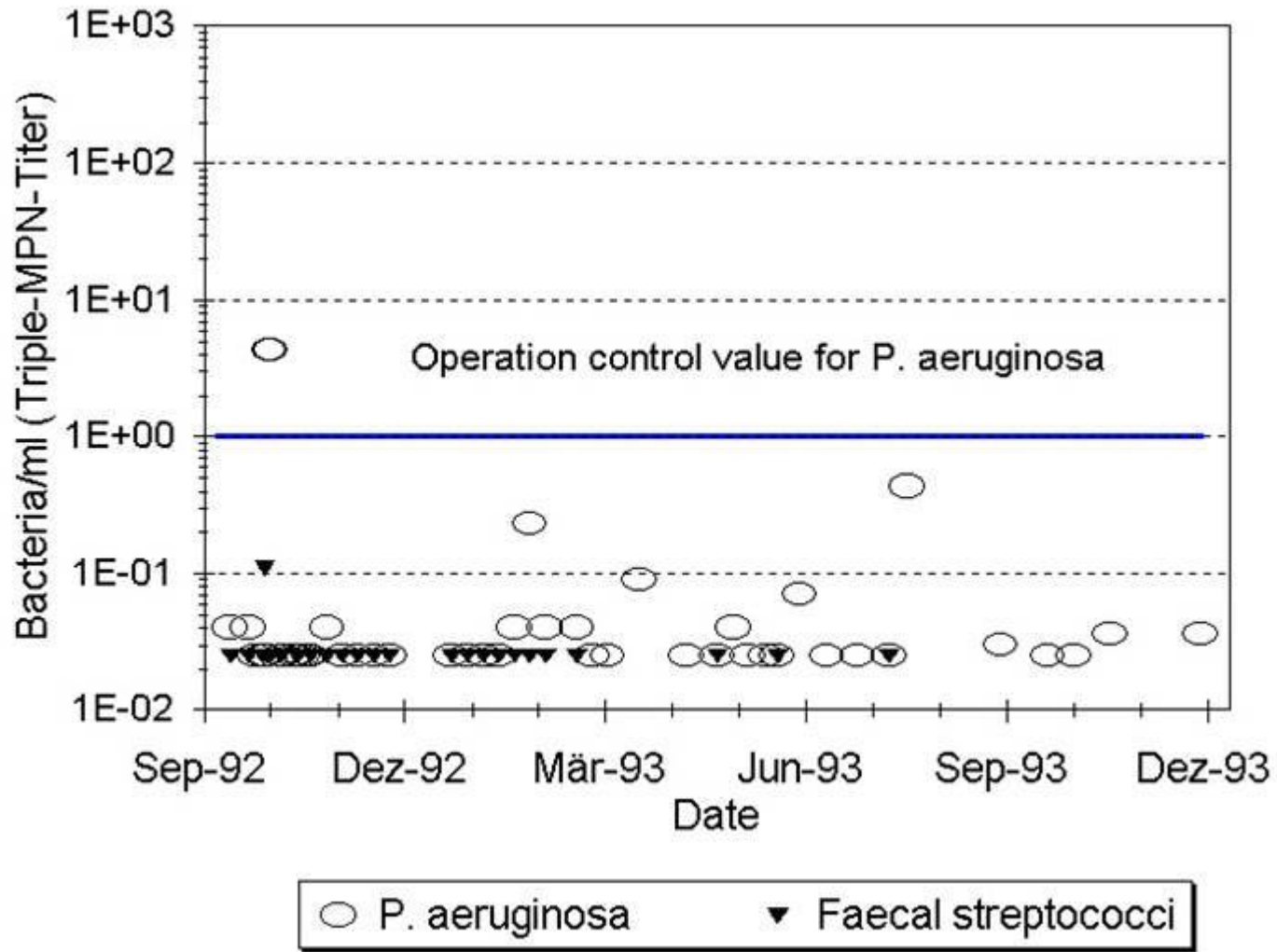
n: RBC and



UV-Disinfection



System: RBC and
UV-Disinfection

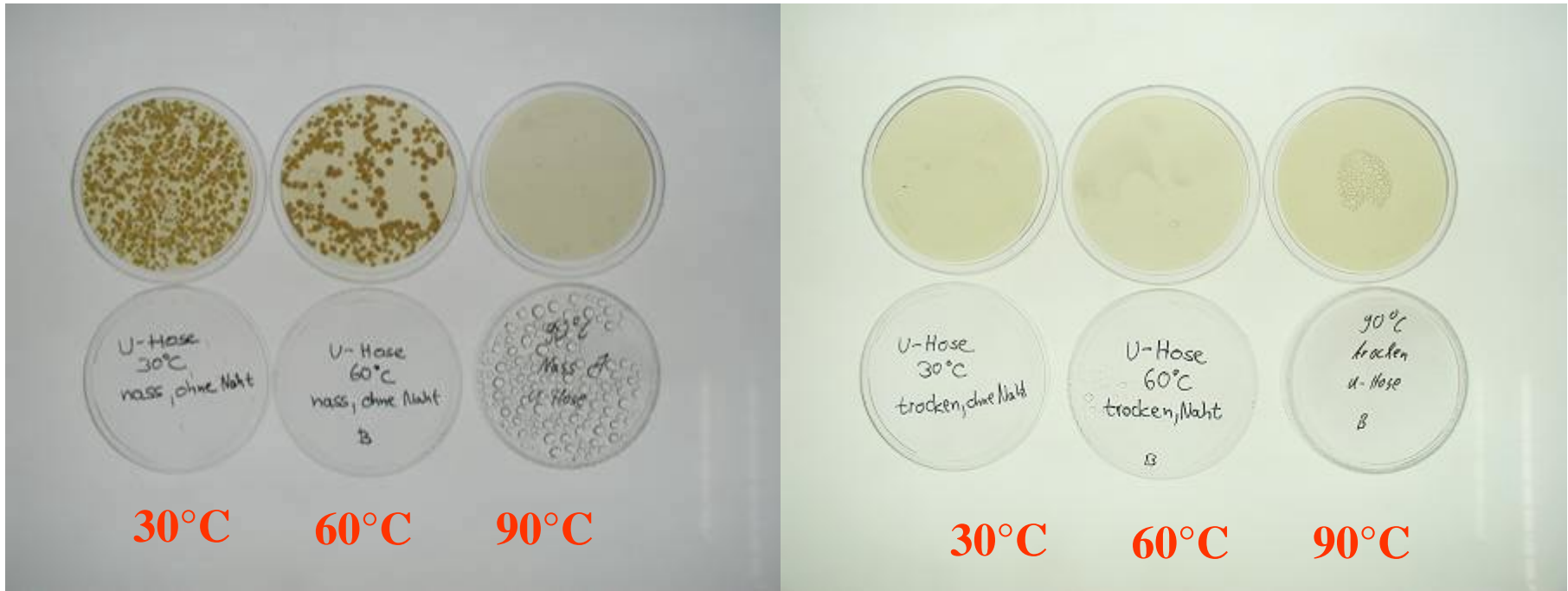


System: RBC and
UV-Disinfection

Laundry wash with recycled greywater

wet textiles

dry textiles



No proven difference between textiles washed with drinking and recycled water



System: SBR and
UV-Disinfection

Where are we heading to?

- Decentralised utility systems
- Modular systems instead of individually designed and manufactured plants
- Compact, closed and low-noise systems
- Low operational costs.

In conclusion:

In Germany, decentralised greywater recycling technologies:

- are available at all levels,
- have proved a high efficiency in saving water, and
- reducing the negative impacts on the environment caused by conventional systems
- can reduce more and more the individual water costs.

Was hemmt die Entwicklung?

- **Wenig / keine Fördermittel**
- **Anschluß- und Benutzungszwang**
- **Lobby der Wasserversorger**
- **Deutschland wird pauschal als Wasserreiches Land gesehen und vernachlässigt internationale F & E Arbeit**
- **Unsicherheiten und Kostendruck bei den Planern sich mit neuen Technologien auseinanderzusetzen**