

# water



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## FEATURES

OZWATER 2005

MEMBRANE TECHNOLOGY  
CHEMICALS OF CONCERN

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# INNOVATIVE SANITATION FOR URBAN AND PERI-URBAN AREAS

R Otterpohl

Professor Ralf Otterpohl, Director of the Institute of Municipal and Industrial Wastewater Management at the Hamburg Technical University, opened the Technical Sessions of the convention with a keynote speech focussed on alternative wastewater systems. It was unusual in two respects. First, it focussed not just on recycling of water but on recycling of nutrients, ie N, P, K and biomass for sustainable agriculture.

Secondly, he described applications of both high and low-tech systems operating in sophisticated housing and commercial developments in Germany as well as what we term 'appropriate technology' in Mexico, Africa and Eastern Europe.

His main thesis was clear... we should separate not only blackwater from greywater, but also as far as possible, yellow water from blackwater, and where feasible, treat faeces by composting in well-designed dry toilets. However, these can only operate successfully if the urine is to a large extent separated from the solids. Figure 1 summarises the proportion of nutrients in our excreta. Note that the majority is contained in the sterile urine.

In southern Australia we are accustomed to think solely in terms of our limited water supplies. In Europe, water supply is perhaps not so critical, but wastewater discharge is still a problem and also Ralf



Professor Ralf Otterpohl

quoted statistics which demonstrated their unsustainable use of phosphorous to grow their food. Almost all is supplied from the deposits in Africa, ie. Morocco. (Australians should be reminded that we also rely on imported or mined phosphorous).

'Yellow water' is the accepted term for the separately collected urine, for later use as fertiliser. Lest readers think this is far-fetched, there are thousands of urine-diverting toilets in operation, mainly in Sweden, and he showed examples (Figure 1) where large tanks or flexible containers store the collected urine from urban

developments until Spring when it is sprayed by local farmers onto their fields, supplying adequate quantities of nitrogen and phosphorus.

Irrespective of urine separation he maintained that the way of the future was to design decentralised systems, minimising the volume of water involved so that it was easier to disinfect and recycle locally, the vacuum toilet being the technology mainly used. He confessed that it would not be feasible to retrofit such systems into already developed communities, but maintained that a start has to be made, and he has personally invested into a housing development in Lubeck-Flintenbreiche where vacuum toilets for blackwater with minimal flush have been accepted by the residents since 2000 (Figure 3). The concentrated blackwater is mixed with shredded solid wastes and digested to form biogas, used for power and heating. Figure 4 is a photo of the equipment installed in the basement of the community building in Lubeck-Flintenbreite, in effect a mini WWTP. Greywater is treated in a constructed wetland. Operation and maintenance is carried out by trained contractors

He noted that centralised wastewater systems have some 70-80% of their assets locked in their pipes and sewers but

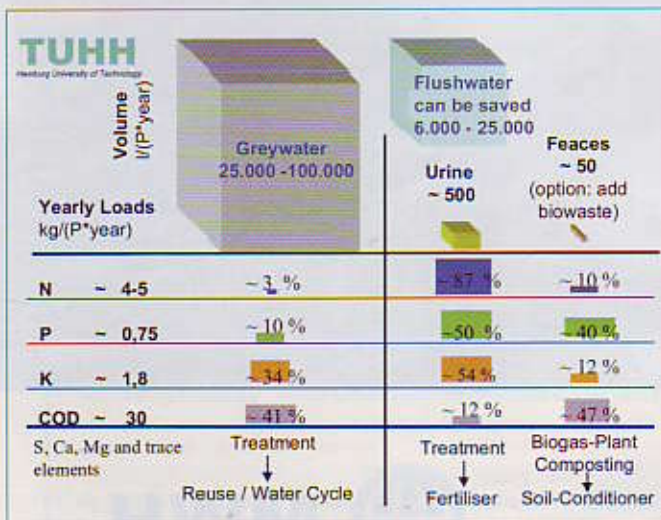


Figure 1. Average human excretion. (P\*year = per person per year).



Figure 2. A Swedish suburb incorporating urine-separating toilets with 'yellow water' used for local agriculture.

Toilets and resulting Dilution		
Type of Toilet	Daily Flow per P.	Pro and Con's
Flushing toilet	25-40 l	+ widely accepted - waste of water - high dilution
Vacuum-toilet	9 l	+ low water demand + well developed (ships) - high-tec / expensive
Separating toilet	6 l 1,5 l	+ little water / little dilution - simple fertiliser reuse - little experience
Waterless Urinal	1,2 l	+ no water / no dilution - maintenance required
Composting-toilet	1,5 l	+ no water needed - high space demand - maintenance needed
Desiccation toilet		++ Desiccation for hot climates

Figure 3. Efficiency of various toilet systems.

economy of scale applies only to the treatment plant itself. Building decentralised treatment systems for cluster housing or apartments would eliminate the reticulation, and economy of scale might be replaced in the future by the economy of numbers, i.e. factory production of the hardware. With an equivalent population of 400, Lübeck-Flintenbreite is already competitive with conventional

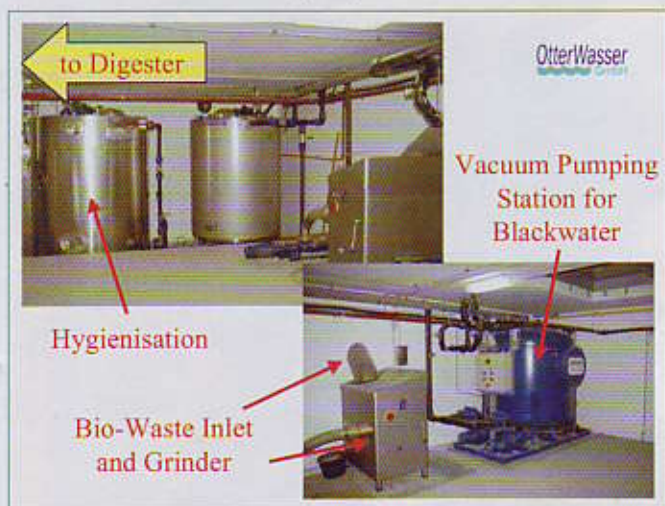


Figure 5. Treatment equipment in basement.

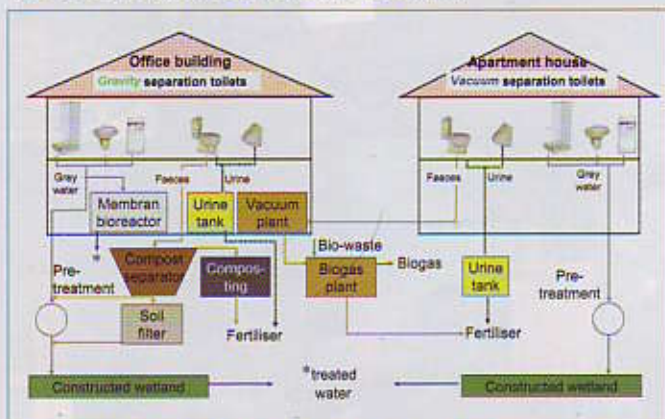


Figure 6. Gravity separation toilets in the office building and vacuum separation toilets in the apartment house of the WWTP Stahnsdorf, Berlin. EU-Project of the Centre of Competence for Water, Berlin Water Works/Veolia Water (Peter-Fröhlich et al., 2004).

## Ecological Settlement Lübeck-Flintenbreite



Figure 4. Peri-Urban Settlement Lübeck-Flintenbreite (400 inhabitants). Vacuum toilets plus Biogas-System for Blackwater plus Biowaste.

sewerage and he posed a question, when would such systems be on sale in DIY hardware stores? In 10-20-30 years?

Others in Germany are developing similar systems. Figure 5 illustrates a project in Berlin, and Figure 6 the design for a sustainable hotel. The development of membrane systems is a large factor for successful local recycling.

Dry toilets have been in use for many years but to be widely acceptable it is essential to minimise the volume of water entering the composting chamber, both from urine and anal cleansing. There have been recent developments in this technology. One successful project by Eco-San-Res of Sweden is installing dry sanitation with urine diversion into 4-storey apartments serving 15,000 people in Mongolia. Both the compost and the urine provide fertiliser for local agriculture. He quoted examples of successful dry toilets for local Mexico and in primary schools in the Ukraine.

He finished with two questions: Will utilities have clients in future? Will utilities take innovative technology as a strategic tool?

The above is a very brief summary of his written paper on the CD ROM which discusses very thoroughly the advantages and disadvantages of these alternative systems and quotes details of examples world-wide.

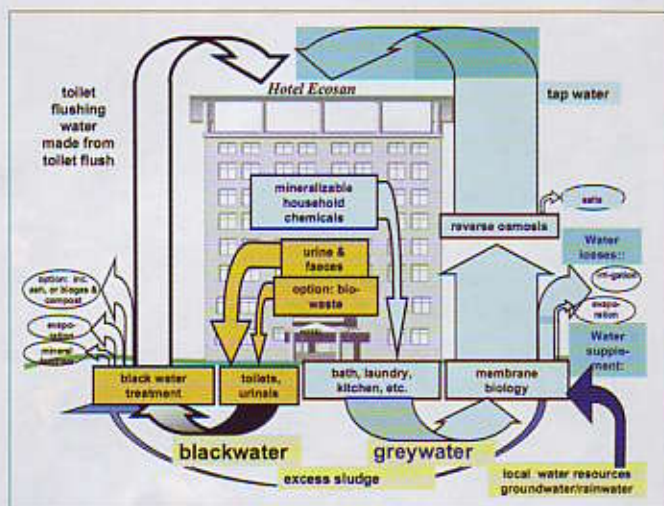


Figure 7. Projected design for sustainable hotel (patent to Ulrich Braun, INTAQUA, Hamburg University of Technology).