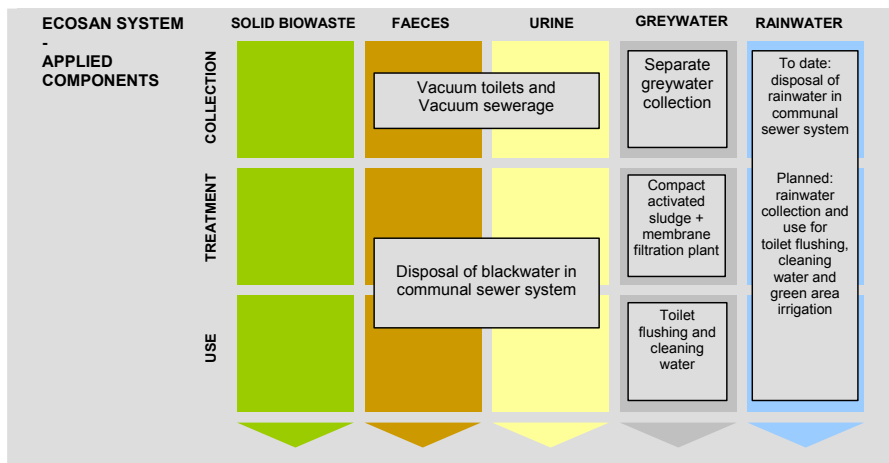




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Vacuum sewerage and greywater recycling, office building "Ostarkade" of the KfW Bankengruppe

Frankfurt am Main, Germany



1 General Data

Type of Project:

New office building in urban area

Project Period:

Start of operation: November 2002

Project Scale:

300 workplaces and 13 apartments

Address:

Palmgartenstrasse 5 –9
60325 Frankfurt am Main, Germany

Planning Institution:

RKW Architektur + Städtebau
Ip5 Ingenieurpartnerschaft

Executing Institution:

KfW Bankengruppe, Frankfurt am Main



Figure 1: KfW building "Ostarkade" in Frankfurt am Main, Germany (Photo: KfW)

2 Objective of the project

Improvement of KfW's in-house environmental balance.

Reduction of operation and maintenance costs through water saving and recycling.

Demonstration of innovative technologies in closed-loop concepts of wastewater management.

3 Location and general conditions

The KfW, among other activities, finances investments and accompanying consulting services in developing countries on behalf of the German Ministry for Economic Cooperation and Development (BMZ).

At its Frankfurt offices, staff of the KfW presently work in nine different buildings in the city centre. KfW moved into the first property, the main building at the Palmengarten, in 1967; this building is undergoing basic renovation. Construction work has started and is scheduled for completion by the end of 2005. The most recent building in the group, the

Ostarkade, was opened in November 2002.

The Ostarkade building contains many innovative facilities and combines economic with ecologic demands in many different ways.

The building has 7 floors and offers space for around 300 workplaces, with 13 apartments on the two top floors.

4 Technologies applied

60 vacuum toilets, 20 vacuum urinals, vacuum pipes and a vacuum pumping station are installed in the building.

Greywater from hand washing, cleaning and kitchens is collected in a separate gravity pipe system.

Greywater is treated in a compact activate sludge reactor combined with membrane filtration. The membrane fil-

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Figure 2: Vacuum toilet in KfW building Ostarkade (Photo: GTZ)

tration guarantees pathogen free water for reuse. The treatment plant is located in the basement of the building and also receives wastewater from the KfW's catering facilities.

The vacuum sewerage and the greywater collection and treatment system will also be extended to the main building, currently being renovated.

A rainwater collection system has not yet been installed, as only a small volume of water is expected to be collected from the Ostarkade building. Rainwater collection and reuse is however planned for all buildings during the renovation of the main building.

5 Type of reuse

The treated greywater is used for toilet

flushing and cleaning water.

Blackwater (faeces, urine and flushing water) collected in the vacuum system is not treated and used, due to local regulations and the complexity of reuse in this case. It is currently disposed of in the communal sewerage system. The possibility of anaerobic treatment of the blackwater was considered, but has not been implemented due to financial constraints and the limited space available.

When a rainwater collection system is installed it is planned to use it for the irrigation of green areas, toilet flushing and cleaning.

6 Costs

Investment costs vacuum system:



Figure 3: Vacuum pumping unit (Photo: KfW)

80.000 Euro

Investment costs greywater system: 50.000 Euro

Initial cost estimates showed that the return on the additional costs of KfW's wastewater management system is about 2-5 percent per year depending on the future rise in waterprices.

Combined water and wastewater fees in Frankfurt are around 4 Euro/m³.

7 Design information and technical specifications

The target value for the design of the water supply and disposal system was 50 l per capita and day. The vacuum system and greywater recycling has enabled the actual water consumption to be reduced to less than 20 l per day and capita.

The greywater treatment system operates at a capacity of ca. 500 l/h and produces bathing quality water.

The vacuum system was supplied by the company Roediger Vakuum- und Haustechnik, and the greywater treatment system by ACO Passavant, with the membrane technology in particular being supplied by Weise Water Systems.

8 Practical experience and lessons learned, comments

As the pilot project involved many innovative technologies, several initial technical problems arose. All problems could be solved quickly with the support of the highly committed suppliers. The toilet and treatment facilities are now



Figure 4: Greywater treatment facility in KfW Ostarkade (Photo: GTZ)

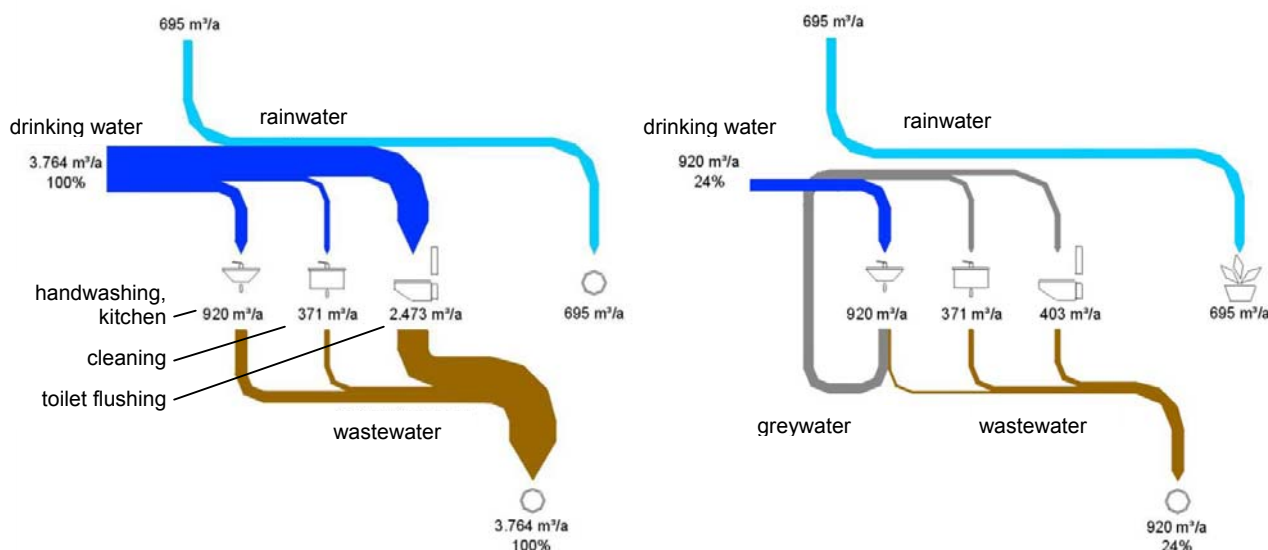


Figure 6: Water balance in the KfW building Ostarkade: on the left with conventional technology and on the right with vacuum system and greywater recycling (Figures: IP5, Martin Selig)

well accepted by users and operating staff.

Initially the vacuum system experienced problems with pipe blockages during the first three months. After making some technical adjustments however, the system has been operating with no major problems for the last two years.

The greywater treatment system was originally designed exclusively to treat greywater, but now also receives wastewater from the building's kitchen. This has caused problems with the system performance. The membrane system in particular has had problems and needed to be adapted to the much higher pollution load in the water. It would be better to treat highly charged kitchen wastewater separately from greywater, e.g. with the blackwater from toilets.

Cost-efficiency of reuse systems increases with the scale of the project. In the KfW buildings, vacuum sewerage and greywater recycling was found to be cost-efficient for the Ostarkade building. Rainwater collection will only become cost-efficient when the system is extended to include the main buildings as well. Brownwater treatment for reuse was not found to be cost-efficient in this context using currently available technologies and reuse options.

9 Available documents and references

Environmental report, KfW Bankengruppe, 2003.
http://www.kfw.de/DE/Service/OnlineBib/148/KfWUmweltbericht_engl.pdf

10 Institutions, organisations and contact persons:

Project owner:

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 KG

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