LIFE Project Number

LIFE 03 ENV/D/000025

PROGRESS REPORT No. 01

Reporting Date

12.07.2004

LIFE PROJECT NAME

Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater (SCST)

Project Data

Project location	Wastewater Treatment Plant Stahnsdorf Schenkendorfer Weg 1-9 14532 Stahnsdorf
Project start date:	01.01.2003
Project end date:	30.06.2006
Total project duration (in month)	42 months
Total budget	2,223,474€
EC contribution:	465,635 €
(%) of total costs	20.9
(%) of eligible costs	30.0

Beneficiary Data

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2. LIST (I) KEY-WORDS AND (II) ABBREVIATIONS

Key-Words: new sanitation concepts, gravity separation toilet, vacuum separation toilet, waterless urinals, compost separator, digestion, constructed wetland, septic tank

Abbreviations:

KWB Kompetenzzentrum Wasser Berlin (Berlin Center of Competence for Water)
BWB Berliner Wasserbetriebe
AR Anjou Recherche

3. EXECUTIVE SUMMARY

The main goal of this project is to develop new sustainable sanitation concepts which have significant advantages in relation to ecological as well as to economical aspects compared to the conventional systems (end-of-pipe-system). After successful project completion, the new sanitation concept should be used in Berlin areas, where sewer systems are not installed, as well as other locations (national and international).

The management of the project has been achieved as foreseen. No relevant modifications have been necessary.

In relation to the technical development all eight tasks have been started. Some later than scheduled but this does not endanger the goal and end date of the project. The first results from the greywater treatment with the constructed wetland show that the effluent quality is comparable to the wastewater treatment plants of Berlin

In contrary to the proposal the new sanitation concept using vacuum separation toilets will be realised in the office building instead of apartment building. Furthermore not fifteen but ten flats are taken into account for the project and all bathrooms will be completely retrofitted instead of installation of new toilet systems only. Due to the fact that external assistance for designing is necessary the costs for external assistance is higher than planned. The precise figure will be available earliest at the end of 2004. All modifications do not endanger the goal of the project.

For the information and discussion with the national and international public and colleagues about this project many presentations, publications and visits of the demonstration project have been undertaken and organised, respectively.

The envisioned progress up to the interim report in March 2005 will be the realisation and start up of operation of the sanitation concept in the apartment building, exchange of the gravity separation toilets against vacuum separation toilets in the office building, designing, installation and operation of the digester. Furthermore all work from subcontractors (Life-Cycle-Assessment, Urine treatment, Fertiliser usage) will continue. Different international presentations are also foreseen.

In relation to the financial issues 325.906 € (21 %) of the total eligible costs of 1.552.116 € and 511.515 € (23 %) of the total real costs of 2.223.474 €, respectively, have been spent until now. The 30 % threshold of the total real costs will be achieved presumably at the end of 2004.

List of key deliverables and outputs see **Annex 3.1**.

4. PROJECT MANAGEMENT

The main tasks of the involved persons in the project from beneficiary and partners are shown in **Annex 4.1**. It has to mention that the project management is divided into the *administrative project manager* (Dr. Luck, *contact person*) and into the *technical project manager* (Dr. Peter-Fröhlich). This is an agreement between the beneficiary and the partners, according to the Project Partnership Agreement which has been signed.

The organisation of the project is shown in **Annex 4.2**.

5. TECHNICAL DEVELOPMENT

5.1 General

At the end of July 2004 all tasks have started, some began later than scheduled (see Gantt-chart, chapter 10). However the goal and date of the end of this project are not affected. There has been one uncertainty in relation to the tenants of the apartment building in taking part at this project. But at least the new sanitation concept can be realised in ten apartments. This is five less compared to the proposal which does again not endanger the goal of the project.

A general overview of the project site wastewater treatment plant Stahndorf can be seen in **Annex 5.1.**

5.2 Task 1 Management and reporting to EC

During the last 17 month following main tasks were carried out by the management:
- organisation of the project start (distribution of tasks to the planning departments)
- preparation and execution of three project meetings
- controlling of the project progress
- controlling of the project finances
-controlling of the technical performance
- preparation of the progress report

5.3 Task 2 Realisation of the sanitation concepts for the office building

Sanitation system inside the office building

As the basic evaluation for the sanitation concepts inside of the office building already started in November 2002, the preliminary planning of the sanitation concepts inside the office building could be commenced in January 2003, followed by the implementation engineering planning started in March 2003 and the tendering period started in June 2003. The installation of the sanitation concepts inside the office building was carried out between August and October 2003. The realisation of the sanitation concept inside the office building is in time according to the EU-Life-proposal. The vacuum plant and the test vacuum separation toilet were fixed at the beginning of December 2003 (line scheme of the sanitation concepts inside the office building see **Annex 5.2**; pictures of the toilet rooms, the urine tanks and the vacuum plant see **Annex 5.3**).

Sanitation concept outside the office building

The basic evaluation for the system engineering planning for the outside treatment units of the office building started in January 2003, followed by the preliminary systems and construction engineering planning in February/March 2003, the implementation systems and construction engineering planning in April to June 2003 and the tendering period from July until the end of September. The realisation of outside treatment units began at the end of October 2003. Due to the winter, completion of the outside treatment units was delayed by 2 months. According EU-Life-Proposal the realisation of the outside treatment units are delayed by 4 months (flow chart of the outside treatment units see **Annex 5.4**; pictures of the outside treatment units during construction period and after completion are shown in **Annex 5.5**).

The preliminary planning of membrane bioreactor for greywater treatment was started in December 2003. Implementation of systems engineering planning was done in January/February 2004. The construction of membrane bioreactor plant is ordered. As the greywater flux of the office building is not sufficient for the constructed wetland and the membrane bioreactor operated in parallel, the start up of the experiments are planned to begin with the start up of the sanitation system of the apartment house, which will deliver increased amounts of greywater.

5.4 Task 3 Realisation of the sanitation concepts for the apartment building

The basic planning and cost appraisal of the sanitation concepts for the apartment house was initiated in November 2003. The provision of funding for total reconstruction of the bathrooms and the approval of the estate department of the BWB was obtained in January 2004. The information talks with the tenants took place in February and March 2004. In April the preliminary planning of the sanitation system inside the apartment house and the preliminary systems and construction engineering planning of the outside treatment units for the apartment house were started (scheme of the apartment house and participant flats **Annex 5.6**).

5.5 Task 4 Operation and testing

With the start up of the new sanitation concept with gravity-separation-toilets inside the office building (separation toilets; waterless urinals; urine tanks, vacuum separation toilet, vacuum plant) the test phase began in time according the EU-Life-proposal. Acceptance analysis of the new toilet system started, using questionnaires. First evaluation of the questionnaires shows, that the gravity separation toilets and the waterless urinals are accepted by the users. Collected urine was analysed regarding nutrient content, pathogens and pharmaceutical residues. The nutrient concentration was below the mean values of urine. This may be due to the fact, that the users have already urinated early at home and the first urine has the higher nutrient concentration.

Since the start up of the outside treatment units (compost separator; soil filter; constructed wetland) in March 2004, weekly measurement of their degradation performance are carried out. The relevant measured data (NH_4-N, N_{anorg}, CSB, P_{total} suspended solids, pH) in the outflow of the constructed wetland never have exceeded the lower limit according water legislation concession for WWTP-Ruhleben, one of the WWTP in Berlin with the lowest effluent standards, until now (see result diagrams in **Annex 5.7**). First unexpected result of the operation of the compost separator and soil filter is that using a waste water pump with cutter knife for brown water transport leads

to an insufficient filtering performance of the filter bags. Hence the soil filter was blocked after one month of operation time due to high suspended solid content from the compost separator of the faecal filtrate. To solve this problem a hydro cyclone in the influent to the compost separator may be the appropriate solution. This is decided at present.

5.6 Task 5 Life-Cycle-Assessment (LCA)

Preliminary talks and task adjustments with the Technical University Berlin (TUB) department of water quality control, about the LCA task took part in February and March 2004. The project team decided for the TUB as partner for LCA since a lot of the data needed and experiences are already available and existing, respectively, at TUB. This data were collected for another LCA-project ("Comparisons of the conventional system in Berlin with the ecological case study system in Lübeck Flintenbreite"). A contract between the KWB and TU Berlin will be signed in August 2004.

5.7 Task 6 Dissemination

A large amount of dissemination activities were carried out over the whole project period (see chapter 7; and **Annexes 7.1 – 7.3**)

5.8 Task 7 Industrial style urine treatment for utilization

Requests of a proposal for this task were enquired at Technical University Hamburg-Harburg (TUHH), department of Municipal and Industrial Wastewater Management, Technical University Berlin (TUB), department of chemical engineering and at the Cottbus University of applied sciences department of chemical engineering. Technical University Berlin (TUB) declined to make a proposal because no experiences with urine are actually available at the department. University of applied sciences Cottbus didn't sent a proposal. The proposal of the TUHH was available in April 2004. Last adjustments of the tasks were carried out. Beside the unique proposal, TUHH was chosen as partner because they also work in the field faecal composting and they have numerous experiences in the field of wastewater treatment, from which we can benefit. Furthermore "sustainable sanitation" is a high ranked topic at this University. The contract between KWB and TUHH will be signed in August 2004. According EU-proposal task 7 should have been started at the beginning of 2004. The delay of 6 month won't lead to an extension of the project.

5.9 Task 8 Fertiliser usage

Requests of a proposal for the task Fertiliser Usage were enquired in December 2003/January 2004 at the Humboldt University Berlin (HUB), faculty of agriculture and horticulture department of crop sciences and at the University of Bonn, institute of plant nutrition. Proposals were available in February 2004. Even if the proposal of the university Bonn was less expensive then the HUB-proposal, the project team decided to work with the HUB because of the advantage of location (project supervision, project visitors), the other type of soil (sand instead of clay) and the climate in the Berlin region. Last adjustments were carried out in March 2004. The contract was signed in May 2004. Experimental works already started in May 2004. The delay of 4 months won't lead to an extension of the project. A first status report can be seen in **Annex 5.8**.

6. PROBLEMS ENCOUNTERED

a) Toilet system in office building and apartment building

The company Roediger is not able to produce a vacuum separation toilet for the market within the timeframe of the project. Until now only vacuum separation toilets are available which are altered gravity separation toilets. One of it is in operation in the office building since December 2003. The experience shows that it works in general but, among others, the flushing system has to be improved. For that reason and to make maintenance easier, it was decided by the project team to realise the vacuum separation toilet concept in the office building and not in the apartment building. To change the concepts for both buildings is not difficult. Vacuum pipes are already installed in addition to the pipes necessary for the concept with gravity separation toilets in the office building. The gravity separation toilets will be operated until the installation in the apartment building is finished.

b) Number of flats (reduction from 15 to 10)

Until now 12 tenants from the apartment building agreed for the installation of gravity separation toilets. But due to the fact that the flats of two tenants are in the first floor it is not possible to install two additional ducts to the cellar. These ducts would have to be installed through the flats beneath.

c) Complete retrofitting of the baths

In contrary to the description in the proposal the bathrooms will be completely retrofitted. The main reason for this decision was to increase the number of tenants who take part to this demonstration project.

d) Engineer/Design Partner 2 (BWB): partly external assistance (Berlinwasser Services)

In contrast to the proposal a part of designing and supervision (*Engineer/Design*) of the construction had to be realised by external assistance (Berlinwasser Services) since Berliner Wasserbetriebe (BWB) had not the capacity of appropriate engineers. For that reason the budget for external assistance according the proposal will be higher. The precise figure will be available earliest at the end of the year.

The additional costs for complete retrofitting of the bathrooms is assumed of about 3.000 € per bathroom. The precise difference of the costs due to the reduced number of flats and complete retrofitting of bathrooms can be given after the tendering in autumn this year.

The modifications described above do not endanger the goals of the project.

7. DISSEMINATION

During the actual project duration of 1 ½ years an intensive dissemination was already carried out. Beside several publications in reputable journals and presentations at appropriate symposia and conferences (see **Annex 7.1**), a presentation for local and trade journals was arranged on 24 November 2003 (see **Annex 7.2**). More press publications can be seen also in **Annex 7.2.** In addition the project was often presented to interested people and institutions in KWB and at the project site Stahndorf, respectively (see

Annex 7.3). Furthermore the project is presented on the KWB-internet-page http://www.kompetenz-wasser.de/engl/projekte/proj_scst.htm in German, English and French. A project board is also installed at the project site in Stahnsdorf.

All activities in relation to the dissemination of this project show an increasing interest to this subject nationally and internationally. Examples are the presentations in Philadelphia and Prague (No 12 and 18, **Annex 7.1**). Both presentations are based on an invitation of members of the Scientific/Technical Committees. One more important example is the *4th IWA-World Water Congress and Exhibition* in Marrakech from 19-24 September 2004. On this important international conference a side event on *Sustainable Sanitation* will take place for three days.

8. ENVISIONED PROGRESS UP TO 31. MARCH 2005

Task 1: *Management and reporting to EC*

Continue of the management of the project. Realisation of the interim Report for the whole project in March 2005.

Task 2: *Realising of the sanitation system for the office building*

Exchange of the gravity separation toilets against vacuum separation toilets (altered gravity separation toilets, see a), chapter 6) at the end of 2004. Designing and installation of the digester (gas plant).

Task 3: *Realising of the sanitation system for the apartment building*

Carry out the sanitation concept inside and outside the apartment building beginning of 2005.

Task 4: *Operating and testing*

Office building: The operation of the sanitation facilities including the gravity separation toilets will continue until the end of 2004. After this time the operation will continue with vacuum separation toilets including the digester. Different operation variants according the proposal will be tested.

Apartment building: Start up of the operation of the facilities in and outside at the end of 2004. Different operation variants according the proposal will be tested.

Membrane bioreactor: Start up of the membrane bioreactor for greywater treatment at the end of 2004.

Task 5: *Life-Cycle-Assessment*

Start up of Life-Cycle-Assessment in July 2004. Collection of construction phase data completed at the end of 2004 (Milestone). Interim report in March 2005.

Task 6: *Dissemination*

Presentation and publication of the project:

- 4th *IWA World Water Congress and Exhibition* in Marrakech, Marocco 19.-24. Sep. 2004;
- EWA Conference *Nutrient Management* in Amsterdam, 28.-29. Sep. 2004;
- Final Workshop *Wastewater as a Resource* between the Technical University Berlin and the Tshingua University Beijing in Beijing, China, 11.-13. Oct. 2004;
- Leading-Edge Conference on Sustainability in Water-Limited Environments, 8-10 Nov. 2004, Sydney, Australia;

Different presentations of the project to different interested persons/institutions in Berlin (project site Stahnsdorf, KompetenzZentrum Wasser Berlin) as in the past.

Task 7: *Industrial style urine treatment for utilisation*

Start up of this task in July 2004. Begin of operation of the first production unit (vacuum evaporation) in September/October 2004 (Milestone). This milestone should have been achieved in March 2004 according the proposal. But due the postponed start of this task of six months this milestone is also postponed. Interim report in March 2005.

Task 8: *Fertiliser usage*

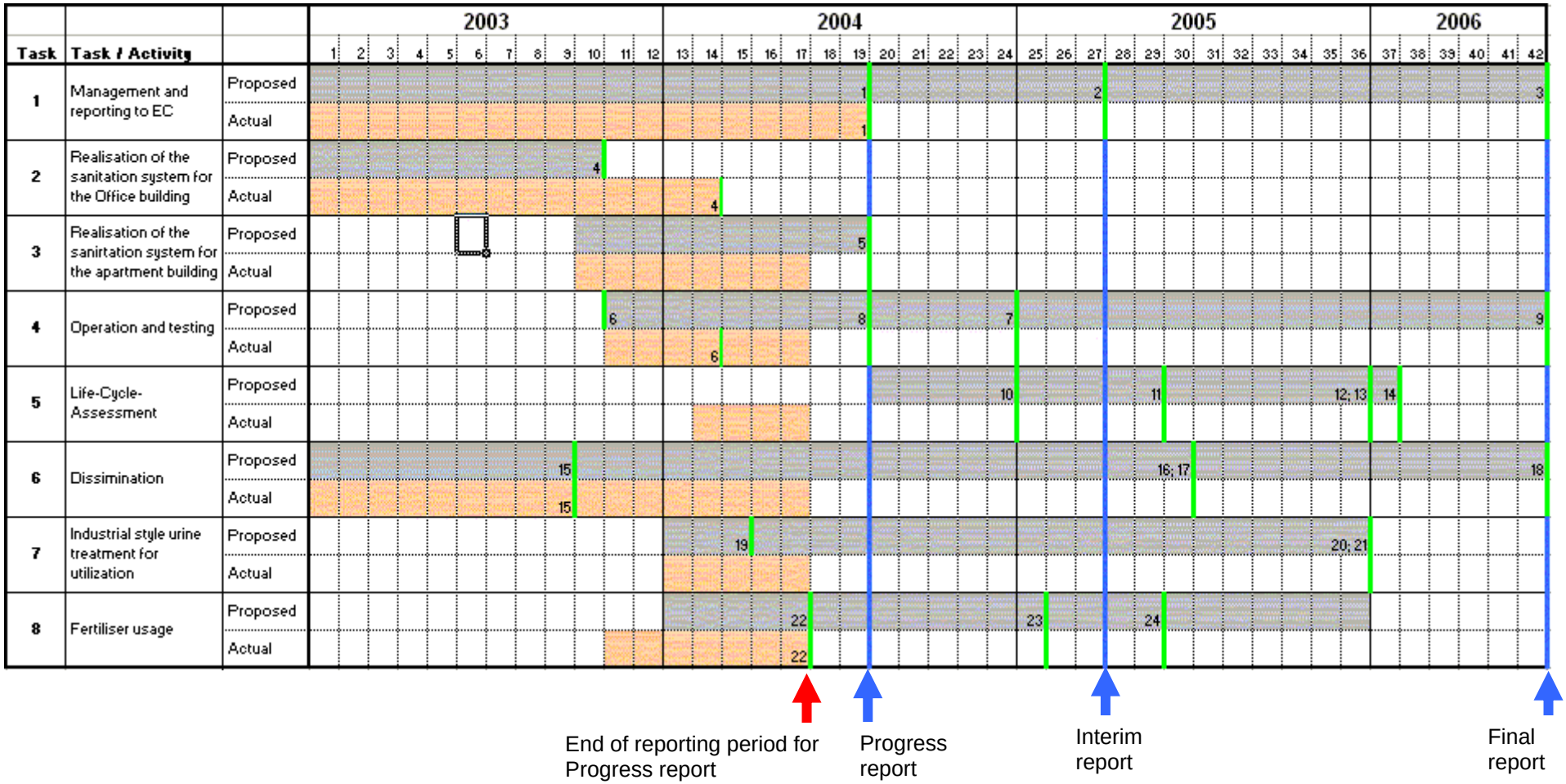
Carry on this task. Attitude study 1 (pot experiment with urine) finished at the end of January 2005 (Milestone). Start of field experiment 1 (urine) in August 2004. Start of pot experiment 2 (faeces) and field experiment 2 (urine/faeces) in March 2005. Start of acceptance survey by farmers and consumers in January 2005). Interim report in March 2005.

9. FINANCIAL ISSUES

Cost category	**Total cost according the Commissions decision (eligible cost) in €**	**Cost incurred from the start date to 31.05.04 (eligible cost) in €**	**%**
1. Personnel	462,742	164,982	35.7
2. Travel	31,620	7,516	23.8
3.Outside assistance	440,625	62,012	14.1
4. Durables			
- *Infrastructure*	214,620	61,652	28.7
- *Equipment*	27,500	652	2.3
- *Prototypes*	0		
5. Consumables	250,469	7,212	2.9
6. Other costs	23,000	1,542	6.7
7. Overheads	101,540	20,338	20.0
SUM TOTAL	1,552,116	325,906	21.0

The 30 % threshold value is expected to be reached at the end of 2004.

10. PROGRESS AND PLANNED ACTIVITIES



Numbers in the Gantt-chart indicate the defined milestones (see description next page)

Remarks to the Gantt-chart

milestone No.	description
1	Progress Report
2	Interim Report
3	Final Report
4	complete installation of the equipment for the new sanitation concept with gravity-separation-toilets
5	complete installation of the equipment for the new sanitation concept with vacuum-separation-toilets
6	start up of the new sanitation concept with gravity-separation-toilets
7	end of testing of the new sanitation concept with gravity-separation-toilets
8	start up of the new sanitation concept with vacuum-separation-toilets
9	end of testing of the new sanitation concept with vacuum-separation-toilets
10	collection of construction phase data completed
11	material- and energy-flux-analysis of SCST and conventional system completed
12	impact assessment of LCA completed
13	sensitivity analysis completed
14	decision support method for choice of optimal wastewater system completed
15	installation of an internet page, installation of links to the SCST-page
16	1st CD-ROM with description of the demonstration project, first results and presentation is available
17	realisation of a project workshop
18	2nd CD-ROM with description of the demonstration project, results and presentation including workshop is available
19	start up of production unit on a semi-technical scale
20	end of the operation of the semi-technical production unit
21	results of the evaluation of the experiments
22	fertiliser experiment 1 started
23	attitude study 1 finished
24	fertiliser experiment 2 started

11. ANNEXES

Annex 3.1 List of key deliverables and milestones

Task			Date	Status
Task 1	**Deliver-ables**	Progress Report	Month 19 31.7.2004	available
Task 1	**Mile-stone**	Progress Report	Month 19 31.7.2004	available
Task 2	**Deliver-ables**	Project plans for the office building, evidence of the office building sanitation system due to invoice of sanitation and construction enterprises and photos of the sanitation system of the office building (part of the progress report from Task 1)	Month 19 31.7.2004	two selected project plan see Annex 5.2 and 5.4, Photos see Annex 5..1, 5.3 and 5.5, invoices not added to this Progress Report due to the size of it
Task 2	**Mile-stone**	Complete installation of the equipment for the new sanitation concept with gravity-separation-toilets	Month 31.10.2003	only inside was completed, outside March 2004
Task 3	**Deliver-ables**	Project plans for the apartment building, evidence of the apartment building sanitation system due to invoice of sanitation and construction enterprises and photos of the sanitation system of the apartment building (part of the progress report from Task 1)	Month 19 31.7.2004	Plans, Photos and invoices are not available yet since the designing is under way at present, but an overview of the tenants who take part at this project can be seen in Annex 5.6
Task 3	**Mile-stone**	Complete installation of the new sanitation concept with vacuum-separation-toilets	Month 19 31.7.2004	The completion of the installation will be at the end of 2004. Not vacuum separation toilets will be used but gravity separation toilets. Vacuum separation toilets will be installed in the office building at the end of 2004 (exchange of gravity separation toilets)
Task 4	**Deliver-ables**	First important results about the different investigation phases with the gravity separation toilets (part of the progress report from Task 1)	Month 19 31.7.2004	see Annex 5.7
Task 4	**Mile-stone**	Start up of the new sanitation concept with gravity-separation-toilets	Month 10 31.10.2003	in time inside, in March 2004 outside
Task 5	**Deliver-ables**			First deliverables April 2005!
Task 5	**Mile-stone**			First milestone 31.12. 2004!
Task 6	**Deliver-ables**	Information about the web address	Month 9 30.9.2003	realised in time (www.kompetenz-wasser.de; research, SCST)
Task 6	**Mile-stone**	Installation of an internet page, installation of links to the SCST-page	Month 9 30.9.2003	realised in time
Task 6	**Deliver-ables**	Report about all dissemination activities like presentations and publications of the demonstration project (part of the progress report from Task 1)	Month 19 31.7.2004	see Annex 7.1, 7.2, 7.3, 7.4 and 7.5 of the Progress Report; Annex 7.4 and 7.5 are examples of the publications. The Prague-paper is similar to the most other publications.
Task 7	**Deliver-ables**	Report including the first qualitative and quantitative figures about the produced fertilisers (part of the progress report from Task 1)	Month 19 31.7.2004	not available since the start of this Task is postponed from 1 January to 1 July 2004
Task 7	**Mile-stone**	Start up of production unit on a semi-technical scale	Month 15 31.3.2004	not started since this Task is postponed for 6 month; Production will start in Sep/Oct 2004
Task 8	**Deliver-ables**	Report including the first documentation about the effect on corn yield due to different fertilisers (part of the progress report from Task 1)	Month 19 31.7.2004	report is added to this Progress Report, Annex 5.8
Task 8	**Mile-stone**	Fertiliser experiment 1 started	Month 19 31.7.2004	in time

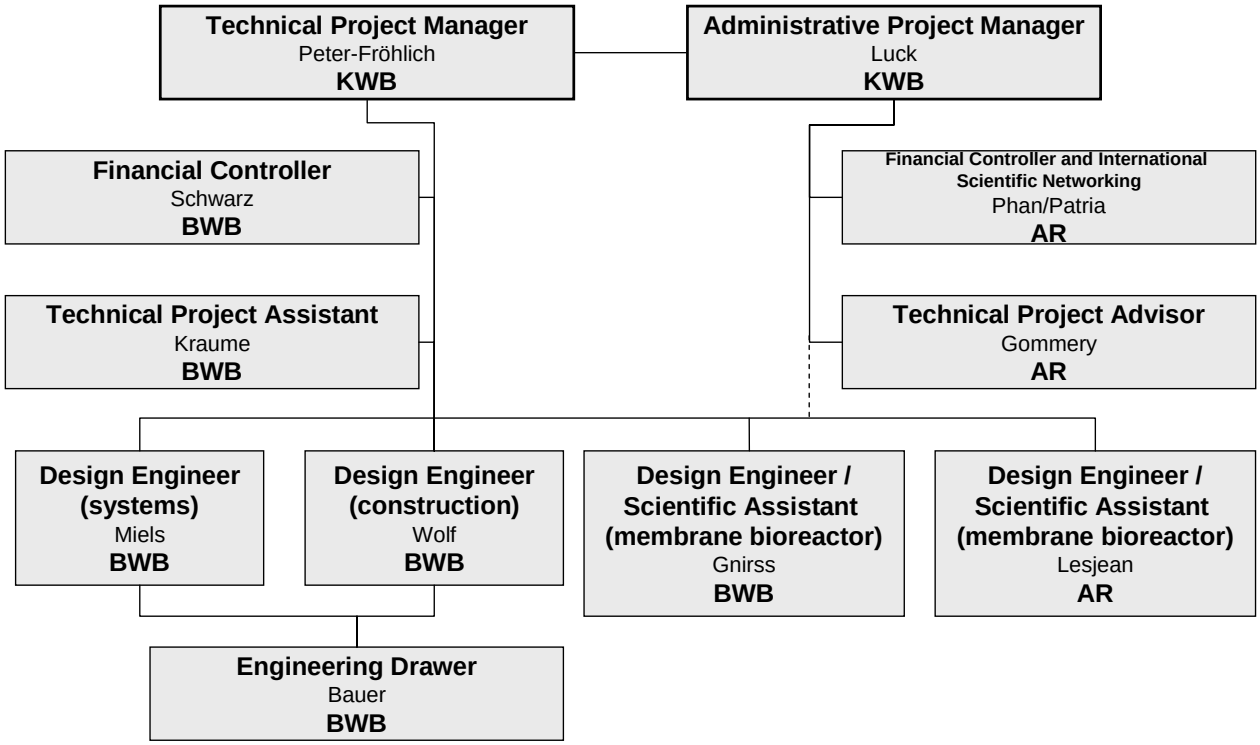
Annex 4.1 Tasks of the different persons of the beneficiary and partners

Name/Organisation Task	Luck **KWB**	Peter-Fröhlich **KWB**	Kraume **BWB**	Miels **BWB**	Bauer **BWB**	Wolf **BWB**	Schwarz **BWB**	Gnirss **BWB**	Phan **AR**	Gommery **AR**	Lesjean **AR**	Patria **AR**
project management	**X**	**X**										
technical project advising										**X**		
financial control (KWB)	**X**											
financial control (BWB)		**X**					**X**					
financial control (AR)									**X**			**X**
international scientific networking									**X**			**X**
reports	**X**	**X**	**X**									
dissemination (publications, presentations, press, internet-page)	**X**	**X**	**X**									
preparation of meetings		**X**	**X**									
execution of meetings		**X**										
minutes writing			**X**								**X**	
basic evaluation for the system engineering planning for the outside treatment units of the office building			**X**									
preliminary systems engineering planning for the outside treatment units of the office building				**X**								
preliminary constructional engineering planning for the outside treatment units of the office building						**X**						
engineering drawings for the SCST-project for the office building					**X**							
implementation systems engineering planning for the outside treatment units of the office building				**X**								
implementation constructional engineering planning for the outside treatment units of the office building						**X**						
construction supervision of the systems engineering for the outside treatment units of the office building				**X**								
start up of the outside treatment units of the office building				**X**								
supervision of the SCST-unit operations inside and outside the office building		**X**	**X**									
monitoring of the pilot test phase		**X**	**X**									
evaluation of results		**X**	**X**									
preliminary and implementation planning of the membrane biology for the greywater treatment								**X**			**X**	

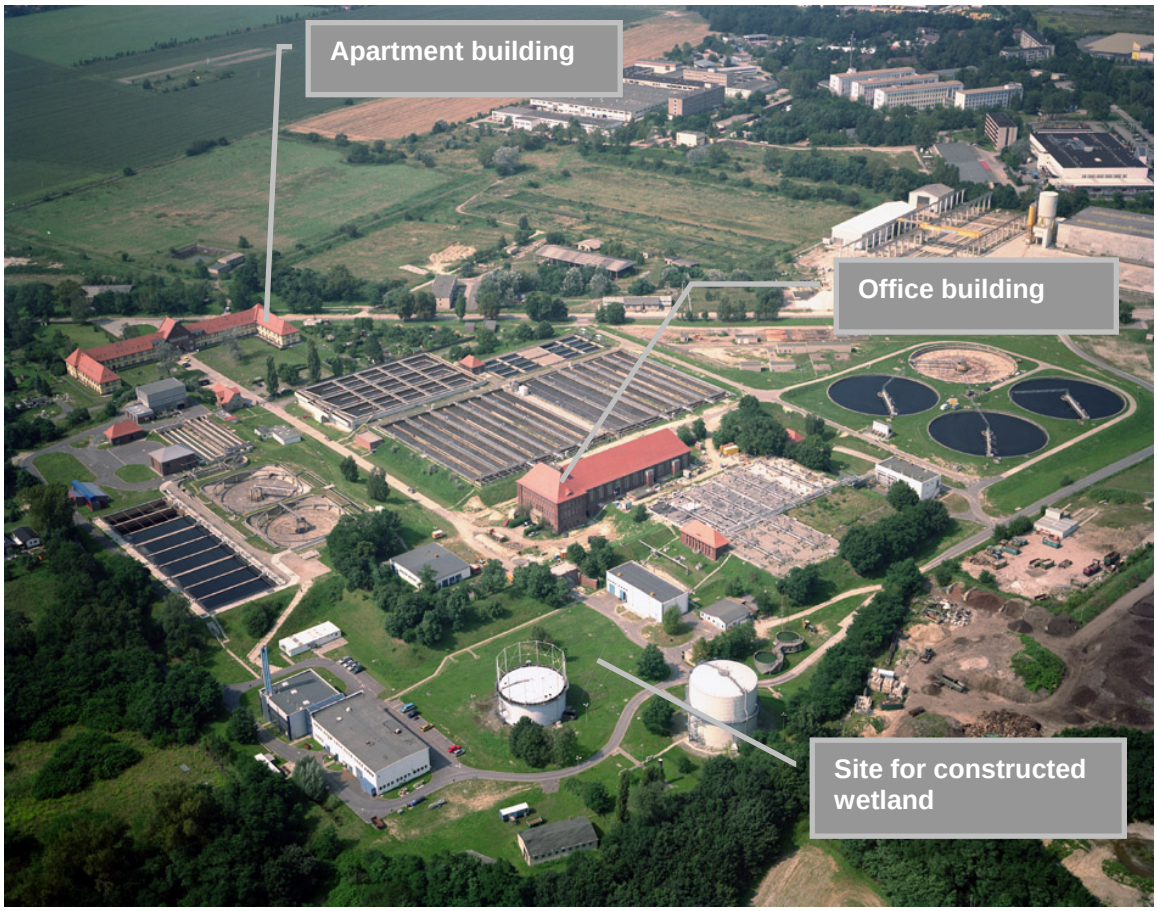
Continuing **Annex 4.1** Tasks of the different persons of the beneficiary and partners

Name/Organisation Task	Luck **KWB**	Peter-Fröhlich **KWB**	Kraume **BWB**	Miels **BWB**	Bauer **BWB**	Wolf **BWB**	Schwarz **BWB**	Gnirss **BWB**	Phan **AR**	Gommery **AR**	Lesjean **AR**	Patria **AR**
employee survey (questionnaires preparation and evaluation)			**X**									
talk concerning the realisation of the separation concept with the apartment house tenants		**X**										
basic evaluation for the system engineering planning for the outside treatment units of the apartment house			**X**									
preliminary systems engineering planning for the outside treatment units of the apartment house				**X**								
preliminary constructional engineering planning for the outside treatment units of the apartment house						**X**						
engineering drawings for the SCST-project for the apartment house					**X**							

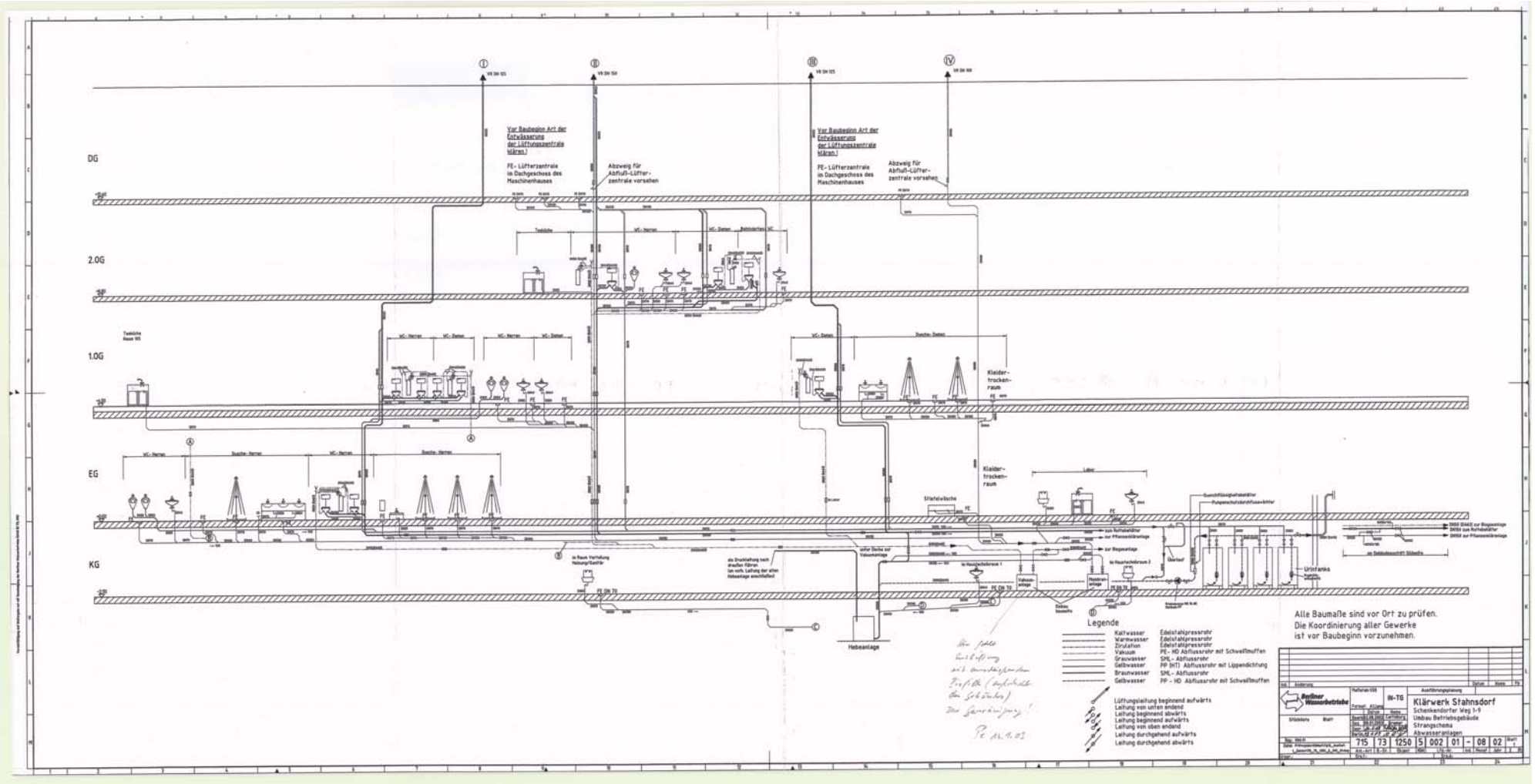
Annex 4.2 SCST-Organisation Chart



Annex 5.1 Aerial view of the project site Stahnsdorf



Annex 5.2 line scheme of the sanitation system inside the office building see



Annex 5.3 Pictures of the toilets, urine tanks and vacuum plant

Gravity separation toilet

Waterless urinals (Ernst urinal left); Urimat right))

Vacuum separation toilet

Vacuum control valves

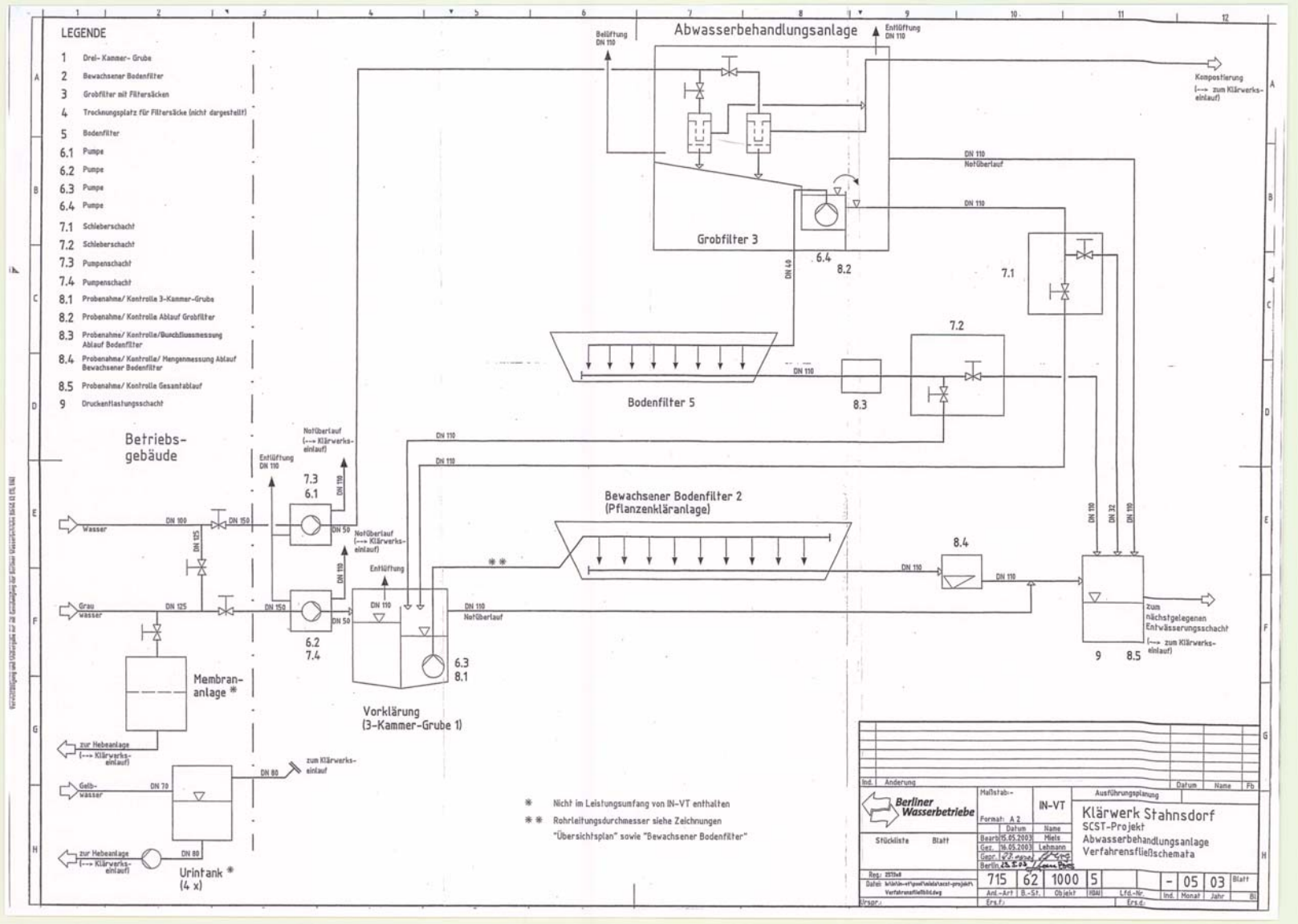
Continuing **Annex 5.3** Pictures of the toilets, urine tanks and vacuum plant

User information

Urine tank facility (picture made during press presentation)

Vacuum plant

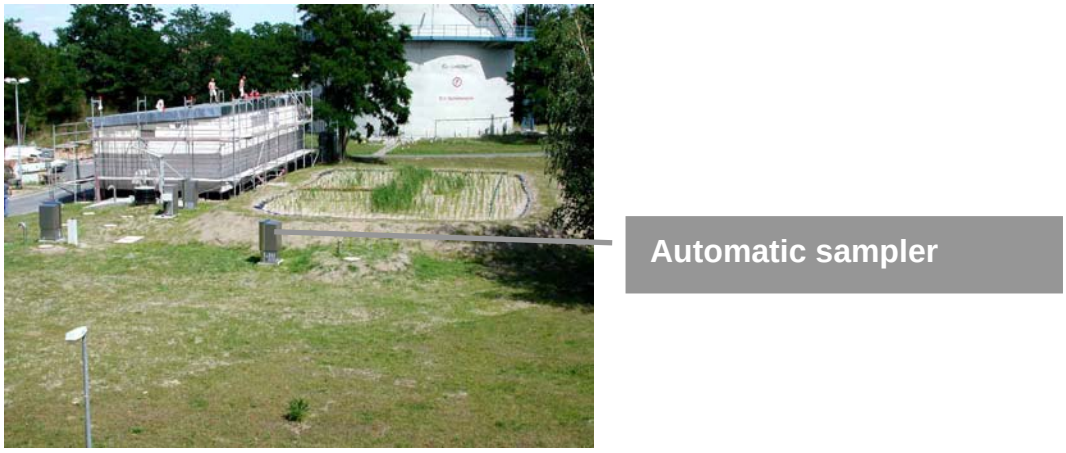
Annex 5.4 Flow charts of the outside treatment units



Annex 5.5 pictures of the outside treatment units during construction period and after completion

Realisation of constructed wetland
(status: 24.11.03)

Unit operations of constructed wetland
(status: 8.12.03)



Constructed wetland (status: 07.07.04)

Annex 5.6 Scheme of the apartment house and participant flats

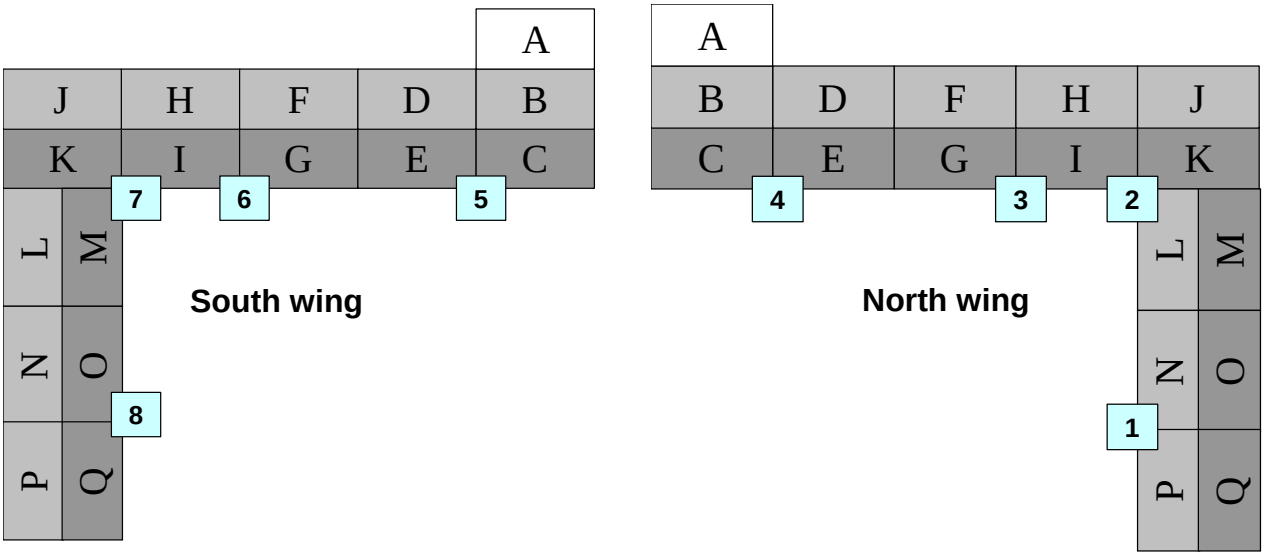
Project participant tenants of the apartment house Stanhsdorf

south wing

Flat	floor	name	house No	persons
H	1.	Danneberg	6	3
I	Base-ment	List Schmutzenhofer	6	2
J	1.	Paulmann	7	2
K	Base-ment	Gebhardt	7	2
L	1.	Haack	7	2
M	Base-ment	Dupke	7	2

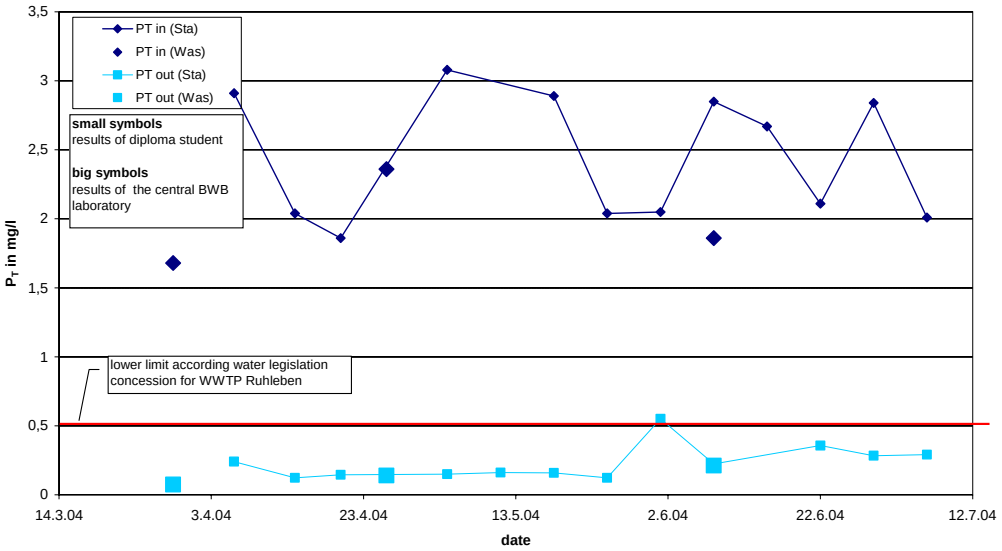
north wing

Flat	floor	name	house No	persons
D	1.	Langer	4	3
E	Base-ment	Moldenhauer	4	3
F	1.	Dannenberg	3	3
G	Base-ment	Winkelmann	3	4

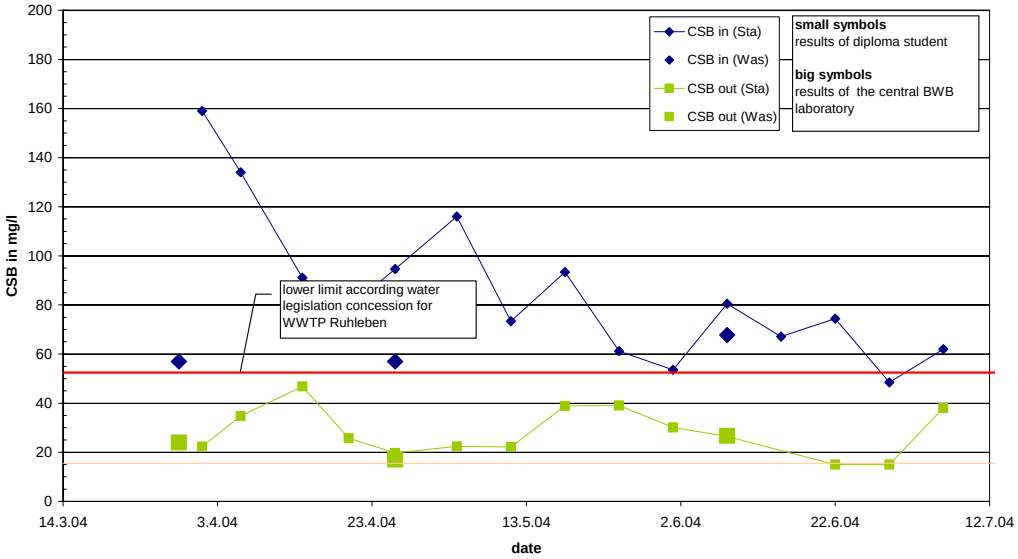


Annex 5.7 Results of measurements of the constructed wetland

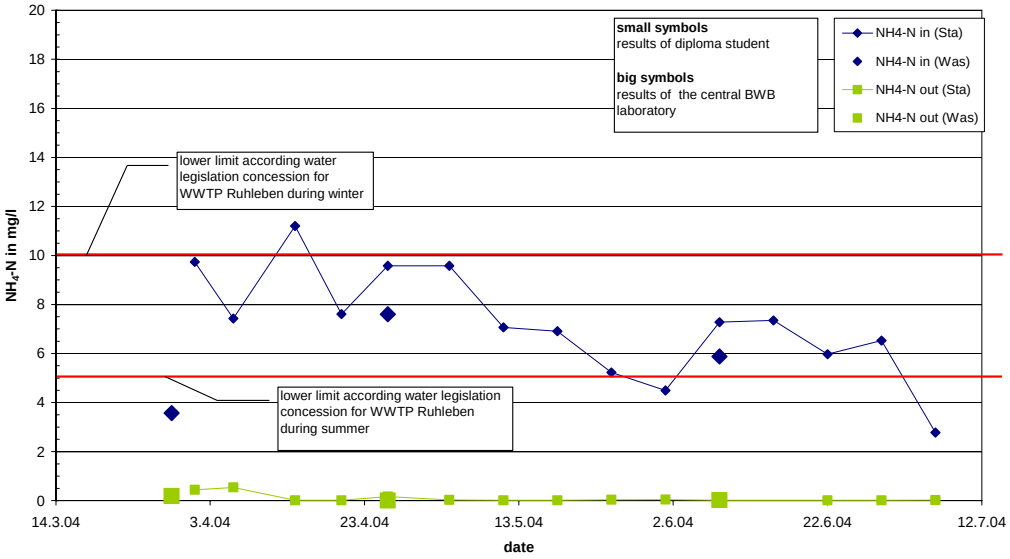
P_T constructed wetland



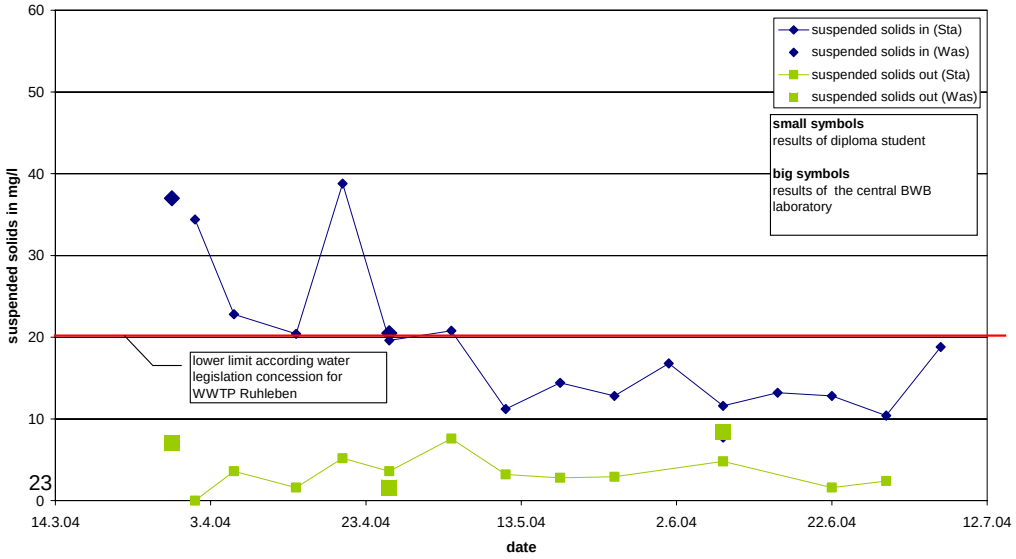
CSB constructed wetland



NH_4-N constructed wetland



suspended solids constructed wetland



Annex 5.8 Status report of HUB (fertiliser usage)

HUMBOLDT-UNIVERSITÄT ZU BERLIN

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Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater (SCST)

Task 8, Fertiliser usage

First Report

Presented in by: Dipl.- Ing. agr. A. Sasse, MSc NRM

Scientific Supervision: Prof. Dr. F. Ellmer

Content:

1. Task Overview
2. Pot Experiments
3. Field Experiments
4. Acceptance
5. Time Scale
6. Current Status of Work

1. Task Overview

Task 8 of the SCST project deals with the use of fertilisers from human urine and faeces as well as with there acceptance as such.

First investigations focus on the effects on plants fertilised with these materials and grown at controlled conditions in pot experiments. These trails are expected to show in an relatively easy way how different plants react if fertilised with urine or faeces and what major problems (if any) can be expected. They enable to evaluate the nutrition absorption of the plants and may also give first guidelines in respect of the optimum amount of fertiliser to be used. Pot experiments are carried out starting from the beginning of May 2004 with urine (yellow-water) and starting in March 2005 with faeces.

However, the information received from pot experiments is limited because of the relatively controlled environment the plants are cultivated in. Field experiments simulate the complex environment of a plant grown at a farmers field. Only they will give real data of yield, diseases or possible problems. They also enable to assess the loss of ammonia gas to the atmosphere during use of urine as fertiliser. Field experiments are carried out starting in August 2004 with urine and starting in March 2005 with faeces and urine.

Task 8 also includes an investigation of the acceptance of fertiliser from human urine or faeces. Only if farmers and consumers will accept these materials to be brought to the fields, they can be implemented successfully. Surveys are carried out in 2005 to assess the reaction of the mentioned groups if confronted with this type of fertiliser. The derived results from pot- and field experiments will be used within the surveys to inform farmers about the fertilising effects of urine and faeces.

Finally, recommendations with respect to use of urine and faeces based fertilisers, as well as to their introduction will be made.

2. Pot Experiments

Experiments with plants grown in standardised trail pots (Mitscherlichgefäße) are carried out twice – one for each type of fertiliser. At the beginning, spring wheat (*Triticum aestivum L.*), oat (*Avena sativa L.*), maize (*Zea mais L.*) and hemp (*Cannabis sativa L.*) are treated with urine in different concentrations. This choice of species covers energy-, forage-, and food crops. Grain yield as well as yield of green plant material, dry matter content and content of nutrients from treated plants are compared with such from equally mineral- fertilised and non treated variants. Therefore, the content of nutrients in the soil is also established before and after growing season. The soil analyses include establishment of nitrogen, phosphorus, potassium, carbon, and acidity. Observations like germination and sensitivity to diseases are recorded as well. Weekly establishment of the leaf colour provides also information of the nutrient status of single plants during period of growth.

All pots are equal in size and shape and contain the same amount of homogenised soil (6500g). With three replications, a number of 96 pots are used in total. They are exposed to the weather but protected from birds. The plants are cultivated in a light and sandy soil as it is typically found in Brandenburg and are provided with optimum water conditions. Special water is used which contains almost no minerals to prevent nutrient intake from that side. The amount of water consumed, will be established for each single pot. This may give evidence of different efficiencies of water use. Fertiliser application splits into two equal halves to prevent acid burn. 50 % is mixed to the soil while filling the pots and the application of the remain follows at the main period of growth.

Fertiliser application splits into two equal halves to prevent acid burn. 50 % is mixed to the soil while filling the pots and the application of the remain follows at the main period of growth (see **picture 1**).

After establishment of the stand, a decollation is carried out to reach the number of 10 individual plants (grain) and 3 plants respectively (maize, hemp).

The pot experiment described above is currently running, see also under point 5. The second pot trail will deal with the fertilising effects from faeces both, as compost and used directly. It is planned to start in March 2005 with the same choice of plant species. This experiment will be carried out equivalent to the investigations with urine.

Picture 1: Filling of the standardised pots in May/June 2004

3. Field Experiments

Equivalent to the pot experiments described above, two series of investigations are carried out under field conditions. In August 2004, rapeseed (*Brassica napus L.*) and in September winter rye (*Secale cereale L.*) will be cultivated and fertilised with urine. In March 2005, the investigations on faeces will follow with hemp, maize and spring wheat. End of the analyses will be reached with harvest time, i.e. August and September 2005 respectively. The tests will include all investigations mentioned for the pot trails, and additionally dehydrogenase activity, emission of ammonia gas from the soil, as well as leaf area index. One main inspection feature will be grain and green mater yield, because this provides an rather objective view in terms of fertiliser value for the farmer.

The second field experiment will also include combinations of urine and faeces as fertilisers. In total, seven variants will be tested at this trail as following:

a. Control (non fertilised)
b. Mineral fertiliser (150 kg N/ ha)
c. Urine (N equivalent to b.)
d. Compost from faeces (N equivalent to b.)
e. Faeces (N equivalent to b.)
f. Urine + Compost from faeces (N equivalent to b.)
g. Urine + Faeces (N equivalent to b.)

Continuing **Annex 5.8** Status report of HUB (fertiliser usage

The combination of faeces and urine may provide a more balanced nutrient supply. Fertilisers will be added at the corresponding main growing periods.

In total, 64 test parcels have to be set out at one location (Berlin- Dahlem) for urine treatment (first experiment) and 84 for faeces and urine mixed (second experiment). It is planned to repeat the trail at a different type of soil at Thyrow, (Brandenburg). However, final decisions have not been made yet.

Laboratory analyses will be realised at the faculty's own facilities as far as possible. However, gas analyses will have to be outsourced.

Continuing **Annex 5.8** Status report of HUB (fertiliser usage)

The preparations for the tests described, will be accompanied by the build up of a suitable data storage system. It is planned to use the software MICROSOFT ACCESS®. The program SPSS® will be used for data evaluation and interpretation.

4. Acceptance

Surveys will be undertaken in 2005, to assess the acceptance of urine and faeces based fertilisers. This is planned to be done within the scope of different B.Sc. theses. Not only farmers, but also consumers, consultants, and food traders are to be questioned. The focus will be at agricultural properties, located close to the sewage work Stahnsdorf, were urine and faeces are collected separately. On the other hand, wholesalers, retail trade and consumers in and around Berlin are asked to answer the questions as well. However, exact target groups have to be chosen yet, regarding to their role of interest and representativness.

An appropriate questionnaire design must be developed to get an objective view of what the reactions of the stakeholders will be in a real case. Here, sustained information concerning the benefits and potential dangers have also to be given to the participants. The information derived from the described pot and field experiments will be used at this point as appropriate.

Continuing **Annex 5.8** Status report of HUB (fertiliser usage)

5. Time Scale

TIME SCALE TASK 8

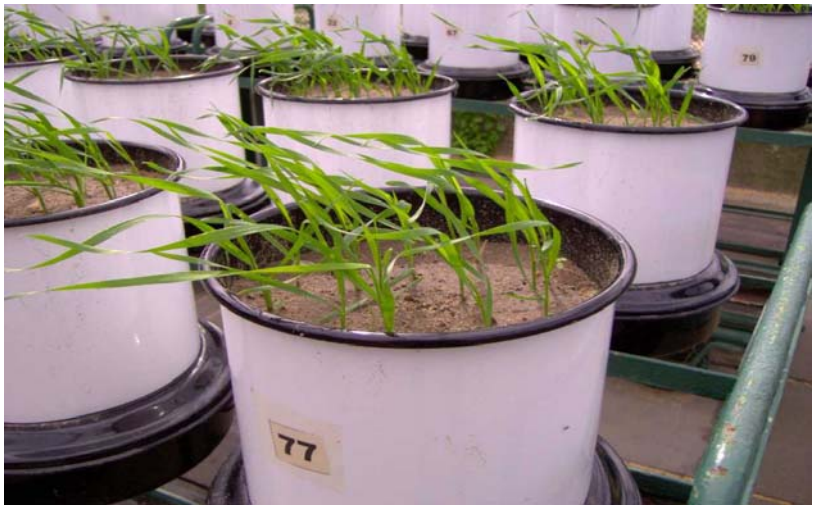
	2004												2005												2006					
Object	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Detailed planning	■	■	■	■	■	■	■																							
Pot experiment 1(urine)						■	■	■	■	■	■	■																		
Field experiment 1 (urine)								■	■	■	■	■	■	■	■	■	■	■	■	■										
Data analysis/ Interim report first year													■	■	■															
Pot experiment 2 (faeces/compost)															■	■	■	■	■	■										
Field experiment 2 (urine/faeces/compost)															■	■	■	■	■	■										
Acceptance survey													■	■	■	■	■	■	■	■	■	■	■	■						
Data analysis/ Final report																		■	■	■	■	■	■	■	■	■	■	■	■	■

6. Current Status of Work

This point refers to the status of the project at the end of June 2004.

The phase of detailed planning of the following experiments is running at present and will be ended within the next weeks.

Pot experiment 1 (urine) has been set up (see also **picture 1**). The decollation has also been carried out already (**picture 3**). See **picture 2** to get an impression of the present growing stage of spring wheat. The variants do not differ significantly until now. Due to the early growing stage, differences in terms of expected yield cannot be seen yet. Application of the last share of fertiliser will follow next.



Picture 2: Wheat plants at the end of June 2004

Picture 3: Maize at the end of June 2004

Annex 7.1 presentations and publications of the project

No.	Presented by	Event	Title of the presentation or publication
1	Dr. Peter-Fröhlich	Informationsveranstaltung des KompetenzZentrums WasserBerlin (KWB) am 21.11.2001 auf der Schleuseninsel in Berlin	Lesouéf, A., Peter-Fröhlich, A., Kraume, I., Phan, L. (2001): Pilotvorhaben dezentrale Sanitärtechniken. Informationsveranstaltung des KompetenzZentrums WasserBerlin (KWB) am 21.11.2001 auf der Schleuseninsel in Berlin (keine schriftliche Fassung)
2	Dr. Peter-Fröhlich	Informationsveranstaltung des KompetenzZentrums WasserBerlin (KWB) für Freifrau von Friesen, Senatorin für Wirtschaft und Technologie in Berlin, am 28.11.2001 im Klärwerk Ruhleben	Lesouéf, A., Peter-Fröhlich, A., Kraume, I., Phan, L. (2001): Pilotvorhaben dezentrale Sanitärtechniken. Informationsveranstaltung des KompetenzZentrums WasserBerlin (KWB) für Freifrau von Friesen, Senatorin für Wirtschaft und Technologie in Berlin, am 28.11.2001 im Klärwerk Ruhleben (keine schriftliche Fassung)
3	Dr. Peter-Fröhlich	Workshop Zukunftsfähiges Abwassermanagement Lambertsmühle in der Lambertsmühle am 6.6.2002.	Peter-Fröhlich, A., Lesouéf, A., Kraume, I., Phan, L., Gommery, L. (2002): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Workshop Zukunftsfähiges Abwassermanagement Lambertsmühle in der Lambertsmühle am 6.6.2002, KA, H 10, S. 1339-1342.
4	Dr. Peter-Fröhlich	Information der für Stahnsdorf zuständigen Gesundheitsbehörde in Belzig am 16.6.2002.	Peter-Fröhlich, A., Lesouéf, A., Kraume, I., Phan, L., Gommery, L. (2002): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Information der für Stahnsdorf zuständigen Gesundheitsbehörde in Belzig am 16.6.2002.(PowerPoint-Präsentation als Tischvorlage verteilt)
5	Herr Keller Frau Kraume Dr. Peter-Fröhlich	Betreuung des SCST-Standes auf Schaufenster der Wissenschaft „Welt des Wassers“ in den Arkaden des Potsdamer Platzes in Berlin vom 11.-15.9.2002.	Keller, S., Kraume, I., Peter-Fröhlich, A. (2002): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Schaufenster der Wissenschaft „Welt des Wassers“ des Forschungsmarktes Berlin in den Arkaden des Potsdamer Platzes in Berlin vom 11.-15.9.2002. (Ausstellung und PowerPoint-Präsentation)
6	Dr. Peter-Fröhlich	Vortragsreihe „Die Welt des Wassers“ in der URANIA in Berlin am 14.9.2002.	Peter-Fröhlich, A., Lesouéf, A., Kraume, I., Phan, L., Gommery, L. (2002): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Vortragsreihe „Die Welt des Wassers“ in der URANIA in Berlin am 14.9.2002. (keine schriftliche Fassung)
7	Dr. Peter-Fröhlich	Water Management and R&D Activities in Berlin, Study Tour of Senior Water Professionals from USA, KompetenzZentrum Wasser Berlin, 23.-25.9.2002.	Peter-Fröhlich, A., Lesouéf, A., Kraume, I., Phan, L., Gommery, L. (2002): Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater. Water Management and R&D Activities in Berlin, Study Tour of Senior Water Professionals from USA, KompetenzZentrum Wasser Berlin, 23.-25.9.2002. (keine schriftliche Fassung)
8	Dr. Peter-Fröhlich	Fortbildungsprogramm „Städtischer Umweltschutz China“ an der TU Berlin am 13.2.2003.	Peter-Fröhlich, A., Lesouéf, A., Kraume, I., Phan, L., Gommery, L. (2003): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Fortbildungsprogramm „Städtischer Umweltschutz China“ an der TU Berlin am 13.2.2003. (gleiche Präsentation wie in URANIA, keine schriftliche Fassung)
9	Dr. Peter-Fröhlich	2nd International Symposium on Ecological Sanitation in Lübeck, 6.-11.4.2003.	Peter-Fröhlich, A., Kraume, I., Lesouéf, A., Phan, L., Gommery, L. and Oldenburg, M. (2003): Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater. 2nd International Symposium on Ecological Sanitation in Lübeck, 6.-11.4.2003, Preprints on www.gtz.de/ecosan/download/ ecosan-Symposium-luebeck-proceedings-draft.pdf

Continuing **Annex 7.1** presentations and publications of the project

10	Dr. Peter-Fröhlich	Conference Wasser Berlin 2003, Berlin Centre of Competence for Water – Research for the Future, 11.4.2003.	Peter-Fröhlich, A., Kraume, I., Lesouéf, A., Phan, L., and Oldenburg, M. (2003): New Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater- Pilot project. Conference Wasser Berlin 2003, Berlin Centre of Competence for Water – Research for the Future, 11.4.2003, Conference Proceedings and www.kompetenz-wasser.de (in preparation). Furthermore Conference CD (English and German version) (in preparation).
11	L. Gommery S. Keller L. Phan R.J. Schwarz	Trade Fair, Wasser Berlin 2003, Berlin Centre of Competence for Water, 7.- 11.4.2003.	Peter-Fröhlich, A. (2003): New Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater (SCST) - Pilot project. Trade Fair, Wasser Berlin 2003, Berlin Centre of Competence for Water, 7.- 11.4.2003, Poster.
12	Dr. Peter-Fröhlich	World Water & Environmental Resources Congress 2003 in Philadelphia, USA, 23.- 26.6.2003.	Peter-Fröhlich, A. ., Kraume, I., Lesouéf, A. and Oldenburg, M. (2003): Separate Discharge and Treatment of Urine, Faeces and Greywater - Pilot Project. World Water & Environmental Resources Congress 2003 in Philadelphia, USA, 23.- 26.6.2003. American Society of Civil Engineers (ASCE).
13	--	--	Peter-Fröhlich, A. ., Kraume, I., Lesouéf, A. and Oldenburg, M. (2003): Separate Discharge and Treatment of Urine, Faeces and Greywater - Pilot Project. Hydroplus, nº 135, July-August, pp 81-86.
14	Dr. Peter-Fröhlich	Water Middle East 2003, International Exhibition and Conference for Water Technology, 6.- 8.10.2003 in Manama, Bahrain	Peter-Fröhlich, A. ., Kraume, I., Lesouéf, A. and Oldenburg, M. (2003): Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater – Recycling of Nutrients. Conference Papers of Water Middle East 2003, International Exhibition and Conference for Water Technology, 6.- 8.10.2003 in Manama, Bahrain, BCEB – Bahrain Convention & Exhibition Bureau, P.O. Box 11644, Manama, Kingdom of Bahrain, www.bahrainexhebitions.com, pp 285 – 294.
15	Dr. Peter-Fröhlich	Städtesymposium Wasser – Berlin trifft Paris im dbb-Forum in Berlin am 23.10.2003	Peter-Fröhlich, A., Luck, F., Lesouéf, A., Kraume, I., Lesjean, B.,Oldenburg, M. (2003): Sanitation Concepts for Separate Treatment of Urine, Faeces and Greywater. Städtesymposium Wasser – Berlin trifft Paris im dbb-Forum in Berlin am 23.10.2003, www.kompetenz-wasser.de/engl/projekte/scst and www.kompetenz-wasser.de/engl/veranstaltungen
16	Dr. Peter-Fröhlich	Sitzung Arbeitskreis Abwasser der Brandenburgischen und Berliner Wasserver- und Abwasserentsorgungsunternehmen in der Unternehmenszentrale der Berliner Wasserbetriebe am 30.10.2003.	Peter-Fröhlich, A., Luck, F., Lesouéf, A., Kraume, I., Lesjean, B.,Oldenburg, M. (2003): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Sitzung Arbeitskreis Abwasser der Brandenburgischen und Berliner Wasserver- und Abwasserentsorgungsunternehmen in der Unternehmenszentrale der Berliner Wasserbetriebe am 30.10.2003 (Vortrag als ppt-Datei an Teilnehmer verteilt).
17	--	--	Peter-Fröhlich, A., Kraume, I., Lesouéf, A. und Oldenburg, M. (2004): Separate Ableitung und Behandlung von Urin, Fäkalien und Grauwasser. Korrespondenz Abwasser, H1, S. 38-43.
18	Dr. Peter-Fröhlich	2nd IWA Leading-Edge Conference on Water and Wastewater Treatment Technologies. Prague, Chech Republic, 1 – 4 June 2004.	Peter-Fröhlich, A. ., Kraume, I., Luck, F., Lesouéf, A. and Oldenburg, M. (2004): Demonstration Project for Separate Treatment of Urine, Faeces and Greywater – Cost Comparison with the Conventional Wastewater System. 2nd IWA Leading-Edge Conference on Water and Wastewater Treatment Technologies. Prague, Chech Republic, 1 – 4 June. Final Programme and Abstract Book, pp 127-129.

Annex 7.2 presentations in media

No	Presented by	Event	Title of the presentation or publication
1	Dr. Peter-Fröhlich	Treffpunkt Wissens Werte, Wasser Welten,Wenn aus Wasser Abwasser wird.... , Podiumsdiskussion von infoRadio (Moderation: Thomas Prinzler) in der Investitionsbank Berlin am 1.4.2003.	Peter-Fröhlich, A. (2003): Wenn aus Wasser Abwasser wird.... Treffpunkt Wissens Werte, Wasser Welten, Podiumsdiskussion von infoRadio (Moderation: Thomas Prinzler) in der Investitionsbank Berlin am 1.4.2003, Sendetermine: 6.4.2003, 9.05 Uhr, 21.4.2003, 11.05 Uhr.
2	--	--	Peter-Fröhlich, A. (2003): Pilotvorhaben Neue Sanitärkonzepte in Berlin. Newsletter 2, KompetenzZentrum Wasser Berlin, S. 1 - 2.
3	Dr. Peter-Fröhlich Dr. Luck Fr. Kraume	Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003	Peter-Fröhlich, A., Luck, F.,Kraume, I.(2003): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser; Nachhaltiges Örtchen – die sanitäre Revolution. Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003, Presseinformation. (Tagesspiegel, Märkische Allgemeine, WWT 1-2 2004, Entsorga, Wasserspiegel)
4	-	Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003	(2003):Pflanzendünger aus der Toilette – Pilotprojekt im Klärwerk Stahnsdorf: Exremente als Nährstoffe. Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003, Potsdamer Landkurier (Märkische Allgemeine), 25.11., S. 19.
5	-	Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003	(2003):Eine rauschende Idee: Kompetenzzentrum Wasser erforscht ressourcenschonende Toilettensysteme – Projekt wird von der EU gefördert. Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003, Der Tagespiegel, Wissen & Forschen, 25.11., S. 27.
6	-	Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003	(2003):Das getrennte Örtchen: Im Klärwerk Stahnsdorf werden neue Sanitärkonzepte erprobt / Europäische Union fördert Forschungsprojekt mit 466.000 Euro. Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003, Wasserspiegel-Magazin, Die Mitarbeiterzeitschrift der Berlinwasser, Nr. 6, S. 15.
7	Dr. Peter-Fröhlich Dr. Luck	Presse- und Fototermin im Klärwerk Stahnsdorf am 11.12.2003	Peter-Fröhlich, A., Luck, F. (2003): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser; Nachhaltiges Örtchen – die sanitäre Revolution. Presse- und Fototermin im Klärwerk Stahnsdorf am 11.12.2003, Presseinformation. (Berliner Kurier)
8	-	Presse- und Fototermin im Klärwerk Stahnsdorf am 11.12.2003	(2003):Wie ein Berliner aus Sch... richtig Schotter machte – Wunder-Klo Mit Vakuum-Technik geht's ökologischer und gibt's EU-Mittel. Presse- und Fototermin im Klärwerk Stahnsdorf am 11.12.2003, Berliner Kurier, 18.12., S. 19.
9	Dr. Peter-Fröhlich	Presse- und Fototermin im Klärwerk Stahnsdorf mit Merita Schmidt, Stahnsdorfer Ortsanzeiger, am 12.12.2003	Peter-Fröhlich, A. (2004): Ein maßgeblicher Beitrag zum Umweltschutz – Pilotprojekt im Klärwerk Stahnsdorf: Neue Sanitärsysteme für Ressourcenschonung von Wasser, Nährstoffen und Energie. Presse- und Fototermin im Klärwerk Stahnsdorf mit Merita Schmidt, Stahnsdorfer Ortsanzeiger, am 12.12.2003, Stahnsdorfer Ortsanzeiger, 15. Jahrgang, Heft 1, S. 4.

Continuing **Annex 7.2** presentations in media

10	-	Presse- und Fototermin im Klärwerk Stahnsdorf mit Merita Schmidt, Stahnsdorfer Ortsanzeiger, am 12.12.2003	(2004): Ein maßgeblicher Beitrag zum Umweltschutz – Pilotprojekt im Klärwerk Stahnsdorf: Neue Sanitärsysteme für Ressourcenschonung von Wasser, Nährstoffen und Energie. Presse- und Fototermin im Klärwerk Stahnsdorf mit Merita Schmidt, Stahnsdorfer Ortsanzeiger, am 12.12.2003, Stahnsdorfer Ortsanzeiger, 15. Jahrgang, Heft 1, S. 4.
11	Dr. Peter-Fröhlich	Pressetermin mit Herrn Björkmann von der Schwedischen Wasserwirtschaftzeitschrift „Cirkulation“ im KompetenzZentrum Wasser Berlin am 19.1.2004	Peter-Fröhlich, A., Luck, F., Lesouéf, A., Kraume, I., Lesjean, B.,Oldenburg, M. (2004): Neue Sanitärkonzepte für die separate Erfassung und Behandlung der Teilströme Urin, Fäkalien und Grauwasser. Pressetermin mit Herrn Björkmann von der Schwedischen Wasserwirtschaftzeitschrift „Cirkulation“ im KompetenzZentrum Wasser Berlin am 19.1.2004, (ppt-Präsentation sowie Übergabe einer entsprechenden Tischvorlage) (Bericht über SCST erscheint in der Wasserwirtschaftszeitschrift „Cirkulation“)
12	-	Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003	(2004): Kompetenzzentrum Wasser Berlin gGmbH: Teilstrom-Projekt gestartet. Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003, WWT 1-2, S 7.
13	-	Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003	(2004): Kompetenzzentrum Wasser Berlin testet die NoMix-Toilette: Ökologie im Örtchen. Presse- und Fototermin im Klärwerk Stahnsdorf am 24.11.2003, Entsorga-Magazin 1-2, S 33-34.
14	-	Interview von Claire Pineau des KWB mit A. Peter-Fröhlich zum SCST-Projekt im März 2004	(2004): Innovative Sanitärkonzepte in Berlin. Interview mit A. Peter-Fröhlich zum SCST-Projekt, Newsletter 4, Kompetenzzentrum Wasser Berlin, S 2.
15	-	-	(2003): SCST – Sanitärkonzepte zur separaten Behandlung von Urin, Fäkalien und Grauwasser. Jahresbericht, KompetenzZentrum Wasser Berlin, www.kompetenz-wasser.de, S. 10-11.
16	Dr. Peter-Fröhlich	Presse- und Fototermin mit Märkischer Oderzeitung im Klärwerk Stahnsdorf am 7.7.2004	(2004): Artikel über SCST-Projekt in Märkischer Oderzeitung. Presse- und Fototermin mit Märischer Oderzeitung im Klärwerk Stahnsdorf am 7.7.2004, (in Vorbereitung)

Annex 7.3 -presentations at the KWB, Stahnsdorf and outside of Berlin

No.	date	presented from	location	occasion/reason	involved persons/group
1	1.4..2003	Dr. Peter-Fröhlich	KWB	Informationsreise nach Europa	Mr. Landers, Sydney Water, Australien
2	19.6..2003	Dr. Luck	KWB	Information über KWB	A. Frerot, Generaldirektor von Veolia Water, Paris
3	25.6..2003	Dr. Luck	KWB	Information über KWB	J.M. Lambert, Personaldirektor von Veolia Water, Paris
4	9.7.2003	Dr. Peter-Fröhlich	KWB	Informationsbedarf für dezentrale Abwasserkonzepte	Dr. Henkel und Kollegen vom Verband Deutscher Grundstücksnutzer e.V (VDGN)
5	17.7.2003	Dr. Luck	KWB	Information über KWB	CAEPI (China Association of Environment Protection Industry) (15 Persons)
6	23.9.2003	Dr. Peter-Fröhlich	KWB und Stahnsdorf	Sitzung des ATV-DVWK-Fachaussussses ATV-DVWK FA KA 8 (Weitergehende Abwasserreinigung) im KWB	See next table!
7	15.10.2003	Dr. Luck	KWB	Information über KWB	R. Müller, Betriebsdirektor des Werkes Bendigo/Veolia, Australien Z. Chowdhury, Senior Assosiate, Malcon & Pirnie, Phönix, USA
8	24.10.2003	Hr. Pawlowski Dr. Peter-Fröhlich Dr. Luck Dr. Weigert	Stahnsdorf	Städtesymposium Wasser – Berlin trifft Paris im dbb-Forum in Berlin am 23.10.2003	See next table!
9	2.12.2003	Fr. Kraume	Stahnsdorf	Meeting der EU-Arbeitsgruppe ZerO-M (Sustainable Concepts Towards a Zero Outflow Municipality) an der TU Berlin (Prof. Kraume) www.zero-m.org	See next table!
10	22.12.2003	Dr. Luck	KWB	Information über KWB	H.E. Lesueur, Stellvertrentender Direktor F&E Veolia Environment, Paris
11	11.2.2004	Dr. Peter-Fröhlich	EAWAG, Zürich	Erfahrungsaustausch	Dr. Larsen, Dr. Lienert. Dr. Maurer, Dr. Truffer, EAWAG, Zürich
12	16.2.2004	Dr. Peter-Fröhlich	KWB	Information über das KWB	Frau Dr. Peschel-Gutzeit, Aufsichtsratsmitglied der BWH
13	24.2.2004	Dr. Luck	KWB	Information über das KWB	H.R. Black, Personaldirektor Europa Veolia, Paris
14	16.3.2004	Dr. Luck	KWB	Information über das KWB	H.W. Merkel, Direktor des Instituts IWW Mühlheim, Ruhr
15	26.3.2004	Hr. Lesjean	Stahnsdorf	Austauschschüler Gymnasium Lyon mit Canisius-Kolleg in Berlin	ca. 42 Schüler des Gymnasiums Lyon (ca. 16 Jahre alt) und 4 Betreuer.
16	31.3.2004	Dr. Peter-Fröhlich	KWB	Information über das KWB	See next table!
17	5.4.2004	Dr. Luck	KWB	Information über das KWB	H.B. Wricke, Direktor des TZW Dresden
18	28.4.2004	Dr. Peter-Fröhlich	Stahnsdorf	Information über Berlinwasser für Kolleginnen und Kollegen aus Bahrain durch p2m in Berlin am 28.4.2004	See next table!
19	3.5.2004	Dr. Luck	KWB	Information über das KWB	H.A. Jansen, Bereich Chemie, TNO-Energie, Umwelt und innovative Verfahren, Niederlande
20	19.5.2004	Dr. Peter-Fröhlich	KWB	Information über das KWB	Frau S. West, Neue Abwasserkonzepte, Sydney Water Cooperation, Australien
21	24.5.2004	Dr. Peter-Fröhlich	Stahnsdorf	Wunsch nach Erfahrunsaustausch, da eigenes Projekt	See next table!
22	24.5.2004	Dr. Luck und B. Lesjean	KWB und Stahnsdorf	Information über das KWB	Frau V. Lecompte, Stellvertretende Direktorin für Kommunikation, Veolia Water, Paris
23	27.5.2004	Dr. Luck	KWB	Information über das KWB	Istanbul Water and Sewerage Administration
24	7.6.2004	Dr. Peter-Fröhlich	KWB (Hohenzoll erndamm)	Seminar: “Forschungen zum nachhaltigen Management der Wasserressourcen und der Abwasserentsorgung in Berlin (Deutschland)”	Chinesische Delegation über Carl Duisburggesellschaft See next table!

Continuing **Annex 7.3** -presentations at the KWB, Stahnsdorf and outside of Berlin

Participants at SCST-presentations at the KWB, Stahnsdorf und outside of Berlin:

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6			
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	Prof. W.	Hegemann	Obmann, ehem. TU Berlin
	Dipl.-Ing. J.	Jost	AWEL, Schaffhausen, Schweiz
	Dr. H.	Meyer	Ingenieur- und Unternehmensberatung, Bochum
	Dr. M.	Roth	Universität Stuttgart
	Dr. E.h. P.	Schleypen	Bayrischer Landesamt für Wasserwirtschaft, München
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	Cécile	Bernard	Muséum National d´Histoire Naturelle
	Olivier	Jacque	STREA
	Antoine	Montiel	SAGEP
	Ludwig	Pawlowski	Berliner Wasserbetriebe
	Anton	Peter-Fröhlich	Berliner Wasserbetriebe
	Jean-Pierre	Trouvé	SIAAP
	Bodo	Weigert	KWB
	Francis	Luck	KWB
	Inge	Herbert	Veolia Water Deutschland
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	Fabio	Masi	ALT (Ambiente e Lavoro Toscana – O.N.L.U.S. (Italy))
	Erwin Dietmar	Nolde Sperfeld	Fbr (Fachvereinigung Betriebs- und Regenwassernutzung e.V. (fbr))
	Ahmed Latifa	Ghrabi Bousselmi	LEE (Institut National de Recherche Scientifique et Technique, Laboratoire Eau et Environnement (Tunisia))
	Ahmet	Baban	MRC-ESERI (Tübitak-Marmara Research Center (Turkey))
	Hussein	Abdel-Shafy	NRC (Water Research & Pollution Control Department, National Research Centre, Dokki, Cairo (Egypt))
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	Gerd	Wach	WB (Universität Hannover, Zentrale Einrichtung für Weiterbildung (weiterBILDUNG))
	Bouchaib Fatiha	El Hamouri El Hafiane	WTRU (Institut Agronomique et Vétérinaire Hassan II, Wastewater Treatment and Reuse Unit (Morocco))
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	P.	Bierwirth	Mitglied des Beirates BWB/MdB/stellvert. Umweltpolitische Sprecherin der SPD-Bundestagsfraktion
	A.	Klug	MdB
	N.	Rüster	Mitarbeiter von Frau Klug
	R.	Jäger	MdB
	P.	Brüggemann	Referentin AG Umwelt

Continuing **Annex 7.3 -** presentations at the KWB, Stahnsdorf and outside of Berlin

18			
	Mrs. Zubaida Ali	Al Hashimi	Director, Sewerage & Drainage Directorate , Ministry of Works & Housing, Kingdom of Bahrain
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	Hr.	Soppert	Geschäftsführer p2m, Berlinwasser
21			
	Dr. Mathias	Barjenbruch	Universität Rostock
	Fr. Susann	von Wolffersdorff	Universität Rostock, Diplomandin
	Herr	Wriege	Universität Rostock, Doktorand
24			
	Bao	Ligang	Teilnehmer des InWEnt-Fortbildungsprogramms „Management der Wasserversorgung und Abwasserentsorgung“ Oktober 2003-Juni 2004
	Du	Qin	dto.
	Feng	Hong	dto.
	Gu	Jianxin	dto.
	He	Guixian	dto.
	Liu	Xiangdo	dto.
	Ma	Chuanji	dto.
	Nan	Haitao	dto.
	Wan	Guodon	dto.
	Wan	Jungxia	dto.
	Wan	Yanhan	dto.
	Wu	Hong	dto.
	Xia	Ping	dto.
	Xie	Chunde	dto.
	Xing	Haoran	dto.
	Xu	Min	dto.
	Yuan	Qu	dto.
	Zhan	Yanrong	dto.
	Zhou	Quan	dto.

Paper*)

on

Demonstration Project for Separate Discharge and Treatment of Urine, Faeces and Greywater - Cost Comparison with the Conventional Wastewater System

Dr.-Ing. A. Peter-Fröhlich, Dipl.-Ing. I. Kraume, Dr.-Ing. F. Luck,
Dr.-Ing. A. Lesouëf and Dr.-Ing. M. Oldenburg

for presentation at

2nd IWA Leading-Edge Conference
on Water and Wastewater Treatment Technologies

in Prague

from

1 – 4 June 2004

Demonstration Project for Separate Discharge and Treatment of Urine, Faeces and Greywater - Cost Comparison with the Conventional Wastewater System

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Abstract The Berlin Centre of Competence for Water (Kompetenzzentrum Wasser Berlin) together with its partners Berliner Wasserbetriebe and Veolia Water has started a pilot project about new sanitation concepts. In order to define the experiments for testing new, sustainable sanitation concepts a pre-study has been performed. This study included a cost comparison between two new sanitation concepts with gravity and vacuum separation toilets and the conventional system. It could be demonstrated that the new sanitation concepts may have cost advantages depending on the situation. This was a further motivation starting a pilot project near Berlin testing the above mentioned toilet systems under realistic conditions. The operation of the gravity separation toilets concept started in October 2003.

Keywords Decentralised wastewater concepts; urine; gravity separation toilet; vacuum separation toilet; cost comparison

Introduction

The conventional centralised concepts for water supply and wastewater, developed for ages in industrialized countries, imply high costs and high water consumption, which make them not suitable as a sustainable solution especially for developing countries. Further development, testing and dissemination of alternatives to conventional wastewater systems are therefore becoming more and more indispensable for ecological, economic and societal reasons. More sustainable approaches should consider the reuse of treated water as well as the recycling of the nutrients if possible. Furthermore the energy consumption for wastewater discharge and treatment should be minimised. Such techniques and concepts are already available and in use, but further developments and validations are necessary.
These are the reasons why the Berlin Centre of Competence for Water (KWB) initiated with Berliner Wasserbetriebe (BWB) and Veolia Water (VW) a demonstration project for new sanitation concepts which should represent a relevant solution for:

- remote areas, where the connection to a central system (e.g. large sewer networks) would not be technically or economically interesting,
- rapidly growing conurbations in developing countries,
- countries with scarce water resources and
- a contribution to the sustainable development with the recycling of nutrients and water.

Methods

The project is divided into two phases (***Phase I***, pre-study and ***Phase II***, pilot project). ***Phase I***, a theoretical approach, has been completed at the end of 2001.

- **A literature-based project review**, patent reviews and a collection of information about the various projects were made. Furthermore existing projects with separate treatment in Germany, Denmark and Sweden have been visited. These information and detailed economic investigations have been the prerequisite for continuing the project.
- **Cost comparisons between a conventional and two new sanitation concepts** for an intended new housing estate in the federal state Brandenburg near Berlin have been made. The housing estate should be realised stepwise from 672 up to 5,000 inhabitants within the next 10 years. For the economic calculation three different sanitation concepts have been compared for different cost levels:
  - **Conventional sanitation concept:** Conventional flush-water toilets with stop bottom, one sewer system, normal gravity sewer system for the area, pumping station with transport sewer to the existing sewer network, system operated by the public supplier.
  - **Separation sanitation concept (gravity, composting of faeces):** Gravity separation toilets with separate outlets for urine and faeces, collection and storage of the urine, transport to the farmer nearby and utilisation in agriculture, faeces transported by a gravity sewer system, aerobic treatment in a compost separator, utilisation of the compost in the horticulture on the area, transport of greywater in gravity sewer system, treatment in a constructed wetland, transport to the receiving water.
  - **Separation sanitation concept (vacuum, digestion of faeces):** Vacuum separation toilets, gravity urine transport, storage of the urine, transport to the farmer nearby and utilisation in agriculture, faeces transported by a vacuum sewer system, common treatment with ground bio waste in a biogas plant, biogas utilisation by the equipment of the energy concept, transport of the digested sludge to the farmer nearby and utilisation in the agriculture, transport of greywater in gravity sewer system, treatment in a constructed wetland, transport to the receiving water.

The comparison of these three sanitation concepts has been considered for four scenarios which are summarised in Table 1.

Table 1 Scenarios for the cost comparison of the 3 different sanitation concepts

	Inhabitants	Water Operator *
Scenario 1	672	Local company
Scenario 2	5,000	Local company
Scenario 3	672	Berliner Wasserbetriebe
Scenario 4	5,000	Berliner Wasserbetriebe

*This determines the costs of the "conventional" system and the costs for drinking water in all scenarios

A decision based on an economic point of view should consider three aspects:

- Costs of the investment
- Costs of the reinvestment
- Operation costs

These costs have been considered and the following assumptions were made for the cost calculations:

- Lifetime of the project: 50 years
- Duration of the components depending on their lifetime. Reinvestment after the end of the lifetime
- Real interest rate: 3.5 % per year
- Maintenance costs were calculated as a percentage rate of investment. Personal costs were taken in consideration separately.
- Operation costs divided into costs for
  - personal equipment
  - maintenance
  - water and wastewater
  - electricity
  - others equipment

The specific costs for water, wastewater, connection fees, energy and other costs were based on the information of the local company or of the Berliner Wasserbetriebe. With these assumptions and information the costs for the whole project period were calculated as dynamic prime costs (DPC). The DPC are the sum of money which is necessary for financing the whole project (investment, operation, reinvestment; see Figure 1) for the assumed lifetime based on today's cost level.

The calculations have been realised with the German guideline "Dynamische Kostenvergleichsrechnung" (dynamic cost comparison calculation) published by the "Länderarbeitskreis Wasser LAWA", a working group of all German federal states concerning water management) (LAWA, 1998). This method can also described as a life cycle cost analysis.

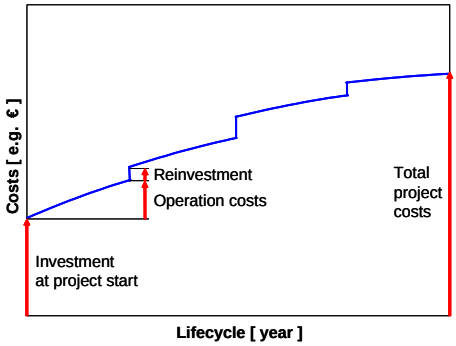

Figure 1 Demonstration of the total project costs (DPC)

Results

a) Literature survey and visits

The main results from the pre-study are:

- 17 new sanitation projects already exist in Western Europe (Table 2).
- The activities in relation to new sanitation concepts are increasing all over the world.
- The separation of urine, faeces and greywater based on the use of new toilet bowls, has proven to be feasible and accepted by the users (Johansson, 2001; Hellström and Thurdin, 1998; Swedenviro, 2001).
- Once urine is separated from the faeces, several configurations exist, differing between them by the collection and transport system chosen and the treatment of the three effluents (faeces, urine, greywater) (Otterpohl *et al.*, 1999).

Table 2 Existing new sanitation projects in Western Europe in 2001

No.	Project Name	Country	City	Project Start (year)	Toilet Installation	URL Project	Responsible Organisation
1	Hamburg-Allermöhe	Germany	Hamburg	1990	Composting toilet		
2	Hamburg-Braamwisch	Germany	Hamburg	1992	Composting toilet	www.oekologische-siedlung-braamwisch.de	Ökologische Siedlung Braamwisch e.V.
3	Kiel-Hassee	Germany	Kiel	1992	Composting toilet		Ökologische Siedlung Hassee
4	Öko-Technik-Park Hägewiesen	Germany	Hannover	1992	Solitar vacuum toilet	www.oeko-technik-park.de	BauBeCon AG mit Stadtwerke Hannover AG
5	As	Norway	As	1992	Drying toilet		
6	Ecological Village Björnsbyn	Sweden	Björnsby near Lulea	1994	Separation toilet		NLH (Norrbottens Läns Hushallningssällskap - the Agricultural Society of Norrbotten County)
7	Bielefeld Waldquelle	Germany	Bielefeld	1995	Composting toilet		
8	Palsternackan	Sweden	Stockholm	1995	Separation toilet		
9	Understenshöjden	Sweden	Stockholm	1995	Separation toilet		
10	Freiburg Vauban	Germany	Freiburg	1998	Vacuum toilet	www.vauban.de	
11	Gebers	Sweden	Skarpnäck	1998	Separation toilet (Drying toilet)	www.iees.ch/cs/cs_4.html	Fastighetsägare, BRF Konditorn, Gebersvägen 24, 128 65 Sköndal
12	Kiel-Vieburg	Germany	Kiel	1998	Composting toilet		
13	Hyldespäldet	Denmark	Kopenhagen	1999	Separation toilet		
14	Mön Museum	Denmark	Mön	1999	Separation toilet		
15	Wohnsiedlung Flintenbreite	Germany	Lübeck	1999	Vacuum toilet	www.flintenbreite.de	infranova GmbH & Co. KG, Flintenbreite 4, 23554 Lübeck
16	Lambertsmühle	Germany	Burscheid	2000	Separation toilet		Wupperverband
17	SolarCity Linz-Pichling	Austria	Linz	2001	Separation toilet		SBL Stadtbetriebe Linz

b) Cost comparison

The cost comparison between the conventional and new sanitation concepts shows that the new sanitation concepts have not only ecological advantages but can also have economical advantages (see below). The cost advantage is very depending on the specific conditions of the housing estate. For the chosen example (see methods) cost advantages occur in the most cases of the new sanitation concepts which are shown in Figure 2 to Figure 5.

In the *Scenario 1* (Figure 2) only the sanitation concept with gravity separation toilets is significantly less costly than the conventional system. With increasing inhabitants, shown in *Scenario 2* (Figure 3), both new sanitation concepts lead to cost savings compared to the conventional system after 3 and 9 years, respectively.

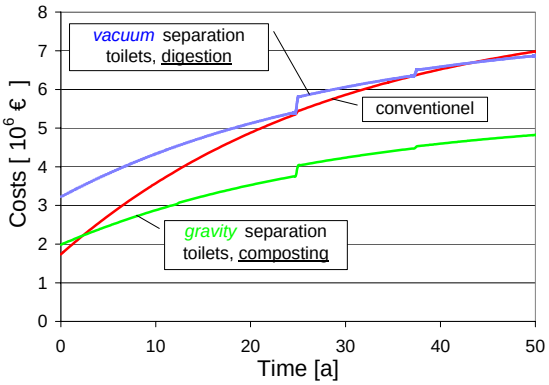

Figure 2 Total project costs for the conventional and the new sanitation concepts (*672* inhabitants); cost basis: *local company*

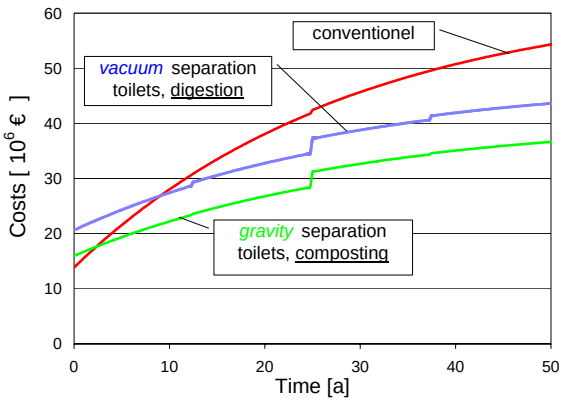

Figure 3 Total project costs for the conventional and the new sanitation concepts (*5,000* inhabitants); cost basis: *local company*

The results from *Scenario 3* (Figure 4) demonstrate only a benefit of the new sanitation concept with gravity separation toilets compared to the conventional system right from the project start. In the *Scenario 4* (Figure 5), which represents the enlarged settlement, both new sanitation concepts are cheaper than the conventional system during the whole operation time.

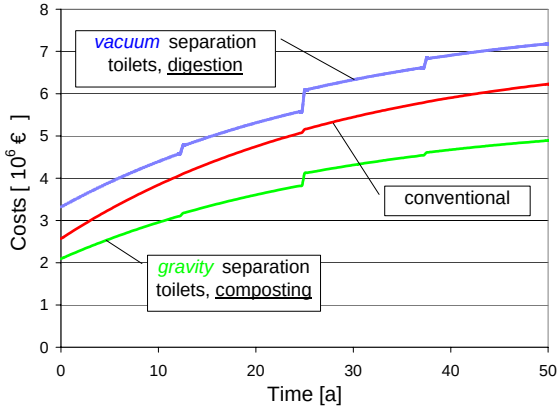

Figure 4 Total project costs for the conventional and the new sanitation concepts (*672* inhabitants); cost basis: *Berliner Wasserbetriebe*

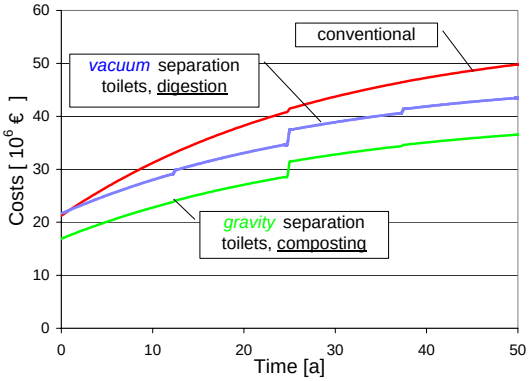

Figure 5 Total project costs for the conventional and the new sanitation concepts (*5,000* inhabitants); cost basis: *Berliner Wasserbetriebe*

The cost comparison between the two new sanitation concepts and the conventional system for the four chosen scenarios show in general that the advantages for the new sanitation concepts are increasing with the size of the settlement.

The results from this cost comparison were an additional motivation for the start of a pilot project testing:

- gravity separation toilets and
- vacuum separation toilets

in conjunction with different treatment configurations. The pilot project started in the year 2002 (***Phase II***). The new sanitation concepts will be tested in existing buildings (office building and apartment house) of the Stahnsdorf WWTP owned and operated by the Berliner Wasserbetriebe. The realisation of the new sanitation concept in the office building took place in the frame of a general restoration of this building. For the apartment house a stepwise realisation of a new sanitation concept is intended.

The general process scheme for the new sanitation concepts in the office building and in the apartment house can be seen in Figure 6.

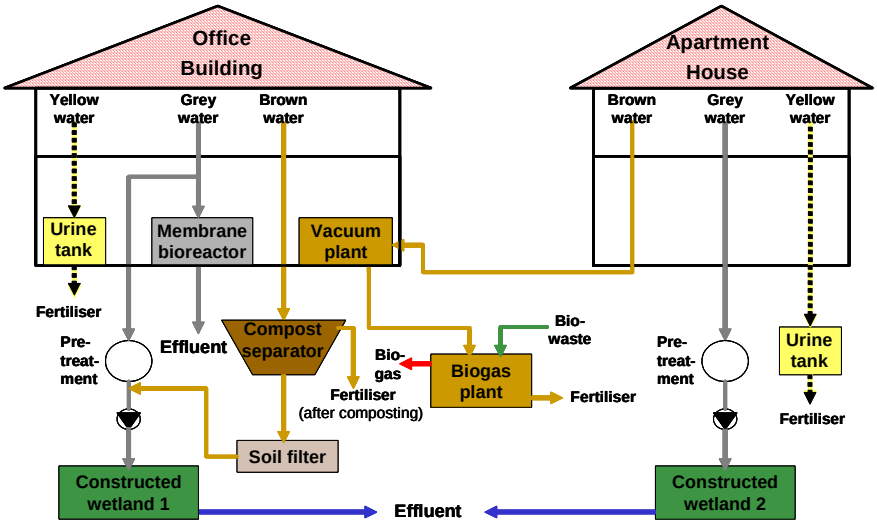

Figure 6 New sanitation concepts with *gravity* separation toilets in the office building and with *vacuum* separation toilets in the apartment house of the WWTP Stahnsdorf

In the new sanitation concept for the office building gravity separation toilets (10 toilets) are used. In the men toilets five waterless urinals installed additionally. The type of the toilet is shown in Figure 7.

With this type of toilet dilution of urine (yellow water), which reinforces the formation of "urine stones" (precipitation of Ca^{+}, Mg^{+}, PO_4^{3-}, mainly into struvite, hydroxyapatite and calcite; Udert *et al.*, 2002), can be prevented due to a moveable plug (see description in Figure 7). Hence formation of "urine stone" may be reduced which should prevent blockages in the urine pipes. Furthermore the volume of urine will not be increased by flush water. This is a further advantage for the urine treatment and handling.

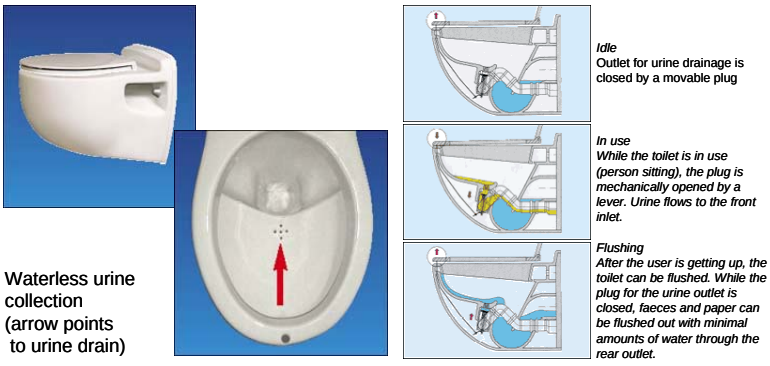

Figure 7 Gravity separation toilet (Roediger-No Mix Toilet; Roediger, 2001)

The faeces (brown water) will be drained and composted. The filtrate from the compost separator will be treated with a soil filter before mixing it with greywater. The greywater passes a septic tank before treatment in a constructed wetland. In parallel to the constructed wetland a membrane bioreactor will also be tested for greywater treatment. The urine flows into storage tanks. Different methods will be tested for handling and treatment of urine before using it as fertiliser. The methods may be adjusting different pH values during urine storage, extraction of the nutrients etc.

For the new sanitation concept for the apartment house (15 flats) vacuum separation toilets are taken into consideration. This type of toilet is under development. In this concept urine and greywater are discharged and transported by gravity, while faeces by transported by a vacuum system. Each flow is also treated separately. Urine will be treated as mentioned above. The faeces will be digested together with ground bio-waste. Digested sludge is also a fertiliser, e.g. for farmlands. Biogas can be used either in gas cookers or in a combined heat and power unit (CHPU). This topic will not be tested in this project. Greywater passes like in the case of the office building through a septic tank before treatment in a constructed wetland.

Since dish washing powders have a high content of phosphate (often more than 30 %) and dishwashing machines are more and more common, for both concepts a phosphate precipitation could also be necessary during greywater treatment.

The treated greywater can be used e.g. for irrigation in general. In this project the effluent of the membrane bioreactor will be investigated with respect to the different options of re-use as water with a lower quality than drinking water.

These two sanitation concepts are technical options belonging to the new approach, others are possible, e.g. composting of the faeces together with bio-waste should a production of biogas not be wished.

The type of greywater treatment for both new sanitation concepts will differ depending on the local situation. For large settlements an activated sludge tank etc. could be a more appropriate solution than a constructed wetland. The size of an activated sludge tank for greywater treatment could be however much smaller than for municipal wastewater treatment due to the far lower load of COD, nitrogen etc. (Otterpohl, 2001).

Conclusion

The results from the pre-study of this project enhanced the motivation for realising a pilot project testing gravity and vacuum separation toilets. Ten gravity separation toilets and a prototype of a vacuum separation toilet are in operation since the end of 2003. The necessary measures for realising the new sanitation concept for the apartment house are prefaced.

Although the cost comparison showed higher costs for the new vacuum sanitation concept compared to the gravity sanitation concept and in spite of a more complex operation, this system may be an appropriate solution especially in case of local water shortages. The flush water consumption should be about 6 l/(p•d) compared to about 15 l/(p•d) for the gravity separation toilet or about 25 – 40 l/(p•d) for the conventional toilet with stop bottom.

Important objects of this pilot project (***Phase II***) are:

- Increasing of the knowledge of design, installation and costs of new sanitation techniques based on separation technologies
- Experience of the operation of new sanitation concepts by investigation of the various modules of the separation concept in different conditions

The interest for these new sanitation concepts is increasing in general and further new projects are realised [e.g. Christ 2003].

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Eine rauschende Idee

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Kompetenzzentrum Wasser erforscht ressourcenschonende Toilettensysteme – Projekt wird von der EU gefördert

VON GIDEON HEIMANN

Eine der letzten Männerbastionen zu Haus gerät ins Wanken: das Im-Stehen-Pinkeln. Denn das Klo braucht demnächst Trennkost. Jene etwas außergewöhnliche Sanitärkeramik der hessischen Firma Roediger, die man seit Mitte Oktober im Verwaltungsgebäude des Klärwerks Stahnsdorf in den Toiletten sehen kann und die eben nur im Sitzen richtig funktioniert, ist freilich nur ein Teil eines kompletten Systems. Es wird zunächst hier in Stahnsdorf erforscht, soll später aber auch in Neubausiedlungen angewandt werden. Es geht darum, Urin und Fäkalien nicht nur getrennt zu erfassen, sondern anschließend auch so zu behandeln, dass daraus Düngemittel für die Landwirtschaft werden.

Außerdem geht diese Technik überaus sparsam mit Spülwasser um. Und damit ist das Thema keineswegs mehr so amüsant. Schließlich ist Wasser nur in unseren Breiten über-flüssig, während es andernorts auf der Welt so knapp wird wie nie zuvor: Mehr als eine Milliarde Menschen hat keinen Zugang zu sauberem Trinkwasser, über zwei Milliarden Menschen leben in Haushalten, die nicht an die Abwasserreinigung angeschlossen sind. Ein leichtes Spiel für Krankheitserreger, Epidemien hervorzurufen. Deshalb ist die Technik gefragt, bei der Lösung des Problems und bei der Schonung der natürlichen Ressourcen mitzuhelfen.

Denn die vom Menschen ausgeschiedenen Stickstoffe (Urin) und Phosphate (Fäkalien) sind ihrerseits wieder gut als Dünger zu verwenden. Wie gut, das sollen Untersuchungen von Wissenschaftlern an Forschungseinrichtungen in Berlin und Brandenburg zeigen. Immerhin sind zumindest die weltweiten Phosphatreserven nicht unendlich – die leicht erschließbaren Lagerstätten sollen gegen Ende des Jahrhunderts schon ziemlich leer sein.

Die uns bekannte Abwasser-Abfuhr ist zwar seit Ende des 19. Jahrhunderts historisch so gewachsen, logisch ist sie freilich nicht. Denn es werden Substanzen miteinander vermengt und mit viel Wasser stark verdünnt, die man besser getrennt halten sollte. Die Trenntoilette an sich ist nichts Neues, vor allem in nicht so dicht besiedelten Regionen Schwedens ist sie sehr beliebt.

ZWEIWEGEKLO. Die Forscher erhoffen sich eine Schonung der Ressourcen. Foto: gih

Solche Anlagen eignen sich aber nicht so sehr für mittlere bis große Wohnsiedlungen, hier muss mehr Technik hinein. Der Urin aus dem speziellen Toilettenbecken gelangt in einen Lagertank. Von dort aus könnte er auf Feldern als Flüssigdünger eingesetzt oder nach dem Eindampfen als Feststoff abtransportiert werden. Interesse bestünde bei Ökobauern durchaus schon, berichtet Anton Peter-Fröhlich von den Berliner Wasserbetrieben, der das Projekt leitet. Die Frage ist nur, wie stark sich die Belastung des Urins durch Medikamentenrückstände auf den Feldern tatsächlich auswirkt und was man nötigenfalls dagegen machen kann.

Für die eher festen Ausscheidungen gibt es zwei denkbare Wege – je nachdem, wieviel Aufwand getrieben werden soll. Die eine Technik stellt die Fortsetzung des Plumpsklos mit anderen Mitteln dar, hier wird das Transportgut nach der Passage durch einen Grobfilter der Kompostierung zugeführt. Technisch anspruchsvoller, aber vom Nutzen her auch ergiebiger, funktioniert's mit einer Vakuumtrenntoilette – ähnlich wie im Flugzeug oder ICE. Hierbei wird der Kot in eine Biogasanlage geleitet, wo Bakterien aus den organischen Bestandteilen Methan herstellen. Das Biogas kann in einer Heizung oder einem Blockheizkraftwerk verfeuert werden. Was dann übrig bleibt, wird zu Dünger.

Das Projekt kostet 2,4 Millionen Euro, wobei die EU daran so stark interessiert ist, dass sie es fördert. Verantwortlich zeichnet das Kompetenzzentrum Wasser Berlin, das von den Wasserbetrieben sowie von weiteren Gesellschaftern getragen wird.