

Water Hub @ NEST: Practical Implications of Source Separation

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Introduction

The NEST Building (nest.empa.ch) is a living lab accommodating housing and office units. The building has been operational for 6 months (since August 2016) and activities are gradually increasing in both the living and the lab aspects, i.e. the life in the building hosting workers and inhabitants as well as the research on technologies implemented in the building. Wastewater research in NEST gravitates around the Water Hub (www.eawag.ch/waterhub) located in the basement. As presented at the previous edition of this conference (Etter et al., 2016), the wastewater streams in NEST are collected separately. Source separation plays the key role in the building's wastewater management, given that resources can best be recovered from separated waste streams (Larsen et al., 2013; Larsen & Gujer, 1996). However, at a practical scale, source separation is still a novel concept and no off-the-shelf solutions exist. Hence, this novel sanitation system requires specific technical know-how and skills of architects, planners, and craftspeople during its conception, design and implementation. In addition, users need to accept the new systems and learn how to use them. This paper shall summarise the findings and practical experience of the first stage of the implementation of source separation in NEST, in order to formulate recommendations for future systems.

Material and Methods

Piping

In NEST, the following streams are collected in separate pipes: urine, brownwater (faeces with flush water), less concentrated greywater (from bathrooms), more concentrated greywater (from kitchens), and rainwater. An additional pipe receives mixed wastewater, wherever the streams cannot be separated at the source.

Urine-Diverting Toilets

To effectively separate urine and faeces at the source, a new urine-diverting flush toilet (Duravit, Hornberg, Germany) has been thoroughly tested in NEST. A series of ten prototypes was installed and maintenance issues reported. Simultaneously, users were asked to respond to two types of surveys: Occasional users were probed about their attitude towards urine-diverting toilets and the tested prototype in particular, whereas regular users were asked to feed back on the toilet's technical functioning. Urine from the toilets was collected in the Water Hub and volumes recorded on a daily basis.

Greywater

Greywater is collected separately as 'light' and 'heavy' greywater, i.e. less polluted greywater from bathrooms, respectively more polluted greywater from kitchens.

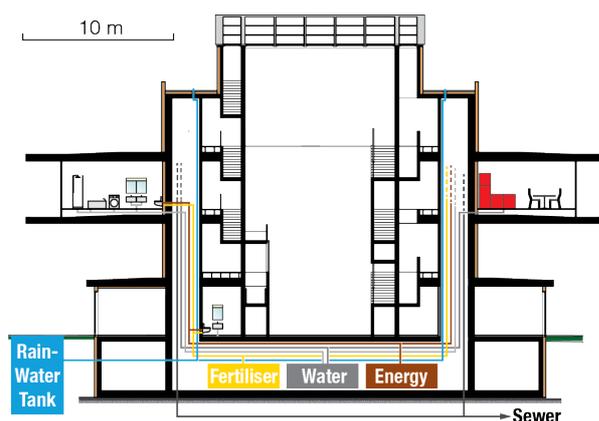


Figure 1. Cross-section of the NEST building indicating the main wastewater flows separated at the source, then collected and treated.

- Less concentrated greywater
- More concentrated greywater
- Brownwater
- Urine
- Rainwater
- Mixed wastewater

Results and Discussion

Piping

Implementing a source separation system in NEST proved to be a challenge. The exchanges between researchers, planners, and later on contractors on the construction site showed not to be sufficient to completely avoid misconnecting pipes. In the brownwater pipe, clogging occurred several times at a bypass in the Water Hub, because the stream had a relatively high solids content and the pipes were sloped at the usual 2% resulting in an excessively slow flow. Given that NEST will be expanded with new units, special care will have to be taken to correctly implement all future connections. A fact sheet was developed for contractors to be briefed to understand the rationale behind source separation and beyond standard solutions.

Urine-Diverting Toilets

First evaluations of the urine-diverting toilets show that the electronically controlled separation valve operates well and that most users appreciate the toilet. A gasket had to be replaced, after urine leaked from the valve unit. The facility management did not experience any additional workload with cleaning the toilets. However, an issue with the toilet design led to the replacement of the urine-diverting toilets with conventional flush toilets during the construction: the prototypes did not fulfil the dimensional norms for barrier-free toilets.

Greywater

Greywater flows were considerably low, given that the inhabitants of NEST had not yet moved in. Thus, greywater treatment has been limited to preliminary lab-scale experiments. Currently, a new unit housing a spa is under construction. Hence, much more 'light' greywater will be available upon completion of the unit. In the future, additional units will complement NEST. Owing to this, source separation will become more of a standard solution.

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