



VUNA Nutrient harvesting from urine

Kai M. Udert, Bastian Etter, Teddy Gounden





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Urine-diverting toilets (UDTs)

Goal: Dehydration of faeces

Volume of faeces is reduced,
most pathogens are killed.

Usually, urine is infiltrated into
the ground.

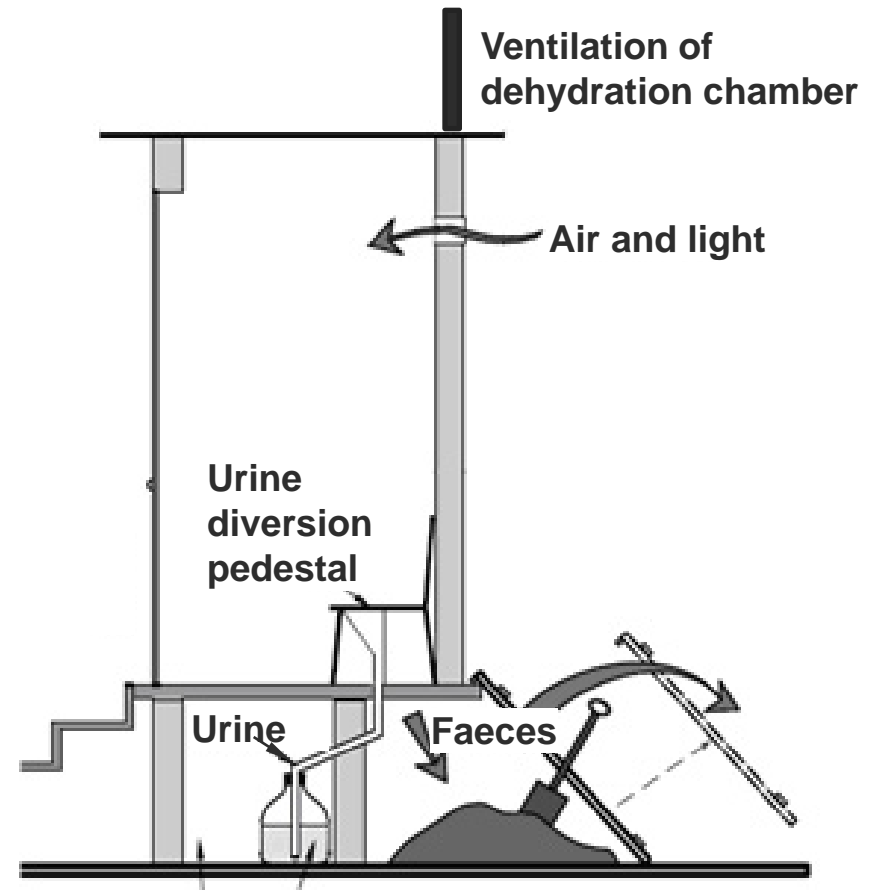
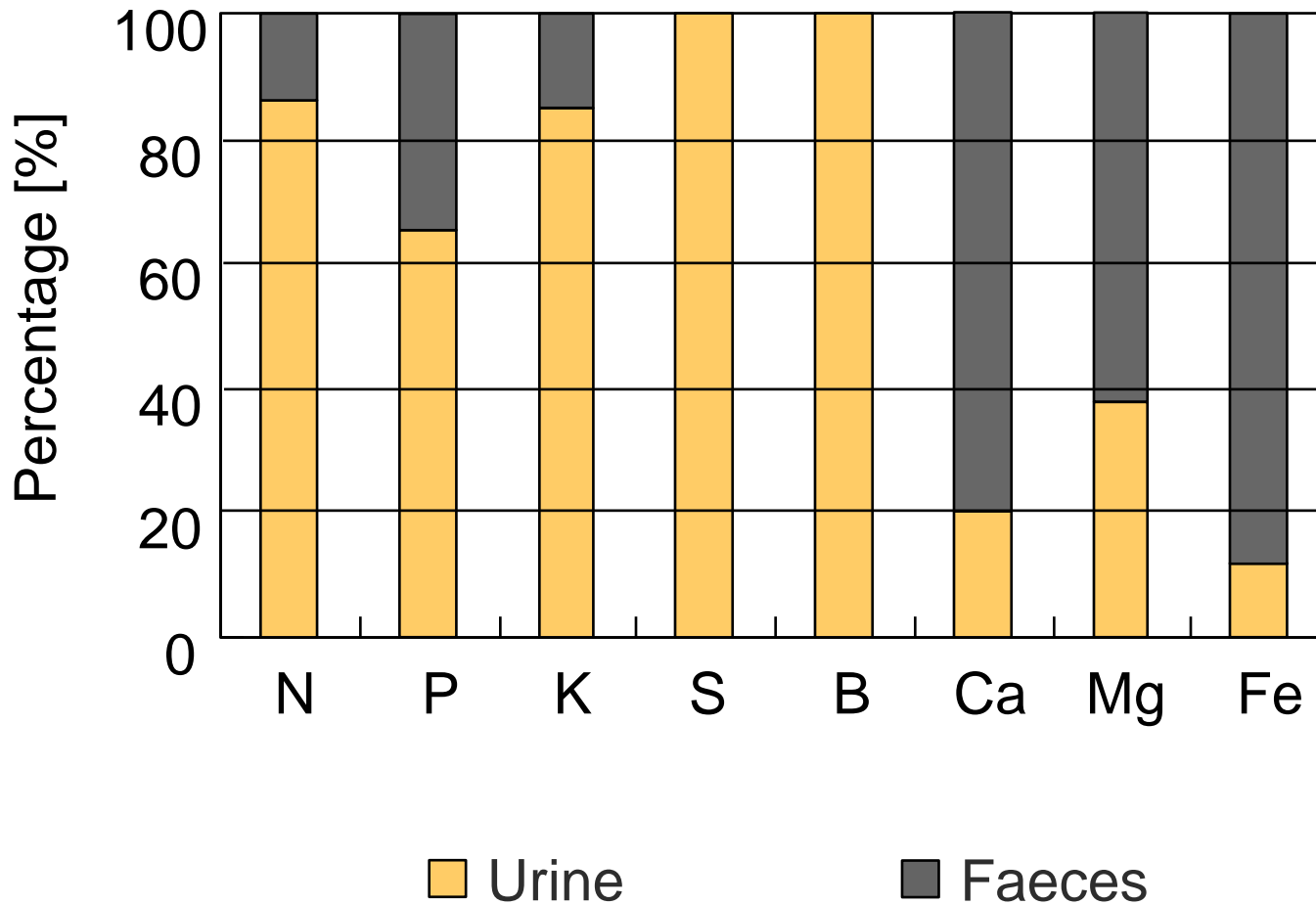


Figure: © WEDC

75,000 UDTs in peri-urban eThekweni



Nutrients from human metabolism



The VUNA project

Promoting sanitation by recovering nutrients from source-separated urine.

- Develop reactor technology
- Manage dispersed urine tanks and reactors
- Explore socio-economic boundaries



Funding and project partners



Funding and support



Swiss Federal Institute of
Aquatic Science and Technology



eThekweni Water and Sanitation



University of KwaZulu-Natal



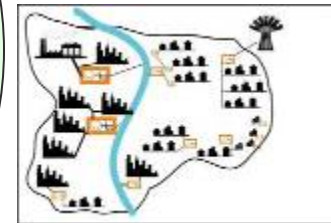
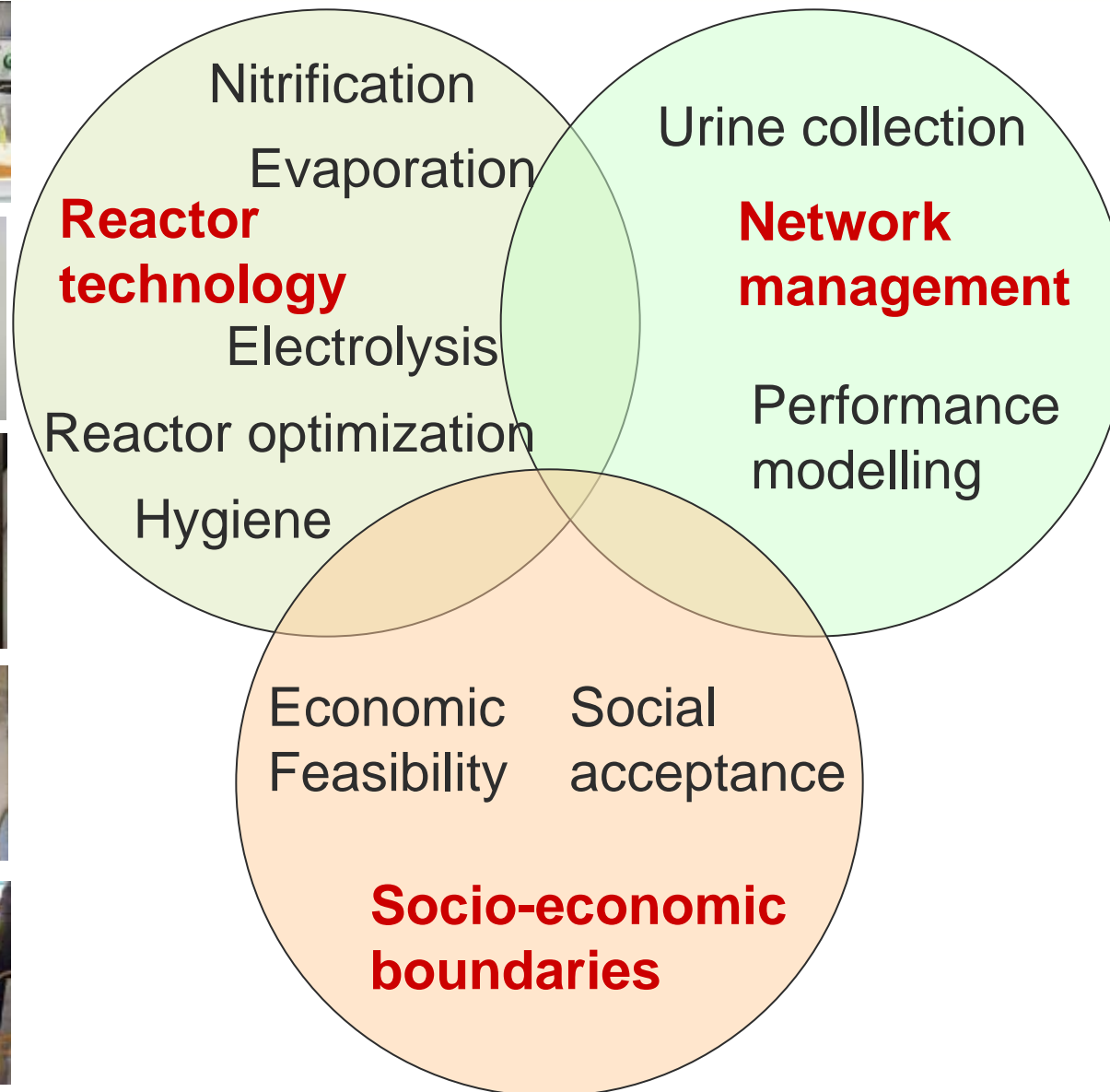
Swiss Federal Institute of
Science and Technology Zurich

Project meeting October 2012 in Durban



Picture: Kai Udert

Objectives and Activities



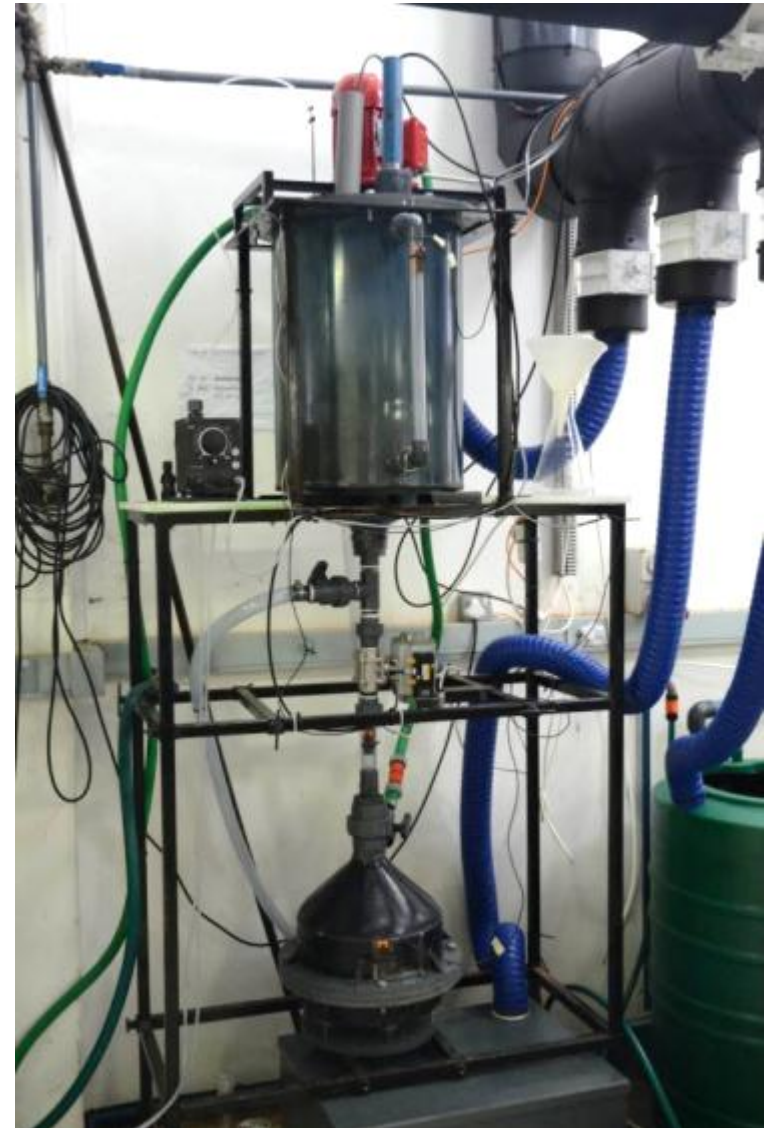
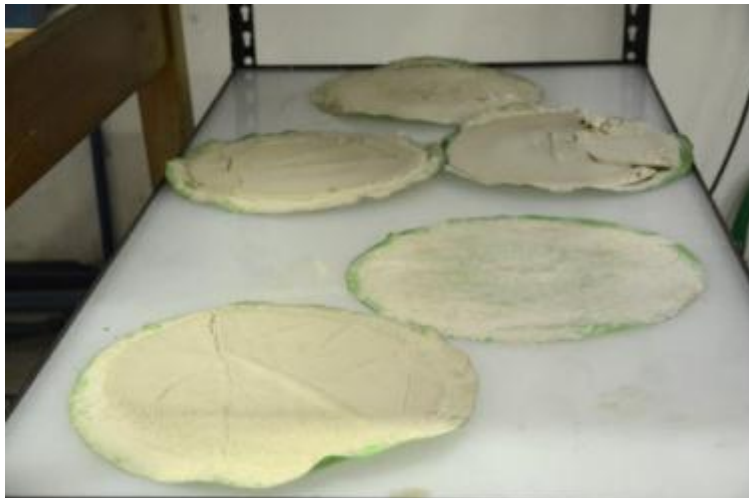
Struvite reactor

Process for phosphorus recovery

Struvite: $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$

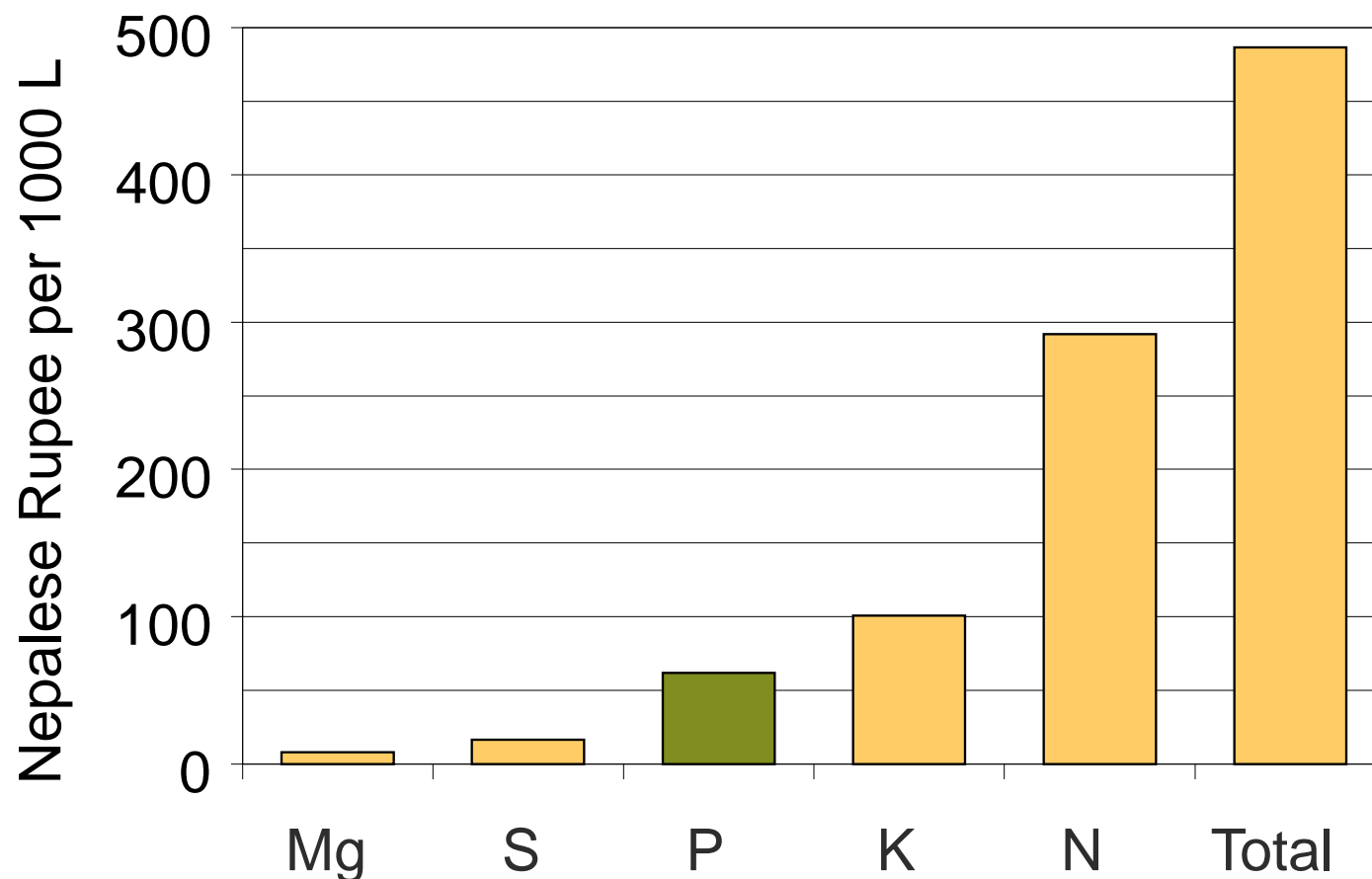
Dosage of a magnesium source

More than 91% P recovery



Pictures: Kai Udert

Fertiliser value of urine in Nepal



Based on Nepalese fertiliser prices in 2008
(Tilley et al. 2009)

Complete Nutrient Recovery

Step 1: stabilisation by nitrification



Step 2: distillation

Up to 97% water removal

Product:

ammonia nitrate concentrate



Reactor operation and optimisation in eThekwin

Presentation by

Max Grau

Tuesday, 14h25

Session B5

Breakaway 1



Picture: Kai Udert

Electrolysis: How small can a urine treatment reactor be?

Electrochemical ammonia removal:

up to $130 \text{ gN} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$

Biological denitrification:

$1.2 \text{ gN} \cdot \text{m}^{-2} \cdot \text{d}^{-1}$

Disinfection



Picture: Hanspeter Zöllig

Hygiene and ecotoxicology: how safe is the product?

Pharmaceuticals
especially antibiotics
and antiretroviral drugs

Pathogens
viruses, bacteria, helminth eggs

By-products
chlorinated organic compounds
from electrolysis



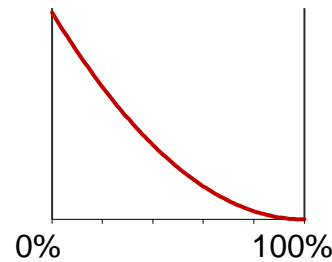
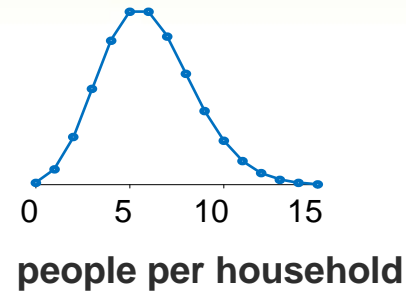
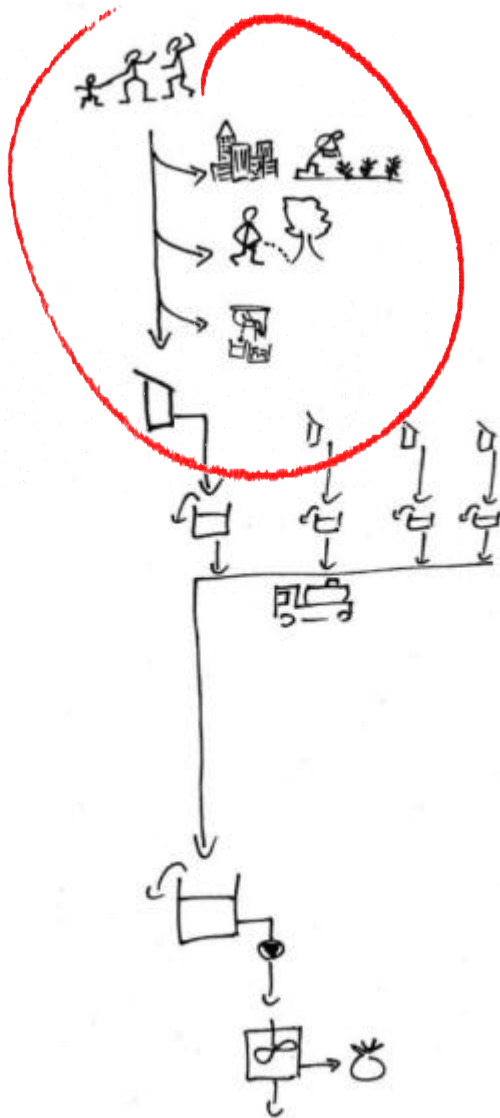
Network management

How to manage a large amount of on-site urine tanks and decentralised treatment reactors?

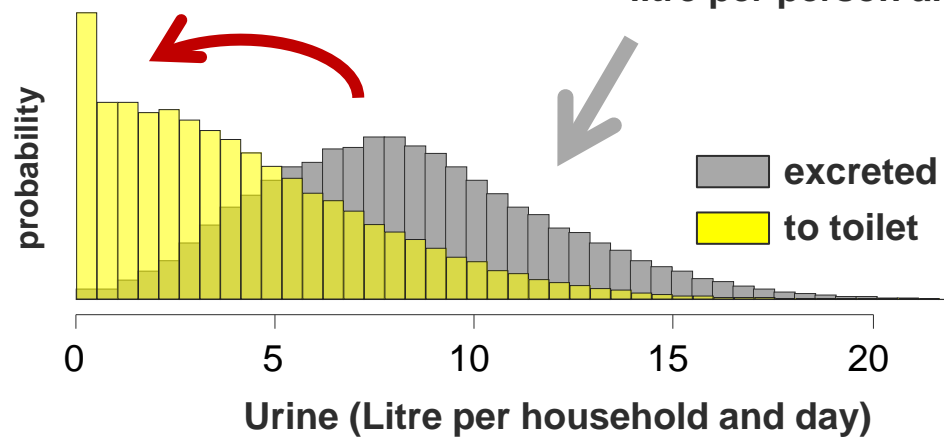
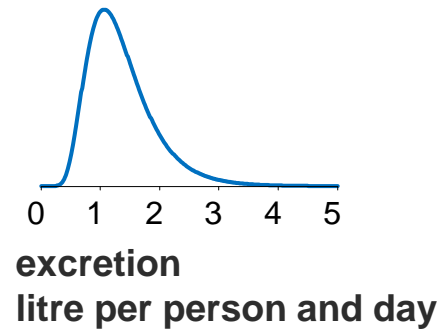
Stochastic modeling can give an answer.



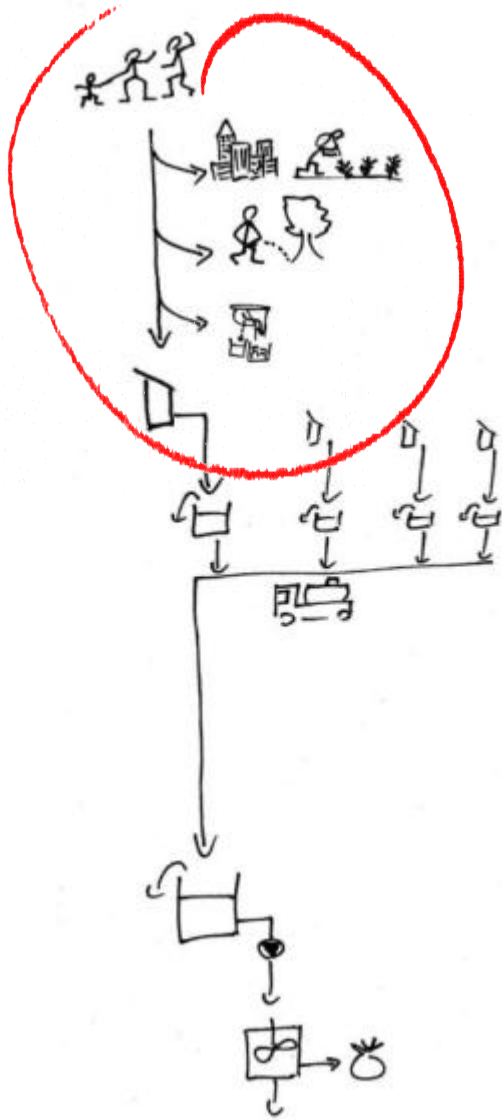
Model-based performance evaluation



% of urine to toilet



Model-based performance evaluation



Presentation by

Thomas Hug

Tuesday, 14h50

Session B5

Breakaway 1

Socio-economic boundaries

At the center of these activities: the toilet users

1. Assessing the acceptance of UDTs
2. Increasing the acceptance of urine diversion by health and hygiene education
3. Involving toilet users in urine transport



Incentives to engage toilet users in urine transport

Are incentives a cheaper alternative to sending out staff for urine collection at the toilets?

Can we raise the awareness for sanitation and hygiene?



Pictures: Thomas Hug, Elizabeth Tilley

Incentives to engage toilet users in urine transport

Presentation by

Elizabeth Tilley

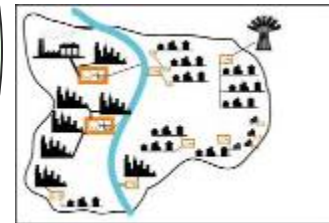
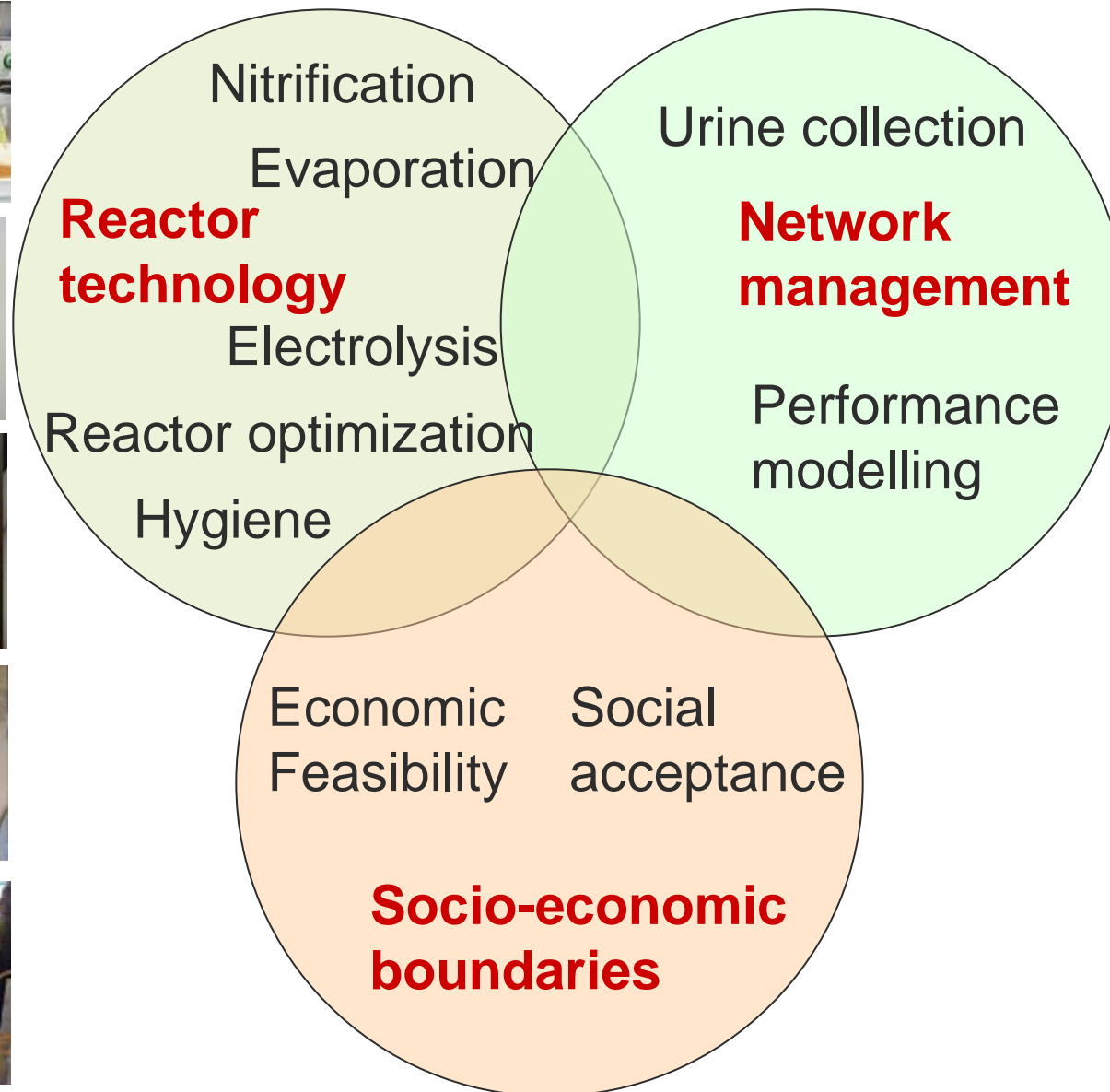
Tuesday, 12h05

Session B4

Breakaway 1



Objectives and Activities





**Thank you for
your attention !**

www.vuna.ch