



Long-term Performance of a small Gravity-driven Dead End Membrane Filtration Unit for Drinking Water Supply in Cases of Disasters

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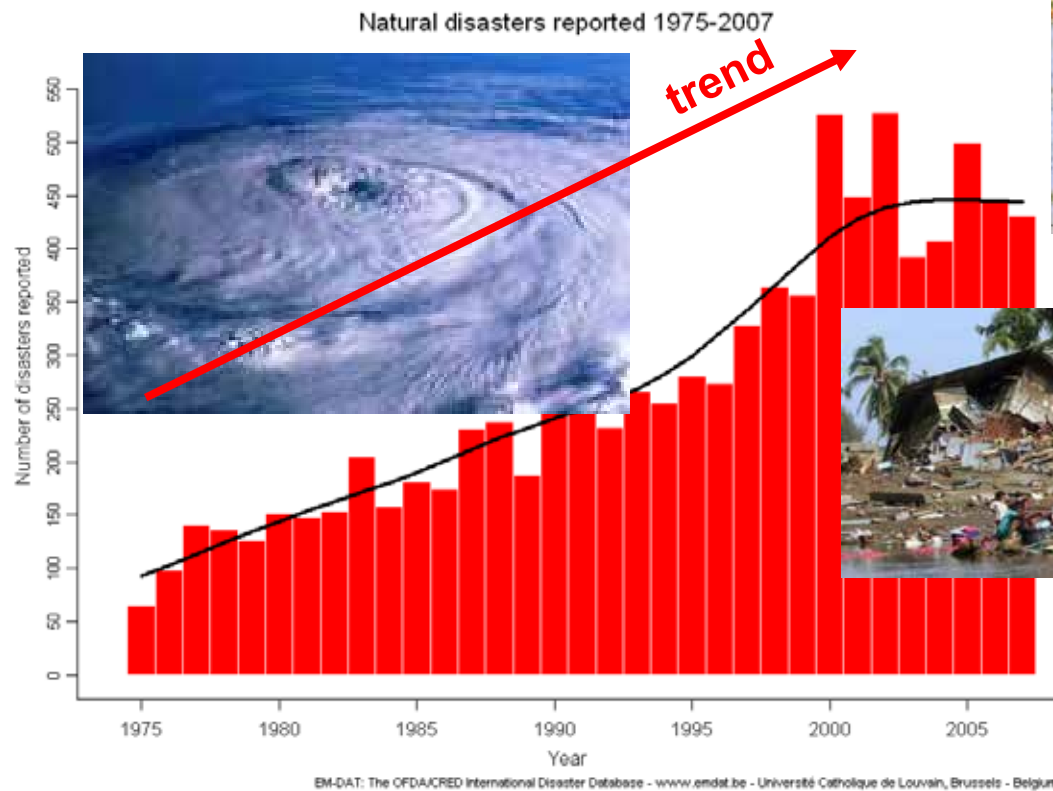
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Introduction and intent



Number of natural disasters reported 1975-2007 (www.emdat.be)

- Ü Growing number of natural disasters against the background of climate change
- Ü Destruction of existing infrastructure
 - Ä Supply of safe drinking water in quantity and quality is not guaranteed



Drinking Water Supply in Cases of Disasters

- Ü Aid organizations distribute mobile waterworks
- Ü Sophisticated systems with high level of technology and demand of
 - Ä energy
 - Ä skilled staff
 - Ä additives (e.g. chemicals).
- Ü Need infrastructure to be transported
- Ü Need time to be set up and fully operational (several days)
- Ü Can serve several (ten) thousand people

- Ü Plants are an indispensable part of natural disaster response!
- Ü **But..... !!!**
 - Ä do not reach people in remote regions with no infrastructure where small communities live!

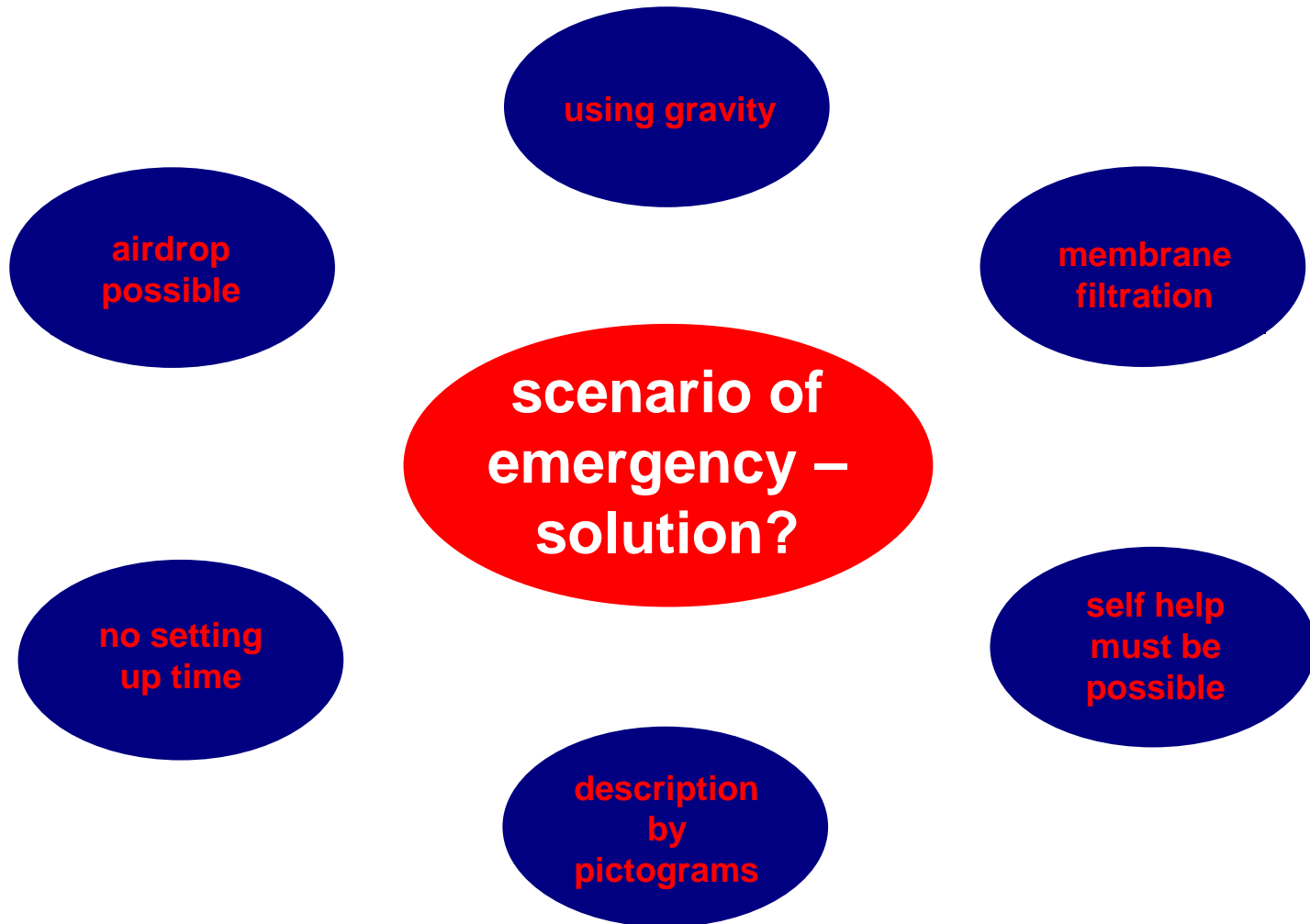


Source: Elga Berkefeld



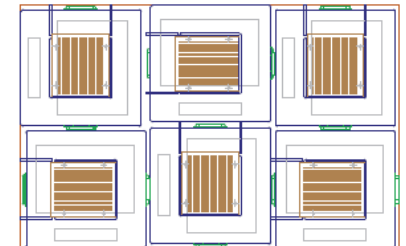
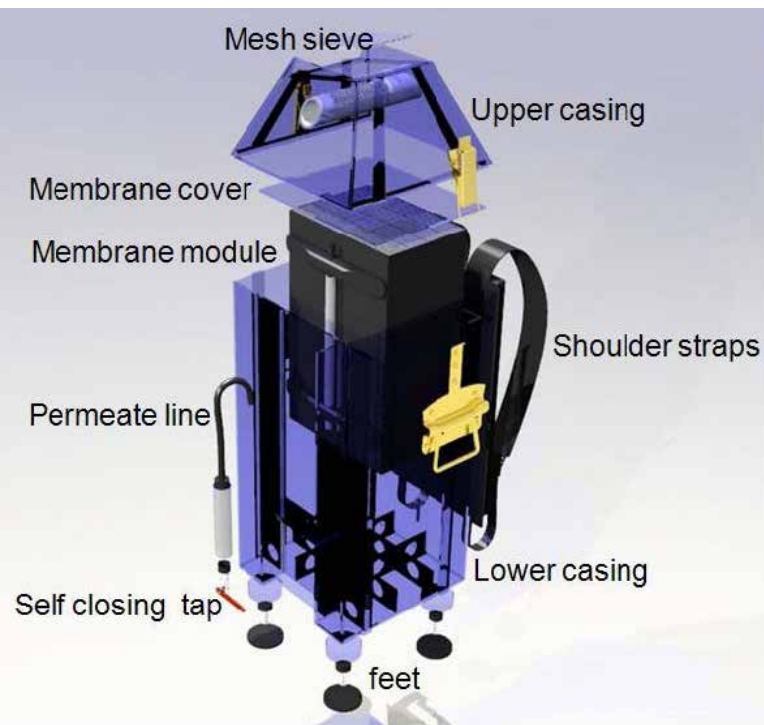
Drinking Water Supply in Cases of Disasters

Ü Difficulties and demands on drinking water supply in remote areas



Drinking Water Supply in Cases of Disasters

Ü Filling The Gap: „The Water Backpack“



Ä The Whole „Manual“:

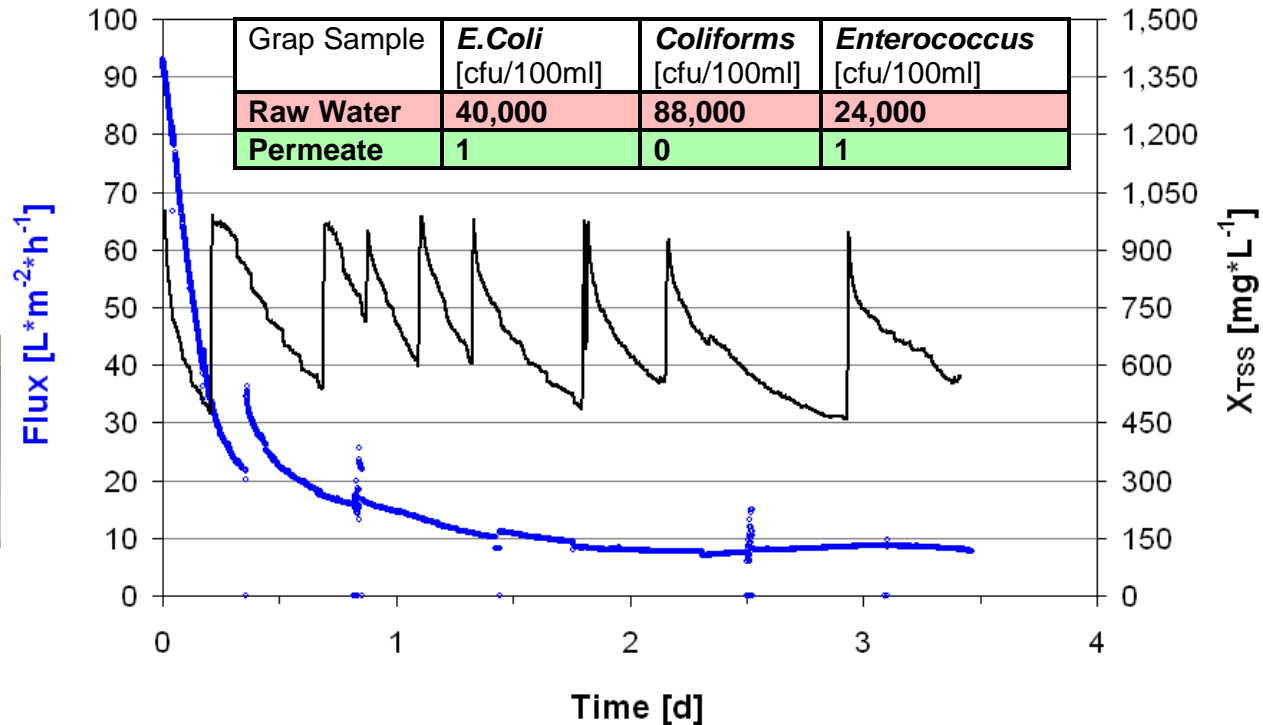


First Investigations – Choice of membrane

Ü Short-term tests with different membrane modules

Ä Continuous Operation with “synthetic” Raw Water

∅ Tap water mixed with soil and effluent of wastewater treatment plant



Ä Chosen Membran Module for the “Water Backpack”

∅ siClaro® Martin Systems, pore size: 100 nm; filtration surface: 11 m²

First Investigations

Ü Results of first investigations

Ä Hydraulic Performance

- Ø First Results: Water Backpack is able to supply a group of around 200 – 500 people for some days
- Ø calculation based on WHO standards for emergency situations: 7 L/(cap*d)

Ä Bacteria and TSS Removal

- Ø Permeate is free of suspended solids (TSS)
- Ø Permeate reaches nearly “drinking water quality” with regard to hygienic demands according to the German drinking water ordinance (TrinkwV 2001)

Ü Questions:

- Ä How long does the layer remain permeable? When does Flux come to zero?
- Ä Is sufficient Bacteria Removal guaranteed for a longer period?

Ü Long-term tests with real surface water concerning hydraulic and bacteria removal



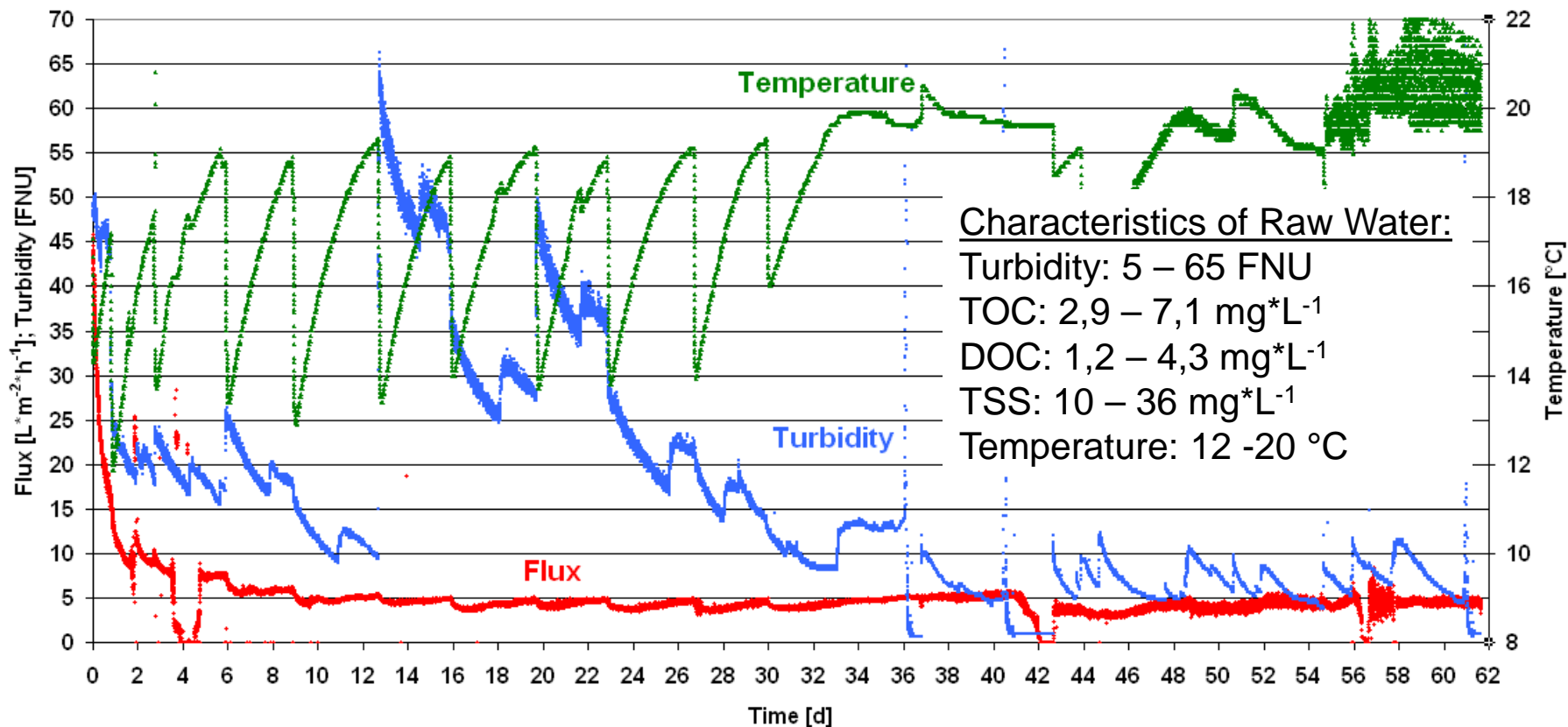
Hydraulic Performance in long-term examination

Ü First long-term tests in laboratory

- Ä Influent: Storm water contaminated surface water
- Ä Continuous operation for 2 Months
- Ä Low TMP (80mbar)
- Ä Recording of Flow Rate ($L \cdot h^{-1}$), Temperature ($^{\circ}C$), Turbidity (FNU)
- Ä Analysis of TOC, DOC and TSS



Hydraulic Performance in long-term examination



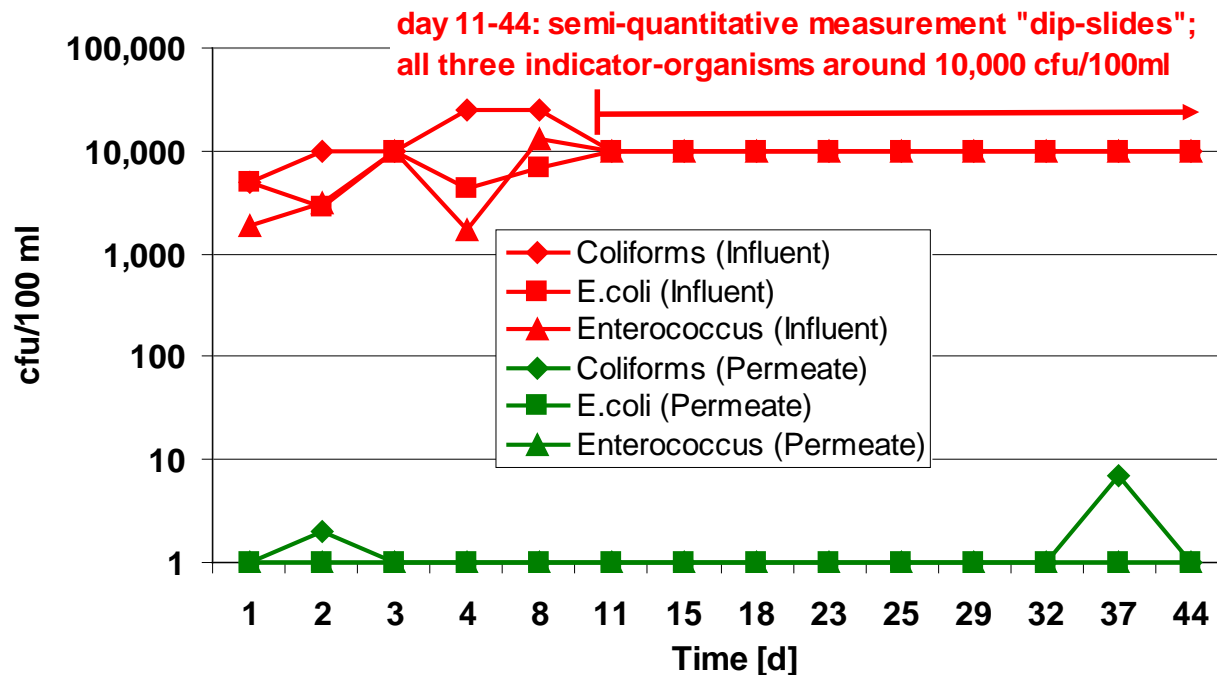
Ü Test conditions:

Ä Continuous Operation, No Crossflow, No Cleaning

Ü Stationary Flux of around 4.5 – 5 L·m⁻²·h⁻¹ after 12 days

Bacteria Removal in long-term examination

Further long-term tests concerning Bacteria Removal



Sufficient Bacteria Removal was guaranteed during whole examination period

Conclusion and Outlook

Ü Conclusion

- Ä Developed „Water Backpack“ is able to produce potable water in sufficient quality (Bacteria Removal) and quantity (Hydraulic)
- Ä 500 people in the first days, 150-200 for a longer period (several months)

Ü Outlook

- Ä Further development to series-production readiness of the „Water Backpack“
 - Ø Investigations concerning process-stability under extreme conditions
 - very high concentration of suspended solids (TSS) $> 1 \text{ g} \cdot \text{L}^{-1}$
 - very high bacterial load, e.g. raw wastewater
 - Ø Improvements regarding the case of the unit
 - material, weight, robustness etc.
 - Ø Field tests
 - functioning in real scenario
 - handling by non-skilled people etc.



The final question is:



Drink this?

Or drink this?





Please visit the following websites for further information:

www.waterbackpack.org

www.uni-kassel.de/fb14/siwawi

