



## Microbial challenges – contamination and aftergrowth

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A photograph of two workers in high-visibility safety gear. The worker on the left is wearing a yellow jacket and helmet, and is operating a high-pressure water sprayer. The worker on the right is wearing an orange and black jacket and a yellow helmet, and is smiling. A large spray of water is directed towards the right. The background shows a grey stone wall and green foliage.

The 10<sup>th</sup> Nordic

# DRINKING WATER CONFERENCE

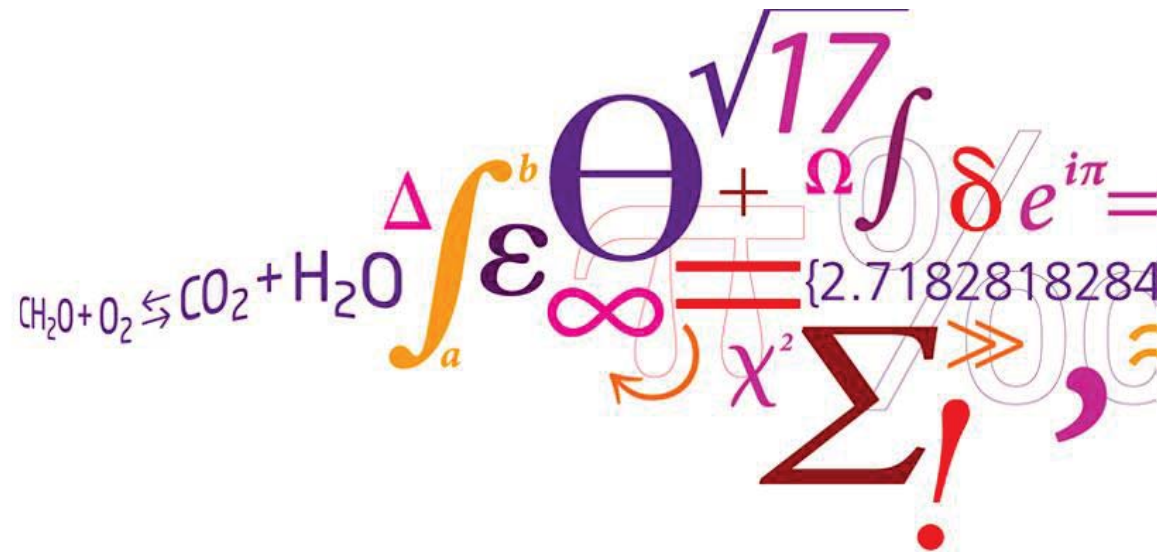
Reykjavík, September 28–30 2016

## PROGRAM

Workshop 4  
 Cooperation in research and development  
 in the Nordic countries

# Microbial challenges – contamination and aftergrowth

Hans-Jørgen Albrechtsen



The 10th Nordic  
 DRINKING WATER CONFERENCE  
 Reykjavík, Iceland, September 28–30 2016

**DTU Environment**  
 Department of Environmental Engineering

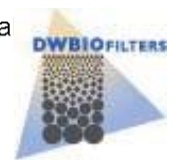
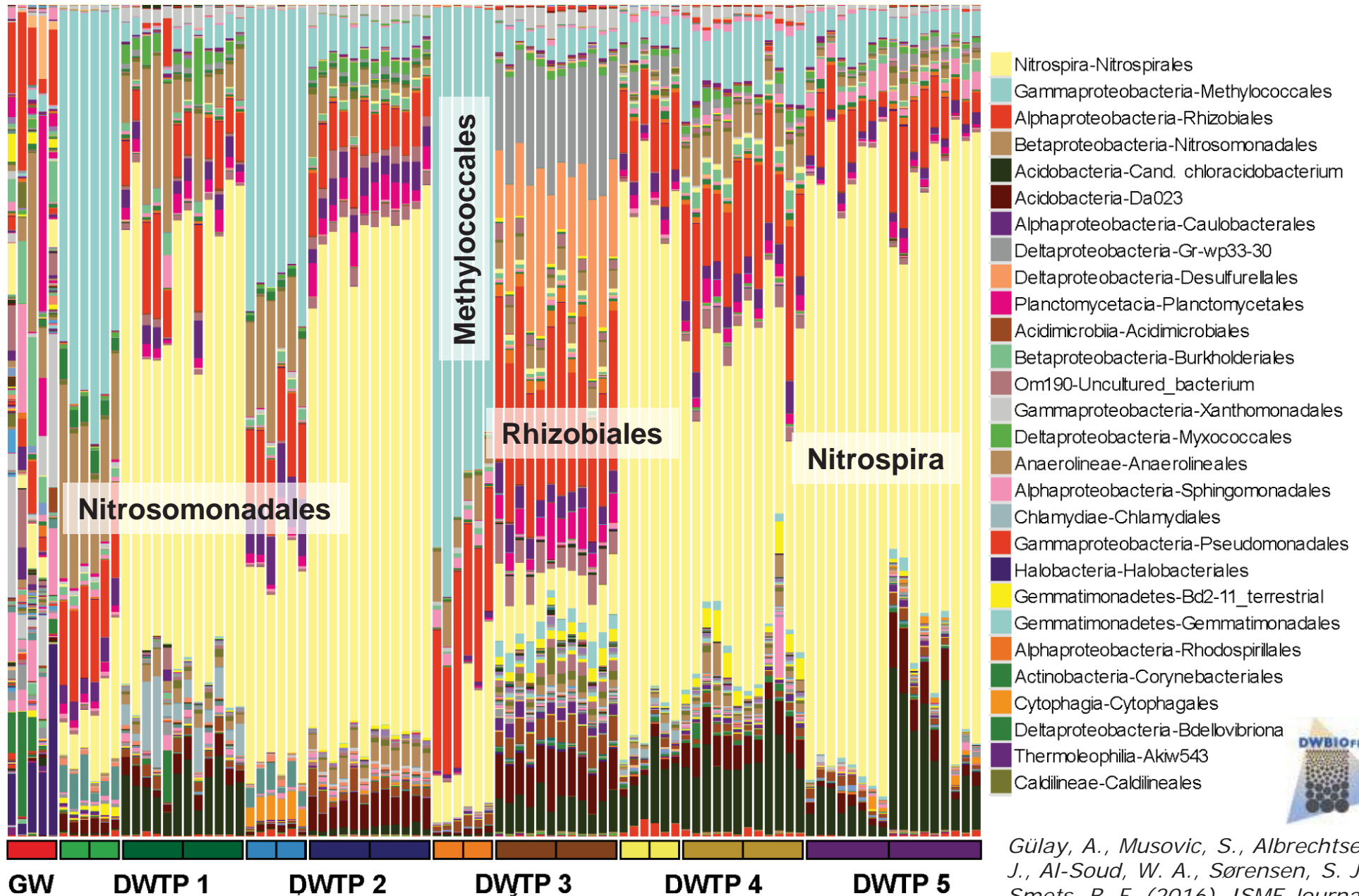
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# Cooperation in research and development in the Nordic countries

- Search for common problems / challenges
- Topics at this conference
  - Measuring methods
  - Risk assessments / water safety plans
  - Lack of compliance in microbial quality at small water works
  - Biofilm
  - Disinfection
- Rapid development in microbial methods
  - Virus
  - Genomics – full genome sequencing
- Important input to risk assessment – QMRA
- Microorganisms dominant risk in water supply

# Microbial communities

## Filter material - Pyrosequencing



Gülay, A., Musovic, S., Albrechtsen, H-J., Al-Soud, W. A., Sørensen, S. J. & Smets, B. F. (2016) *ISME Journal*. 10: 2209–2222

# Køge 2007

Stool samples from patients, end of February 2007

23 patients with 2-5 different pathogenic gastrointestinal organisms

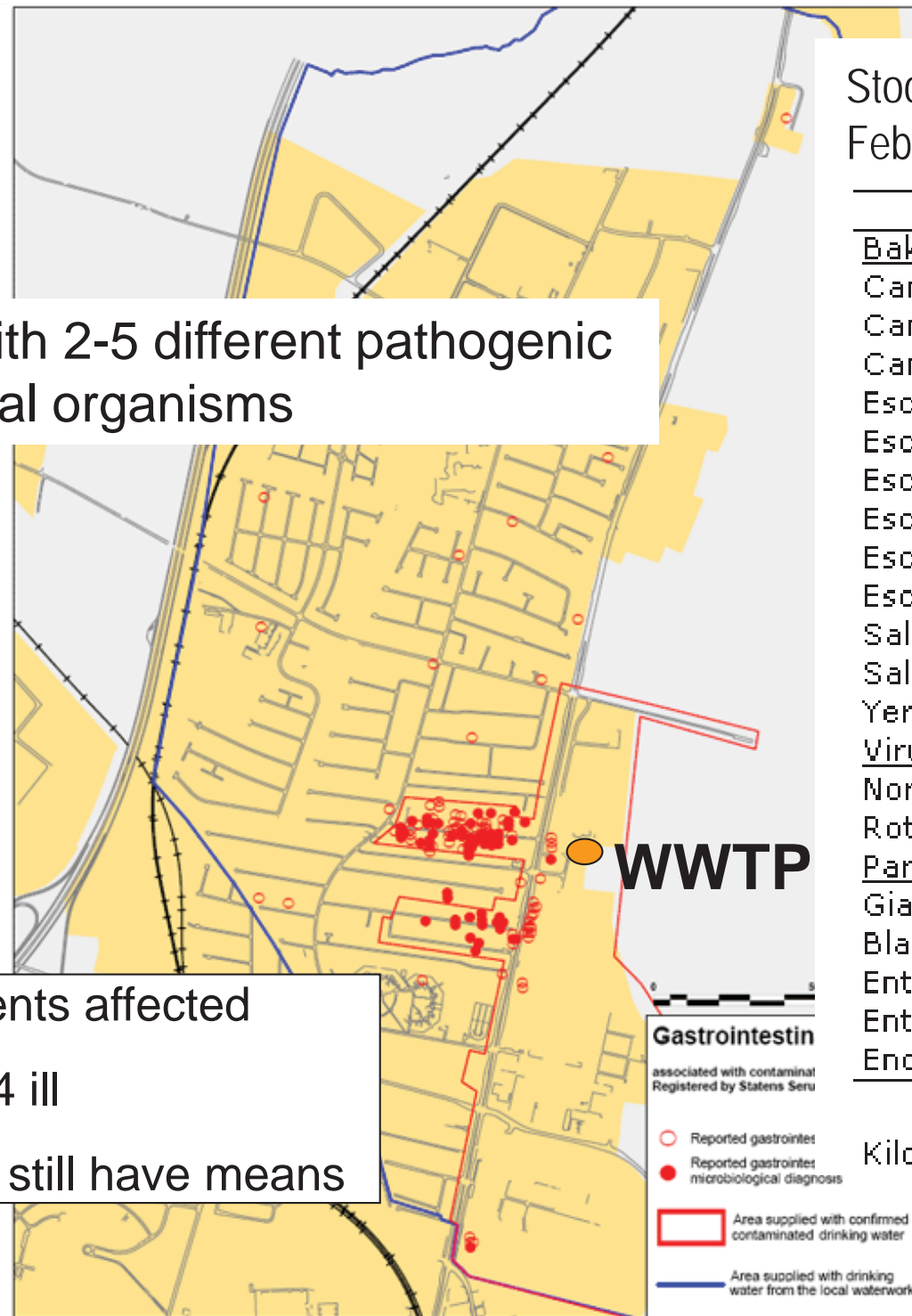
15. Jan. 2007

- 3. april 2007

7,000 citizens affected

At least 224 ill

Approx. 40 still have means



Bakterie	N
Campylobacter jejuni	16
Campylobacter coli	4
Campylobacter lari	3
Escherichia coli (A/EEC)	15
Escherichia coli (EPEC O55)	1
Escherichia coli (EPEC O119)	3
Escherichia coli (EPEC O128)	1
Escherichia coli (ETEC LT)	1
Escherichia coli (VTEC VT1+VT2)	1
Salmonella Stanley	2
Salmonella Senftenberg	1
Yersinia enterocolitica	1
<b>Virus</b>	
Norovirus	32
Rotavirus	3
<b>Parasit</b>	
Giardia intestinalis	4
Blastocystis hominis	12
Entamoeba histolytica/dispar	1
Entamoeba coli	6
Endolimax nana	2

Kilde: EPI-NYT uge 10, 2007

# Biofilm samples – hot water



Galvanized steel

Diam: 16 mm

28 days

Hot water tank

*L.K. Bagh et al., 1999, Biofouling 14 p. 37-47*

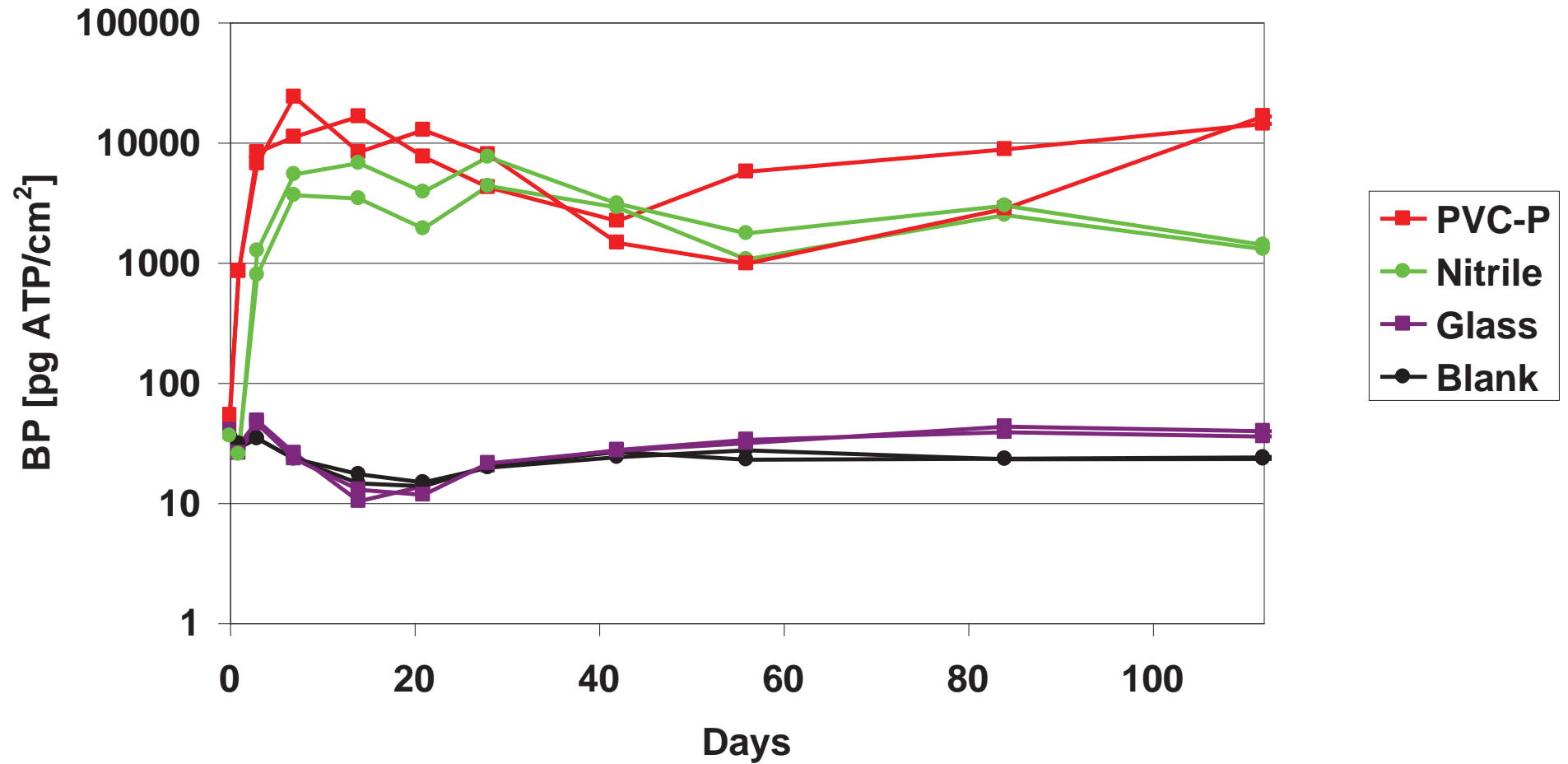
# Microbial growth at materials in water supply



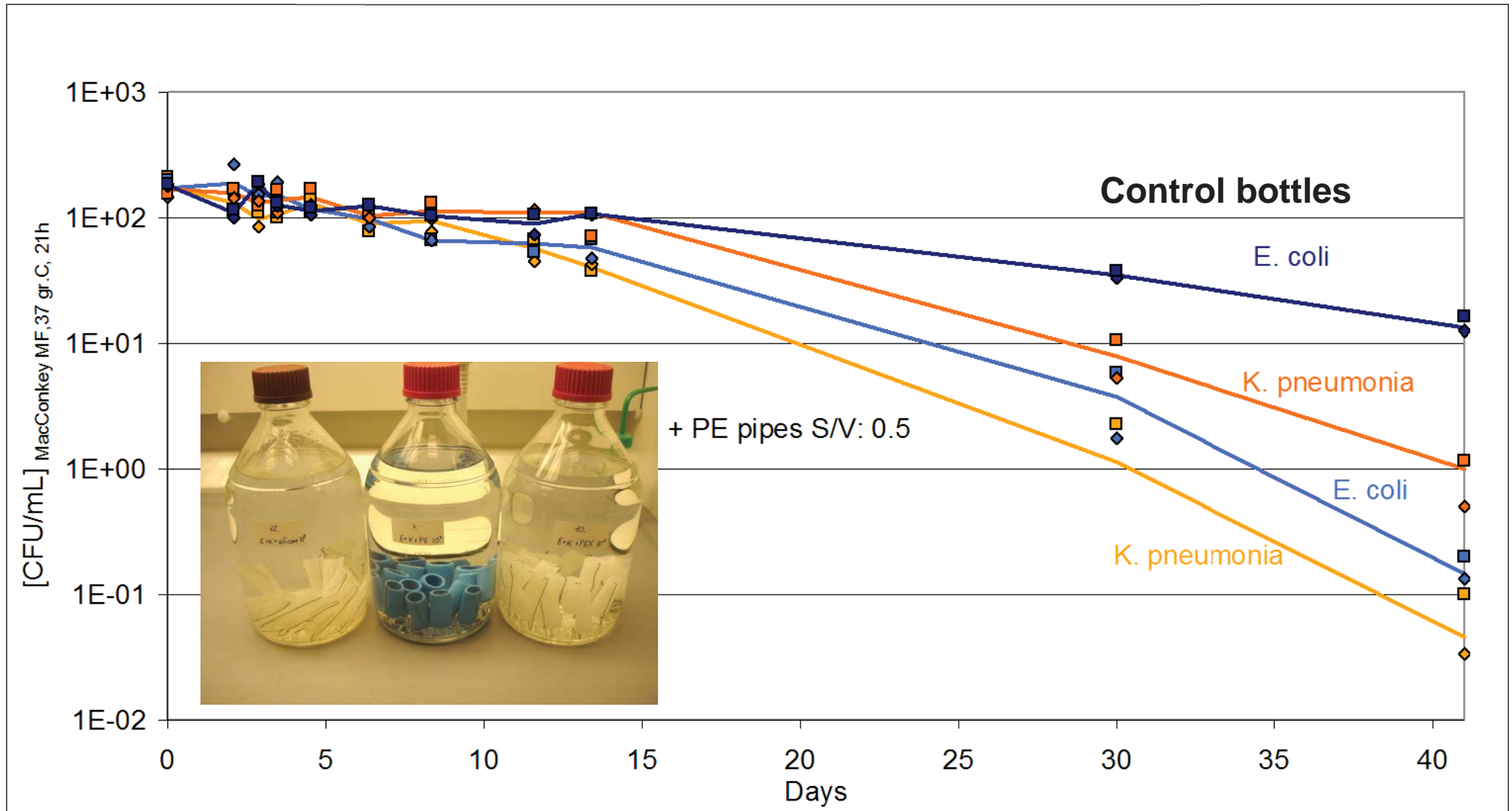


# Development over time

25° C, S/V ~ 0.17 cm<sup>-1</sup>, water exchange 1 x /week



# *K. pneumoniae*, *E. coli* (ATCC 25922) survival in contact with plast pipes



# Topic's

- Aftergrowth in the network
  - Interaction with materials (PE, rubber...)
  - Formation of biofilm
- Emerging pathogens?
- Survival and behavior of pathogens or indicators in the distribution network
  - Interaction with biofilm
  - Interaction with sediment in the distribution system