Challenging conventional sanitation options for health care units

Jelle Roorda, Anja Derksen and Nico Wortel

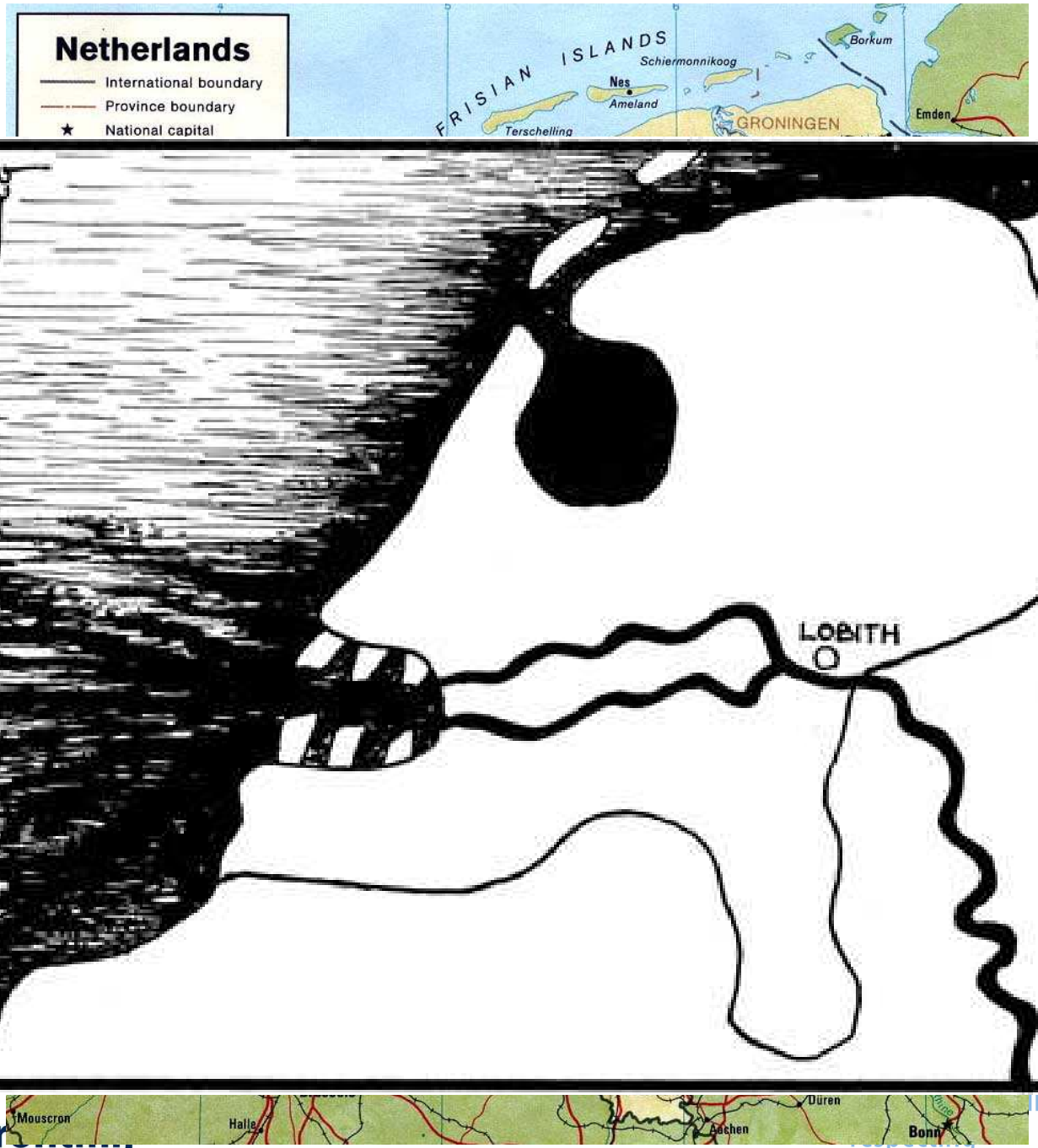
Outline

- Pharmaceuticals in water, a problem?
- Modern sanitation for health care units
  - Hospitals a hotspot
  - Concept for hospital wastewater
  - Concept for hospital urine
  - Innovative concept
- Conclusions

Pharmaceuticals in water?

- Found in treated municipal wastewater
- Found in surface water
- Found in ground water
- Found in drinking water


Netherlands
International boundary
Province boundary
National capital
Province capital
Railroad
Expressway
Road
0 10 20 30 Kilometers
0 10 20 30 Miles
WEST FRISIAN ISLANDS
Schiermonnikoog
Borkum
Nes
Ameland
Terschelling
Vlieland
Waddenzee
GRONINGEN
FRIESLAND
Emden
Delfzijl
Leer
Leeuwarden
Groningen
Harlingen
Den Burg
Texel
Sneek
Heerenveen
Assen
DRENTHE
Emmen
Hoogeveen
Meppel
Coevorden
IJsselmeer
NOORD HOLLAND
Emmeloord
Hoorn
Alkmaar
Lelystad
Dronten
OVERIJSSEL
Zwolle
Lingen
Nordhorn
Beverwijk
Purmerend
Zaanstad
FLEVOLAND
Haarlem
Amsterdam
Raalte
Almelo
Deventer
Rheine
Hengelo
Enschede
Apeldoorn
Hilversum
Amersfoort
Leiden
The Hague
Utrecht
Zeist
Ede
GELDERLAND
Arnhem
Hoek van Holland
Delft
ZUID-HOLLAND
UTRECHT
Gouda
Europoort (international seaport)
Rotterdam
Doetinchem
Vlaardingen
Nijmegen
Kleve
Emmerich
Oss
HOLLAND
Dordrecht
Goch
Wesel
's-Hertogenbosch
Waalwijk
ZEELAND
Middelburg
Breda
NOORD-BRABANT
Tilburg
Dortmund
Bergen op Zoom
Roosendaal
Helmond
Essen
Vlissingen
Eindhoven
Duisburg
Terneuzen
Venlo
Krefeld
Turnhout
LIMBURG
Brugge
Antwerp
Düsseldorf
Wuppertal
Weert
Roermond
Mönchengladbach
Gent
BELGIUM
Aalst
Hasselt
Sittard
Heerlen
Brussels
Leuven
Maastricht
Düren
Mouscron
Halle
Aachen
Bonn
North Sea
FEDERAL REPUBLIC OF GERMANY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Pharmaceuticals in water

- Low concentrations (µg/l, ng/l)
- No direct effect on human health
- What is the long-term effect on living organisms?

Pharmaceuticals in water

Modern sanitation for health care units

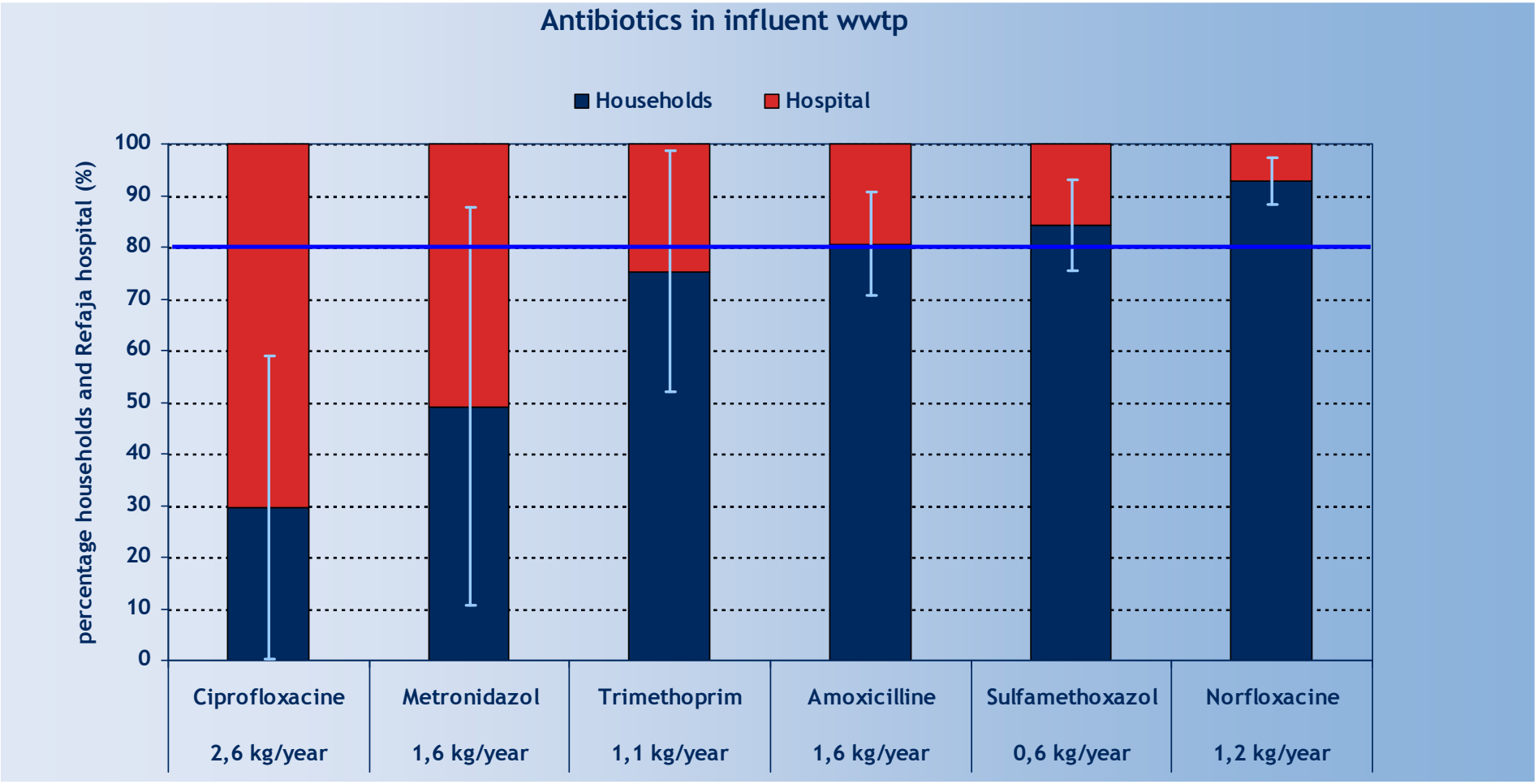
- Hospitals and other health care units hotspot for pharmaceutical emissions ?

- Possible sanitation alternatives:
  - Conventional treatment at wwtp
  - Treatment of hospital wastewater
  - Urine/Faeces separation
  - Innovative combinations

Pharmaceutical emissions

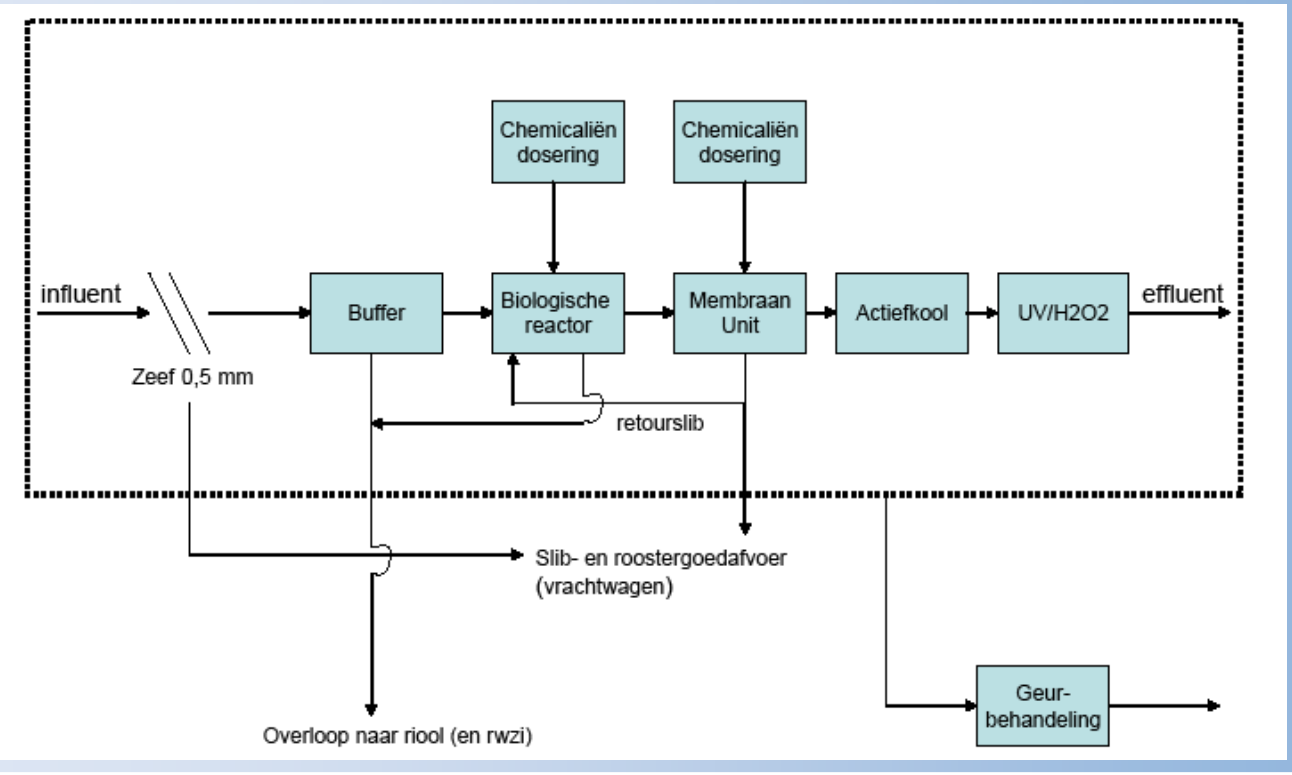
- Pharmaceutical emission from hospitals?
- Mass flow analysis hospital and wwtp:
  - Prescriptions
  - Chemical analysis
- At three hospitals in the Netherlands

Results for antibiotics



Reduction options : hospital wastewater

- City of Zwolle : ISALA hospital 2008-2012



Reduction options : urine hospitals

- City of Sleen (2008):
  - Urine separation in elderly houses
  - Removal of pharmaceuticals from urine
  - Advanced oxidation, ozone, activated carbon and other adsorption media
  - Removal up to 90%




Reduction options : urine hospitals

- City of Boxmeer (2009):
  - Urine separation in Hospital Maasziekenhuis
  - Treatment of urine with animal manure
  - N, P and pharmaceuticals
  - Difficulties:
    - Legislation: urine + manure?
    - Reuse of N and P, removal of pharmaceuticals?

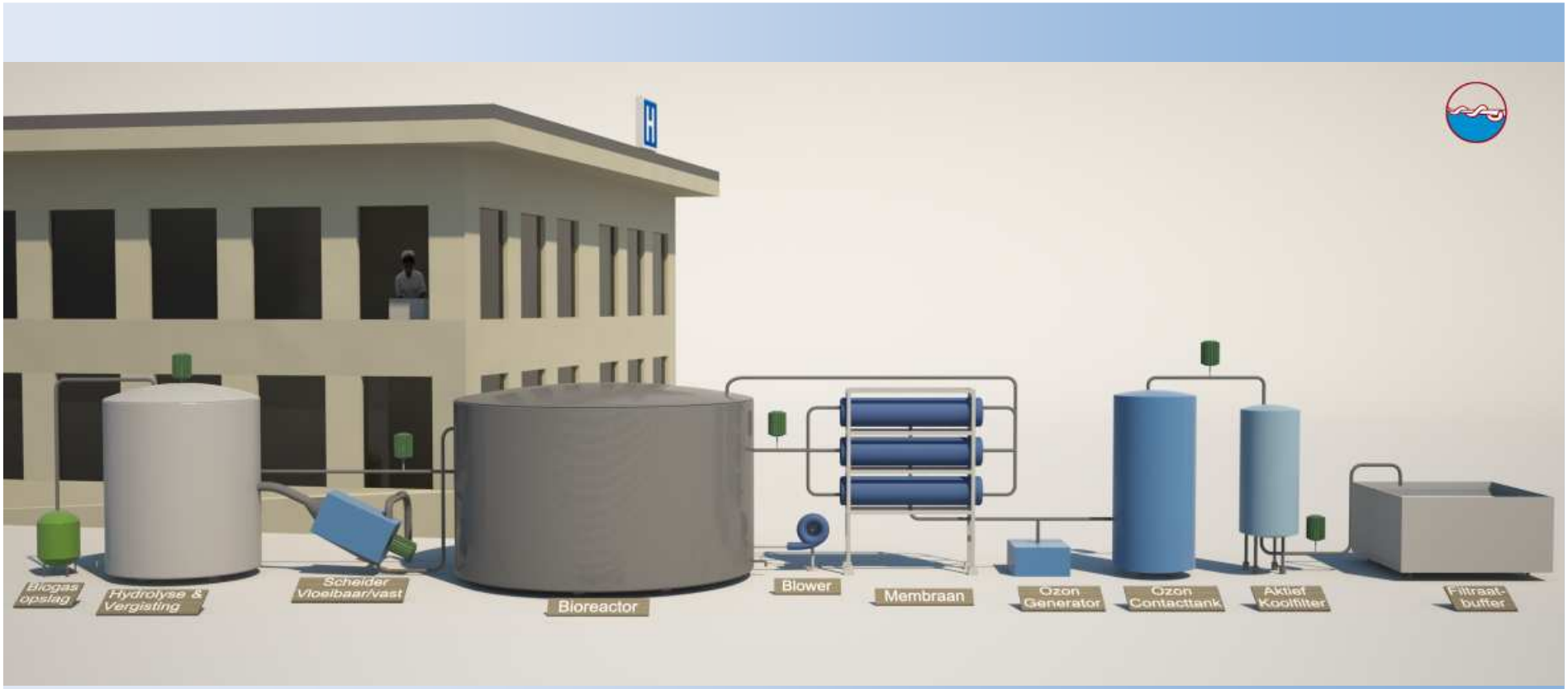

Reduction options : Pharmafilter*

- City of Delft (2008-2010) :
  - Problems with internal logistics
  - Solve by combining waste streams, through the normal internal piping system
  - Usage of biodegradable plastics for bed pans, urinals, plates *and so on*
  - Shredder material
  - Digest material

** Patent pending*

Changes in the hospital …

Changes outside the hospital



Evaluation of sanitation concepts

Scenario	Costs/year	Effect	Costs per amount of pharmaceuticals
Urine	Pharmac.: 100 k€ All: 200 k€	10%	1,0
Urine and feces	Pharmac.: 150 k€ All: 300 k€	10%	1,5
Hospital wastew.	Pharmac.: 150 k€ All: 300-350 k€	>10%	1,5
Hospital wastew. (*concentrated part*)	Pharmac.: 125 k€ All: 200 k€	>10%	1,3
WWTP	Pharmac.: 1.300 k€	75%	1,9
Pharmafilter	Costs < Benefit[a]	>10%	?

Conclusions (preliminary)

- Different sanitation options are available and possible at health care units
- Pharmaceutical emission reduction is possible, but experience with it is limited
- Modern sanitation may play an important role in reducing pharmaceutical emissions
- Innovative concepts may result in minimisation of extra costs

More information?

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