DTU

Danish Agency for Higher Education and Science

Food & Bio Cluster Denmark

Conference on

Healthy, Safe and Sustainable Foods of the Future

13 October

Save the Water in Sustainable Food Processing

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Turning the focus to saving the water

- Food industry is required to use drinking water (Hygiene Directive)

- In Denmark, high quality drinking water made from ground water appears to be a cheap and unlimited ressource
  - However, this is changing – localized scarcities, salt water intrusions, pesticides,
  - Also, discharge of wastewater is expensive
  - Sustainability of use of drinking water for cleaning?

- Elsewhere: Drinking water made from surface water, seawater and ground water – a resource that is becoming increasingly scarce

Challenges in reducing water consumption

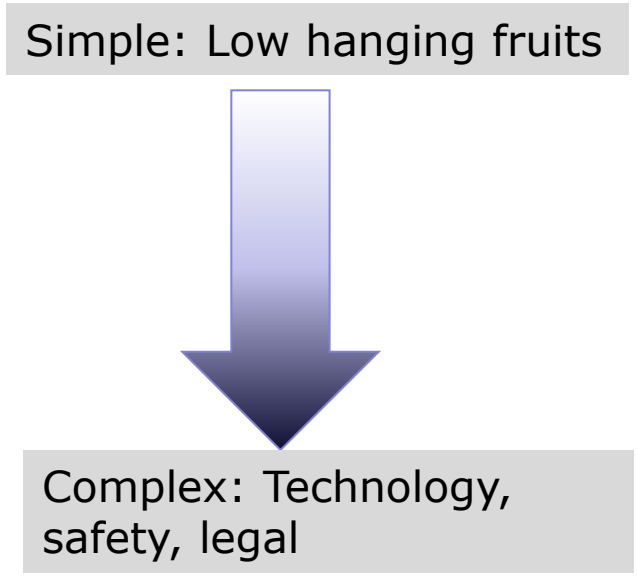
- Water is a major ingredient in foods
- Water is needed for cleaning and sanitation (food safety)
- Water is used in processes such as indirect heating, cooling, sterilization
- Current interpretation of the Hygiene Directive (Hygiene Directive EU 852/2004) emphasizes use of drinking water but clean water can be used if it can be shown that product safety is not jeopardized

3. Recycled water used in processing or as an ingredient is not to present a risk of contamination. It is to be of the same standard as potable water, unless the competent authority is satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form.

DRIP project (2015-2021)

- Aimed to reduce the water consumption in the food industry by 25% by the end of the project

- How?
  - Reduce
  - Recycle
  - Reclaim



- Participating industries save 1.44 mio. m^3/year or 32%

Water (re)use in the food industry

Drinking water

Recycled or reclaimed water (inside)

Recycled or reclaimed water (outside)

Low risk

High risk

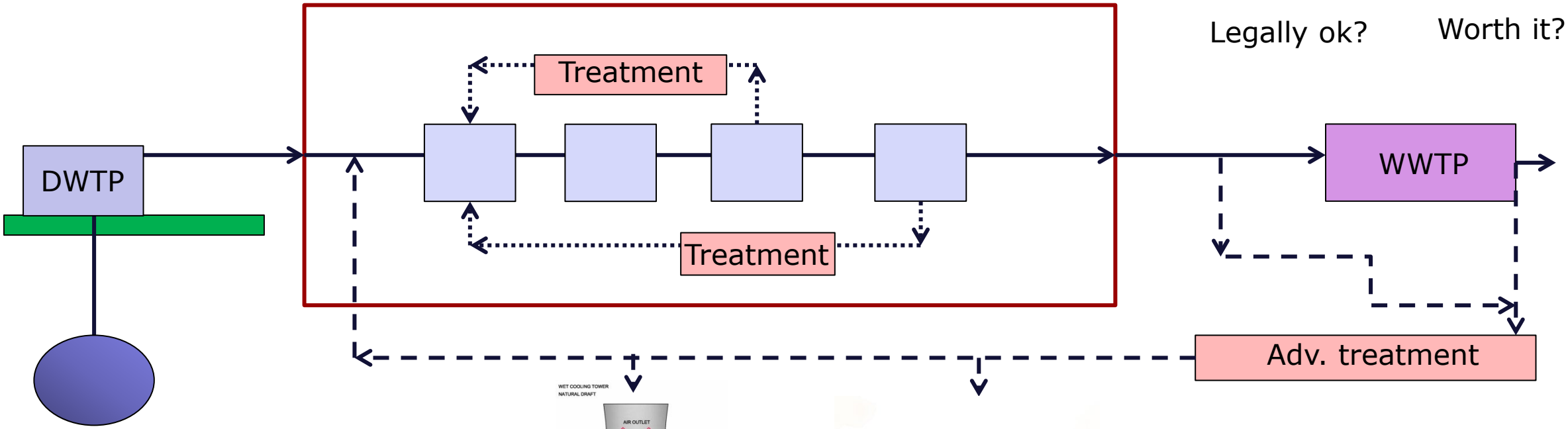
Safety – microbiology, chemistry?

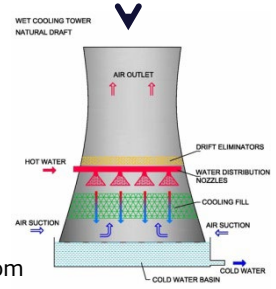
Storage?

Reconditioning treatment?

Legally ok?

Worth it?





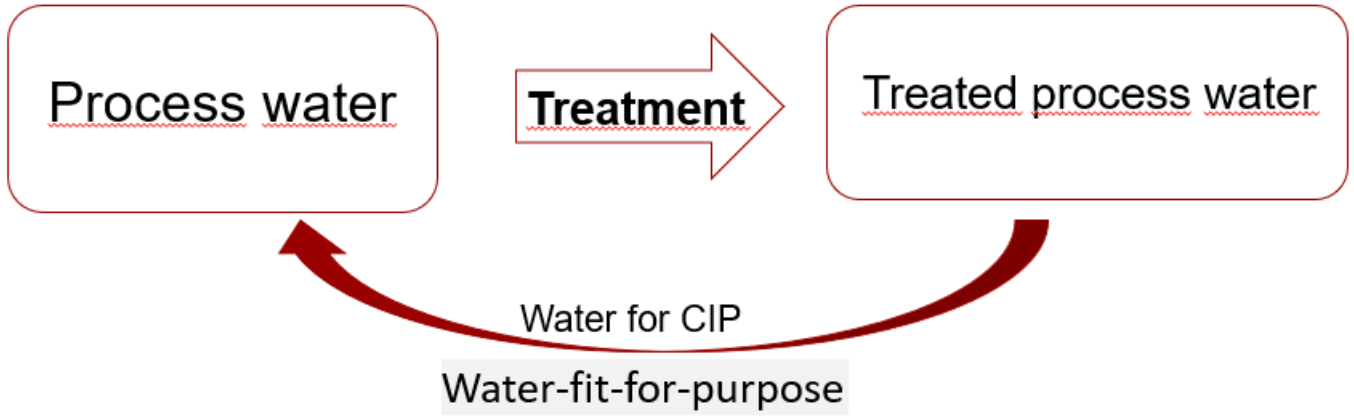
www.fansct.com

http://www.harveyfresh.com.au

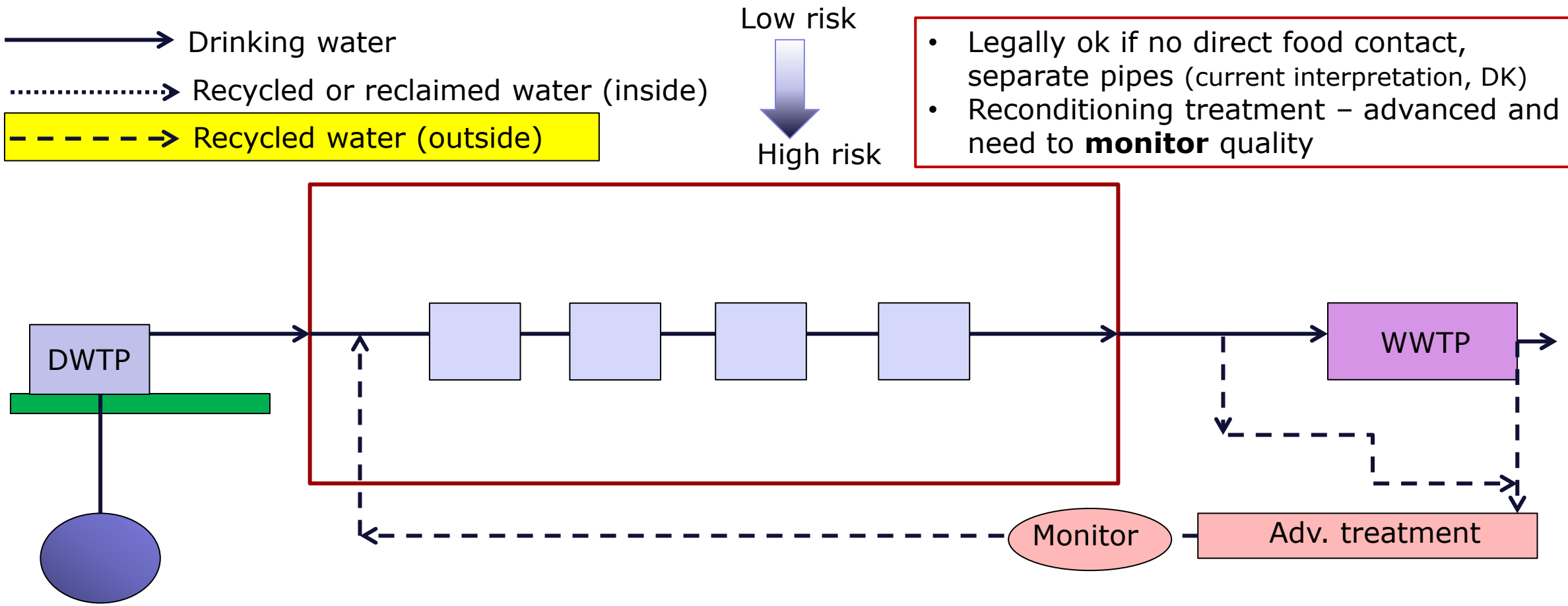
Reclaim example: CIP to CIP

- Use of treated process water in clean-in-place (CIP) operations in a food plant could save significant amounts of potable water (>50%))

- The **process water** is collected after CIP cleaning and is currently sent to the municipal wastewater treatment plant**, so, why not treat this for (re)use in CIP?**



Bigger picture



What is in the process water?

- Drinking water
- Product residues (from product push)
- Cleaning chemicals
- Biocide residues

Approved for cleaning of food contact areas

Identification of hazards

- **Biological**
  - Bacteria
  - Viruses
  - Moulds
  - Parasites

Input from product, drinking water, hygiene

No input of black water

No input of surface water

Prevalence expected to be very low

- **Chemical and physical**
  - Sharp physical objects
  - Biocides, acid and bases
  - N-compounds, e.g., nitrates
  - Functional compounds, e.g. dimethylpolysilozane (antifoaming)

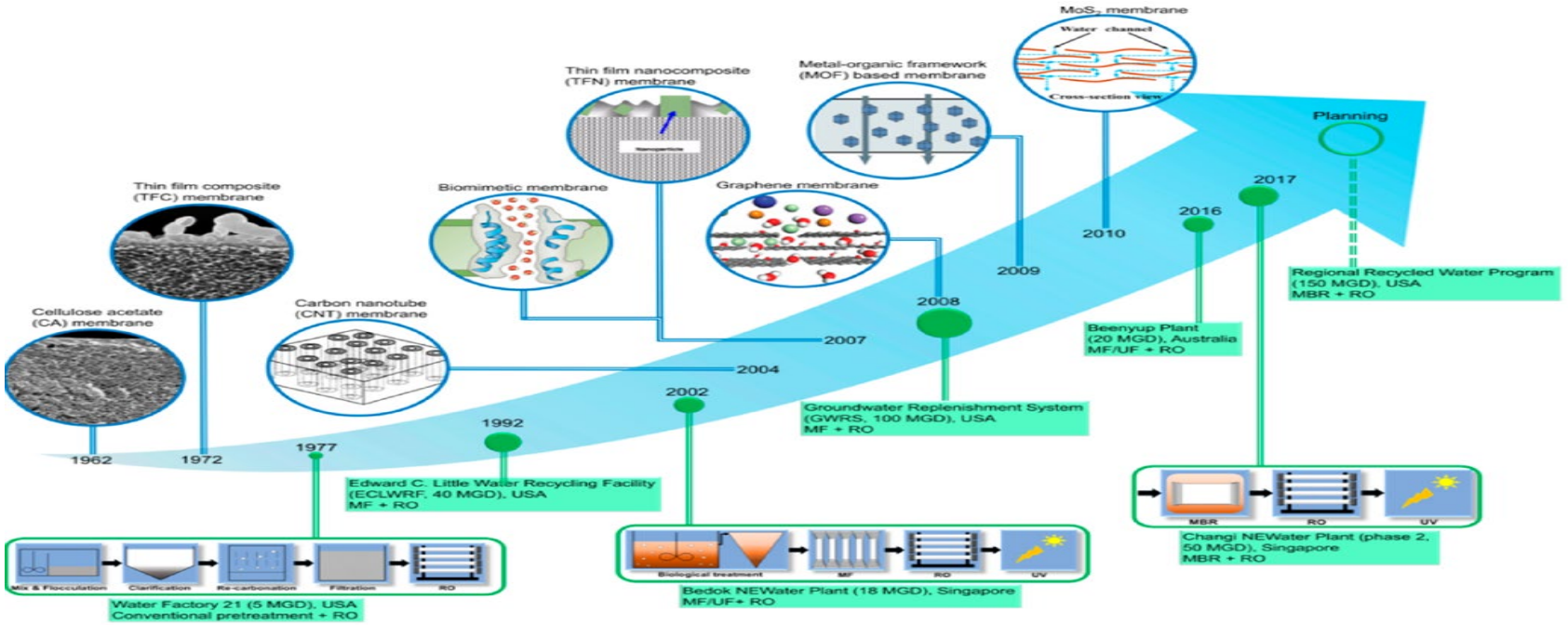
Physical very low prevalence

Daily/regular use for cleaning chemicals

Food grade

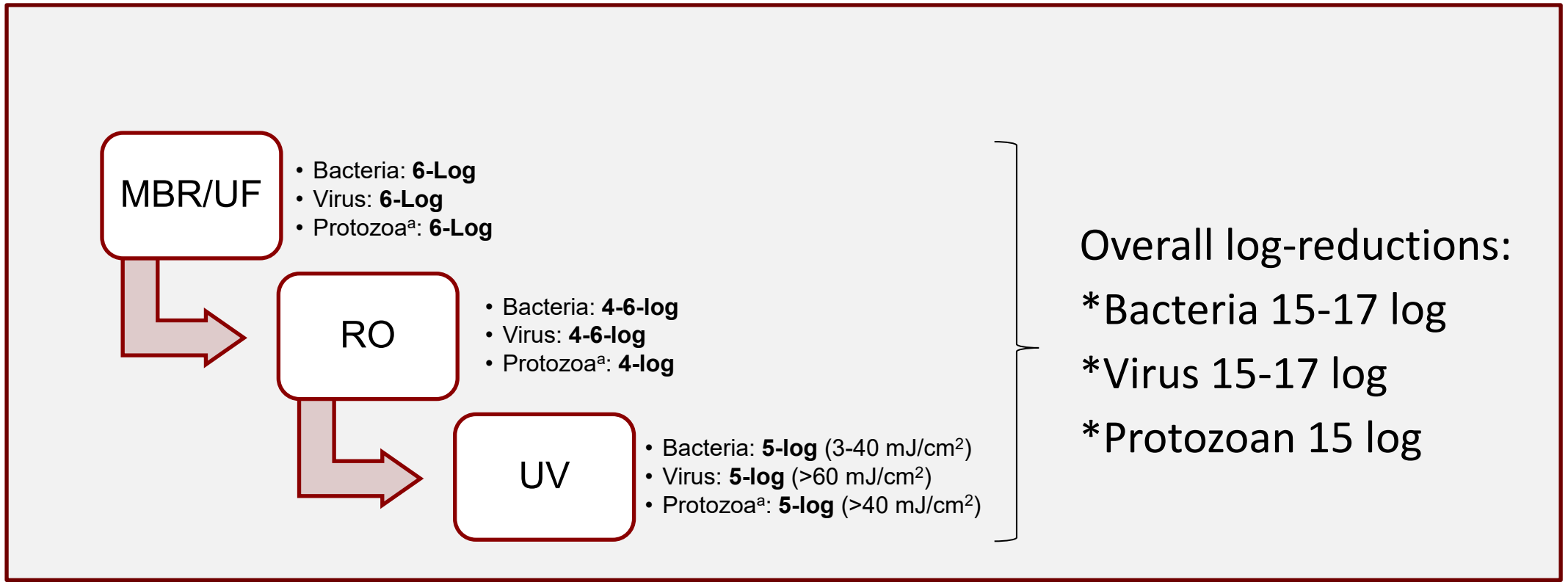
Advanced water treatment – multi-barrier approach

MBR/UF → RO → UV → ClO_2



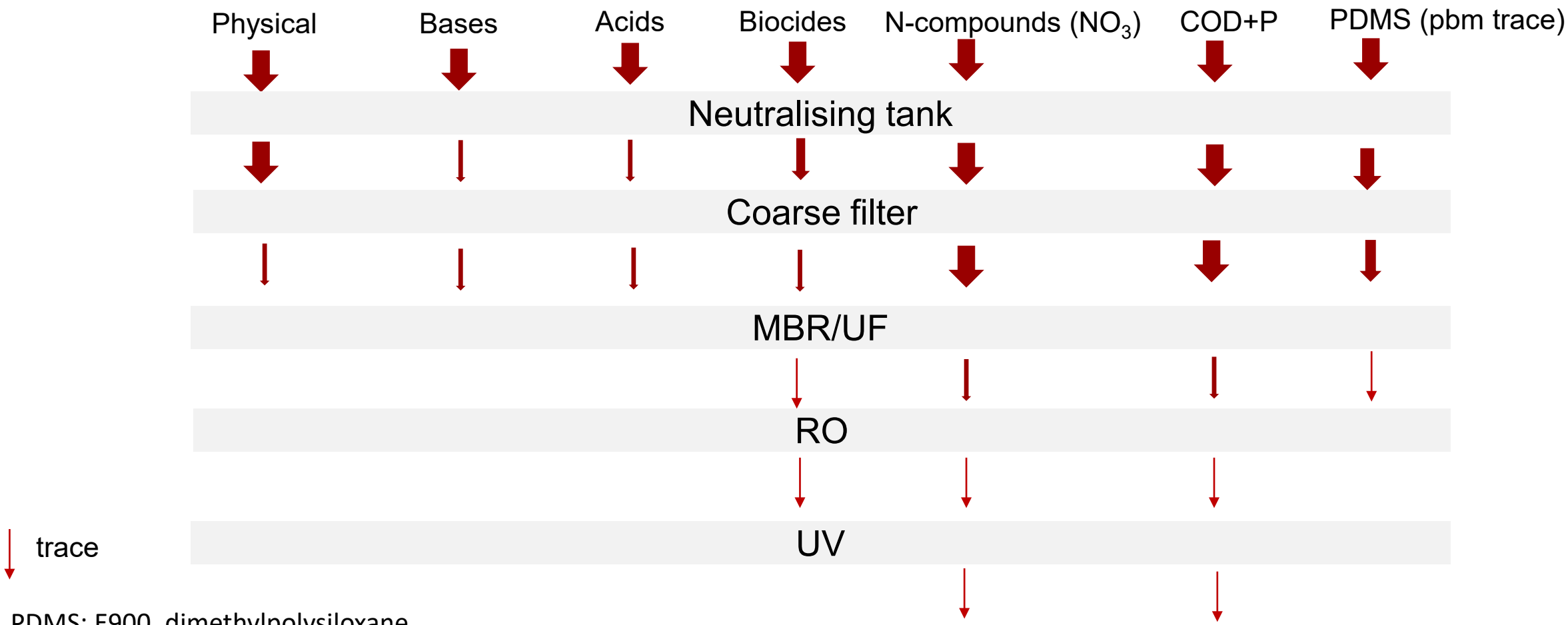
Tang et al. 2018 Environ. Sci. Technol. 2018, 52, 10215−10223

Calculation of microbial risk reduction through the treatment



If ClO_2 is implemented -> additional 2 log reductions

Calculation of relative removal of chemical hazards



PDMS: E900, dimethylpolysiloxane

Conclusions and future research

- **Water-for-purpose** and **treatment technologies** enable large savings in water consumption without compromising **food safety**

- **Payback**: Needs to be worth it – push and pull – or no choice due to **water scarcity**

- **Research questions:**
  - What is the long-term effect of the use of different water?
  - Are our predictions of microbial and chemical treatment effect accurate?
  - Can we further improve our treatment to remove calcitrant organic compounds?
  - How can we best monitor that the water remains fit-for-purpose?
  - Does reuse of water change wastewater emissions, treatment and the recipient

Questions?

DRIP
Water efficient industrial food production

Innovationsfonden
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