

# Waterborne infections and the workplace

## Nedlac and NIOH Covid-19 Legacy Programme

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# Presentation Outline



*“Ensure availability and sustainable management of water and sanitation for all.”*

- Introduction
- Workplace exposure
- The complexity of the situation
- Conditions favouring microbial growth in premise plumbing systems (PPSs)
- What can be done?
- What we do
- Take home message

# INTRODUCTION

Water is essential for life but can also lead to illness when it is contaminated by disease-causing organisms.

## What are waterborne infections?

- Result from the consumption, inhalation, or contact with contaminated water
- Implicate compromised water, sanitation, and hygiene (**WASH**).

## Waterborne pathogens

- Infectious microorganisms commonly transmitted through contaminated water including bacteria, viruses, and protozoa
- A majority are linked to fecal sources on land (e.g., *Escherichia coli* O157:H7 and *Cryptosporidium*)
- Others occur naturally in waterbodies (e.g., *Vibrio* spp., and *Legionella* spp.)
- Gain entrance into EWS, multiply to harmful levels, and infect exposed individuals.

## John Snow and the cholera outbreak of 1854



**169 years later the battle against cholera continues unabated**

Waterborne microbial hazards, continue to be of primary concern in both developing & developed countries (WHO, 2011) Guidelines for drinking-water quality.

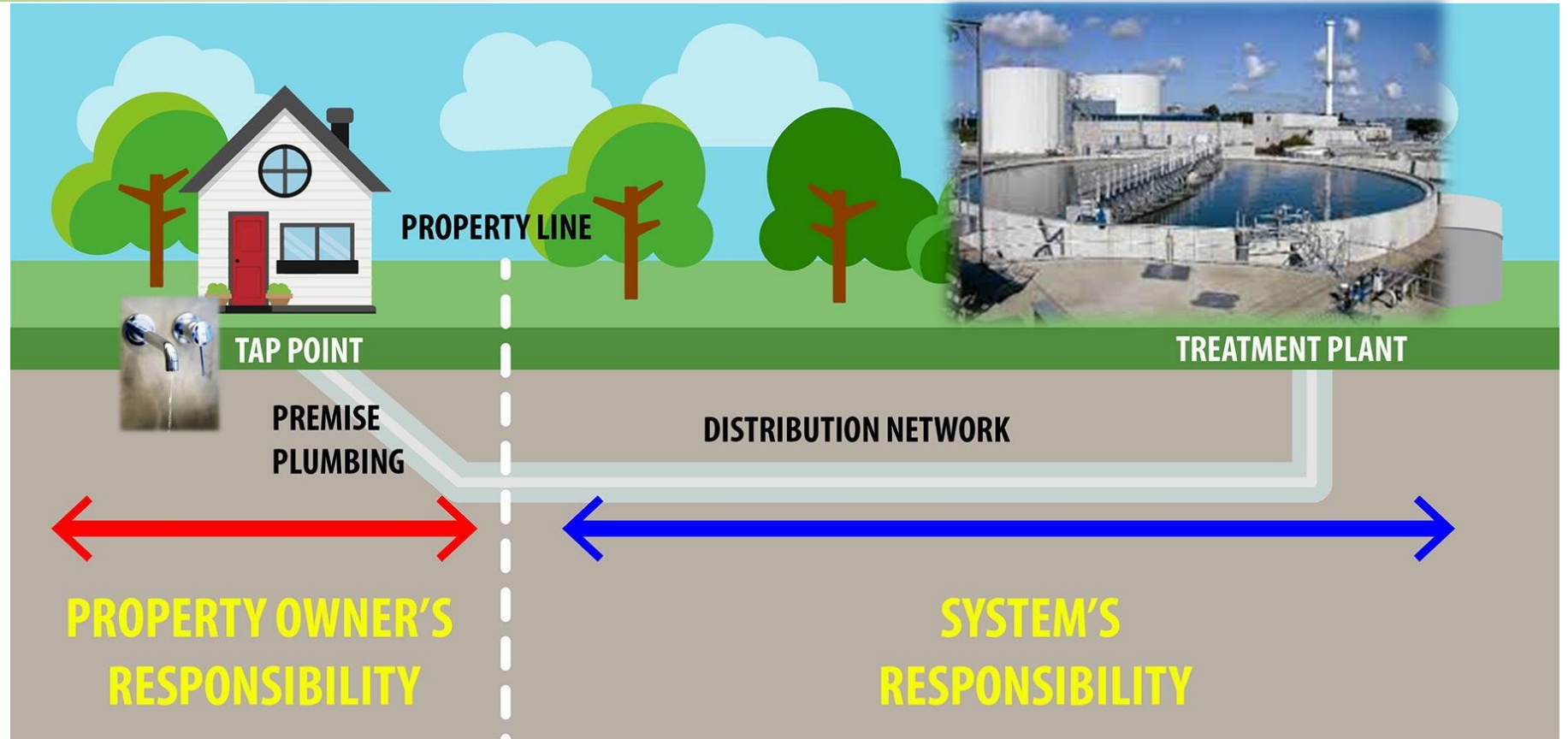
**Novel microbes and antimicrobial resistance**

# Workplace exposure

1. Healthcare workers working with water-related devices that generate aerosols.
2. Sanitation workers (WWTP workers, septic tank and pit toilet emptiers, plumbers etc.)
3. Emergency relief workers (natural disasters like floods, cyclones, tsunamis)
4. Maintenance technicians of air-conditioning or water supply systems, plumbers etc.
5. Laboratory personnel working with potentially contaminated water samples
6. Agricultural workers and landscapers using alternative water sources e.g. treated municipal effluents (RW), grey water, and roof harvested rain water.
7. Professional drivers at increased risk of Legionnaires' disease.
8. Workers at cooling tower facilities

# The complexity of the situation

- Water entering a building is **fit for intended use = SAFE** but it is **not sterile**.
- May contain some pathogenic waterborne microorganisms e.g. **OPPPs like *Legionella*** even at acceptable levels of the indicator bacteria.
- In South Africa, potable water is required to meet drinking water standards South African National Standard (SANS) 241.

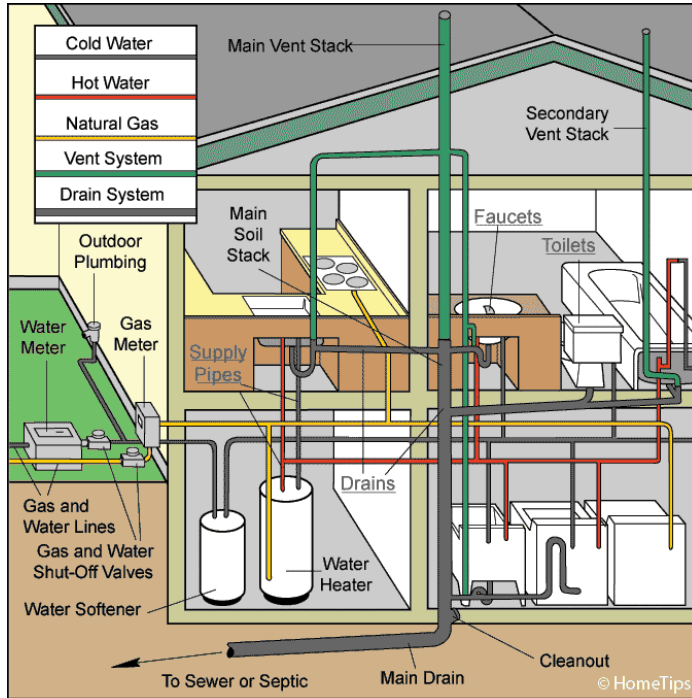


Pierce et al., 2019. Sources of and solutions to mistrust of tap water originating between treatment and the tap: Lessons from Los Angeles County

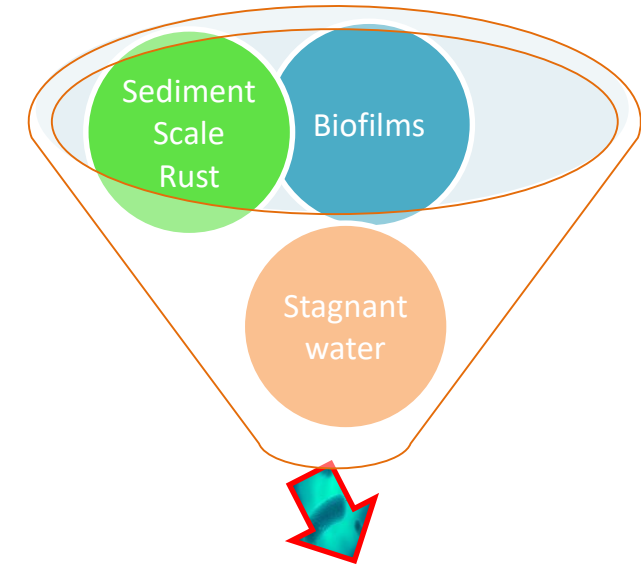
**Microbiological hazards** can arise at any point from 'treatment to tap or point of use'.

# Conditions that favour microbial growth in PPSs

## Large complex buildings



- Long network of pipes
- Disinfectant loss
- Intermittent/reduced usage
- Biofilm development
- Aging infrastructure
- Poorly designed buildings



Perfect *microbial* breeding ground!

## If not well managed

- Water quality issues
- Microorganisms proliferate
- Compromised water quality
- Waterborne infections



**What can be done?**



# Managing water use patterns

- Managing water turn-over in the system to control microbial growth
- Maintains low water age
- Helps in the delivery of fresh water in the building

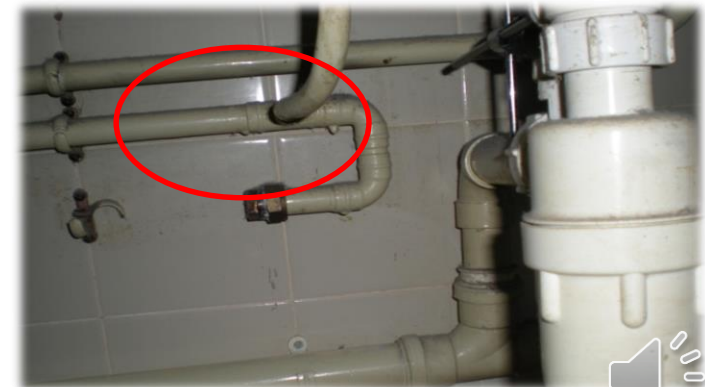
## Design consideration

- Automatic flushing devices for large buildings
- Dead ends/legs must be avoided

## Maintenance consideration

- Routine manual flushing program or remedial measure
- Flushing water is site specific: follow the correct procedure

Dead-ends





# Managing distal ends

- The distal section has a number of unique features that are favourable to biofilm and microbial growth.

- Faucets
- Showerheads
- Thermostatic mixing valves
- Backflow valves
- Interconnection piping
- Aerators

**INCREASED SURFACE  
AREA FOR BIOFILM  
FORMATION**

- Characterised by **small diameter piping** and a **large surface-to-volume ratios**.
- Stagnation issues



# Controlling Biofilm and Microbial proliferation at distal points

## Design considerations

- Limiting the number of outlets, **TOO MANY WILL LEAD TO STAGNATION**
- Preventative flushing procedures e.g. **weekly** for emergency showers
- Use of bio-stable materials
- Minimise the surface area available for biofilm growth
- Using thermostatic valves should be carefully weighed against the risk of scalding and only used when justified by risk assessment:

**BIOFILM GROWTH AND LEGIONELLA PROLIFERATION**

## Waterborne Pathogens Unit, NIOH

- Accredited for microbiological water quality testing (drinking to treated wastewater)
- Respond to queries on microbiological water quality
- Research and human capacity development in the water sector through postgraduate student training.

# TAKE HOME MESSAGE

In a post-COVID-19 world, it is important to acknowledge the hazards that waterborne pathogen infections can pose to the public, and that appropriate prevention is implemented to minimize risks.

- More proactive than reactive
- Know your system- you can not manage what you do not measure
- You are not taken by surprise when there is an influx of guidance documents
- **Guidance documents are not a one-size-fit-all**
- End-point testing (regular monitoring) is just a snapshot, addresses only parts of the system
- False sense of security
- **Apply TQM and weakest link theories**
- **Water quality management system esp. for high-risk buildings**
- **On-site risk assessments by competent person(s)**
- **Review risks and control measures periodically**

**Beware of the first flush!**



**THANK YOU**

