Decontamination
The importance of good quality final water

Water safety in hospitals,

Sted: Oslo universitetssykehus, Ullevål

Tid: 28. november 2023

16:20 – 16:50

WALKER ON WATER

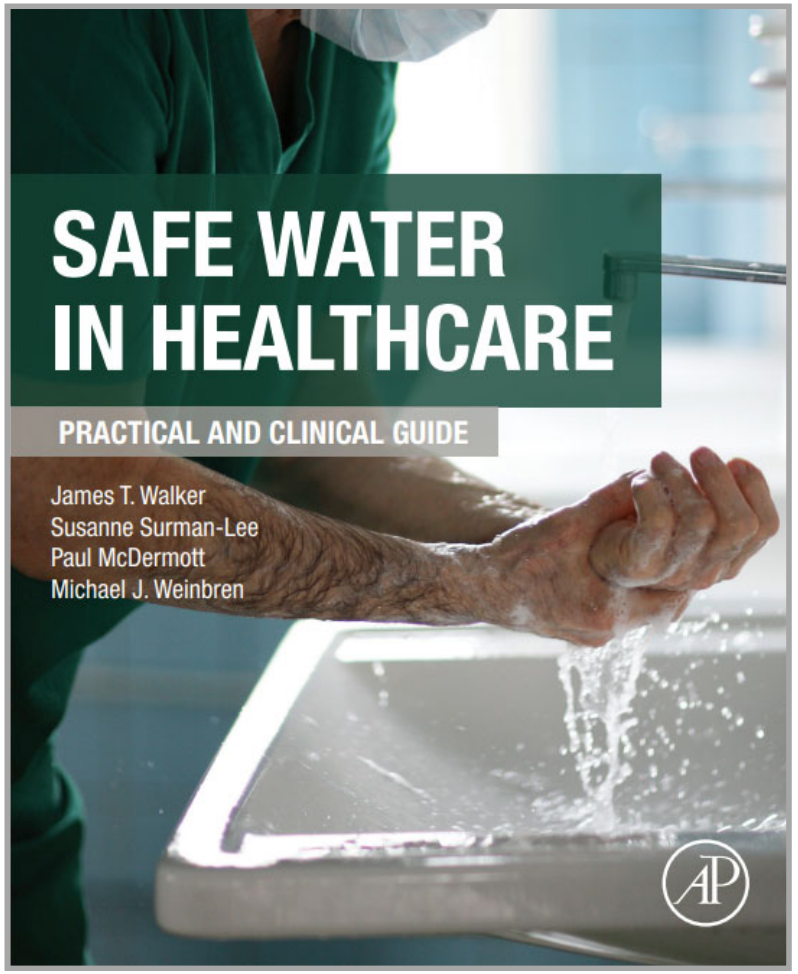
Declarations

Working with the Scottish Health Inquiry to provide expert advice on water microbiology

Provide expert consultancy advice to IDEXX

Chairman of the Central Sterilising Club

Work with other experts to write technical manuscripts and books on safe water issues



Content

Importance of good water supply to your hospital

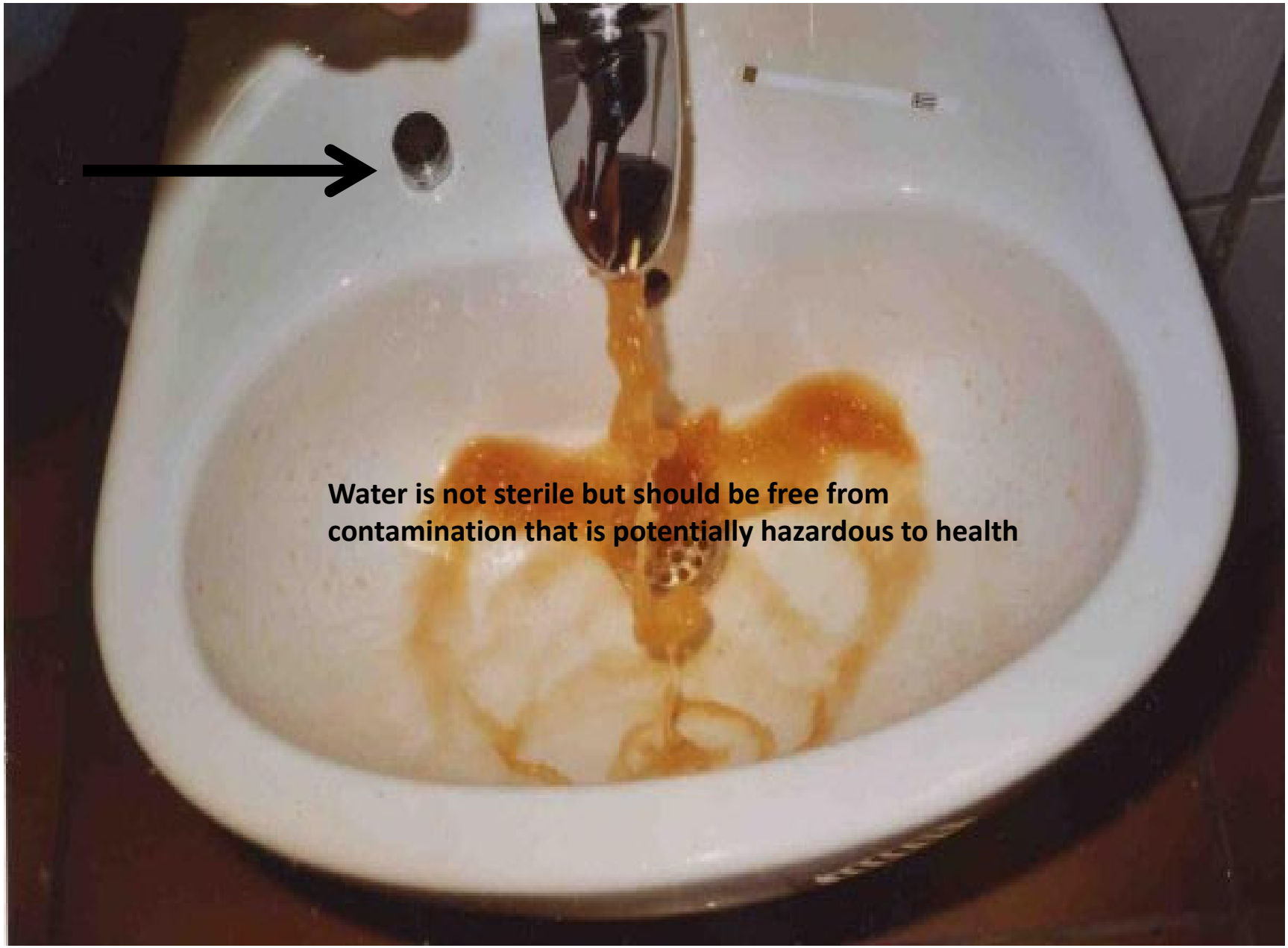
Review water supply and use in a hospital decontamination unit

Define factors in a water system that encourage biofilms and present microbial risks to the user?

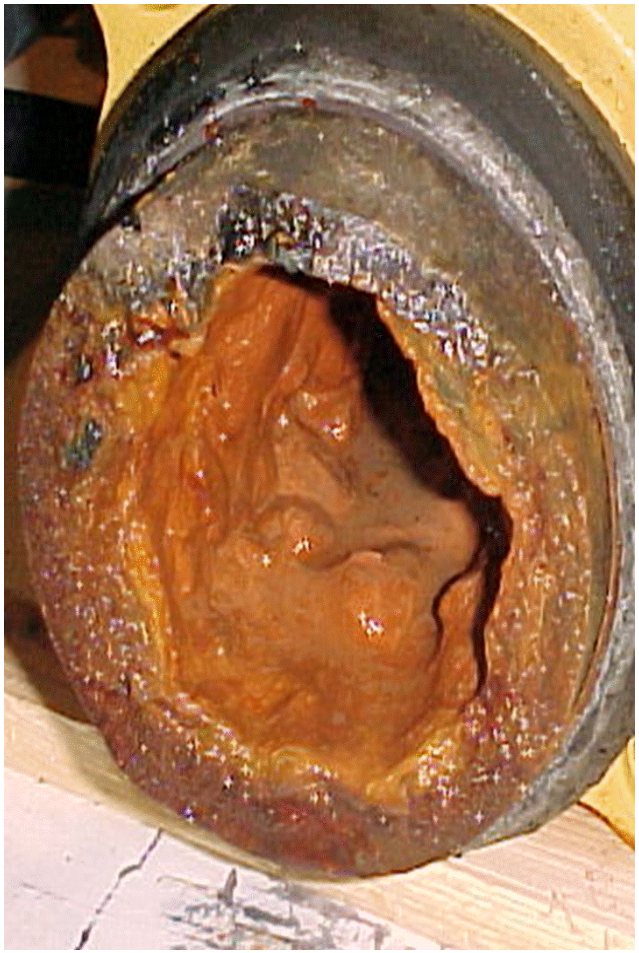
Consider quality of water for manual cleaning of surgical instruments and automated washer disinfectors and flexible endoscopes

Discuss water sampling and control strategies

Pure clean water?


Water is not sterile but should be free from
contamination that is potentially hazardous to health

Contaminants in your supply can significantly impact on cleaning process




逆浸透装置
濃縮水
ーン水


PURE AQUA, INC.
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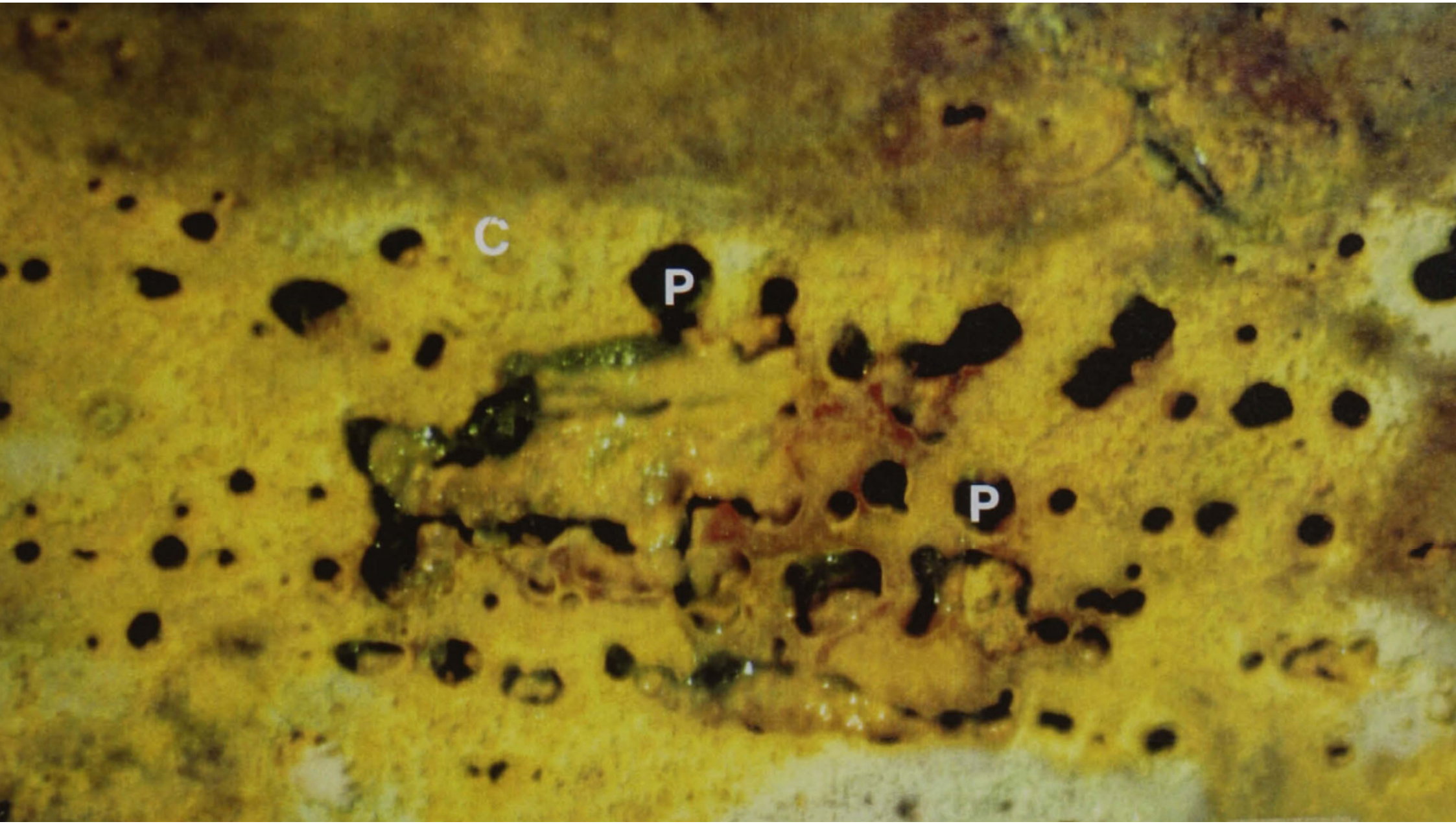
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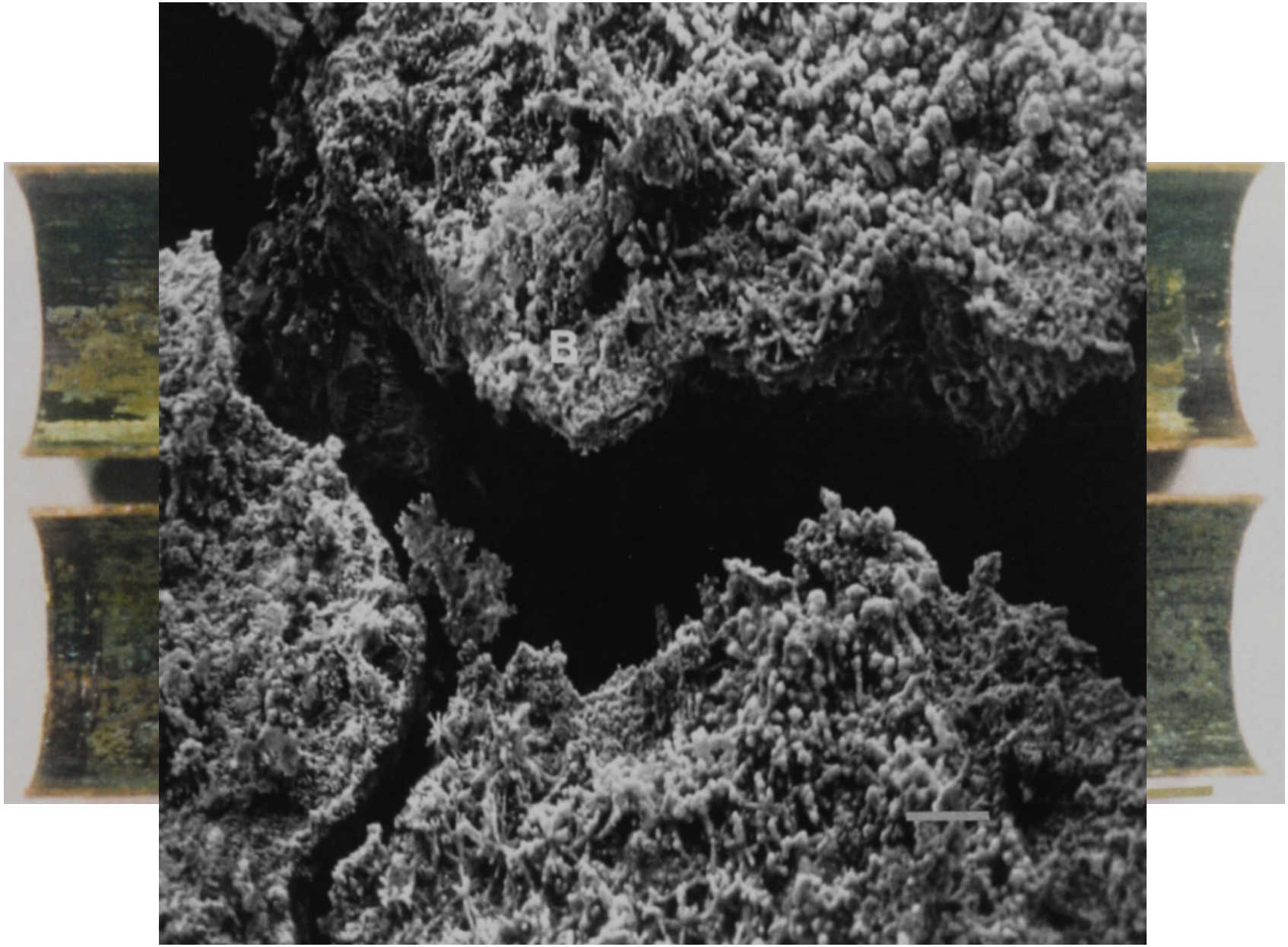
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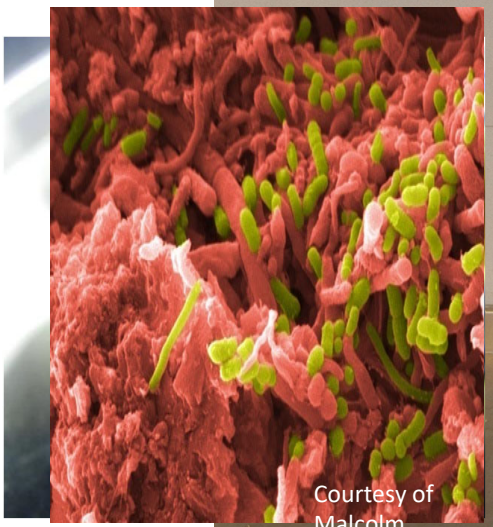
Water for CSSD – planning?

- **Analyse the CSSD's water quality based on the data over 12 months (may be available from the local water supplier).**
- **Is the existing hot and cold water system in the hospital capable of supplying the new unit?**
  - **without creating supply problems to the other hospital departments**
  - **or leading to stagnation that may lead to legionellae colonisation**
- **Decide on the water treatment plant required for the final rinse and control regimen e.g. chemical (high residual chlorine impact on RO)**
- **Determine if the water treatment plant and water storage is to be housed within the endoscopy unit or sited elsewhere. If within the unit, where will it be sited? Is there sufficient space?**

Factors affecting water quality

- **Water hardness - dissolved salts of alkaline metals (principally calcium, magnesium, barium and strontium) result in deposits on load items and may impair spray nozzles, detergents and disinfectants**
- **Ionic contaminants (for example, heavy metals, halides, phosphates and silicates)**
- **Water deposits**
- **Bacterial endotoxins**
- **Total organic carbon**
- **Microbial contamination**

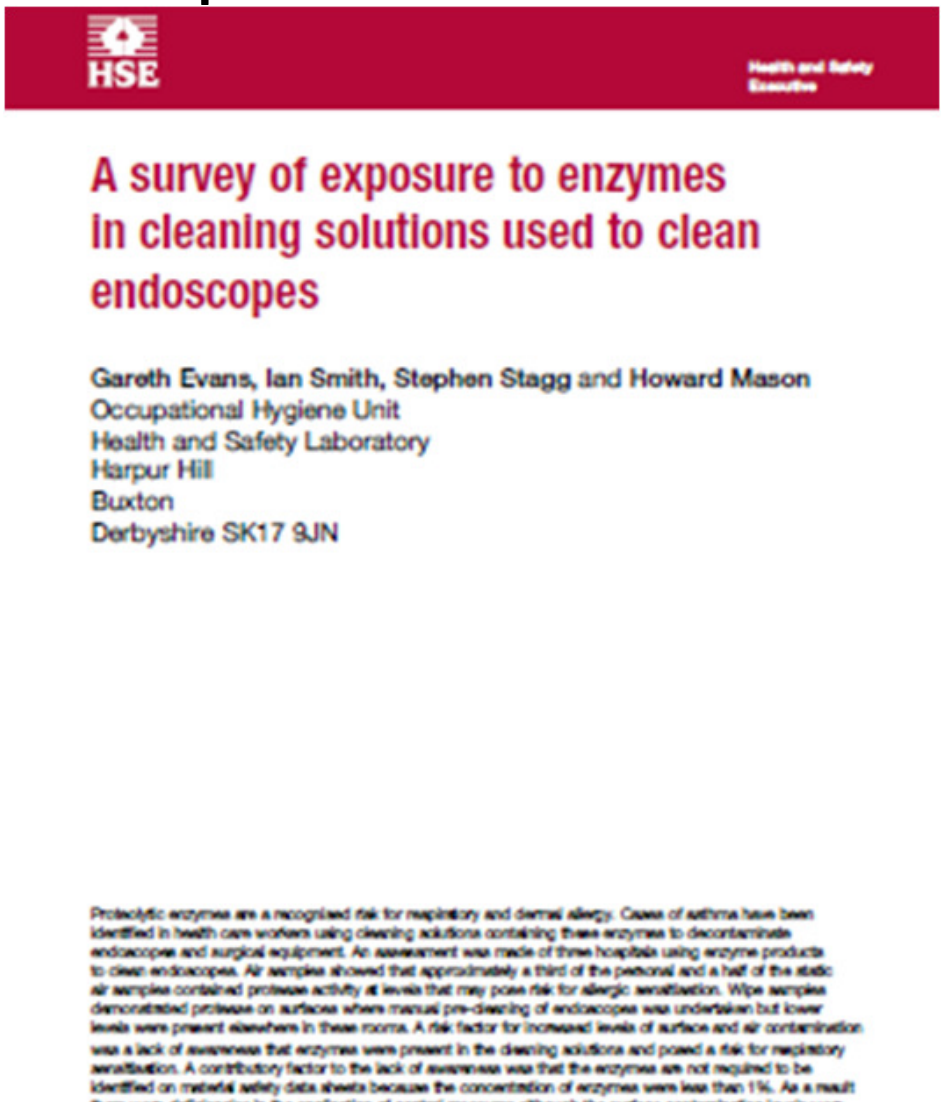


Courtesy of Malcolm Greenhalgh

Dispersal of droplets and exposure of staff

Occupational Exposure

- **Enzyme based solutions**
- **Endoscopy decontamination**
- **Reprocessing surgical equipment will pose a risk to the health of workers**



HSE

Health and Safety Executive

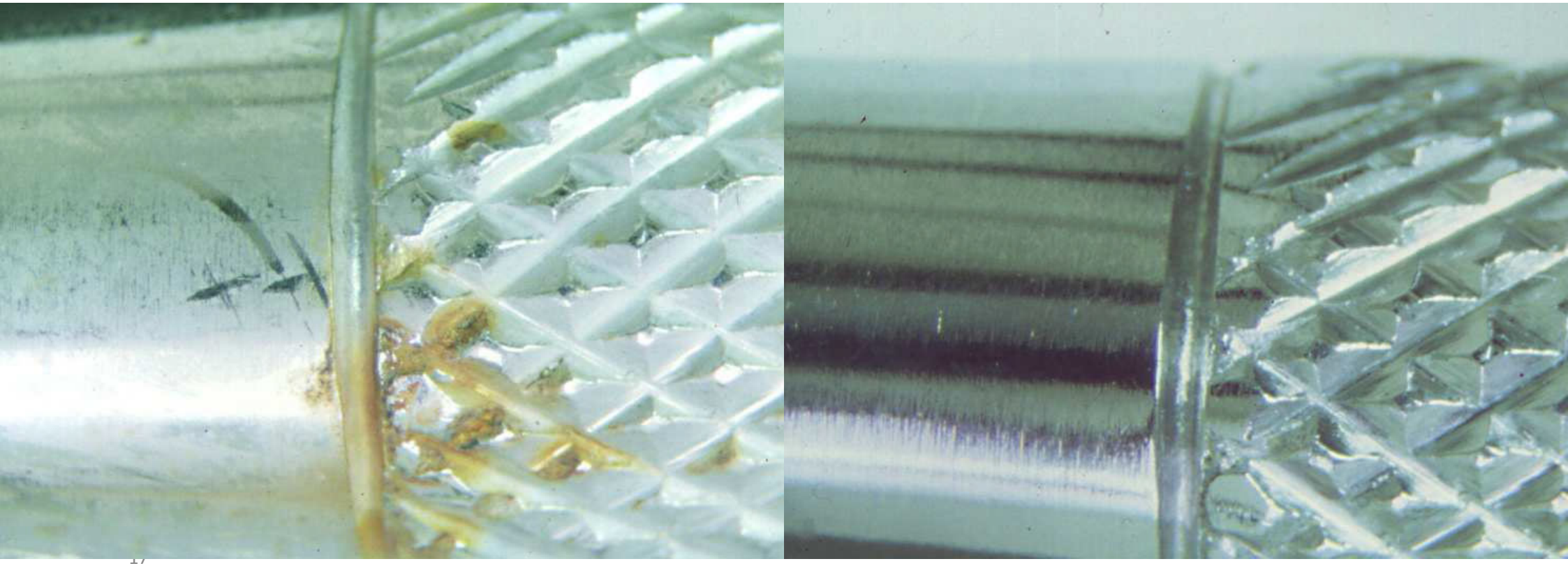
A survey of exposure to enzymes in cleaning solutions used to clean endoscopes

Gareth Evans, Ian Smith, Stephen Stagg and Howard Mason
Occupational Hygiene Unit
Health and Safety Laboratory
Harpur Hill
Buxton
Derbyshire SK17 9JN

Proteolytic enzymes are a recognised risk for respiratory and dermal allergy. Cases of asthma have been identified in health care workers using cleaning solutions containing these enzymes to decontaminate endoscopes and surgical equipment. An assessment was made of three hospitals using enzyme products to clean endoscopes. Air samples showed that approximately a third of the personal and a half of the static air samples contained protease activity at levels that may pose risk for allergic sensitisation. Wipe samples demonstrated protease on surfaces where manual pre-cleaning of endoscopes was undertaken but lower levels were present elsewhere in these rooms. A risk factor for increased levels of surface and air contamination was a lack of awareness that enzymes were present in the cleaning solutions and posed a risk for respiratory sensitisation. A contributory factor to the lack of awareness was that the enzymes are not required to be identified on material safety data sheets because the concentration of enzymes were less than 1%. As a result

Consequences of poor water

- **Water hardness (Calcium, magnesium) can cause scaling and deposits in the washer disinfector or on instruments**

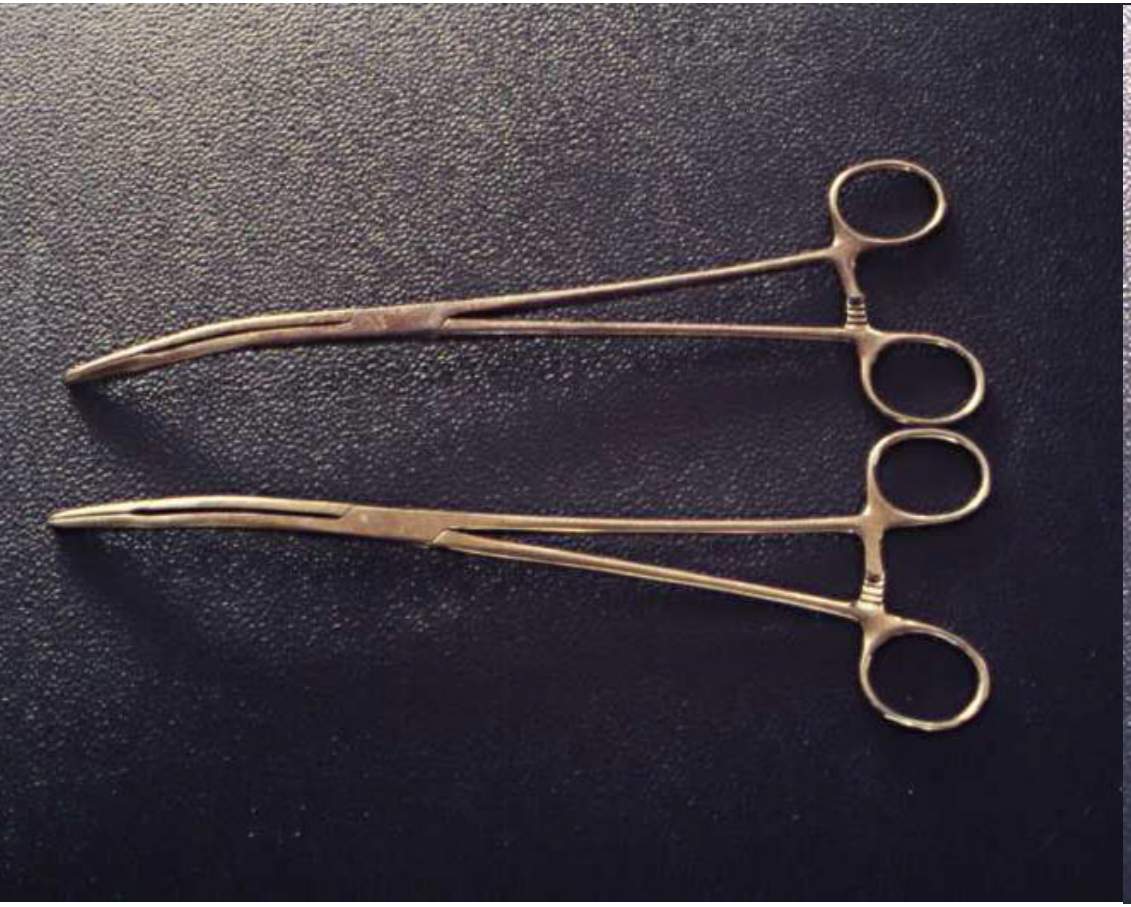


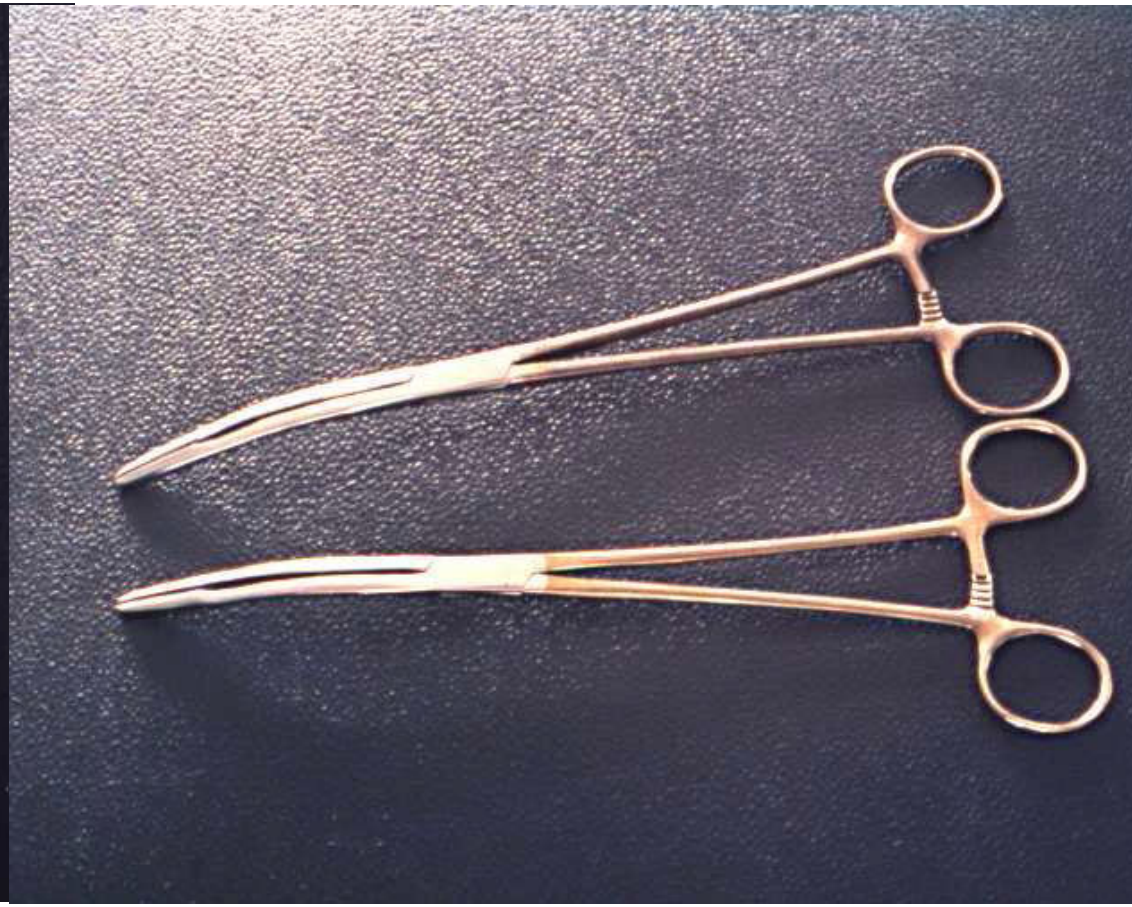
Heavy and non ferrous metals (e.g iron, manganese and copper)

- **Results in dark discolouration's and deposits**

Silicic acids and silicates

- **Stubborn yellow brown or bluish violet glaze deposits**



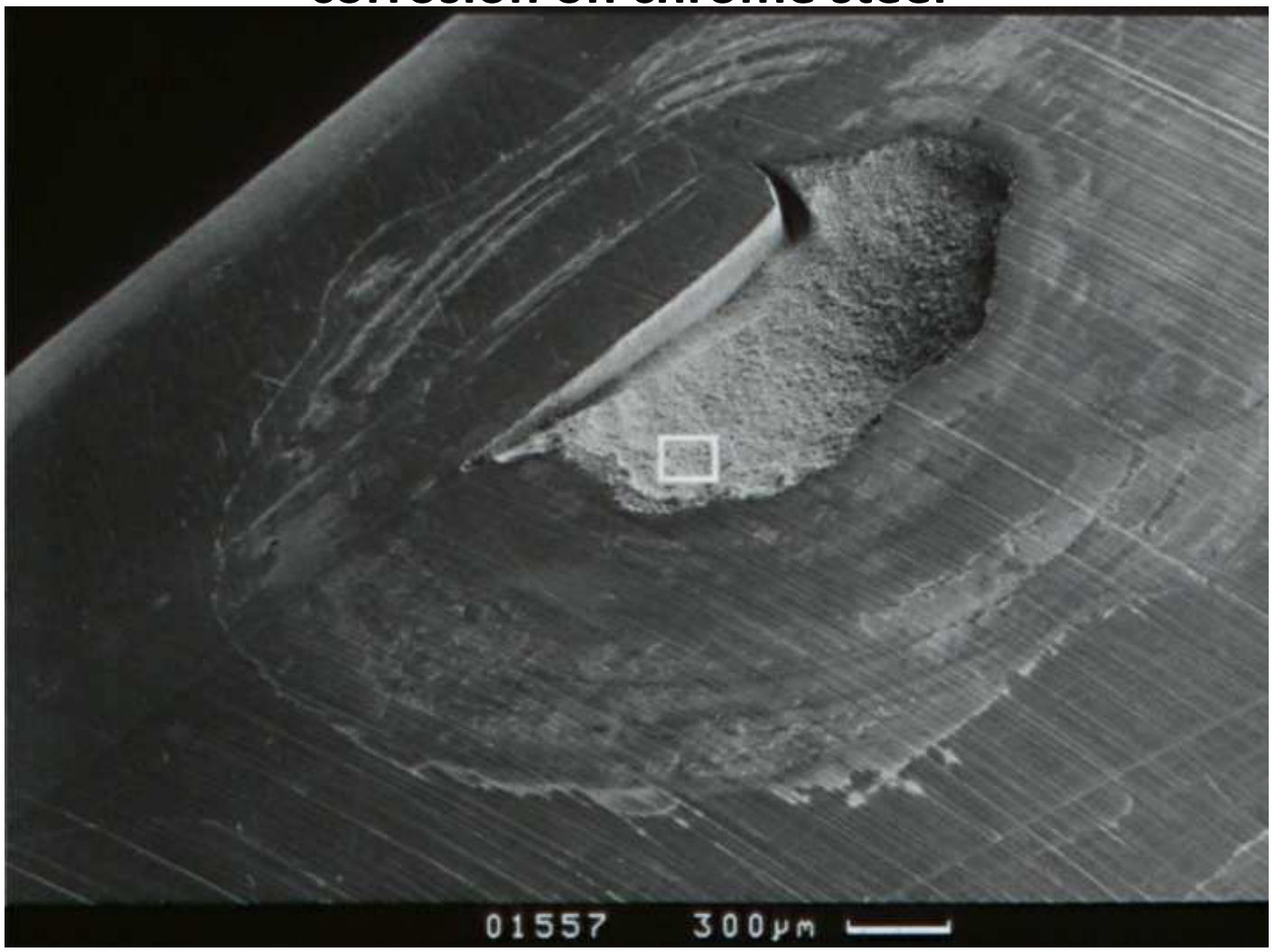


Chlorides

- **Corrosion on chrome steel**

Chlorides

- **corrosion on chrome steel**



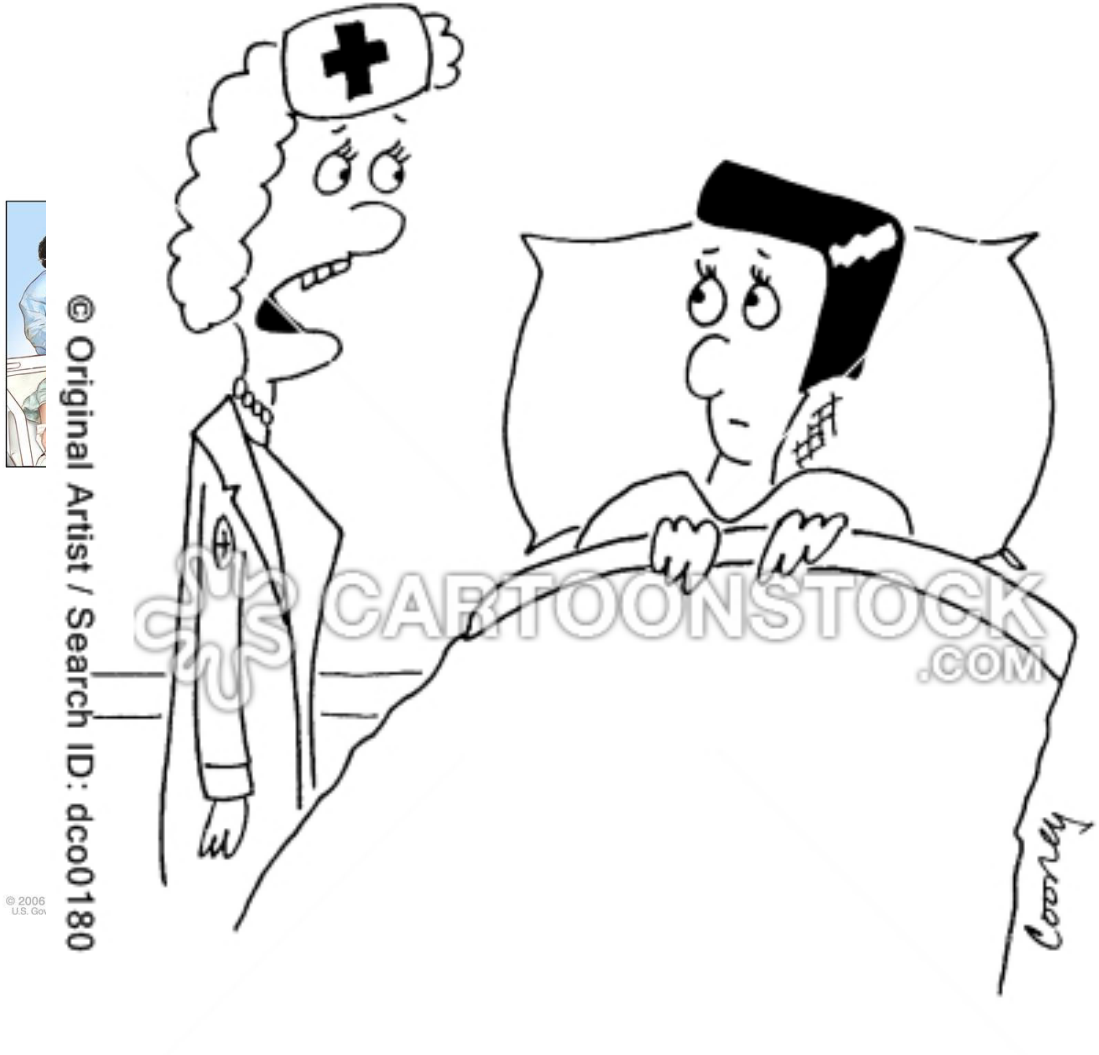
Water

- **Analysis of the local water supply will determine the treatment required to provide quality water for the final rinse stage**
- **Chloride levels – reduce to <10mg/l (carbon filters)**
- **Hardness - reduce to <50mg/l**
- **Reduce the Total Organic Carbon to < 1mg/l**
- **Reduce the conductivity to <40mS/cm by filtering or by Reverse Osmosis**

Water chemistry for EWD

Typical Application in an EWD	Requirement
Initial flush	Hardness less than 200 mg/L CaCO3
Intermediate flush	Hardness less than 200 mg/L CaCO3
Water for diluting disinfectants and detergents	Hardness less than 50 mg/L CaCO3
Final rinse-water	Hardness less than 50 mg/L CaCO3
TOC less than 1 mg/L	Conductivity less than 40 µS/cm, unless disinfectant added

sinfectors



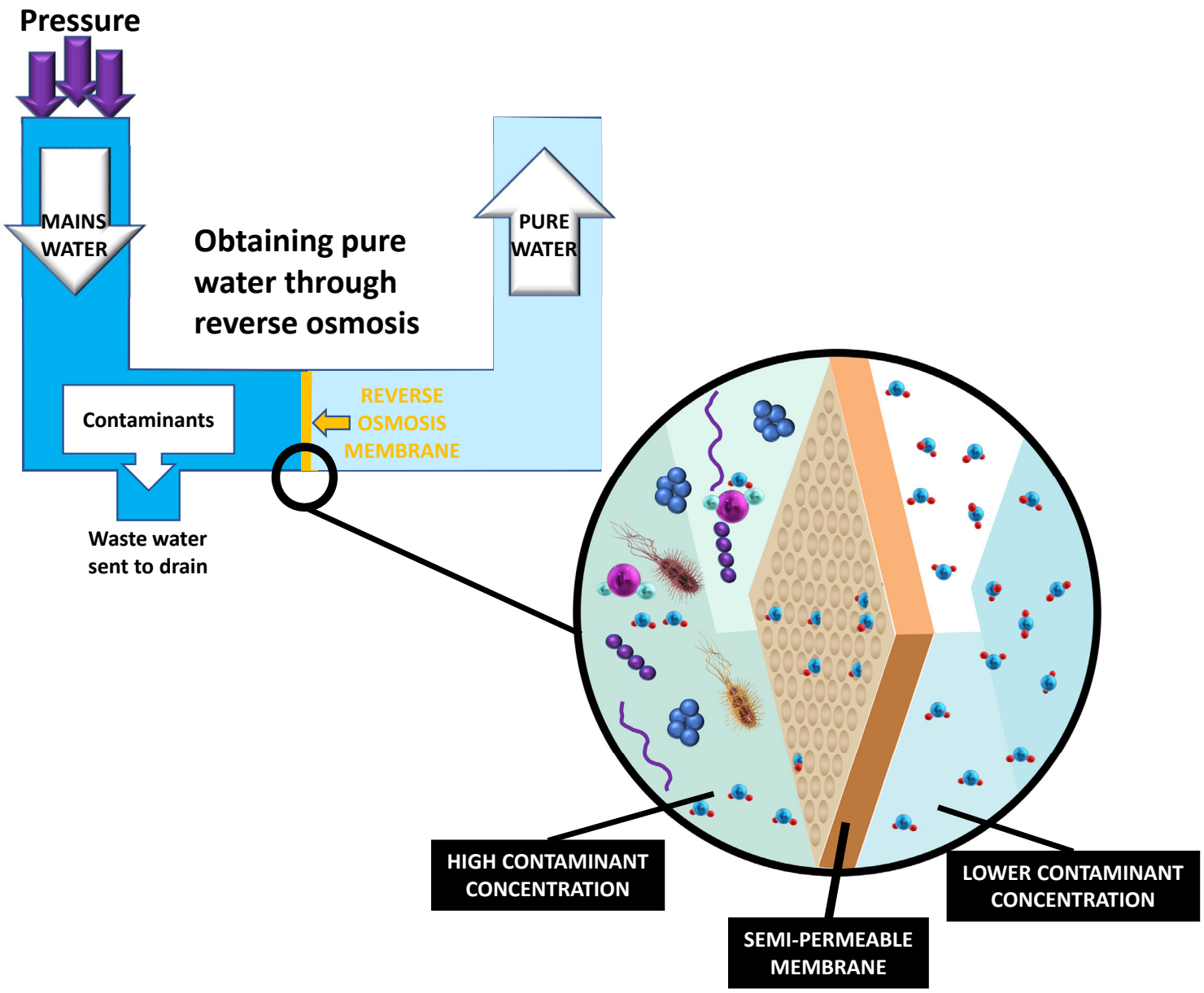
"The doctor went a little too far during your endoscopy. All we can say for sure is that your inner ears look fine."

American Journal of Infection Control
Volume 48, Issue 7, July 2020, Pages 765-769

Major Article

Pseudo-outbreak of *Mycobacterium fortuitum* in a hospital bronchoscopy unit

Silvia Campos-Gutiérrez PhD [a], María José Ramos-Real PhD [a], Rossana Abreu PhD [b], María Soledad Jiménez PhD [c], María Lecuona PhD [a]

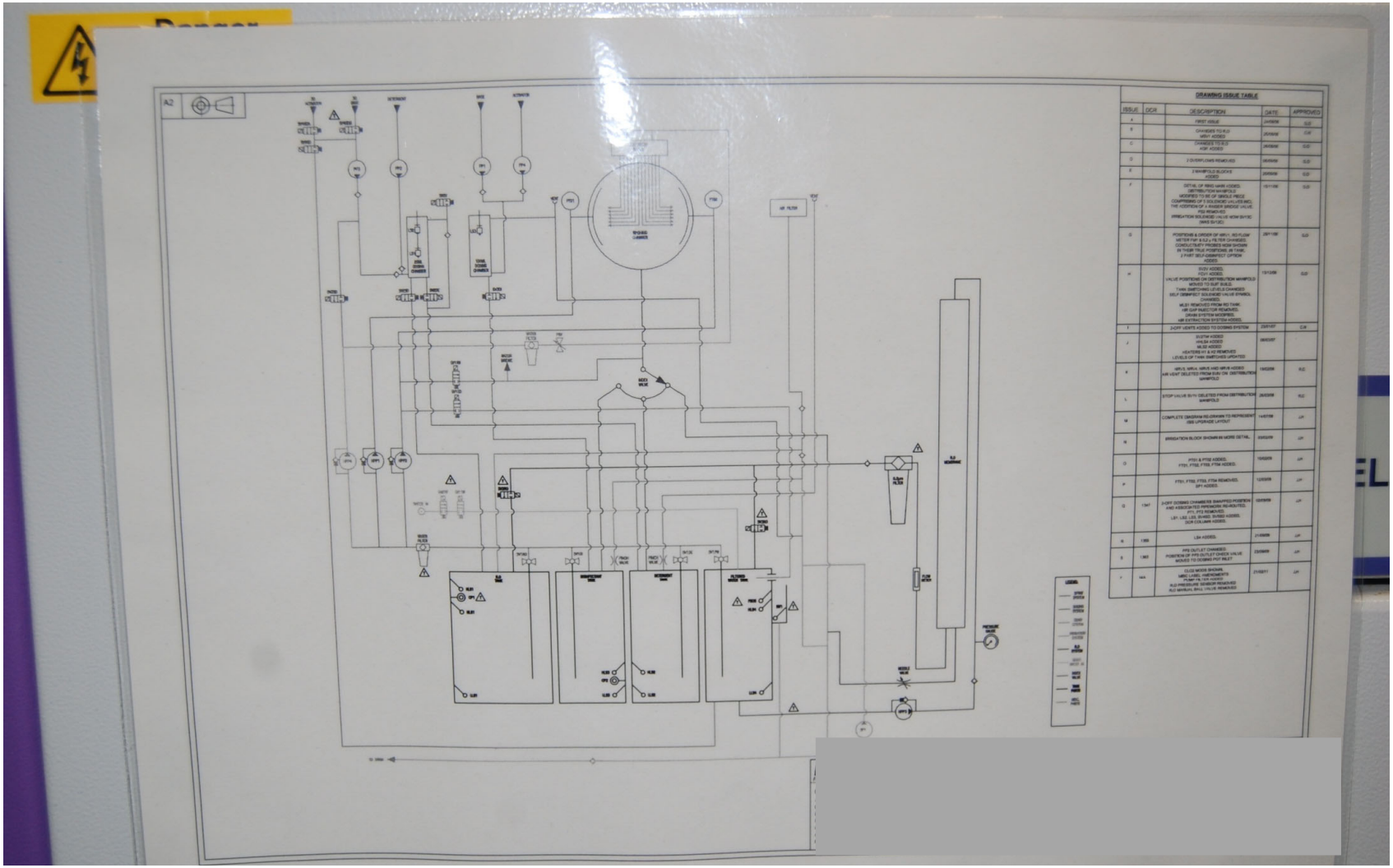

Pressure
MAINS WATER
Obtaining pure water through reverse osmosis
PURE WATER
Contaminants
REVERSE OSMOSIS MEMBRANE
Waste water sent to drain
HIGH CONTAMINANT CONCENTRATION
SEMI-PERMEABLE MEMBRANE
LOWER CONTAMINANT CONCENTRATION

Water
Softeners

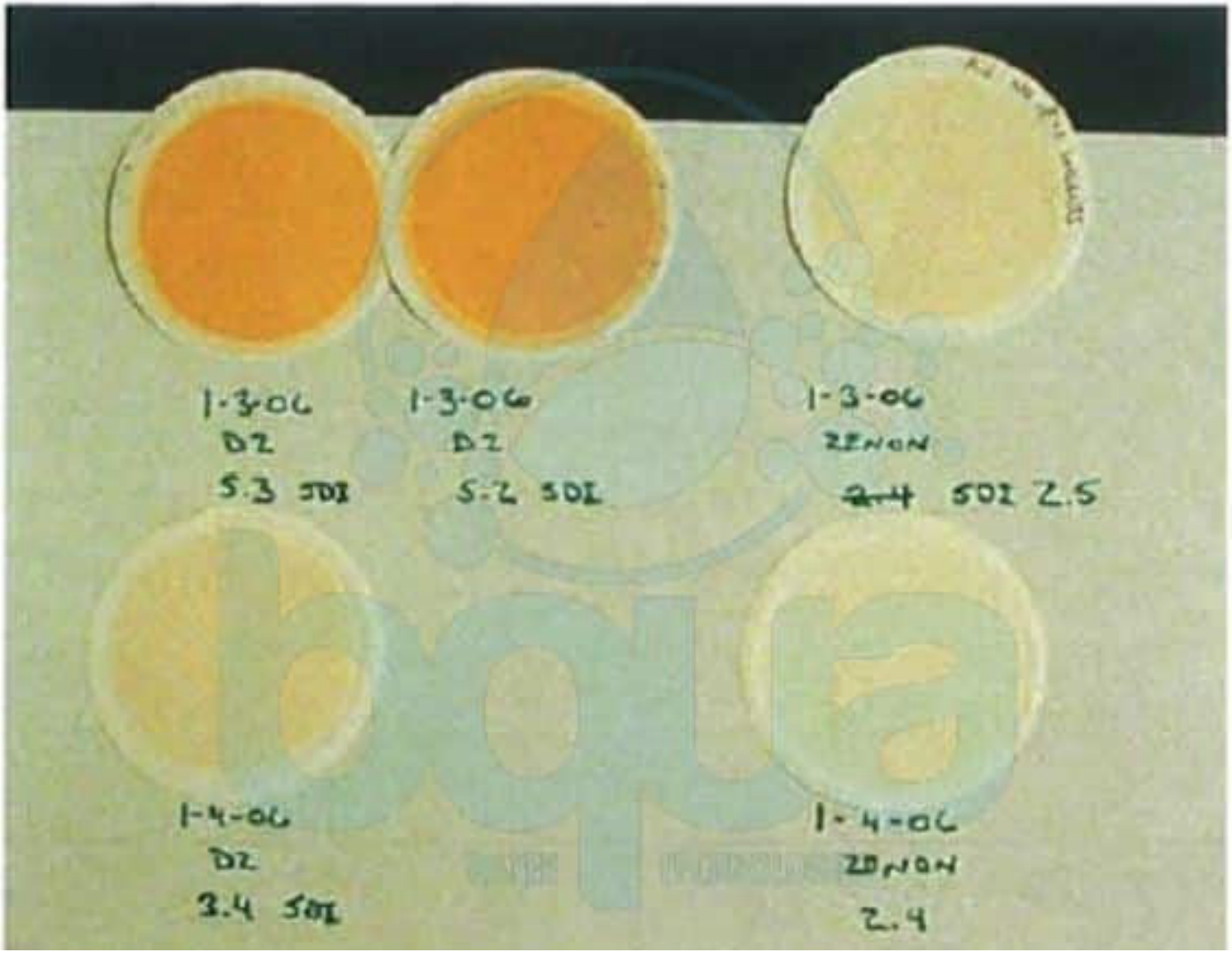
Carbon filters


Carbon Filters
Softeners
Mains water holding tank
RO storage tank
25 Micron 20” Filters
Reverse osmosis cartridges
Salt/Brine Tank
Osiris
VEOLIA

Understanding the layout of your EWD



Quality of incoming water Silt Density Index



Microbiological limits in EWD

- **Endoscopes should be rinsed after the disinfection stage to remove any residual chemical toxicity.**
- **Rinse-water should be free from extraneous material, both inorganic and organic including microorganisms, which could compromise the patient.**
- **Routine total viable counts (TVCs) on the final rinse water.**

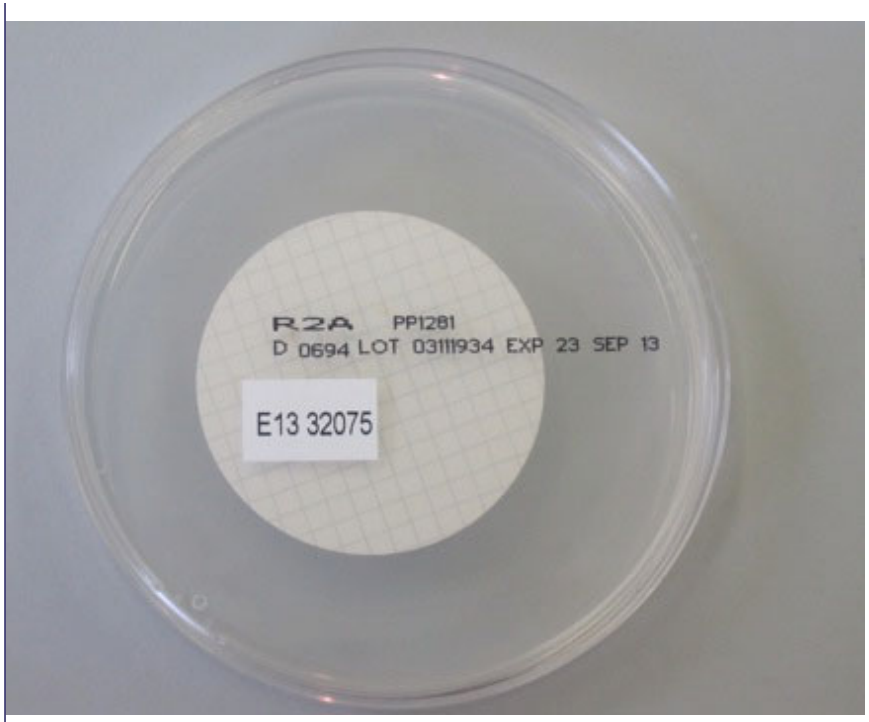
- **The TVC results will give an indication of the water treatment system performance and microbial colonisation of the EWD pipework. If the TVC is high, additional samples can be taken to determine the problem source.**

- **Acceptability: <10 cfu/100 mL**

DH Department of Health

Choice Framework for local Policy and Procedures 01-06 – Decontamination of flexible endoscopes: Testing methods

Version:1.0:England

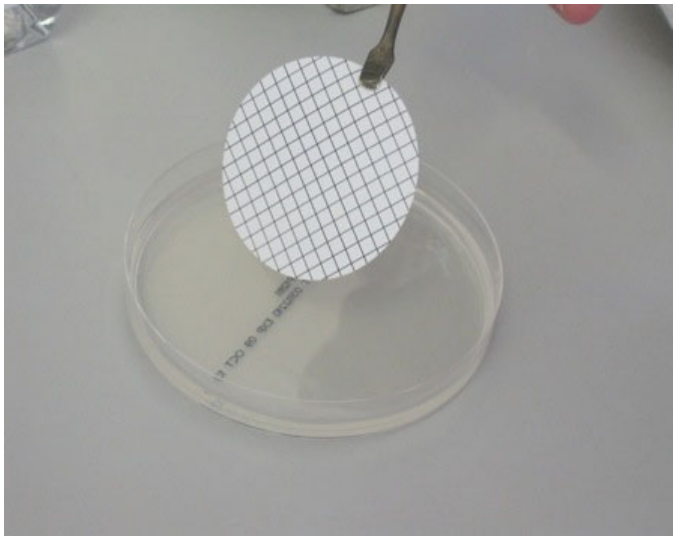


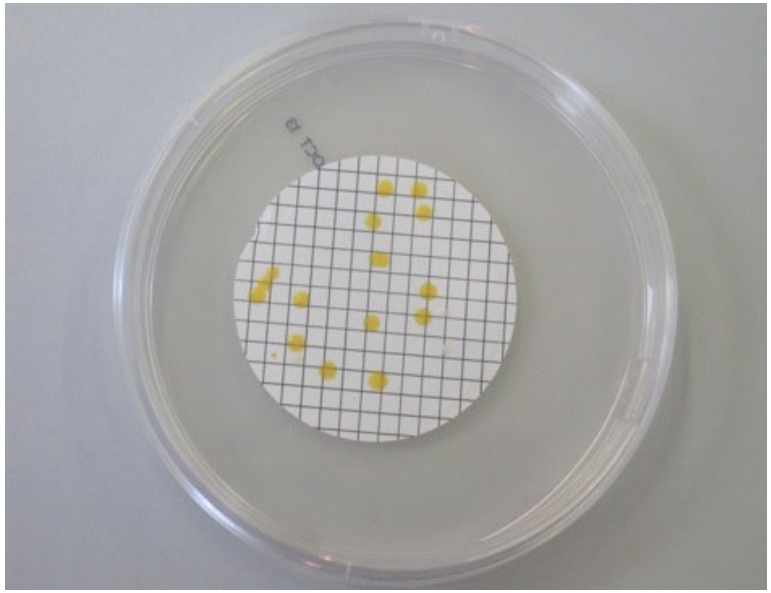
Method: testing

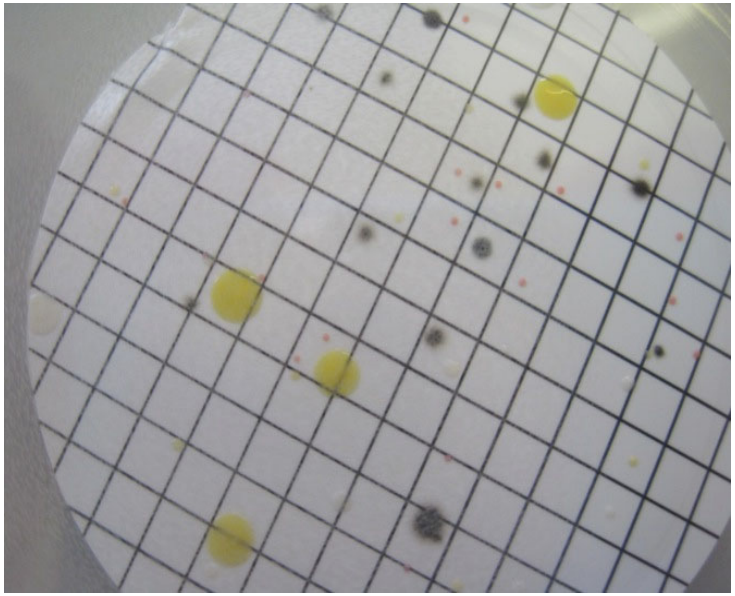
Filter a 100 mL aliquot of the sample through a 0.45 µm filter. Aseptically transfer the filter to the surface of a R2A, TSA or YEA plate and incubate at 28–32°C. Examine the plates after 48 hours' incubation and at five days. If an urgent report is required, preliminary readings could be made at 48 hours' incubation and a final report issued after five days' incubation. Carry out the test in duplicate.

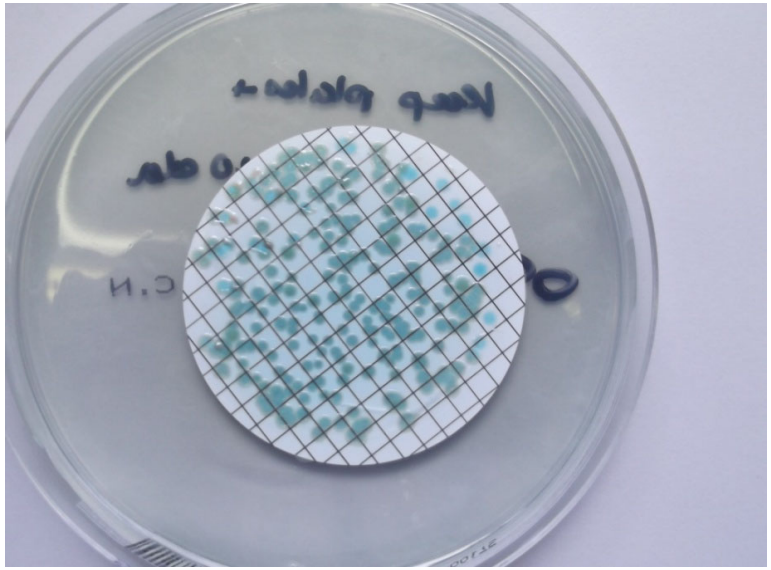
Examine the filters and record the number of colony forming units (cfu) that are visible.

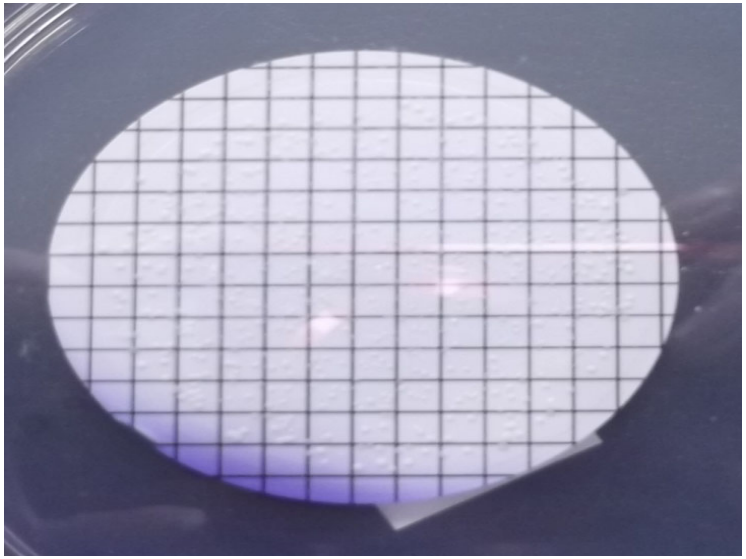
from



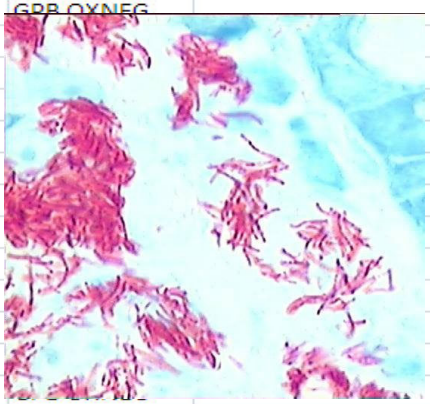






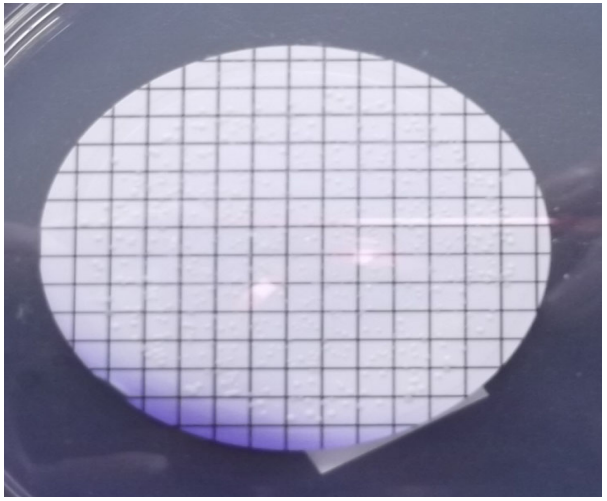


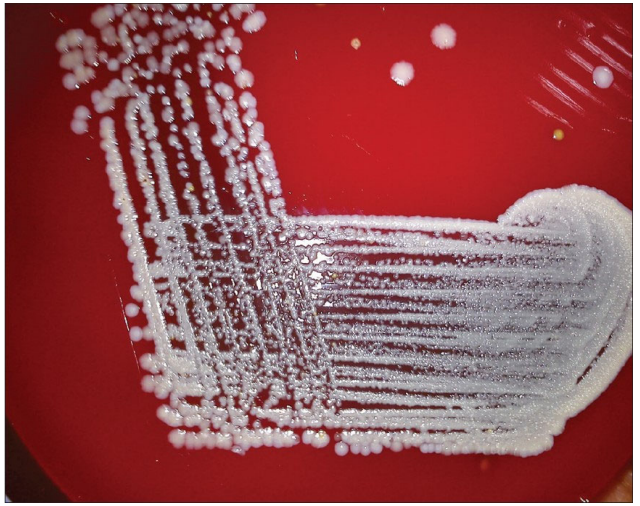
	A	B	C	D	E	F	G
1	DATE	LAB NO	PLACE OF SAMPLING	REFERENCE	COUN	ID	ID
10	05.02.13	4044	LLAN ENDOSCOPY	5055L	>100	GPC OXNEG	
11		4045	LLAN ENDOSCOPY	5055R	0		
12		4046	LLAN ENDOSCOPY	5056L	>100	GPC OXNEG	
13		4047	LLAN ENDOSCOPY	5056R	>100	GPC OXNEG	
23	11.02.13	4786	LLAN ENDOSCOPY	5055L	>100	GPB OXNEG	
24		4787	LLAN ENDOSCOPY	5055R	>100	GPB OXNEG	
25		4788	LLAN ENDOSCOPY	5056R	>100	GPB OXNEG	
26		4800	LLAN ENDOSCOPY	STERILOX LH BAY	>100	GPB OXNEG	
38		5252	LLAN ENDOSCOPY	5056R	>100	GPB OXNEG	
39		5253	LLAN ENDOSCOPY	5055L	>100	GPB OXNEG	
46	15.02.13	5459	LLAN ENDOSCOPY	5055L	>100	GPB OXNEG	
47		5460	LLAN ENDOSCOPY	5055R	>100	GPB OXNEG	
48		5461	LLAN ENDOSCOPY	5056R (?MISLABELLED)	>100	GPB OXNEG	
51		5563	LLAN ENDOSCOPY	5055L	>100		
52		5564	LLAN ENDOSCOPY	5055R	>100		
53		5565	LLAN ENDOSCOPY	5056L	>100		
54		5566	LLAN ENDOSCOPY	5056R	>100		
55		5567	LLAN ENDOSCOPY	5055L	>100		
56		5568	LLAN ENDOSCOPY	5055R	>100		
57		5569	LLAN ENDOSCOPY	5056L	>100		
58		5570	LLAN ENDOSCOPY	5056R	>100		
68		6200	LLAN ENDOSCOPY	5055L	>100		
69		6201	LLAN ENDOSCOPY	5055R	>100		
70		6202	LLAN ENDOSCOPY	5056R	>100		
83		6336	LLAN ENDOSCOPY	5055L	>100		
84		6337	LLAN ENDOSCOPY	5055R	>100	GPB OXNEG	
85		6338	LLAN ENDOSCOPY	5056L	>100	GPB OXNEG	
86		6339	LLAN ENDOSCOPY	5056R	>100	GPB OXNEG	
139		7951	LLAN ENDOSCOPY	5055L	>100	GPB OXNEG	
140		7952	LLAN ENDOSCOPY	5055R	>100	GPB OXNEG	
141		7953	LLAN ENDOSCOPY	5056L	>100	GPB OXNEG	
142		7954	LLAN ENDOSCOPY	5056R	>100	GPB OXNEG	GPC OX NEG
147		8292	LLAN ENDOSCOPY	5055L	>100	GPB OXNEG	GPB OXPOS
148		8293	LLAN ENDOSCOPY	5055R	>100	GPB OXNEG	
149		8294	LLAN ENDOSCOPY	5056L	>100	GPB OXNEG	
150		8295	LLAN ENDOSCOPY	5056R	>100	GPB OXNEG	GPB OXPOS
171	21.03.13	9469	LLAN ENDOSCOPY	5055R	>100	GPB OX NEG	



“GPB Ox negative”

- ZN stain positive
- *Mycobacterium chelonae* group
  - Environmental mycobacteria commonly found in water.



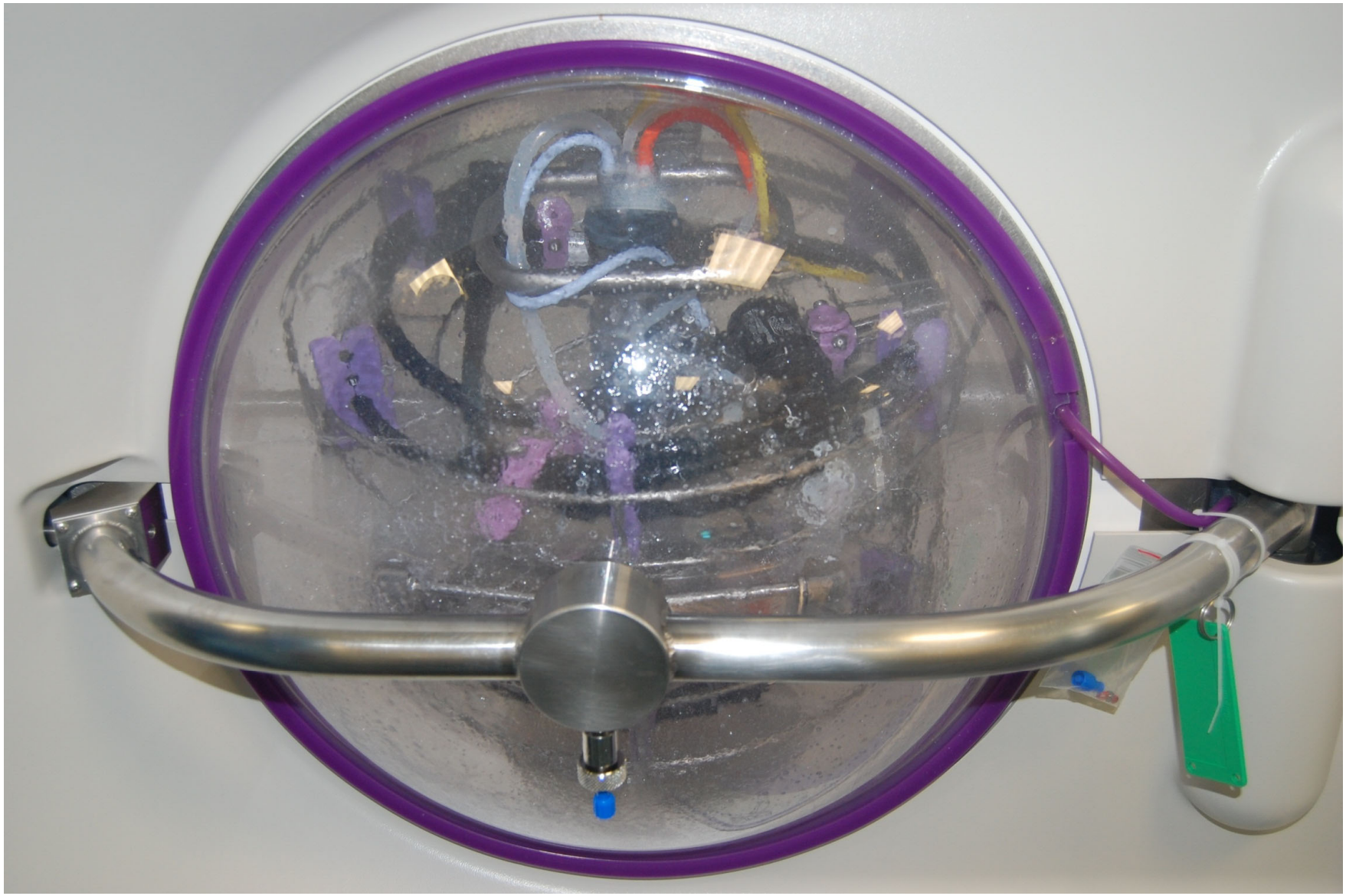


Aerobic colony count in 100ml	Interpretation	Action
<1cfu/100ml	Satisfactory (green)	No action required
1-9cfu/100ml repeatedly	Acceptable (yellow)	Indicates bacterial number are under reasonable level of control, no action required
10-100cfu/100ml	Unsatisfactory (orange)	Risk assessment required to investigate potential problems. Super-chlorinate or repeat EWD self-disinfect
>100cfu/100ml **OR** >0cfu/100 microorganisms of significance	Unacceptable (red)	Risk assessment required, consider taking EWD out of service until water quality improved

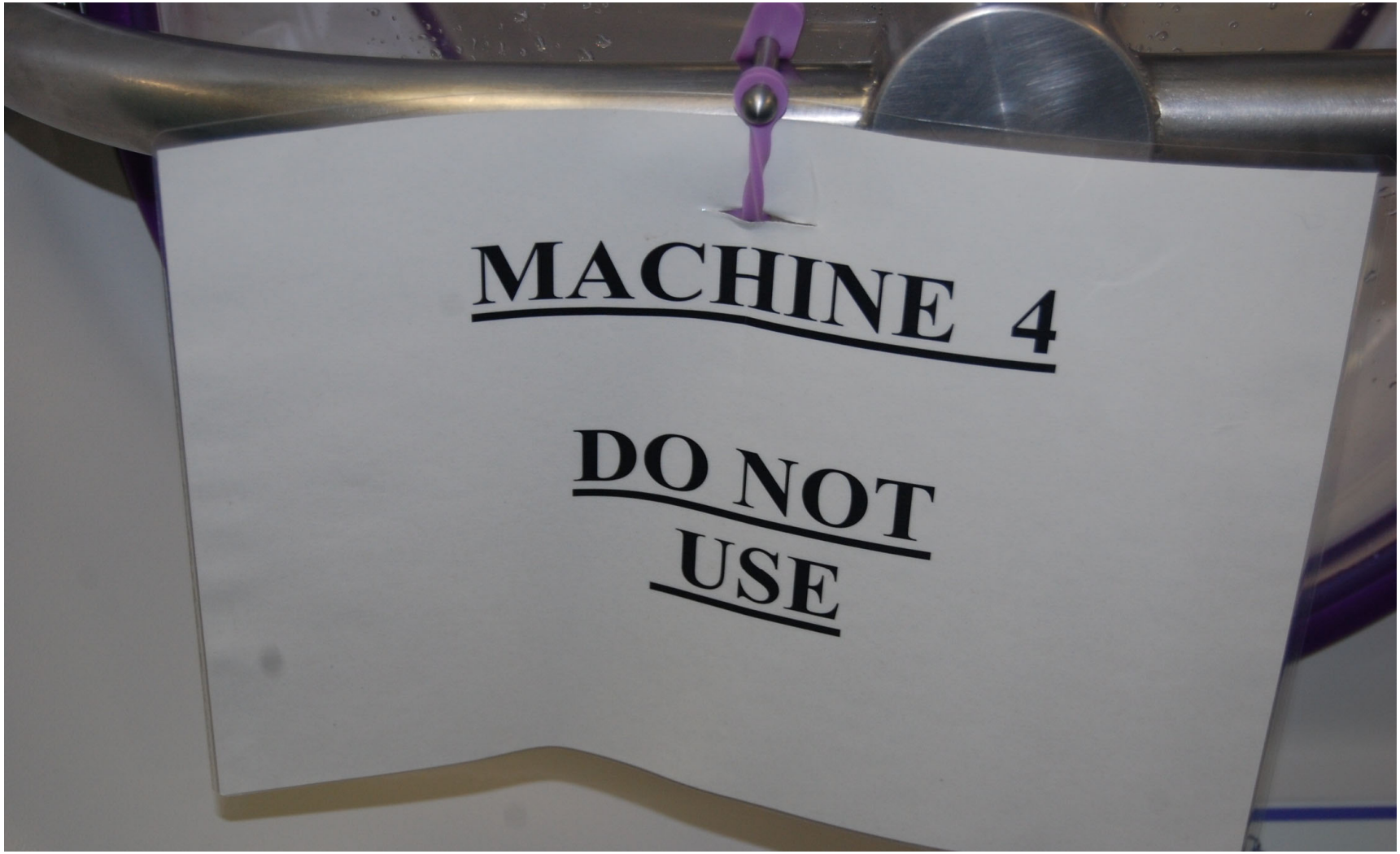
Review of survey data (2017)

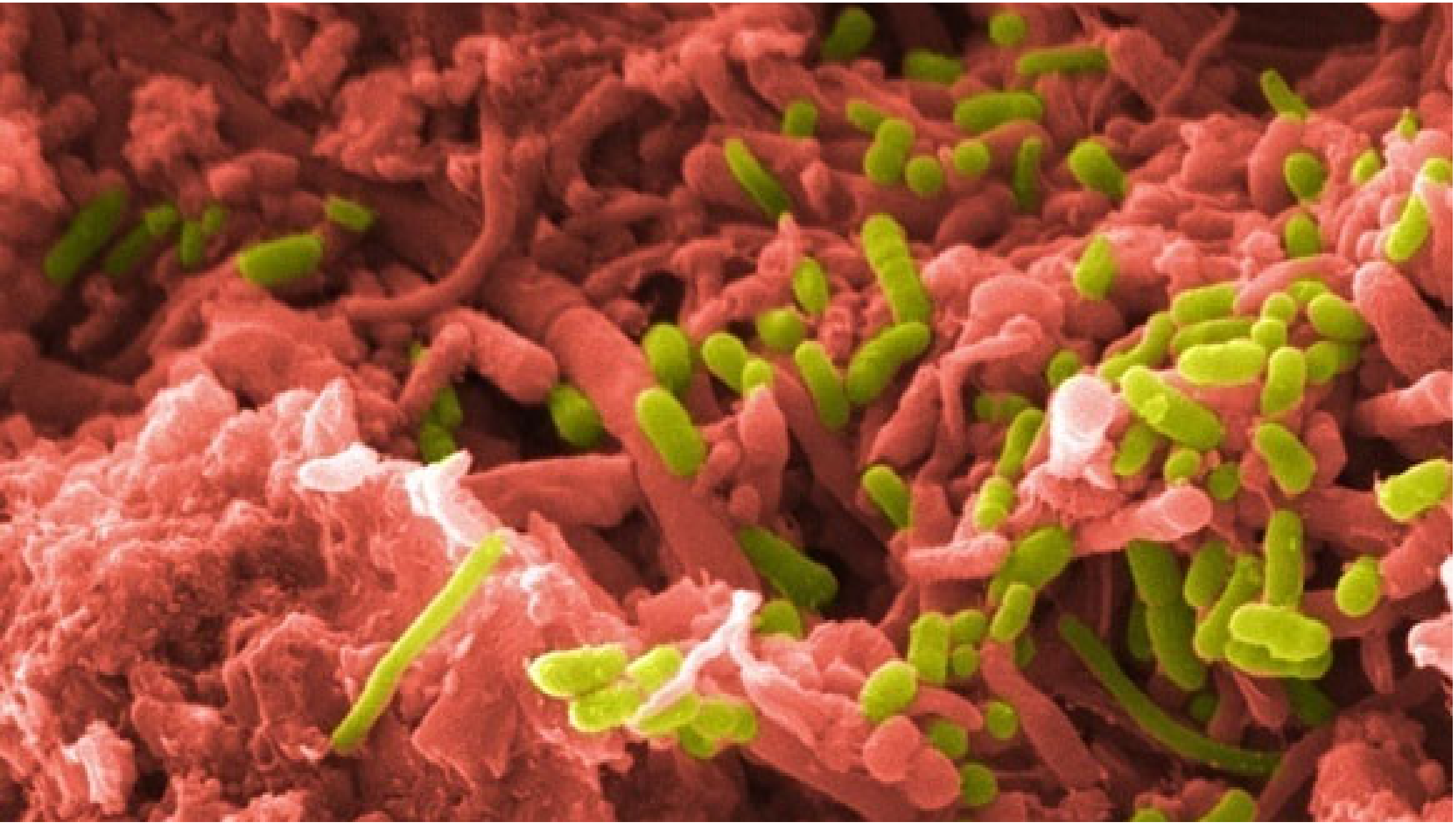
Number of cfu/100ml	Number of samples	Proportion of positive samples
0	4306	35.85%
1-9	5292	44.06%
10-100	1698	14.14%
>100	715	5.95%
Total	**12011**	**100%**

Sampling ports are at different points of the system



Tracking of component parts


MACHINE 4
DO NOT
USE



Understanding the microbiology of your water systems

- **Is your EWD supplied with appropriate water?**
- **Is it tank fed/mains supply?**
- **Are the filters/RO system failing prematurely?**
- **Review water supply**
- **Review chemicals being used, concentration and efficacy**
- **Risk assessment of endoscopes (bronchoscopes, cystoscopes verses colonoscopes)**
- **Interpretation of microbiological data and it's significance to the patient**

Poor water quality will significantly impact the quality of the cleaning process in your decontamination and may results in patient and occupational exposure

Summary

Water supply needs to be monitored for use in a hospital decontamination unit

Appropriate quality of water is required for each purpose

Microbiological biofilms and opportunistic pathogens may create a risk to patients and to the user

Water use for surgical instruments and automated washer disinfectors and flexible endoscopes

Implement a water safety group and water safety plan

Acknowledgements

- **Joy Markey**
- **Adam Stretton**
- **Eleri Davies**
- **Sulisti Holmes**