

National and International approaches to Legionella control in health and aged care facilities.

Dr Vyt Garnys
PhD, B.Sc. (Hons)
M.AusIMM, M.ACA, M.FMA, M.ISIAQ, M.AIRAH,
NABERS Accredited Assessor,
Lead Auditor (OHS&E, Quality)
Principal Consultant & Managing Director
Vyt.Garnys@cetec.com.au

Travis Hale
B.Sc. (Hons)
Lead Auditor (OHS&E, Quality)
Principal Consultant
Travis.hale@cetec.com.au



@CETECptyLtd

GOVT+SCIENCE+ENGINEERING TEAM EFFORT



Guidelines for Managing Microbial Water Quality in Health Facilities 2013

Acknowledgements

The development of this document was managed by the Department of Health's System Support Services Division, Health Infrastructure Branch. The following (listed alphabetically by last name) are recognised for their significant contributions to the document: Janet Cumming, Vyt Garnys, Gregory Jackson, Nicolas Massey, Alex Mofidi and Rosemary Steinhardt.



2016

Acknowledgements

The following individuals and organisations helped to develop and review these guidelines.

Government

- Stuart Adcock, Department of Health and Human Services, Victoria
- Frances Graham, Ministry of Health, New Zealand
- Dr Greg Jackson, Queensland Department of Health
- Dr Chris Lease, Helen Psarras and Andrew Vickers, SA Health, South Australia

CETEC Consortium

- Laura Fitzgerald, Dr Vyt Garnys, Travis Hale and Jack Noonan, CETEC Pty Ltd
- Dr Paul Bartley, The Wesley Hospital
- Brad George and Warren Keep, Norman Disney & Young

External reviewers

- Professor Elizabeth Hartland, University of Melbourne
- Dr Claressa Lucas, Centers for Disease Control and Prevention, United States

Editors and designers

- Biotext Pty Ltd, Canberra

2016

Contents

Acknowledgements	
Introduction	
1 Establishing a <i>Legionella</i> risk management system.....	
2 Analysing your risk	
3 Managing your risk.....	
4 Responding to detections or cases.....	
5 Reviewing your <i>Legionella</i> risk management plan	
Summary	
Abbreviations and definitions	
Appendix 1 Risk assessment tables	
Bibliography.....	





- World Health Organisation – Water Safety Plan (WSP)
- ASHRAE 188 – Legionellosis: Risk Management for Building Water Systems
- UK HSE ACOP – Legionnaires' disease; The control of *Legionella* bacteria in water systems.
- UK HSE HSG274 – Legionnaires' disease

Each standard takes a similar approach;

- Understand the hydraulic system,
- Identify hazards and risks,
- Implement control measures,
- Monitor the control measures and intervene when the control measures are not sufficient.



Australian En-Health 2015	WHO 2005 – <u>Water Safety Plans</u> – <u>Catchment Supply</u>	WHO - Legionella-2007	UK HSE 2013
Understanding Legionella, infection, roles and responsibilities	Roles & Responsibilities & Legal	Legionella	ID & Assessment of Risk
Understand the hydraulic system	Organise Water Safety Plans	Ecology and Environmental Sources	Management of Risk
Identify hazards and risks	Water Supply Description	Approaches to Risk Management	Preventing and Controlling the Risk
Implement control measures	Understand Hazards and Threats	Potable Water & In-Building Distribution Systems	Record Keeping
Monitor the control measures and intervene when the control measures are not sufficient	Control Measures & Priorities	Cooling Towers & Evaporative Condensers	Responsibilities of Industry Stakeholders
	Limits and Monitoring	Hotels & Ships	Notice of Approval
	Management Procedures	Healthcare	
	Supporting Programs	Spas Tubs and pools	
	Documentation & Record Keeping	Disease Surveillance and Public Health Management	
	Validation & Verification	Regulatory Aspects	
	System Assessment, Upgrading or New s Supply	Laboratory Aspects	
	Water Safety Plans for Small Units	Examples	
	WSP Approval, Review & Audit		
	Timescale & Cost Implications		



Design, Control & Remediation of Potable Water Microbial Quality is a Team Effort

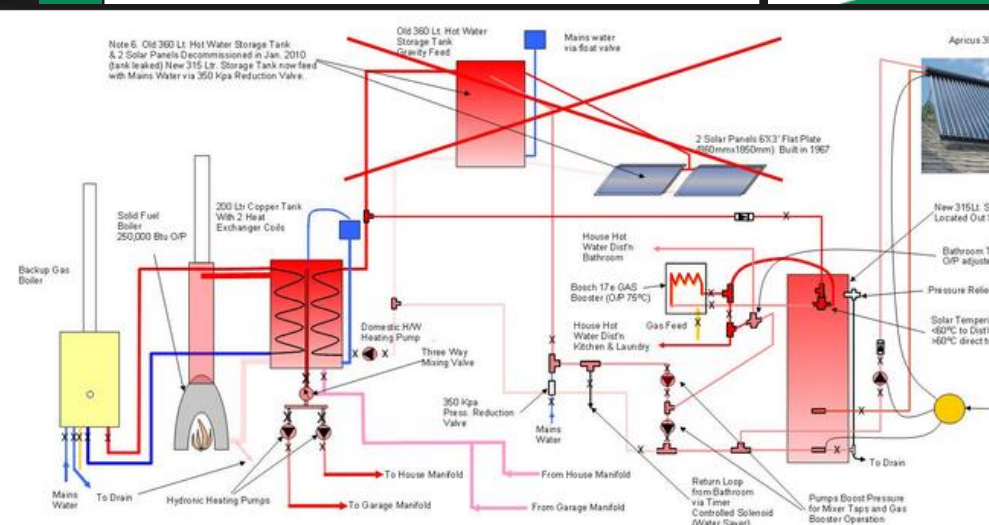
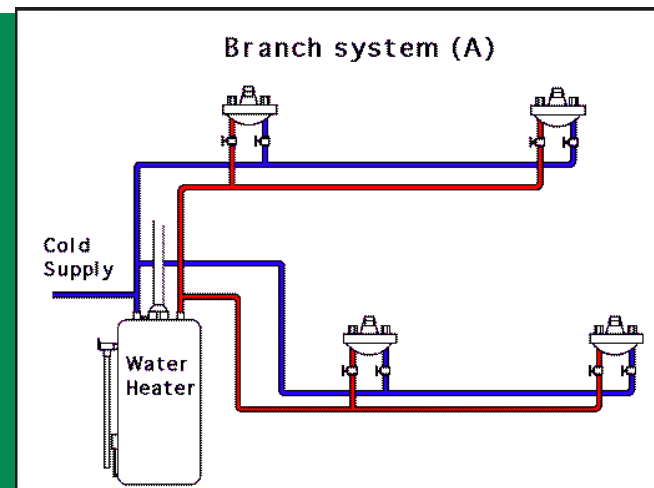


- Form a *Legionella* risk management team
 - - Include; Infection Control, Clinical Areas, Facility Management, Executive Team
 - Need to include sufficient in-house expertise or seek external expertise as required.
- Develop and document the procedures to analyse risk, identify risk mitigation measures, and how to respond to cases / detections.



- **Need to undertake an analysis of your system – understand how it works.**
 - **Include Water Distribution System (WDS)**
 - **Source water quality**
 - **Water distribution system**
 - **Components of the system**
 - **Systems connected to WDS (e.g. Fire sprinklers, garden fountains)**
 - **Materials used to construct system (e.g. plastic pipe, copper)**
 - **Temperatures of system**
 - **Previous results**
 - **At risk patients within the facility**





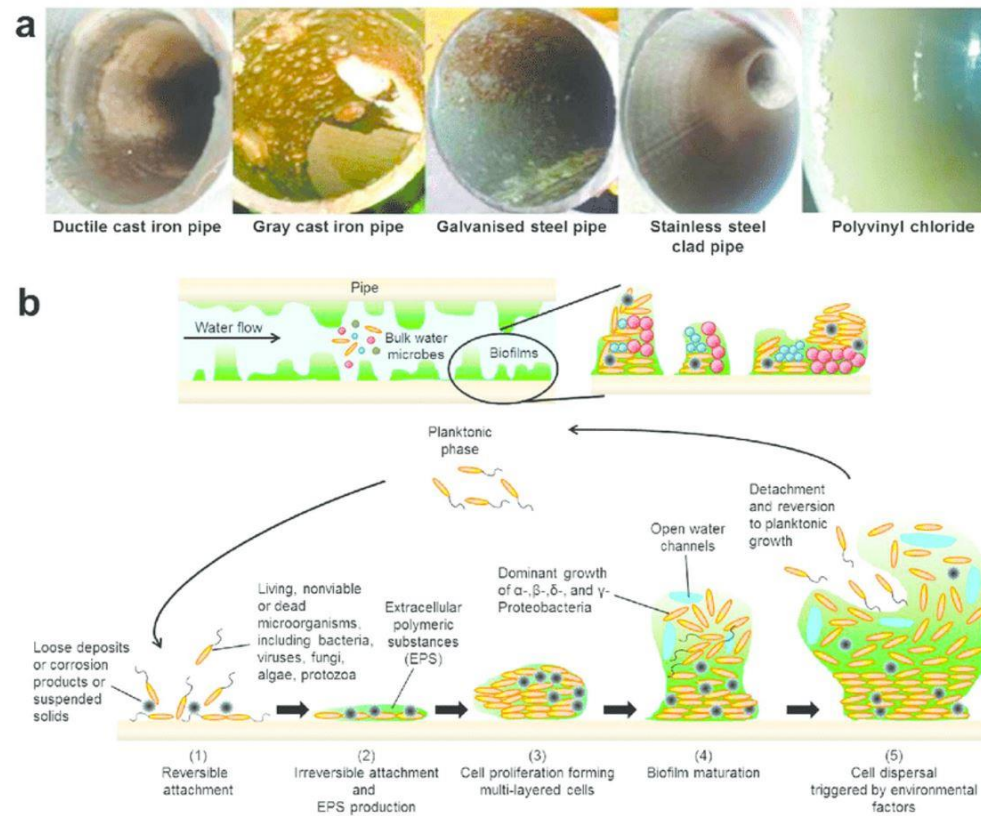
New Developments

- Electronic TMV's
- Electronic Taps with inbuilt TMV and Filters
- Temperature Monitoring
- **All have Biofilm accumulation points**



BIOFILM DEVELOPMENT in PIPES

Figure 1. (a) Biofilm growth on different pipe materials. Reprinted with permission from Ren et al. 43 Copyright 2015, Springer. (b) Biofilm life cycle in DWDS.



BIOFILM GROWTH ON MATERIALS

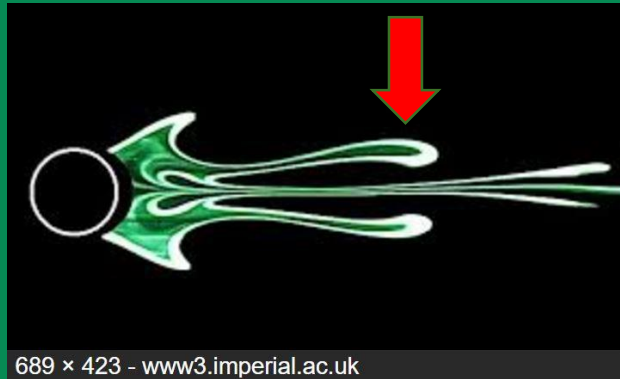
TABLE 4. Composition of communities of microorganisms on the surface of various plumbing materials after 21 days

Organism	Microorganism population ^a (CFU cm ⁻²) on:							
	Mild steel	Stainless steel	Latex	Ethylene-propylene	Polypropylene	Polyethylene	PVCu	PVCc
<i>L. pneumophila</i>	17	13	150	500	37	13	11	7.9
<i>P. aeruginosa</i>	30							
<i>P. acidovorans</i>						40		11
<i>P. diminuta</i>						2		
<i>P. fluorescens</i>				1,000				3
<i>P. maltophilia</i>	10	11	3,000			10	10	
<i>P. mendocina</i>			13			40	0.01	
<i>P. paucimobilis</i>	30	36	5,000	1,600	790	170	140	36
<i>P. stutzeri</i>	140	70	2,000					0.1
<i>P. testosteroni</i>		180				20		8
<i>P. vesicularis</i>	250							3
<i>P. xylooxidans</i>						7		40
<i>Actinomyces</i> sp.	130	2	7,000	8,000		9	0.01	2.8
<i>Aeromonas</i> sp.			6,000					
<i>Alcaligenes</i> sp.	10	10			320	80		30
<i>Flavobacterium</i> sp.	41		15,000	2,400		0.2	90	50
<i>Methylobacterium</i> sp.	20	150			140	30	60	23
<i>Klebsiella</i> sp.			31,000					
<i>Acinetobacter</i> sp.	70	39	22,000	3,100	400	180	40	60
<i>Aspergillus</i> sp.		0.2		4,400				

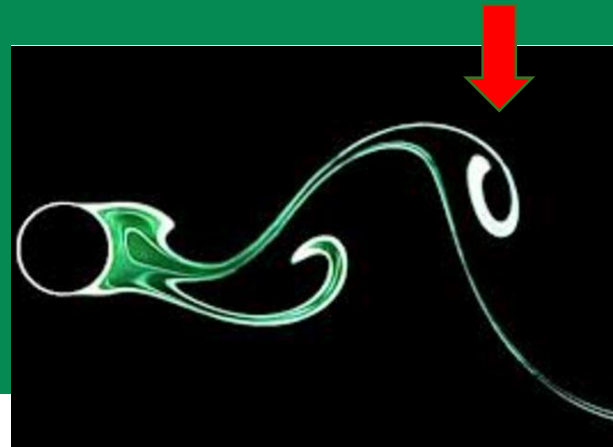
^a Numbers of non-*Legionella* populations are represented as a sum of the CFU cm⁻² occurring on R2A, BCYE, and GVPC media. *L. pneumophila* populations are represented as the mean of those CFU cm⁻² occurring on BCYE and GVPC media.

Hydraulic Design Details affect pipe flow and deposition patterns

Normal flow



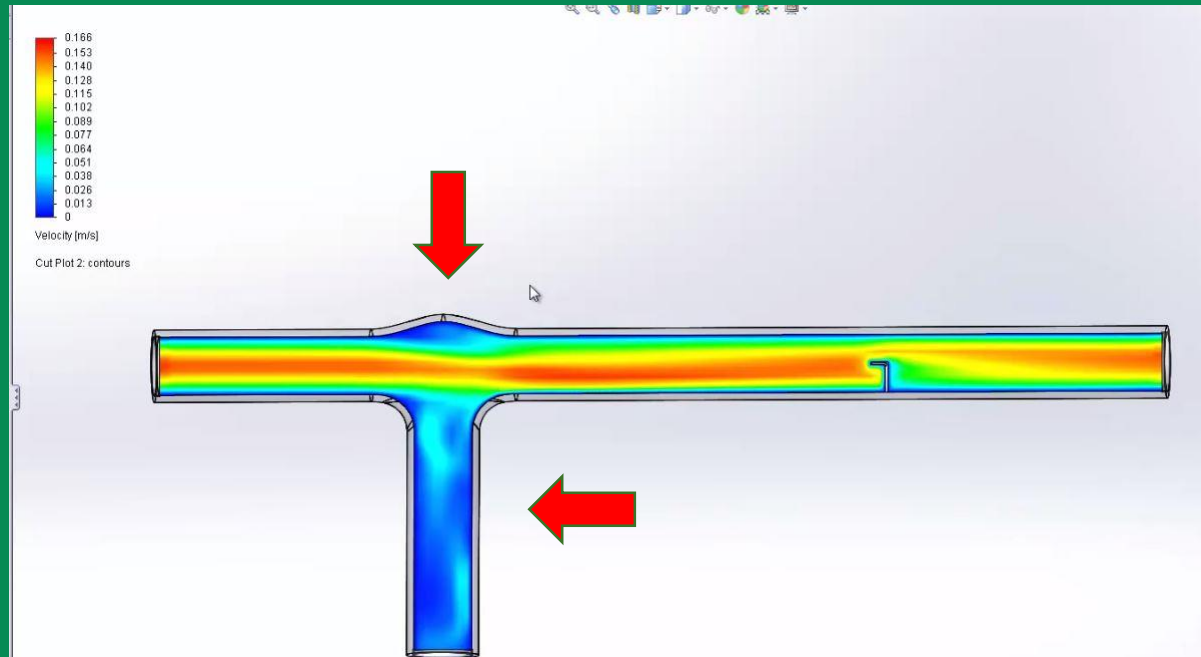
Direction change



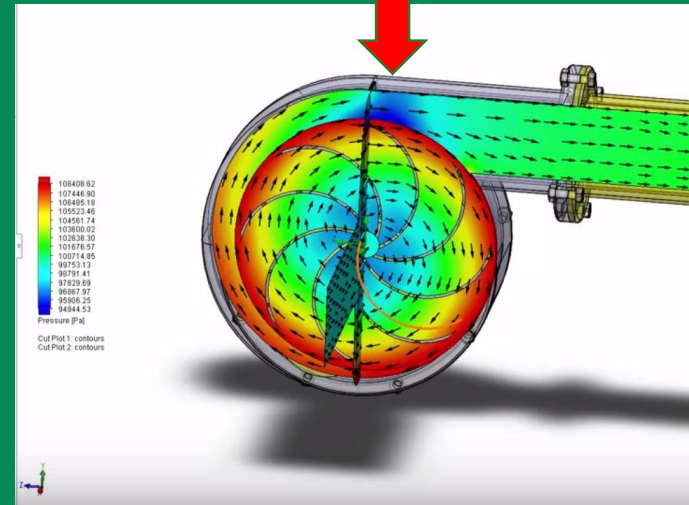
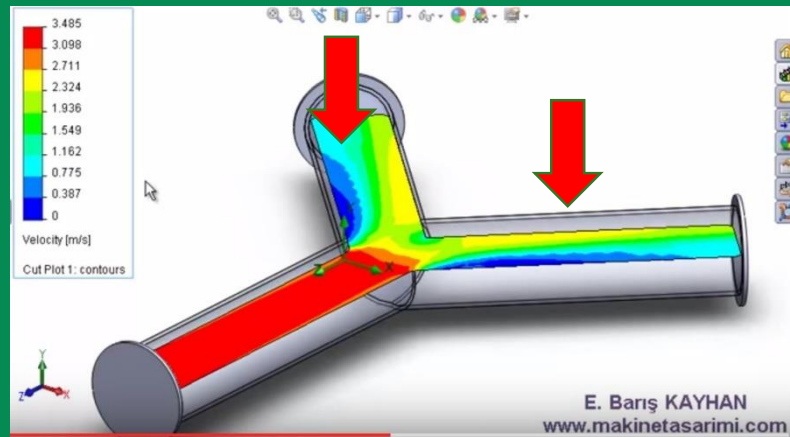
Higher flow



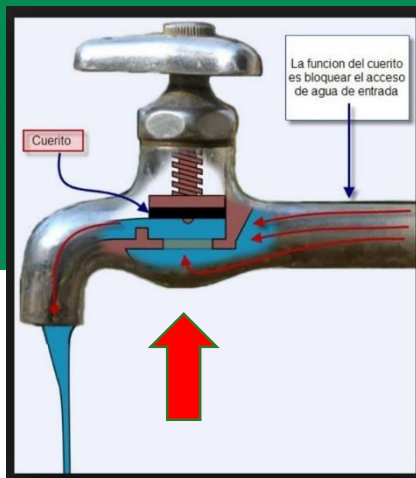
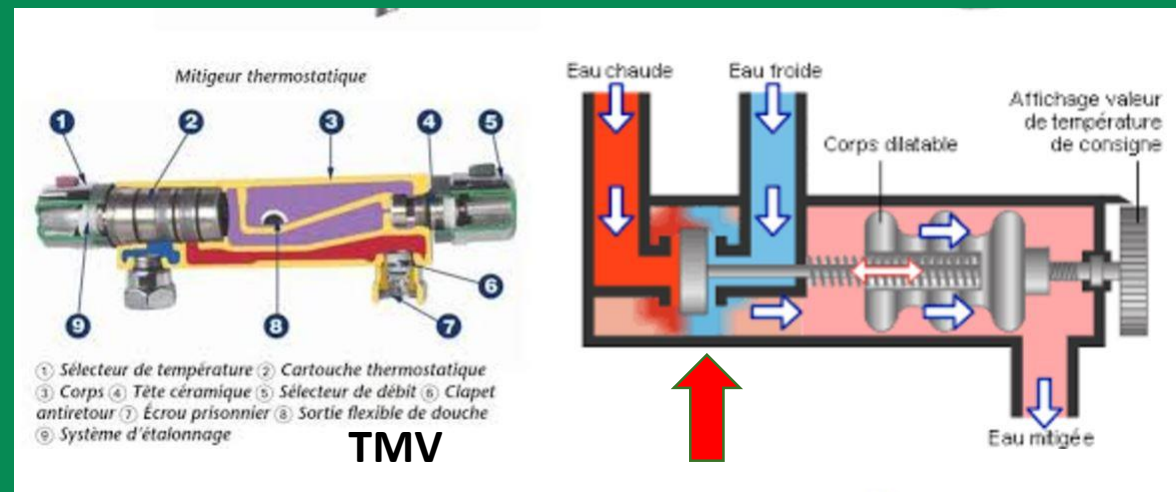
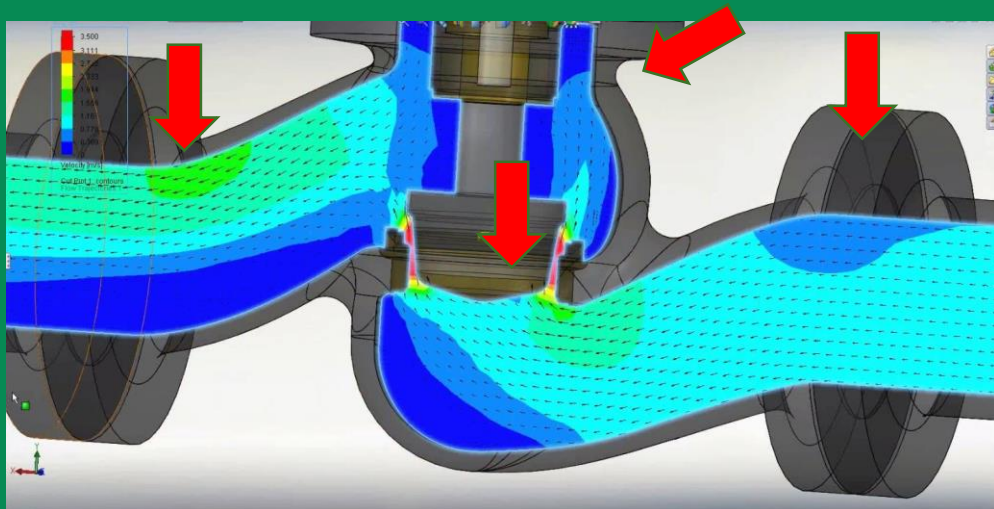
Inactive branches (dead legs) affect pipe flow and deposition patterns



Hydraulic Design Details affect pipe and pump flow and deposition patterns



Fitting and Valve Design Details affect deposition patterns and Flow





- **Conduct risk assessment based on system analysis**
- **Identify hazards and risks**
 - **Hazard** – an agent that may cause harm (e.g. *Legionella* spp)
 - **Hazard source** – Location or condition that may lead to or increase a hazard (e.g. Biofilm)
 - **Hazardous Event** – Situation that may lead to the presence of a hazard (e.g. low temperatures (<60 DegC allow for *Legionella* growth)
 - **Risk** – Likelihood that hazard will cause harm to people in a given timeframe. Also includes magnitude of harm / consequences.



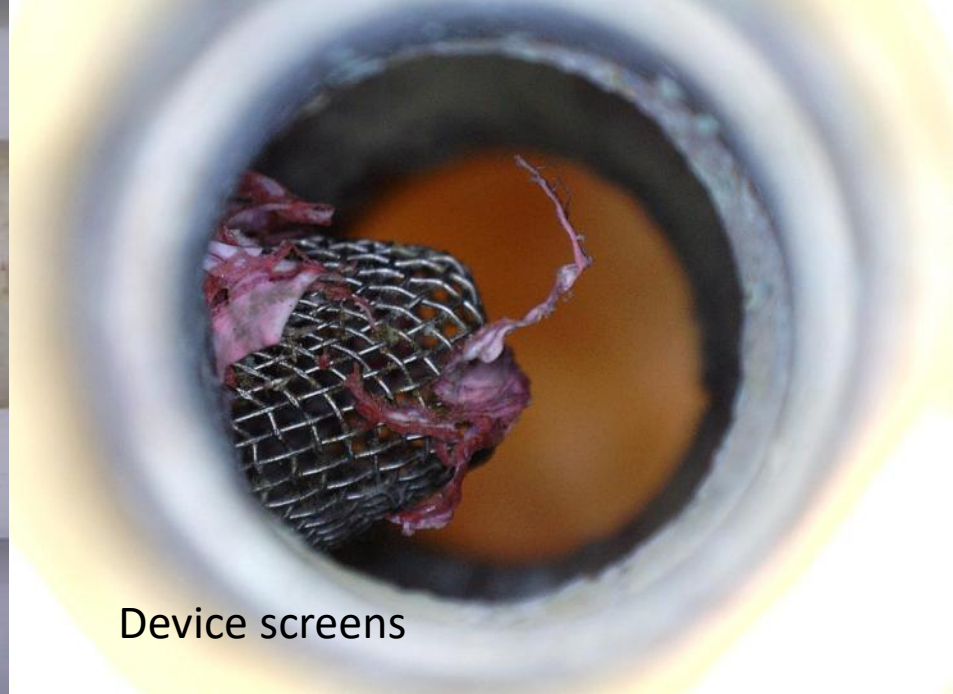
RISK MANAGEMENT – WQRMP SITE INSPECTION

Site inspection is critical





Plastic pipe



Device screens



Showers



Aerators and diffusers

Hazardous Source (system component)	Hazardous Event	Likelihood	Consequence	Inherent Engineering Risk		Likelihood	Consequence	Residual Engineering Risk
Mains Supply	External biological contamination of water supply.	C	4	VH		C	2	M
	External chemical contamination of water supply.	D	4	H		D	2	L
	Cold water above 25 °C.	A	2	H		A	1	M
	Low residual disinfectant allowing for proliferation of bacteria	C	3	H		C	3	H
	Loss of supply due to natural disaster.	E	5	H		E	2	L
	Loss of supply due to scheduled works.	D	3	M		D	2	L
	High solids load resulting in increased microbial nutrients and impairing disinfection.	C	2	M		C	1	L





- Once hazards are identified, risks need to be managed appropriately.
- Control of risk will vary based on hazard, but may be as simple as monitoring.
- Example of control;

Hazardous Source (system component)	Hazardous Event	Controls	Frequency	Reference Procedure
Reduced Pressure Zone Devices	Backflow failure resulting in cross contamination. Debris and biofilm accumulation in strainers.	Testing and servicing Physical clean of strainers during test and servicing Fault prompted non-routine maintenance	Annual Annual	Testing IAW Australian Standards. Service Level Agreement with Plumber.
Header Tanks	Stagnation due to infrequent use	Operational Monitoring	Annual	LRMP Section 7.1
	Biofilm Accumulation	Testing and Servicing Inspection and Cleaning (as required)	Annual	LRMP Section 7.1 Manufacturer Instructions

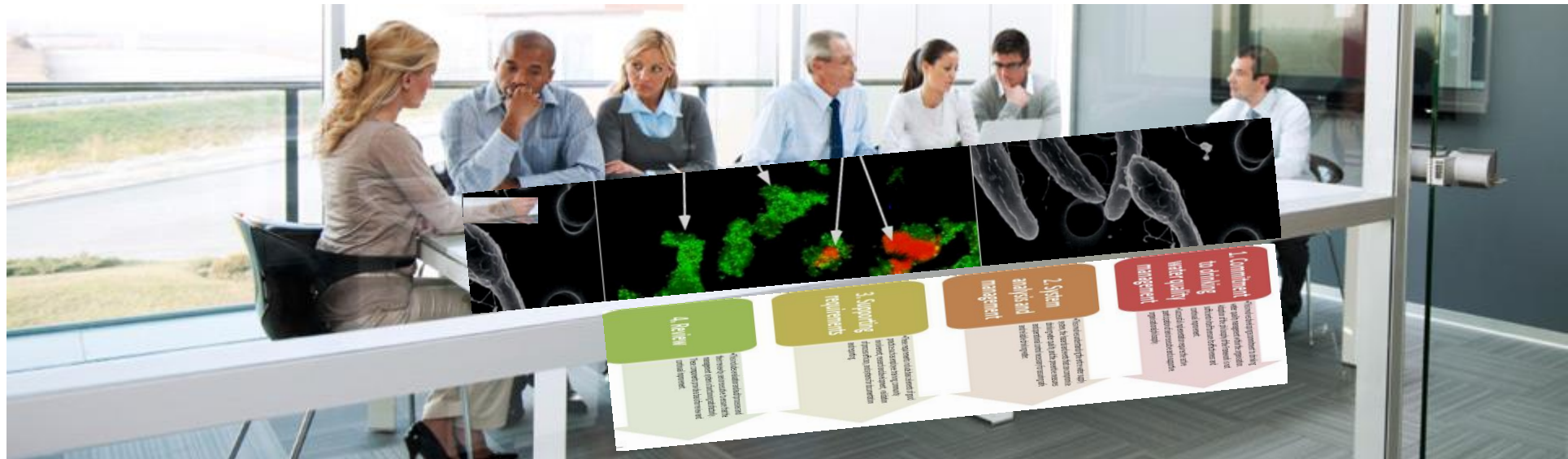


- **Managing risk is not set-and-forget!**
- **Needs testing on a regular basis (Temperature, Free CL, HPC, *Legionella*) to verify conditions have not changed and control measures remain effective.**
- **Criteria is needed to determine if control measures remain sufficient, e.g.;**

Parameter	Frequency	Location	Critical Limit	Reported to	Operational response to exceedance of critical limit	Clinical response to exceedance of limit
<i>Legionella pneumophila</i> SG1; <i>Legionella pneumophila</i> SG2-14; <i>Legionella</i> species	Monthly	Boiler/ Chiller Units (cold water sample) Refer to Appendix F	>10cfu/mL or Detected	Engineering Services Unit Service Supplier	<ol style="list-style-type: none">1. Take the unit out of service.2. Check when unit was last serviced.3. Check fault log to determine if unit has supply has been isolated since last service (i.e. stagnant water).4. Notify the supplier of the boiler or chiller unit.5. Implement flushing maintenance of unit and replace filters.6. Test other units in areas to determine if this is an isolated event.7. Consider if additional controls are	Incident management to convene to determine patient management. Refer to Section 8 Responding to Detections or Cases'.



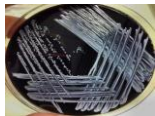
POTABLE WATER - MONITORING & NEW DEVELOPMENTS





- **Several technologies for verification monitoring available - ensure that they are compliant with state requirements (e.g. NATA certified vs Specified Method).**

- **Total Bacteria**

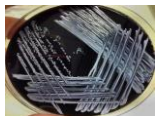


- **HPC by Pour plate – AS 4276.3.2 – 3 Days**



- **Enzymatic Analysis – 1 hour**

- ***Legionella***



- **Traditional Culture Technique - AS/NZS 3896 & Concentration – 10 Days**

- **Combined Immunogenic Enzymatic Assay (CIEA) – Legipid et al – 1 Hour**



- **qPCR (technology improving wrt viable vs non-viable) – 2-5 Days**



- **Culture and MALDI-TOF MS – 6-8 Days**

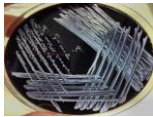


Choose Analysis for Responding to Detections of Cases

- **Response to a suspected case of Legionnaire's disease**



- **Rapid analysis allows for minimization of time for medical and nursing decision making**



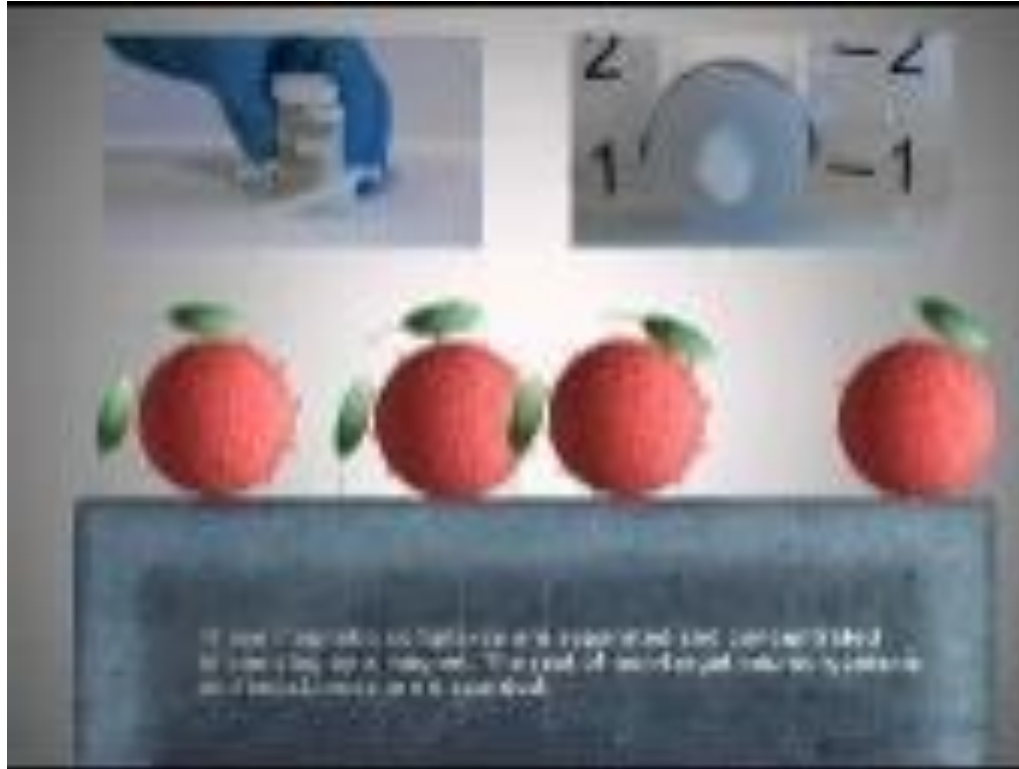
- **Culture techniques for compliance**



- **Molecular techniques for initial typing of sources and specific areas giving rise to clinical incidents**



NEW RAPID ENZYMIC DETECTION



**Legionella- total
viable**

(1 HOUR).



- **Have a plan in place on how to respond to detections / cases.**
- **If patient detection, conduct clinical response + isolation of room to determine if hospital acquired or otherwise.**
- **If a hydraulic detection, isolate outlets associated with detection and disinfect based on local state requirements, e.g;**
 - **VIC – Disinfect ALL outlets associated with the system (e.g. upstream)**
 - **QLD – Disinfect outlets associated with, and ideally adjacent to the outlet**
- **Disinfections can include; thermal pasteurisation, chlorine disinfection etc. Need to be aware of the impact of each option, and the pros / cons.**
- **May consider implementing controls until addressed, e.g. POU filtration.**



REMEDIATION by SANITATION



Removed deposits by controlled chemical sanitation.



REMEDIATION OUTCOMES

- **HEATING – PASTEURISATION**
 - Effective for 1-7 days and not on dead legs
- **SLUG CHLORINATION**
 - Effective 1-2 days and not on dead legs
- **DOSED CHLORINATION**
 - Effective 2-3 weeks and slightly on dead legs
- **DOSED CHLORINE DIOXIDE**
 - Effective 4-6 weeks and slightly on dead legs
- **CHEMICAL CLEAN AND DOSED CHLORINATION**
 - Permanent solution

EMERGENCY DISINFECTION / CONTROL INSTALLED



In-line sanitation dosing or option installed



Risk management plan for
LEGIONELLA
CONTROL

in the operation and maintenance of the
water systems of

Facility name



WQRMP STRUCTURE



1	Risk management team.....	1
2	Risk analysis	2
2.1	System description	2
2.2	Hazard identification and risk assessment	6
3	Risk management.....	10
3.1	Control procedures	10
3.2	Monitoring	11
4	Responding to detections or cases.....	15
4.1	Key incident response people and their responsibilities	15
4.2	Response procedures	15
4	Review of plan	17
	Appendix.....	18
	Key contacts.....	18
	Key documents	18

- The *Legionella* risk management plan is a live document, it needs to be regularly reviewed and adjusted as the hospital system changes.
- Requires involvement of all parties, with all information (positive detections, cases, system performance)
- Only with an active system can the risk mitigation process be given the greatest chance to succeed.





COMMUNICATION – BE PREPARED

- Increased public and **media** awareness and literature availability
- Improvements to dissemination and action to **stakeholders**
- Need improved feedback from **consultants**
- Improved **regulatory reporting** of both water quality and Risk Management Plans

POTABLE AND SAFE WATER IS THE EXPECTATION

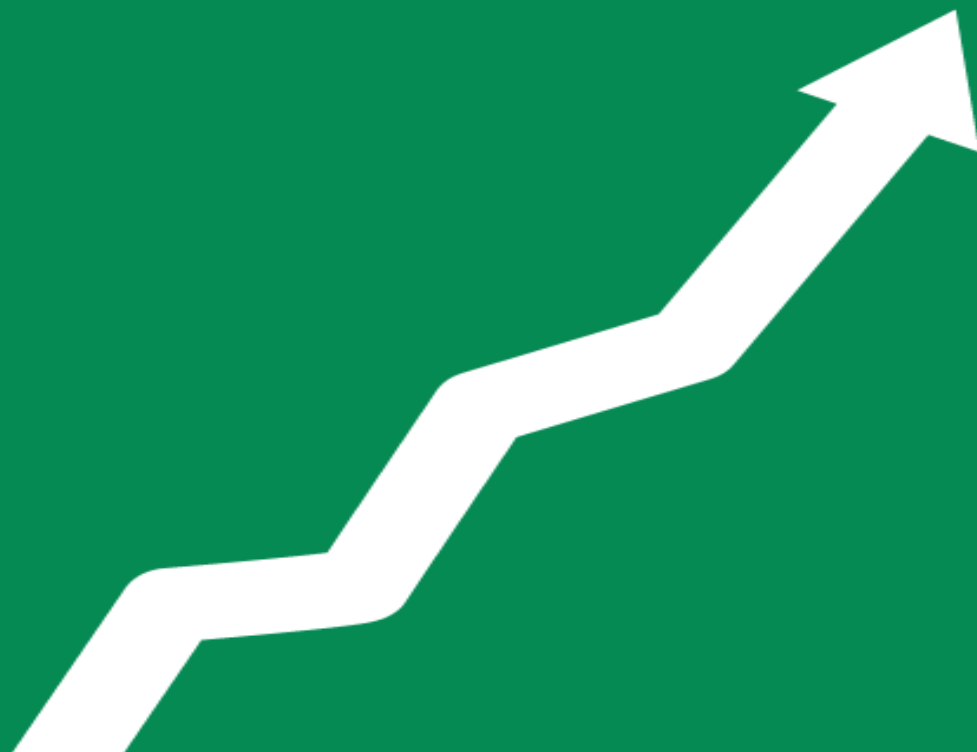


THANK YOU

Dr Vyt Garnys

Vyt.Garnys@cetec.com.au

0419373415





Questions?