Project summary - 1091
Microbial risks from pipeline repair or renewal

Context

Renewal and repair of water mains, valves and hydrants are common procedures, regularly undertaken in water distribution networks and mostly scheduled, although occasionally spectacularly unplanned!

While there is evidence in the literature of increased microbial risk associated with mains bursts and repairs, there is little Australian data. Some international research may not be directly relevant to Australian conditions and control measures (e.g. combined sewers - water and sewer mains laid in the same trench).

We know from a long history of epidemiological research by Monash University, specifically looking at drinking water, that it is no easy task to get information about water-related health impacts other than in major incidents – and even then, only in countries where there is actually monitoring. It was attempted in the CRC WQT project "Health Services Utilisation and Urban Dual Reticulation Systems" which accessed relevant health data of patients living in suburbs of Sydney that were supplied with recycled water for non-potable use. The aim was to see if evidence of any health impacts from the use of recycled water could be seen in GP practice visit history. No difference was discerned compared with patients in nearby suburbs without recycled water. Whilst the context of this study is different, it highlights the difficulties in gathering data in large populations where health impacts are not obviously linked.

The key observation prior to commencing the project was that managing mains breaks to avoid contamination of the water supply is a complex problem, but reaching agreement on what represents good practice in mains repairs would effectively manage the risk - in the absence of having a full understanding of the likelihood of the risk.

The Project

At the 2015 WaterRA Research Symposium, a panel session on pipe breaks and repair put some context around the project aim – to develop a cost-effective, risk-based national framework for pipeline repair and renewal works for the protection of public health.

Around 100 water industry personnel and researchers were in the room, representing an impressive collective of experience, knowledge and wisdom. It was a great opportunity to harness that.

To achieve its aim, the project needed to gain a better local understanding of the contamination risk of renewals and repairs, including possible impacts from current management practices.

Key elements of the project were to:

- Compile the range and nature of risks to consumers from contamination events associated with supply interruptions, and water main repairs and renewals
- Identify scenarios where there could be material risks to consumers from contamination associated with supply interruptions, and water main repairs and renewals
- Provide guidance to water utilities on control strategies to minimise the likelihood of contamination, and how to monitor the effectiveness of these control strategies, to ensure that consumers are not exposed to unacceptable levels of risk

Findings

A literature review gathered together known information on contamination risks and control framework measures.

A 2016 survey of thirty Australian water utilities and development of case studies provided information on current industry practice across Australia.

The survey told us the frequency of pipe breaks among the utilities varied from 3 to 56 per 100 km per year, with no clear correlation between number of connections, length of mains, pipe age, pipe material, environment or any other contributing factor.

The most common control measures being implemented in Australia during pipe repair and renewal works include:

- Flushing
- Excavation to below break
- Controlled shutdown
- Repair under pressure where possible
- Mains isolation

Additional controls are implemented by some utilities when managing high risk broken mains, e.g. disinfection at several points, dedicated crews, separation and hygienic storage of tools and equipment, and sampling/testing.

A pipe repair and renewals control framework has been produced, taking into account existing control strategies and utility-specific risks. Due to the varying controls used and degree of implementation currently being undertaken, the developed framework aimed to be flexible while allowing for areas of improvement to be identified based on individual utility risks and practices

The pipe repair and renewals control framework aligns with the Australian Drinking Water Guidelines (ADWG 2011) Framework for the Management of Drinking Water Quality, which was developed to guide the design of a structured and systematic approach to assuring safety and reliability of drinking water quality.

To consider the risk to public health from repairs or renewals, an onsite dynamic risk evaluation should be undertaken to evaluate the appropriate controls to be used to manage any potential risk.

Key factors identified for effective site evaluation assessments include:

- Training and awareness of staff in potential contamination risks
- Documented dynamic risk assessment process
- Documentation of control measures in place for levels of risk identified on site
- Identified escalation and reporting process

Onsite control repairs should be based on individual risks both to the utility and from site specific conditions.

Conclusions

Australian utilities employ a range of strategies for pipe repair and renewal, including the use of subcontractiors.

Case studies have highlighted the importance of supporting framework elements, including governance, training and research and development activities.

If a water utility already has a framework in place, it is recommended a gap analysis be undertaken against the developed framework to identify areas where additional controls are required.

Further reading

Management of potential contamination risks from pipeline repair or renewal works, Crawford N. and Contos A. (2018) WaterRA Research Report.

Practical Guide to the Operation and Optimisation of Distribution Systems, Mosse P. and Deere D. (2016) WIOA.

Step	Item	Detail
Step 1: Risk approach	Utility-specific hazards	Identify hazards and hazardous events specific to a water supply system or utility
	Risk categories	Define level of risk that the hazard would introduce
	Risk controls	Identify existing and proposed controls that manage the hazard for each risk category
	Control effectiveness	Evaluate the effectiveness of the control (such as, through the prevention or reduction of the hazard)
	Supporting areas	Identify governance, training, communication protocols, documentation and reporting requirements and areas for research and development
Step 2: Pipe break repair event	On-site control measures should be implemented appropriate to site-specific risks and conditions	On-site dynamic risk assessments should be used to select appropriate controls. Key on-site control measures to be evaluated include: • Repair under pressure • Flushing • Hygienic work practices • Disinfection • Testing
Step 3: Evaluation and review	Periodic and ongoing review	Identify and undertake a schedule of compliance audits and implement ongoing review

Summary of control framework for pipe repair and renewals