Australian Water Recycling
Centre of Excellence

A national framework
for validating water-recycling technology

Validating non-treatment barriers for water recycling systems

based on Street map 10

Water is being recycled all over Australia for a variety of uses. To protect the health of people and the environment, treatment technologies used in water recycling schemes need to meet agreed performance targets. Across Australia there is currently no consistent approach to validating that they do so. The Australian Water Recycling Centre of Excellence engaged Water Quality Research Australia to deliver a national framework for validating treatment technologies.

After much consultation, the project team, comprising researchers, industry specialists and regulators, has designed a workable, accepted framework. The next steps are to fill some of the knowledge gaps and negotiate with industry and government to have the framework implemented.

Photo sourced from WaterCorporation

What is validation?

The *Australian Guidelines for Water Recycling (2006)* require that a treatment technology or process be validated before the water recycling scheme is operational. Validation is the confirmation that the treatment process meets the specified performance targets. The guidelines describe the concept of and need for validation but do not specify how the validation should be done.

What is a non-treatment related barrier?

Non-treatment barriers are an integral part of water recycling schemes and associated guidelines. Non-treatment barriers function by reducing or modifying exposure to hazards contained in recycled water and can be applied at two levels.

1. Selection of the end use of recycled water based on quality; for example whether water is used for agricultural irrigation, irrigation of green spaces/sporting grounds, non-drinking residential uses (e.g. toilet flushing) or for augmenting water supplies. For each of these uses the extent of public exposure to hazards can be very different, which means end use restrictions can influence the level of treatment required.

"Validation of water treatment technologies is necessary to protect the public health interests of the Australian community, and water recycling can contribute to important water security and environmental sustainability outcomes."

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According to the Australian Guidelines for Water Recycling, average exposures from non-drinking residential use of recycled water can be more than 10-fold higher than those associated with unrestricted irrigation of green spaces. Applying end-use restrictions can influence the level of treatment required.

2. Application of non-treatment barriers within types of end use, on-site controls. For example, restricting public access to green spaces where recycled water is used for irrigation.

Non-treatment barriers may also lead to inactivation of potential pathogens. The Australian Guidelines for Water Recycling (AGWR) suggest pathogen exposure reductions for the following types of non-treatment barriers:

- restricting the type of end use
- restricting application method
- withholding periods between application and public exposure
- controlling public access
- crop restrictions

Current guidelines for non-treatment barriers

The *Australian Guidelines for Water Recycling* (AGWR) ascribe "equivalent" log reductions to various on-site control non-treatment barriers. These values are based on a mixture of field and laboratory experiments, epidemiological studies and practitioner judgement. However, guidance is not provided on how the effectiveness of these barriers can be validated, and the guidelines note that evidence is limited, with further research required.

Numerous other Australian and international guidelines – Australian Guidelines for Sewerage Systems: Use of Reclaimed Water (2000), US EPA *Guidelines for Reuse (2004),* the *World Health Organization's Guidelines for Wastewater Reuse and Guidelines for the Safe Use of Wastewater, Excreta and Greywater* – discuss the non-treatment barriers and their effectiveness (alone or in combination with treatment barriers); but again, none specify methods for demonstrating measurable reductions achieved.

Validation limitations and difficulties

The evidence supporting the effectiveness of non-treatment barriers is limited and there are data gaps. This is partly due to their nature. In design they are quite straightforward – for example, drip irrigation versus spray irrigation – but their on-site application complicates validation.

There are a range of factors that can influence exposure and the impact of non-treatment barriers and hence need to be considered in validation. Some examples include:

- The influence of temperature, sunlight, humidity and wind on the effectiveness of access restrictions during irrigation
- Varying possibility of coming in direct contact, ingesting or inhaling water near buffer zones
- Consideration of inactivation rates of pathogens in aerosols and the relationship between distance survival and exposure.
- Determining appropriate withholding periods for produce, taking into account varying transport times during which viral and bacterial pathogens may continue to die-off, and additional loss of water can occur, which could contribute to reductions in pathogens on the surface of produce.
- The impact of the height of crops where drip irrigation is used, as crops with no ground contact (e.g. apples or grapes) would have different exposure than crops with ground contact.
- Consideration of crop use – will skin be removed or will the produce be cooked/processed prior to consumption.
- Consideration of the type of irrigation used (spray, various drip types) best suited to the type of soil.

There is also uncertainty about the accuracy of the pathogen reductions attributed to some non-treatment barriers.

Photo sourced from Sydney Water

Photo sourced from Wide Bay Water

"A national validation framework will help address inefficiencies in current approaches to validation. The framework presents a simple way to achieve important outcomes more efficiently and effectively."

Photo sourced from Sydney Water

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Research gaps

There are a range of issues and knowledge gaps that exist for validating non-treatment barrier systems, including:

- determining sampling frequencies and analysis
- transfering results to other sites
- selecting appropriate test organisms for the various non-treatment barriers
- selecting laboratory-grown or environmental organisms
- selecting laboratory-based or field-based studies.

Recommendations

The research gaps listed above need to be resolved before undertaking further research to validate the effectiveness of non-treatment barriers.

National Validation Framework factsheet suite

This brochure is based on a 'road map' report funded by the Australian Water Recycling Centre of Excellence. The 'road map' describes a national approach for validating treatment technologies, and was based on extensive consultation with stakeholders.

This brochure is one of a series that describes the outcomes of the first stage of this national validation project.

Other brochures in the series cover:

> An overview of the draft National Validation Framework
> Perspectives of water recyclers, technology suppliers and regulators
> Validation of various treatment systems
> Building capacity in the industry

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For further information visit www.australianwaterrecycling.com.au

Australian Water Recycling Centre of Excellence

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