



Validation of Wastewater Treatment Processes

INTRODUCTION

In accordance with Department of Health and Australian Guidelines for Water Recycling (AGWR) guidance, Class A recycled water schemes are required to undergo validation to prove the capability of the treatment processes to remove or inactivate pathogens.

ALS Water Resources Group conducts NATA accredited testing to support validation trials according to USEPA guidelines to evaluate wastewater treatment processes as required by AGWR and Department of Health recommendations.

THE VALIDATION PROCESS

Validation requires quantifying the logarithmic removal or inactivation of pathogens by a wastewater treatment process under specified conditions and during full scale operation. The most resistant pathogen and conservative operating conditions are chosen for the validation to calculate a conservative estimate of the logarithmic reduction value (LRV).

The AGWR requires that Class A recycling schemes achieve a median LRV of seven (7) and six (6) for the removal or inactivation of viruses and protozoa, respectively. This requirement eliminates the need for multiple treatment barriers. A wastewater treatment process can be accredited for a maximum LRV of four (4).

CHALLENGE TESTING VALIDATION

The concentration of indigenous pathogens is often too low to demonstrate the maximum 4 LRV for a wastewater treatment process. Therefore, feed wastewater is spiked with a high number of a surrogate microorganism to "challenge" the treatment process. A suitable surrogate is one that is equally resistant to the treatment process as the target pathogen, is safer to work with and is quick and cost effective to assay.

SURROGATE MICROORGANISMS

Viruses are the smallest pathogens and are typically used to validate filtration processes. MS2 bacteriophage is used as a surrogate virus for challenge testing validation as it has a similar size and shape to human pathogenic viruses, is not human infectious and is recommended by the USEPA.

Oocysts of the protozoan *Cryptosporidium parvum* have been used for the challenge testing validation of ozone and chlorine treatment processes and can be used for most processes that inactivate rather than remove pathogens.

ALS is able to supply high numbers of laboratory cultured virus (MS2 bacteriophage) and protozoa (*Cryptosporidium parvum* oocysts) for challenge testing. Other challenge bacteria and viruses can be supplied on request depending upon treatment process utilised (see Table 1).

CHALLENGE TESTING PROCESS

Validation of a wastewater or other treatment process (see Figure 1 overleaf) by challenge testing involves:

1. Operating the treatment process under conservative conditions e.g. water quality and flux.
2. Dosing the challenge organism into the influent wastewater at the appropriate concentration to achieve a max four (4) LRV.
3. Collecting paired samples of the dosed influent and treated effluent wastewater for laboratory analysis.
4. Calculate the logarithmic concentration of the challenge organism in the paired samples.
5. Calculate the LRV of the challenge organism through the treatment process under the specified operating conditions.

The full technical details of the challenge testing are defined in the Department of Health and USEPA guidelines.

Challenge testing can be applied to the validation of treatment processes for other water matrices (Table 1). The Australian Pesticides and Veterinary Medicines Authority (APVMA) have published guidelines for the challenge testing validation of disinfection processes for swimming pools and spas.

Table 1: Treatment process and challenge testing validation options.

Treatment Processes	Challenge Test Organisms	Water Matrices
Ultrafiltration	MS2 bacteriophage	Wastewater
Ultraviolet light	Adenovirus	Greywater
Chlorination/Chloramination/Chlorine dioxide	<i>Cryptosporidium parvum</i> oocysts	Potable
Ozonation	<i>Escherichia coli</i>	Swimming pool/spa
Activated sludge/Media filtration/Bioreactors	<i>Clostridium perfringens</i>	

LEGISLATIVE REQUIREMENTS

All Recycled Water Quality Management Plans (RWQMPs) are required under the AGWR to include the validation and operational monitoring of wastewater treatment processes. Validation testing is required for the initial endorsement by the Department of Health and operational monitoring is performed concurrently with the validation process and subsequently on a routine basis to continually verify the performance of the treatment process. Validation must be repeated if the treatment process or operational parameters are modified, e.g. extending the validation of an ultraviolet treatment process for wastewater with lower transmissivity.

Due to the limitations of the methods used to detect breaches in the integrity of ultrafiltration membranes to remove viruses the Department of Health requires annual validation testing of ultrafiltration processes to be incorporated in the RWQMP.

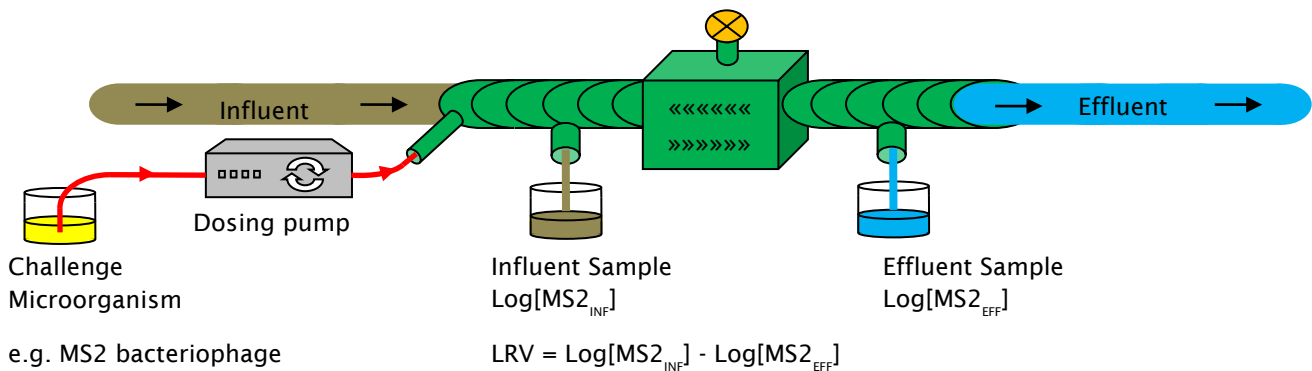


Figure 1: Overview of the validation of a wastewater treatment process by challenge testing with a surrogate microorganism.

SERVICES PROVIDED BY ALS

ALS Scoresby has been involved in the challenge testing validation of a wide range of treatment processes using a number of different challenge test organisms and water matrices (Table 1) and is able to provide a tailored solution to validate the capability of treatment process including:

- Experimental design and sampling protocol.
- Supply and dosing of the challenge test organism.
- Sample collection & NATA accredited laboratory analysis.
- Data analysis and interpretation.
- Reporting for Department of Health endorsement.

For further information please contact the ALS WRG Melbourne Client Services Team on (03) 8756 8000.

REFERENCES

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