

# International Scheme to Evaluate Household Water Treatment Technologies

## The Sydney 905 Purifier

### Product evaluation report

<b>WHO performance classification</b>	Comprehensive protection Two-star (★ ★)
<b>Manufacturer</b>	Sydney 905 Filters (Pty) Ltd 4 Strelitzia Road Southport KwaZulu-Natal 4230 Republic of South Africa www.safewater4u.com
<b>Evaluation procedure</b>	Abbreviated laboratory test
<b>WHO report issue date</b>	Round III, 2021
<b>WHO reference</b>	24/1/2020-R3-18

## Summary of evaluation

This report summarizes the evaluation results of a membrane ultrafiltration device known by the tradename 'the Sydney 905 Purifier', under Round III of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Evaluation of the Sydney 905 Purifier followed the requirements of the WHO protocol for filtration technologies, and investigated the ability of the device to reduce bacteria and viruses. Reduction of protozoa was assigned based on the mean bacterial reduction achieved. Based on the evaluation results, the Sydney 905 Purifier meets WHO performance criteria and is classified as providing *Comprehensive protection* (★ ★)

# 1. Background

Evaluation under the Scheme is based on performance criteria set out in *Evaluating Household Water Treatment Options: Health-based targets and microbiological performance specifications* (WHO, 2011). The criteria were determined by applying quantitative microbial risk assessment methods outlined in the *WHO Guidelines for Drinking-water Quality* (2017) and set out  $\log_{10}$  reduction targets against bacteria, viruses and protozoa, as shown in the table below.

## WHO performance criteria for household water treatment technologies

Performance classification	Bacteria ( $\log_{10}$ reduction required)	Viruses ( $\log_{10}$ reduction required)	Protozoa ( $\log_{10}$ reduction required)	Interpretation (with correct and consistent use)
★ ★ ★	$\geq 4$	$\geq 5$	$\geq 4$	Comprehensive protection
★ ★	$\geq 2$	$\geq 3$	$\geq 2$	
★	Meets at least 2-star (★ ★) criteria for two classes of pathogens			Targeted protection
—	Fails to meet criteria for 1-star (★)			Little or no protection

## Product description

The Sydney 905 Purifier is a 0.01 micron hollow-fibre membrane ultrafiltration device. The filter can be plumbed to a pressurized water supply, or connected to a raw water reservoir outlet such as a bucket or water tank and operated by gravity flow. The full product description, illustrations and use instructions can be found on the manufacturer website: [www.safewater4u.com](http://www.safewater4u.com), or product website: [www.sydney905filters.com](http://www.sydney905filters.com).

# 2. Evaluation approach

This report summarizes the evaluation of the Sydney 905 Purifier only. The evaluation of the Sydney 905 Filter is summarized in a separate report.

**Product-specific test plan:** A product-specific test plan was developed based on the manufacturer's instructions for use; the WHO *Scheme Harmonized Testing Protocol: Technology Non-Specific V 3.0* (2019); and the WHO *Testing Protocol for Filtration Technologies V 3.1* (2020). Testing was conducted at a WHO-designated laboratory, KWR Watercycle Research Institute, in the Netherlands.

**Test organisms:** Evaluation of the Sydney 905 Purifier investigated its performance in removing bacteria and viruses. The test organisms were *Escherichia coli* (*E. coli*) to represent bacteria, and bacteriophages MS-2 and phiX-174 to represent viruses. Based on the available evidence on protozoan cyst removal by size exclusion filters, testing against this microbial group was not conducted (WHO, 2019). The protozoan removal is assigned based on the mean bacterial reduction observed.

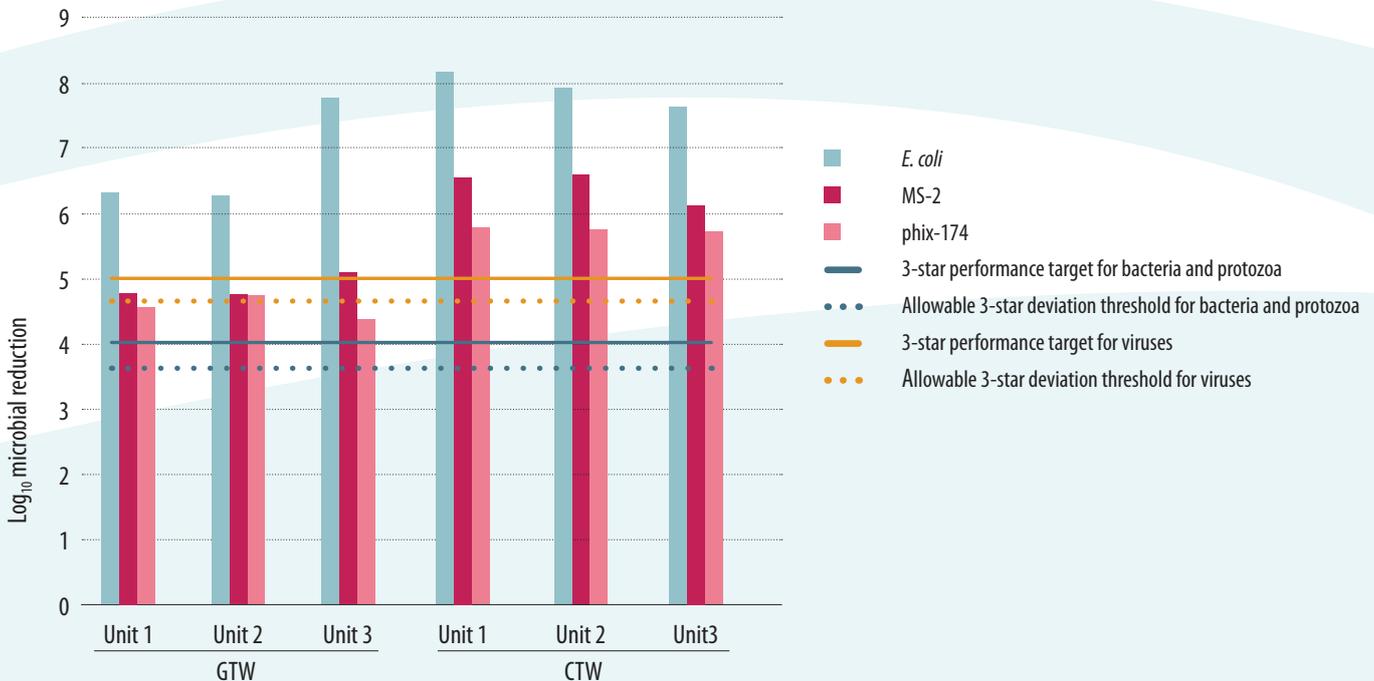
**Test waters:** The device was tested in two waters: General Test Water (GTW), simulating high quality groundwater, and Challenge Test Water (CTW), simulating surface water. Refer to the *Testing Protocol for Filtration Technologies V 3.1* for details on physicochemical characteristics of the test waters.

**Test set-up:** Three new sample units of the Sydney 905 Purifier were provided by the manufacturer for the test. All units were operated according to the manufacturer's use instructions. Pretreatment and posttreatment water grab samples were analysed using methods identified in the product-specific test plan. Testing was conducted over four days: in GTW on Day 1 and 2; and in CTW on Day 3 and 4. This resulted in a total of 12 sample points for each organism i.e. 2 days  $\times$  2 test waters  $\times$  3 test units.

# 3. Results

Fig. 1 presents the results of the bacterial and viral testing for the three units in GTW and CTW. All test water characteristics were within specifications.

Performance across test units<sup>1</sup>



The Sydney 905 Purifier achieved mean log<sub>10</sub> reductions of 7.3 for *E. coli*; 5.5 for MS-2; and 5.1 for phiX-174.

Performance targets for *E. coli* were fully met in both CTW and GTW. While the mean log reductions for viral surrogates MS-2 phiX-174 exceeded the 3-star performance target of 5 log, a third of the MS-2 samples and half of the phiX-174 samples did not meet this performance target.

# 4. Interpretation and application of results

Performance is classified in three ascending tiers: ★ (one-star); ★★ (two-star); and ★★★ (three-star), as shown in the table outlining performance criteria. Both three- and two-star products provide *Comprehensive protection* against all three microbial groups. One-star products meet performance targets for only two of the three microbial groups, providing *Targeted protection*.

Each production unit should consistently meet or exceed the performance target for each microbial group in both test waters (GTW and CTW). However, a maximum deviation of 0.2 log<sub>10</sub> is acceptable for 25% of sample points at the two-star performance tier and 0.4 log<sub>10</sub> at the three-star performance tier<sup>2</sup>. This means that for classification as a two-star product, up to three of the 12 sample points can achieve a minimum reduction of 1.8 log<sub>10</sub> for bacteria or protozoan cysts (instead of 2 log<sub>10</sub>) or 2.8 log<sub>10</sub> for viruses (instead of 3 log<sub>10</sub>). Each phage is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower performing phage.

1 The maximum microbial reduction that can be demonstrated is limited by the pretreatment challenge concentration delivered. For each organism tested, the pretreatment concentration must be sufficient to allow for the demonstration of the performance targets in the table showing the performance criteria. Due to the complexity of using viable organisms, there may be variation in these pretreatment concentrations above what is sufficient, which may lead to demonstrated reductions reported that far exceed the performance targets. However, the emphasis is on whether the performance target has been met and not the extent to which the target was exceeded.

2 These cut-off values were determined using QMRA modelling and selecting ranges that still resulted in appreciable health gains within a specific performance tier

## Performance classification

The Sydney 905 Purifier fully met the performance target for bacteria. For the protozoan reduction, a value of 7.3 log<sub>10</sub> is assigned based on the mean bacterial reduction. For the viral reduction, the three-star performance target was not fully met. As such, the Sydney 905 Filter is classified as providing *Comprehensive protection* (★★).

## Considerations for product selection

	<b>Microbial conditions</b>	Effective against bacteria, viruses and protozoa; can be used under all microbial water quality conditions
	<b>Physico-chemical water characteristics</b>	Can be used to treat turbid water
	<b>Product information and labelling</b>	Check that the product is appropriately labelled and has clear instructions for use

## References

Evaluating household water treatment options: health-based targets and microbiological performance specifications. Geneva: World Health Organization; 2011 ([http://www.who.int/water\\_sanitation\\_health/publications/household\\_water/en/](http://www.who.int/water_sanitation_health/publications/household_water/en/)).

Guidelines for drinking-water quality, fourth edition incorporating first addendum. Geneva: World Health Organization; 2017 ([http://www.who.int/water\\_sanitation\\_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/](http://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/)).

Harmonized Testing Protocol: Technology non-specific version 3.0. Geneva: World Health Organization; 2019 ([http://www.who.int/water\\_sanitation\\_health/water-quality/household/household-water-treatment-scheme-resources/en/](http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/)).

Filtration Technology Testing Protocol: version 3.1. Geneva: World Health Organization; 2020 ([http://www.who.int/water\\_sanitation\\_health/water-quality/household/household-water-treatment-scheme-resources/en/](http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/)).

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