World Health Organization

WHO International Scheme to Evaluate Household Water Treatment Technologies

Grifaid® Family Filter (GFF5)

Product evaluation report

WHO performance classification	Comprehensive protection Two-star (★★)
Manufacturer	The Safe Water Trust Ltd Unit 8 Tower Road Glover Industrial Estate Washington Tyne and Wear NE37 2SH United Kingdom www.grifaid.org
Evaluation procedure	Abbreviated laboratory test
WHO report issue date	Round IV, 2022
WHO reference	22/11/2021-R4-4

Summary of evaluation

This report summarizes the results of evaluating a single stage ultrafiltration device known by the tradename 'Grifaid® Family Filter (GFF5)', under Round IV of the World Health Organization (WHO) International Scheme to Evaluate Household Water Treatment Technologies (the Scheme). Evaluation of the GFF5 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 Grifaid® Family Filter (GFF5) meets WHO performance criteria and is classified as providing two-star (★★) *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 the quantitative microbial risk assessment (QMRA) methods outlined in the Guidelines for Drinking-water Quality (WHO, 2017) and set $\log_{10}$ reduction targets against bacteria, viruses and protozoa, as shown in Table 1.

Table 1. 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)
★★★	≥ 4	≥ 5	≥ 4	Comprehensive protection
★★	≥ 2	≥ 3	≥ 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 Grifaid® Family Filter (GFF5) is a household water treatment device using a polymer ultrafiltration membrane. The filter is operated by a manual hand pump, which pressurizes the source water through the membrane for microbial reduction.

The full product description, illustrations and use instructions can be found at www.grifaid.org.

2. Evaluation approach

Product-specific test plan: A product-specific test plan was developed based on the manufacturer's instructions for use; the *Harmonized Testing Protocol: Technology Non-Specific Verson 4.0* (WHO, 2021); and the *Testing Protocol for Filtration Technologies V 4.0* (WHO, 2021). Testing was conducted at a WHO-designated laboratory, NSF International, in the United States.

Test organisms: Evaluation of the GFF5 investigated its performance in removing bacteria and viruses. The test organisms were *Escherichia coli* (*E. coli*), representing bacteria, and coliphages MS2 and Phi X174, representing viruses. Based on the available evidence on removal of protozoan cysts by filtration media, testing against this microbial group was not conducted (WHO, 2019). The protozoan reduction is assigned based on the mean bacterial reduction observed.

Test waters: The device was tested in two simulated natural 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 4.0* for details on physicochemical characteristics of the test waters.

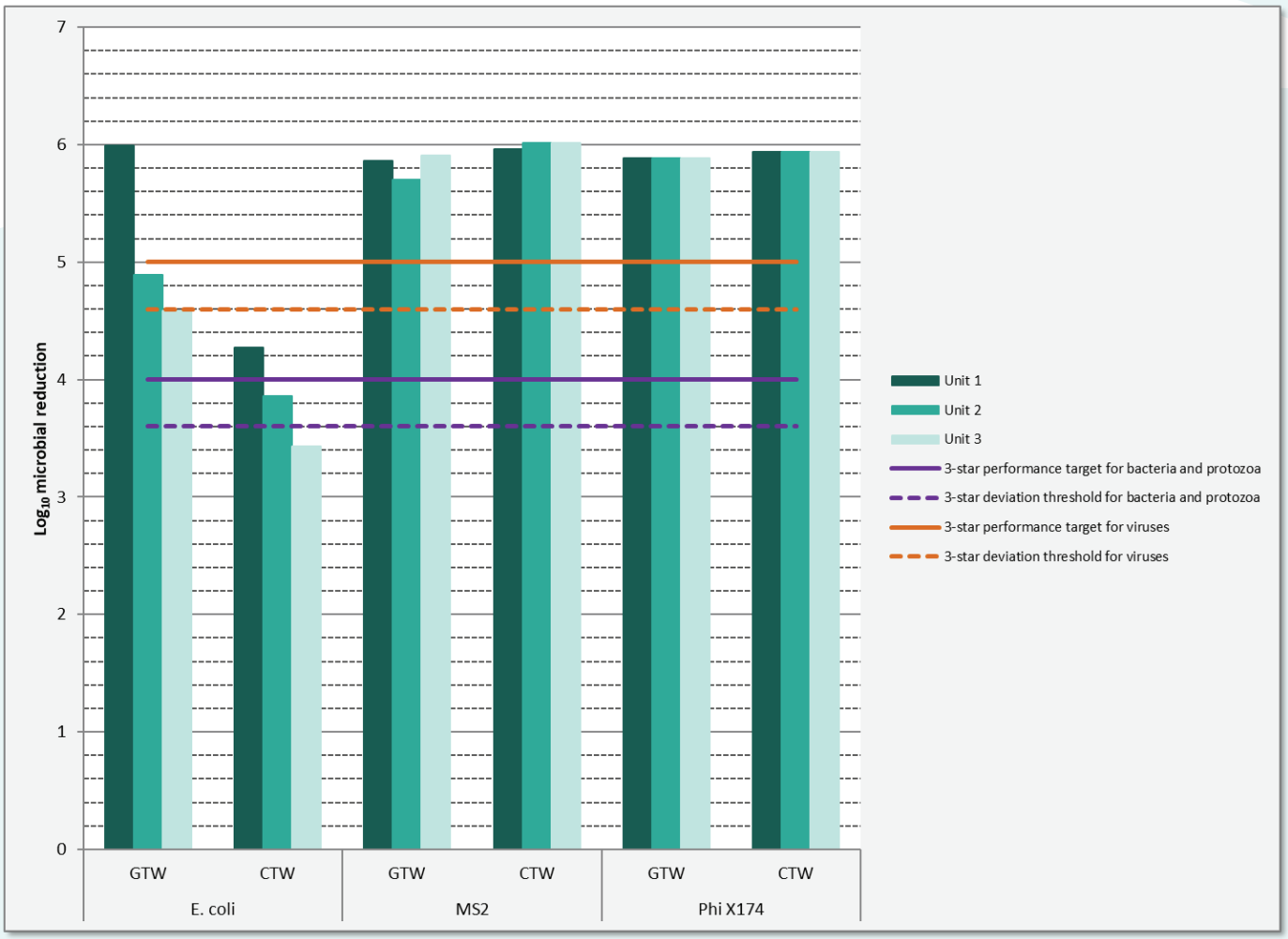
Test procedure: The manufacturer provided three units of the GFF5, which were operated according to the manufacturer. Testing was conducted over four days, using GTW on Days 1 and 2 and CTW on Days 3 and 4. A total of 40 L was processed by each unit each day. The manufacturer's recommended membrane cleaning procedure was conducted at the end of each day. Microbial challenges were conducted at the start of Days 1 and 3, and at the end of Days 2 and 4, resulting in a total of 12 sample

points for each organism (2 sampling points × 2 test waters × 3 test units). Pretreatment and posttreatment water grab samples were analysed using the methods identified in the product-specific test plan.

3. Results

Fig. 1 presents the results of the bacterial and viral testing for the two units in GTW and CTW. On test days 3 and 4, the TDS was slightly below the target level, and the non-challenge batch turbidity was slightly above the target level. All other test water characteristics were within specifications.

Fig. 1. Performance across test units[1]



CTW: challenge test water; *E. coli*: *Escherichia coli*; GTW: general test water.

The GFF5 achieved mean $\log_{10}$ reductions of 4.51 for *E. coli*; and 5.91 for both MS2 and Phi X174.

[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 demonstrate the performance targets shown in Table 1. Due to the complexity of using viable organisms, these pretreatment concentrations may be above what is sufficient, which may lead to demonstrated reductions that far exceed the performance targets. However, the emphasis is on whether the performance target was met and not the extent by which the target was exceeded.

4. Interpretation and application of results

As shown in Table 1, performance is classified in three ascending tiers: ★ (one-star); ★★ (two-star); and ★★★ (three-star). 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 $\log_{10}$ is acceptable for 25% of sample points at the two-star performance tier and 0.4 $\log_{10}$ at the three-star performance tier[2]. 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 $\log_{10}$ for bacteria or protozoan cysts (instead of 2 $\log_{10}$) or 2.8 $\log_{10}$ for viruses (instead of 3 $\log_{10}$). Each phage is treated separately for evaluating acceptable allowance, and the overall claim for viruses is based on the lower performing phage.

Performance classification

The Grifaid® Family Filter (GFF5) fully met the performance targets for viruses, and the minimum performance target for bacteria. For protozoan reduction, a value of 4.51 $\log_{10}$ is assigned based on the mean bacterial reduction achieved. As such, the GFF5 is classified as providing two-star (★★) *comprehensive protection* against all three microbial groups.

Considerations for product selection

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

[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.

References

WHO (2011). Evaluating household water treatment options: health-based targets and microbiological performance specifications. Geneva: World Health Organization (https://apps.who.int/iris/bitstream/handle/10665/44693/9789241548229_eng.pdf?sequence=1&isAllowed=y).

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

WHO (2019). Harmonized testing protocol: technology non-specific version 4.0. Geneva: World Health Organization (http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/).

WHO (2020). Filtration technology testing protocol: version 4.0. Geneva: World Health Organization (http://www.who.int/water_sanitation_health/water-quality/household/household-water-treatment-scheme-resources/en/).

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