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Evaluating household water treatment technologies: lessons from the WHO Evaluation Scheme

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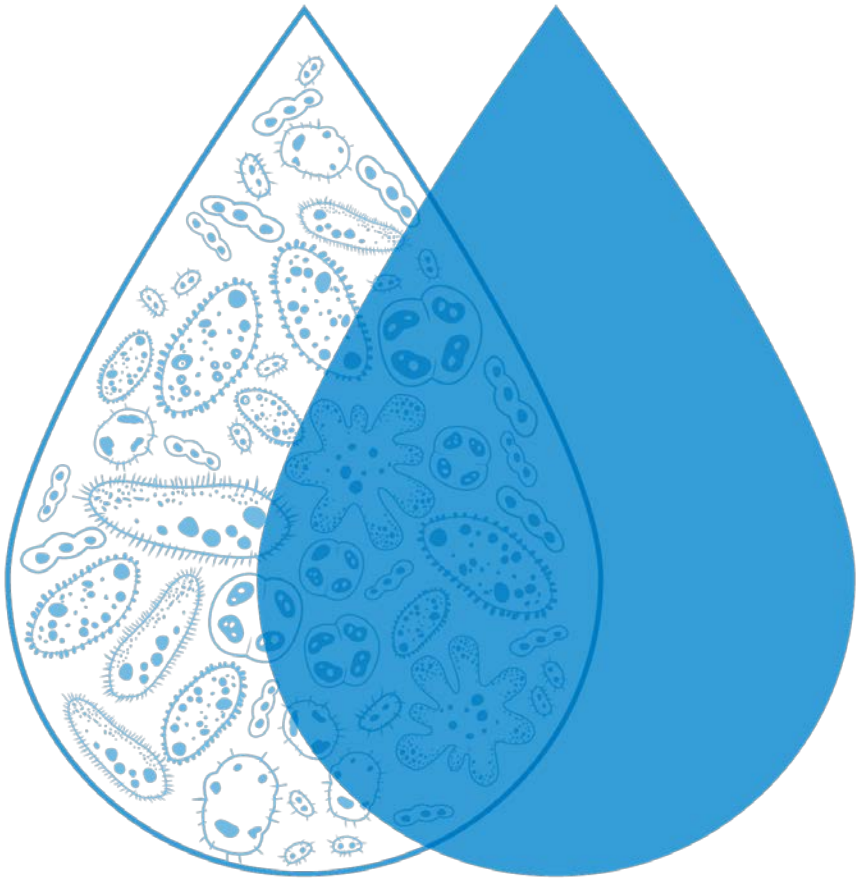
Overview of the Scheme

- Scheme objectives
- Evaluation criteria and procedure



Why an evaluation Scheme?

- Issue: HWT market is diverse; products are increasingly promoted in emergencies
- Need: health-based performance evaluation to guide selection
- Gap: many countries do not have comprehensive health-based regulations to guide such evaluation, nor the technical capacity to implement WHO recommendations for evaluating HWT

Trends in HWT since Scheme was established

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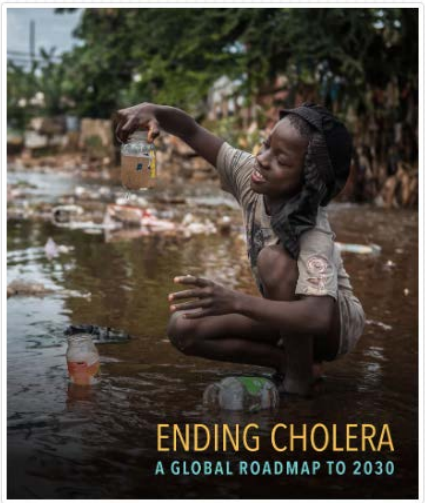
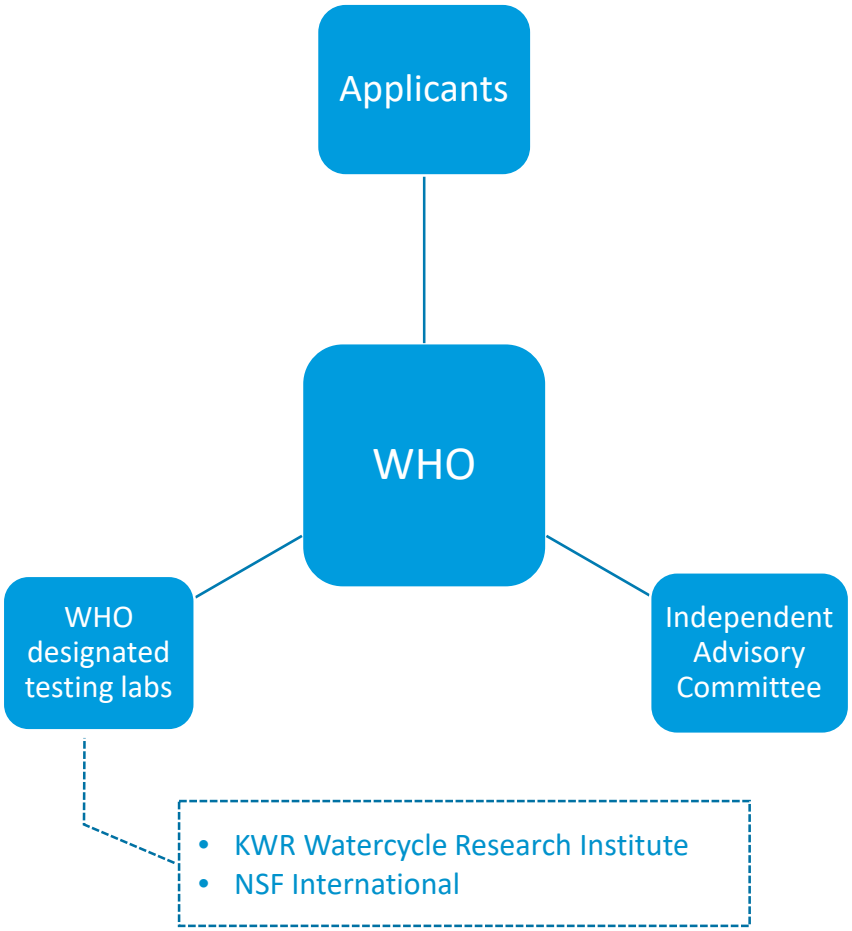
GLOBAL TASK FORCE ON CHOLERA CONTROL



WASH in Health Care Facilities

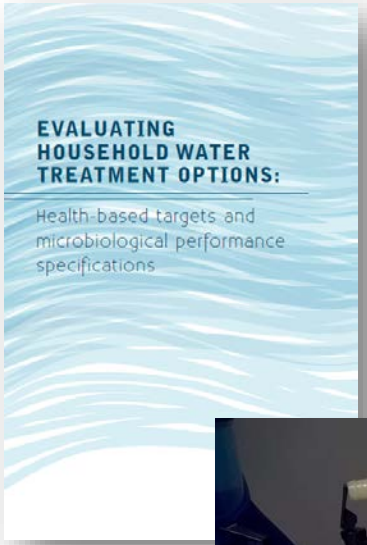
- Demand for HWT stable/ growing
  - 2 billion people globally rely on water drinking-water that is faecally contaminated
  - More people affected by climate-related emergencies; hurricanes, floods, droughts
  - Major global campaigns to end cholera, and on WASH in health care facilities
- Innovation and diversity of new products
  - Multi-stage filters
  - Atmospheric water generators
  - 'Alternative' disinfectants and delivery methods

Scheme objectives



- Promote and coordinate independent and consistent evaluation of HWT products based on WHO criteria
- Strengthen national capacity in conducting complimentary evaluations, regulation of HWT products

Priority products for evaluation



- Priority products for evaluation:
  - Remove microbial contaminants
  - Market-ready
  - Intended for low-resource settings
- Evaluation fee: USD5,000-USD10,000, depending on treatment technology
- What the Scheme evaluation is **not**
  - a certification / endorsement
  - a testing facility for products under research and development (R&D)

HWT performance criteria

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E.g.: If a filter demonstrated 99.999% protozoa reduction, 99.9% bacteria reduction, and 90% virus reduction, what performance classification would it achieve?

Performance classification	Bacteria (log_{10} reduction required)	Viruses (log_{10} reduction required)	Protozoa (log_{10} reduction required)	Interpretation (with correct and consistent use)
10^{-6} DALYs ★★★	≥ 4	≥ 5	≥ 4	Comprehensive protection
10^{-4} DALYs ★★	≥ 2	≥ 3	≥ 2	
★	Meets at least two-star (★★) criteria for two classes of pathogens			Targeted protection
–	Fails to meet criteria for one-star (★)			Little or no protection

99.999% = 5 log **99.9% = 3 log** **90% = 1 log**

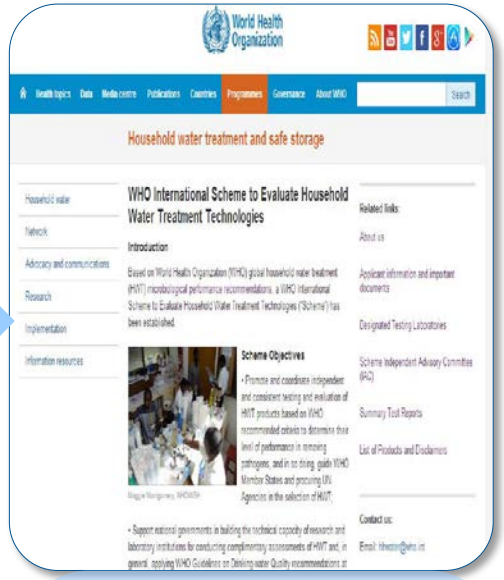
Scheme evaluation procedure

Review of product dossier

WHO and Independent Advisory Committee conduct an assessment of HWT product data and information on safety, performance and field testing

Performance testing

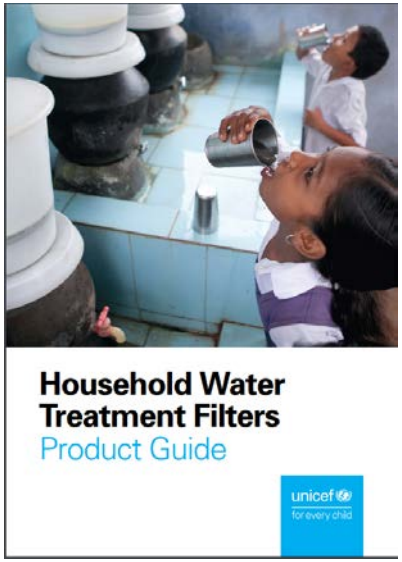
Products tested at WHO designated testing laboratories according to WHO harmonized testing protocols



Listing of results

- WHO and Independent Advisory Committee review test results and assign performance classification.
- Summary results are listed on WHO webpage

Impact and application of the Scheme results



- Embedding HWT performance recommendations in Global Task Force for Cholera Control (GTFCC)
- Working with UNICEF Procurement to ensure that products procured have been evaluated under the Scheme
- Increasing recognition of WHO Scheme results by governments
- Expanding application to health care facilities and schools

Strengthening national capacity

WHO Ethiopia/ Biniyam Fisseha

- Aim: strengthen regulation and testing as part of broader efforts to improve water safety
- Activities
  - Utility, focus and format of virtual and/or in person technical exchanges between laboratories in low/middle income and high income countries
  - Update/wider dissemination of existing training materials
  - Guidance document for selection of water quality field kits
  - Supporting development of national standards and regulations for HWT
  - Sensitization on HWT performance, need for evaluation

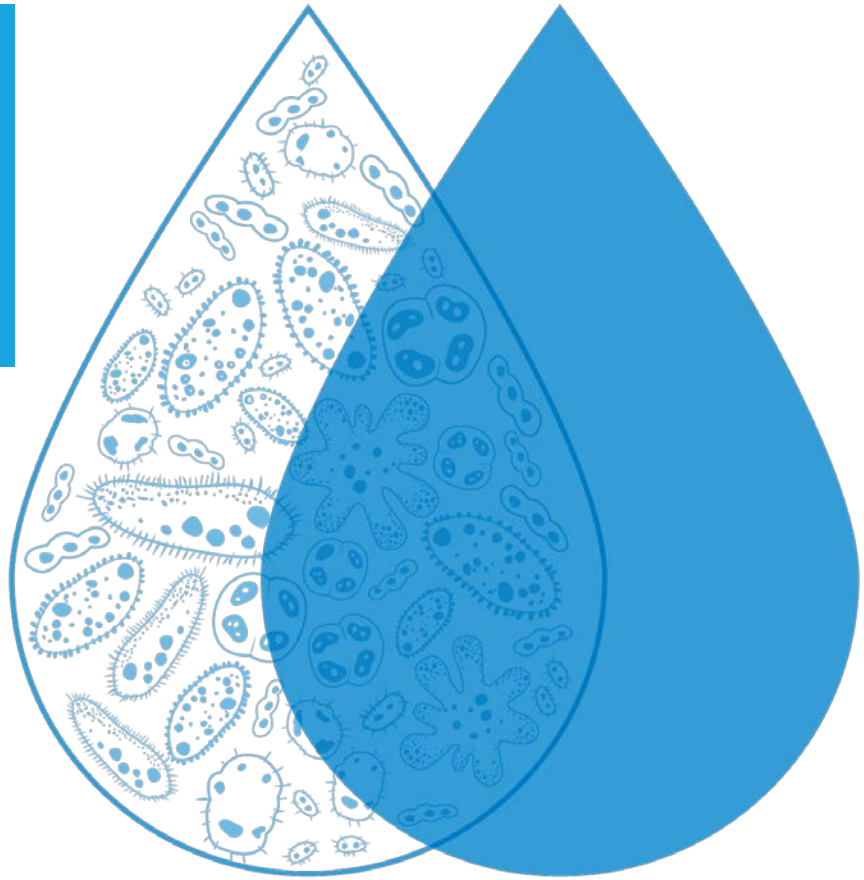
Future Directions of the Scheme

WaterAid

- Focus on strengthening testing capacity in countries
  - Scheme protocols will be adapted for in-country use
  - WHO to act as a resource to help guide local testing of products
- Round IV Expressions of Interest are now being accepted and can be submitted to **hhwater@who.int**

Results from Rounds III

- Overview of Rounds I-III
- Products evaluated in Round III



What does the evaluation consider?

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Microbial reduction

- Meet performance targets for at least 2 of the 3 groups
- Effective across both test waters

Consistency

- Dossier to include evidence of manufacturing quality management system
- All 3 replicates (devices) or samples from two production lots (consumables) tested should meet performance targets
- Chemical disinfectants should deliver expected concentrations in deionized water

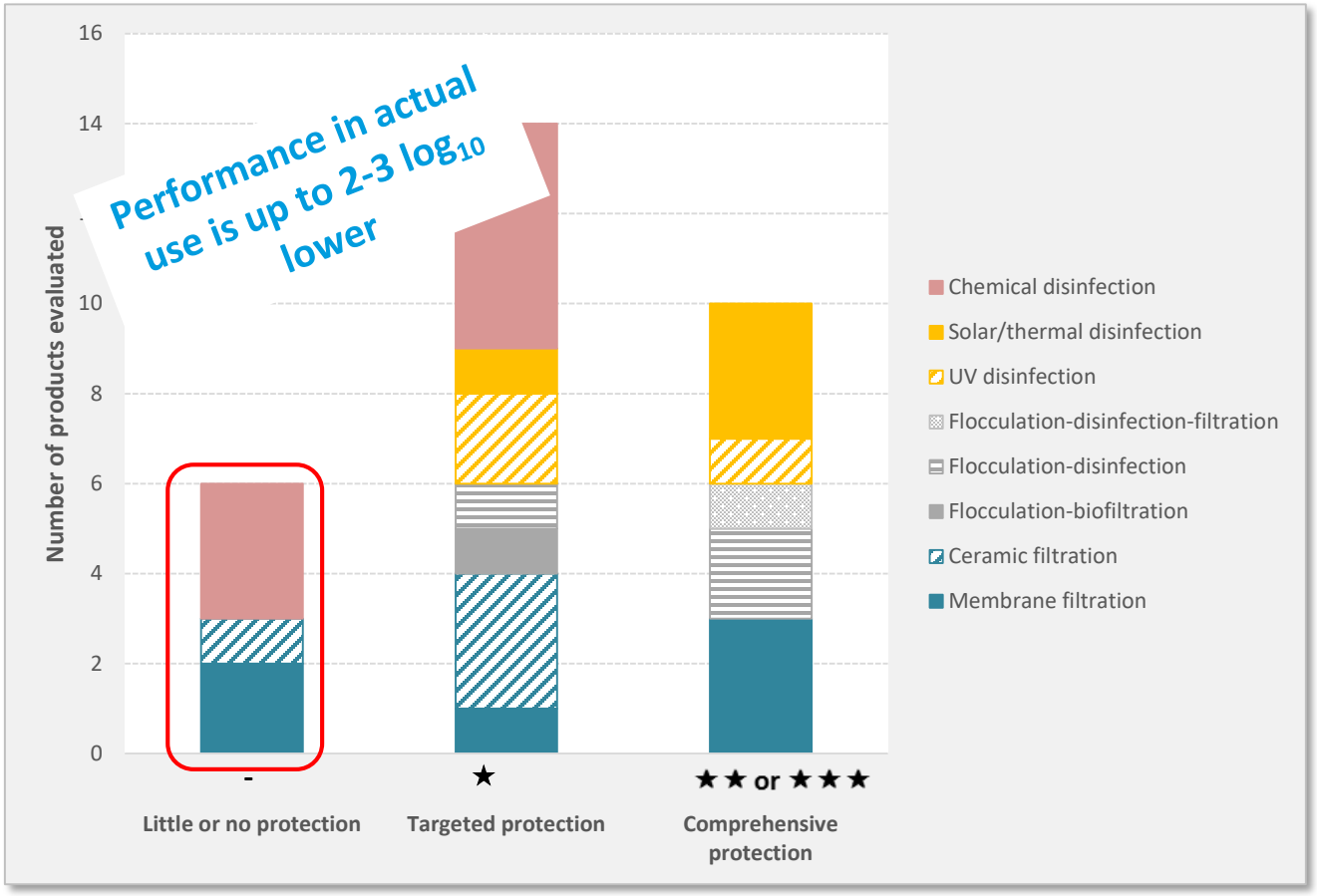
Product safety

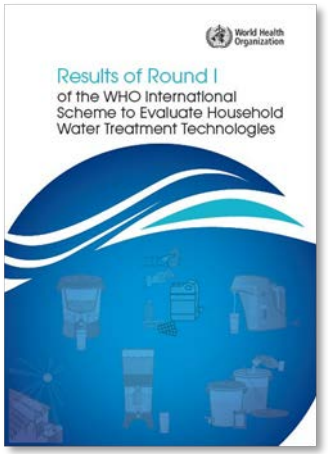
- Leachates / materials in contact with water should not pose a risk to health
- Disinfectant residual concentrations should not exceed limits specified in WHO Guidelines for Drinking-water Quality (2017)

Labelling and instructions for use

- Clear instructions, including (if applicable) dosage, contact time, procedures for maintenance, restoring flow
- Consistent across production samples, brochures, webpage, etc.

Overview of results: Rounds I-II





Round I results

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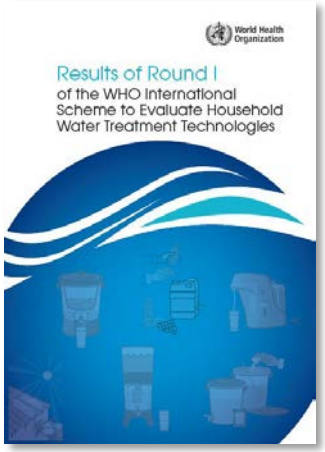
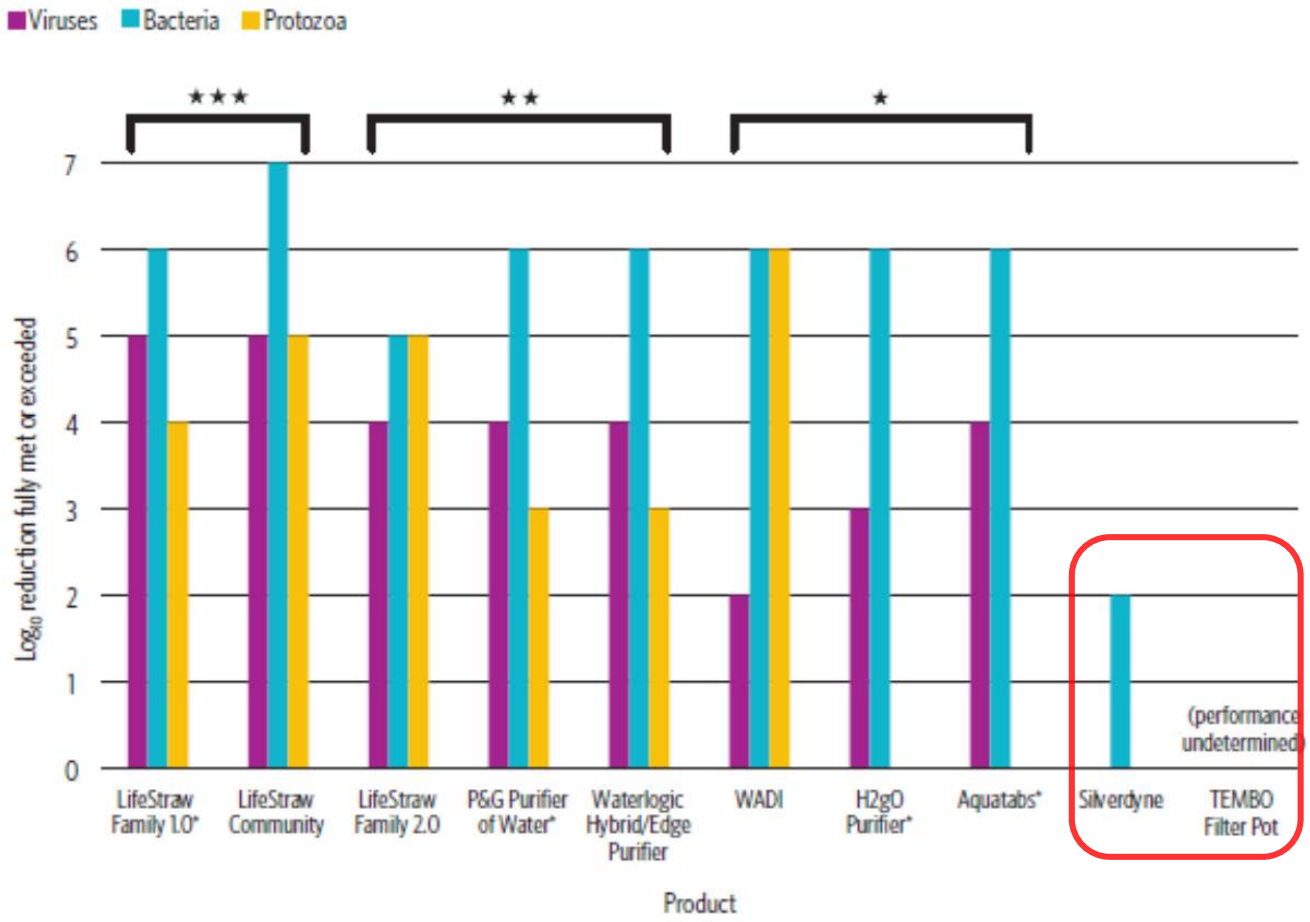


FIGURE 5

Log_{10} reduction of bacteria, viruses and protozoa met or exceeded by products evaluated in Round I



Round II results

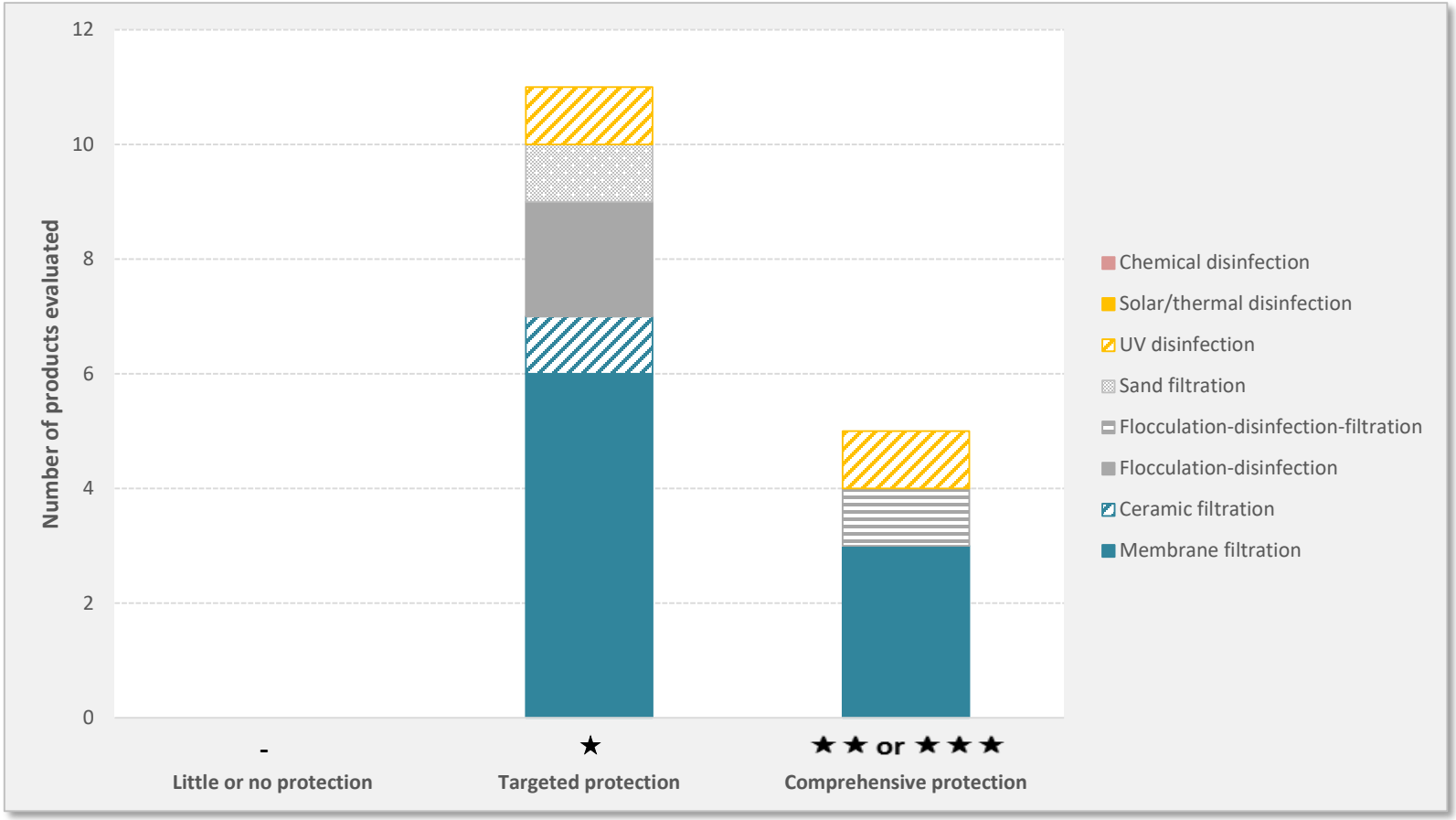
Comprehensive protection ★★★ or ★★	Targeted protection ★	Little or no protection –
• Aquapak	• Aquatabs Flo	• Biocool CleanWater
• Aquasure TAB10	• BlueQ™ 2-stage	• Chloritard
• DayOne Waterbag™	• Mesita Azul °	• GrifAid®M3
• JAMEBI Solar Water Pasteurizer	• Nazava Water Filter	• LifeFilta LFJC Jerrycan
• SolarBag®	• Oasis Water Purification Tablets	
	• SPOUTS Water Purifaaya Filter	
	• Rubicon-Micro	
	• Tulip Table Top Water Filter	
	• Uzima Filters UZ-01	
	• WATA-Standard™	
	• Water Elephant	

°effective in non-turbid water only

Products evaluated in Round III

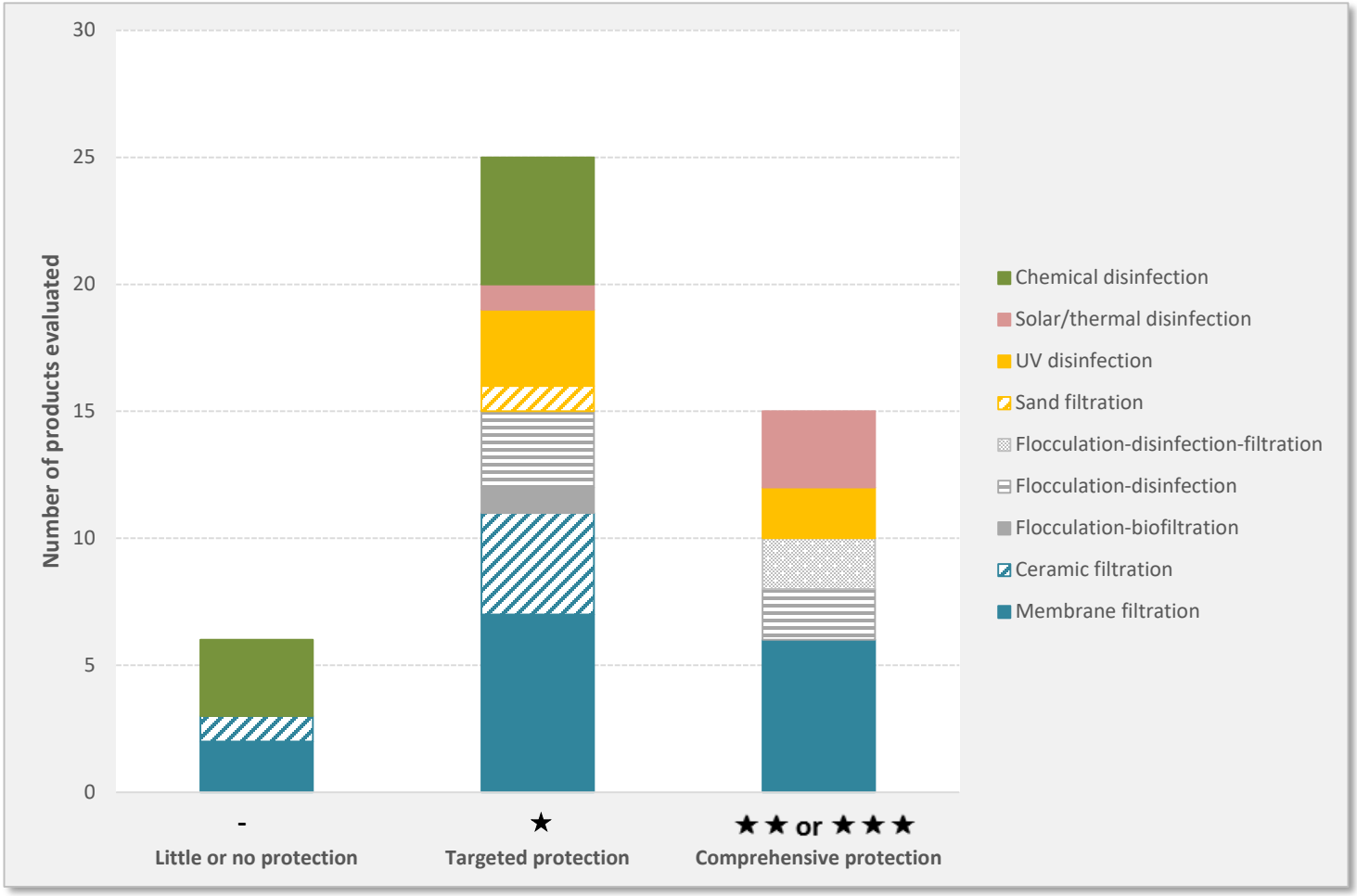
Technology	Product	Manufacturer
Membrane Filtration	BluAct Filter Cartridge	BluAct Technologies GmbH
	Nanofilter™	Gongali Model Co. Ltd
	Katadyn First Response BeFree	Katadyn Products Inc.
	ORISA	Fonto de Vivo
	ROAMfilter Plus	WaterRoam
	Sydney 905 Filter	Sydney 905 Filters (Pty) Ltd
	Sydney 905 Purifier	Sydney 905 Filters (Pty) Ltd
	VF100 Home Filter	Village Water Filters Inc
	VF100 Home Filter + VF200	Village Water Filters Inc
Ceramic Filtration	Katadyn Rapidyn Water Filter Kit	Katadyn Products Inc.
Diatomaceous earth filtration	MINCH Household Water Filter	Desert Rose Consultancy PLC
Flocculation-disinfection	Bishan Gari Water Purifier	Bishan Gari Purification Industries
	PuriBag	PRAQUA PTY LTD
	WaterMaker	Control Chemicals
UV disinfection	Solageo Better Water Maker	Solageo / Trade Without Borders
	Drop2Drink Unit	D2D Water Solutions BV
Solar disinfection	SaWa	4lifesolutions
Chlorine dioxide disinfection	Xinix AquaCare	Xinix AB

Overview of Round III results



Results for 16 products; results for 2 products pending

Technology Performance Round I-III



Results for 46 products tested to date; results pending for 2 products

Questions

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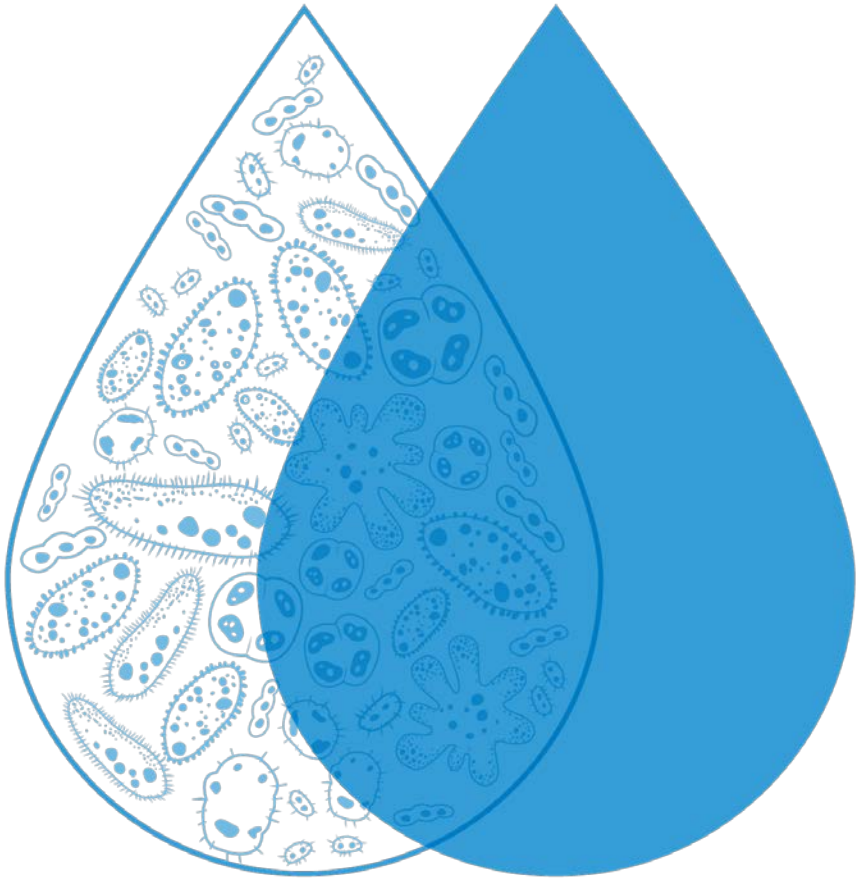
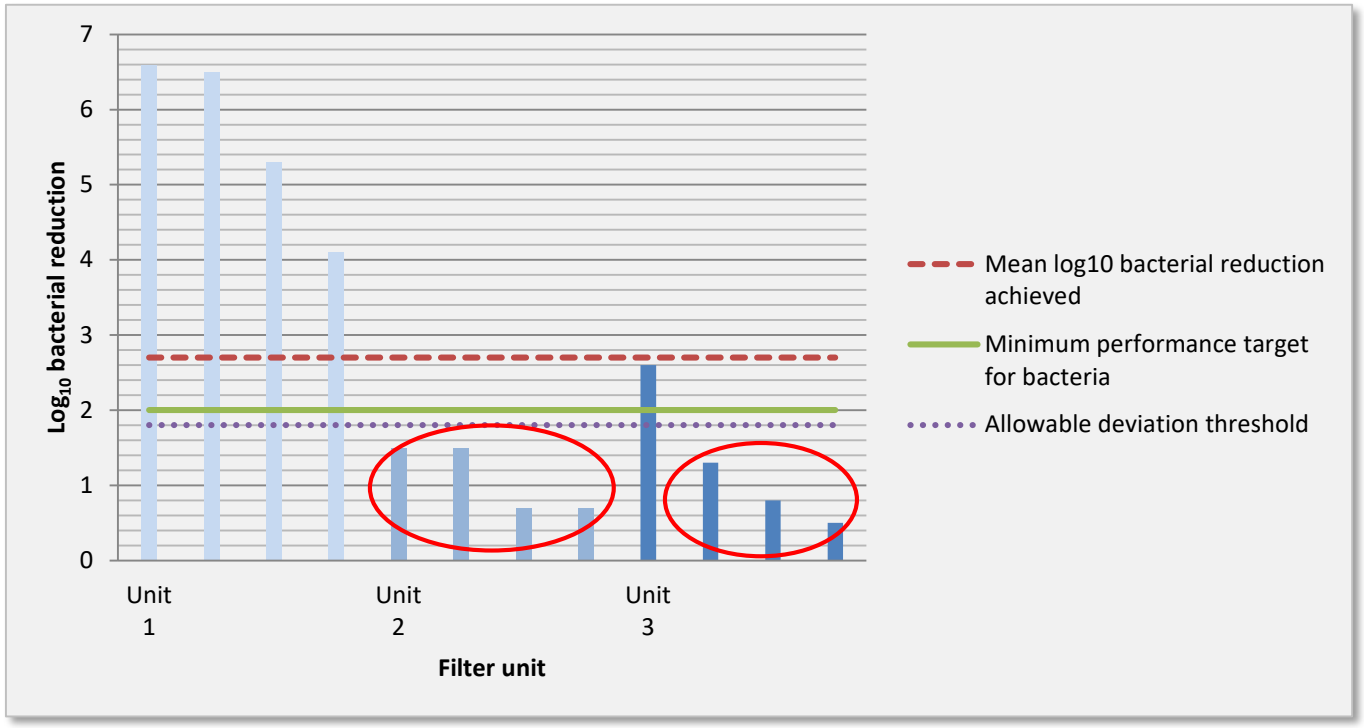
Lessons Learned and Next Steps

- Technology Specific Weaknesses
- Adapting testing protocols for local use

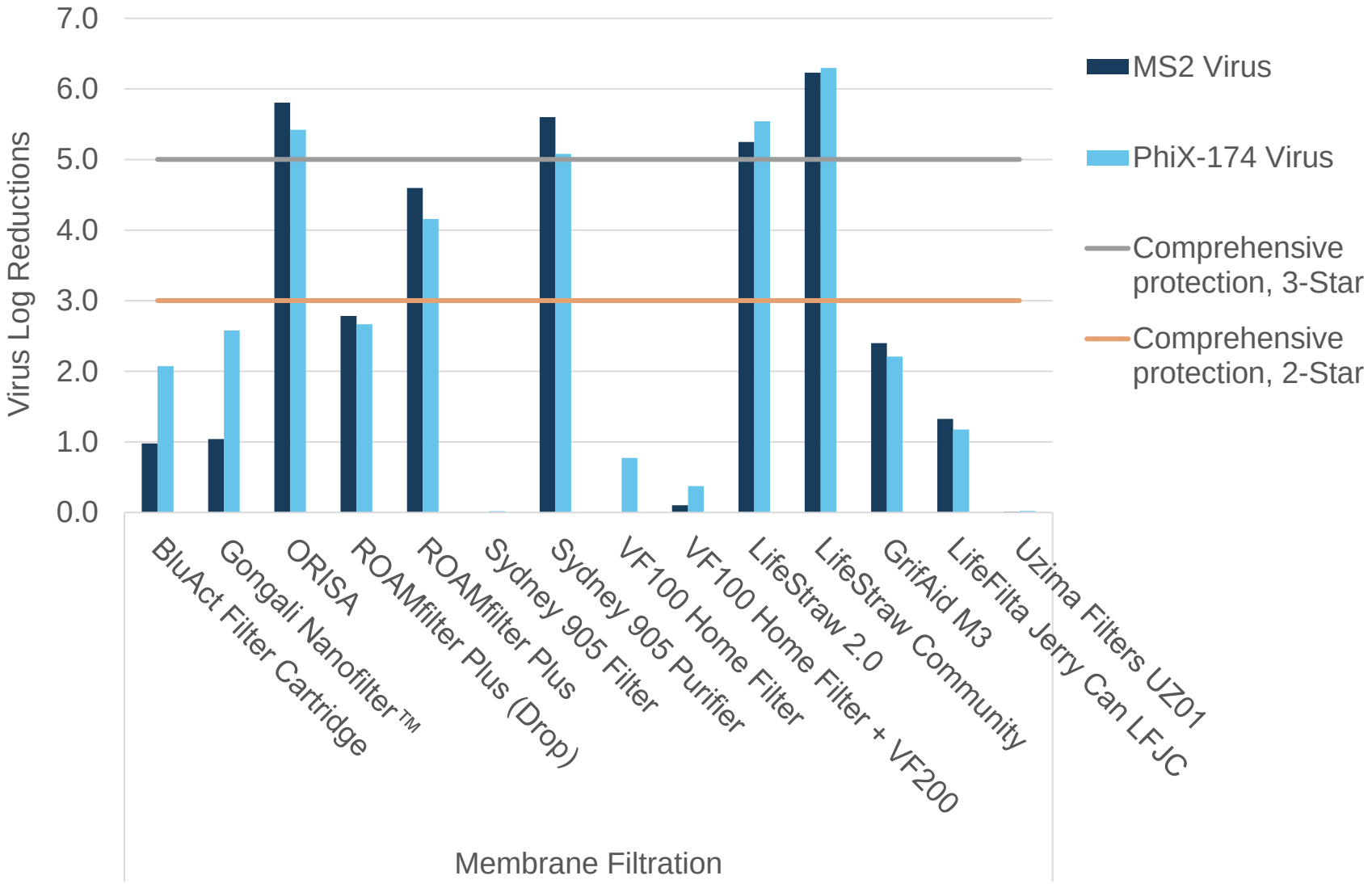


Key takeaway 1: Manufacturing quality control is highly variable

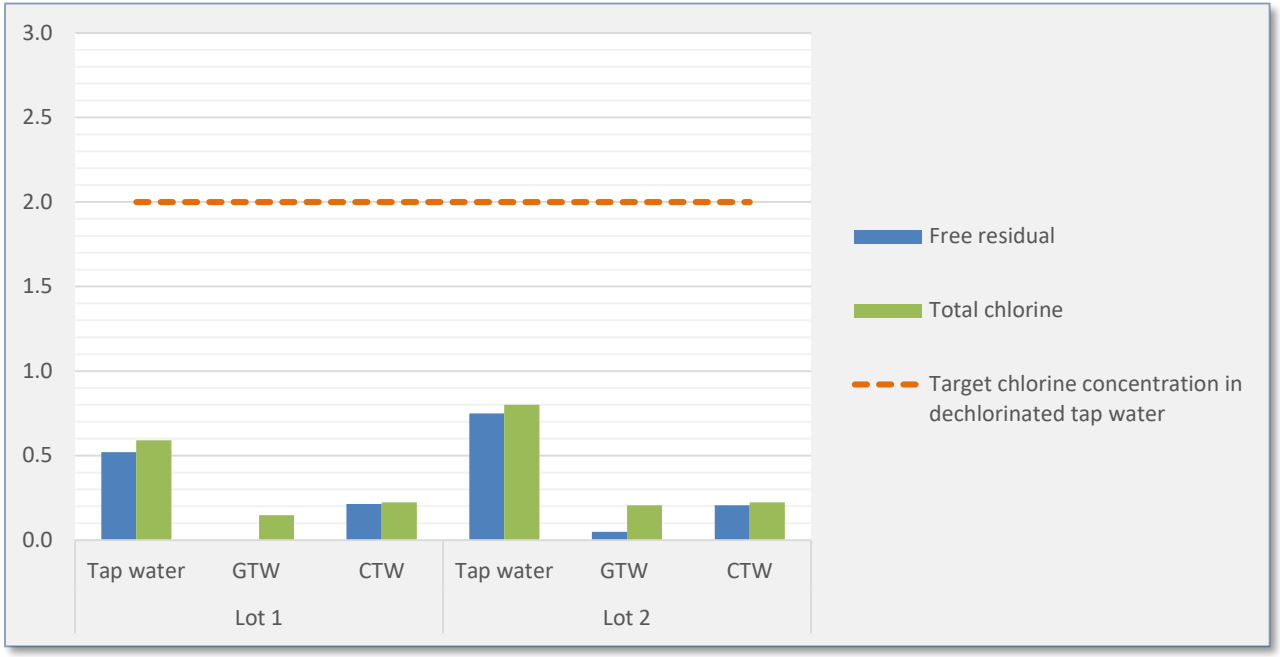


- 6/46 of the products evaluated fail to meet minimum performance criteria
- 5 out of the 6 products have weak manufacturing quality management
- Even among products that pass, reductions range from meeting minimum requirements to exceeding top tier

Key takeaway 2: Variations between membranes

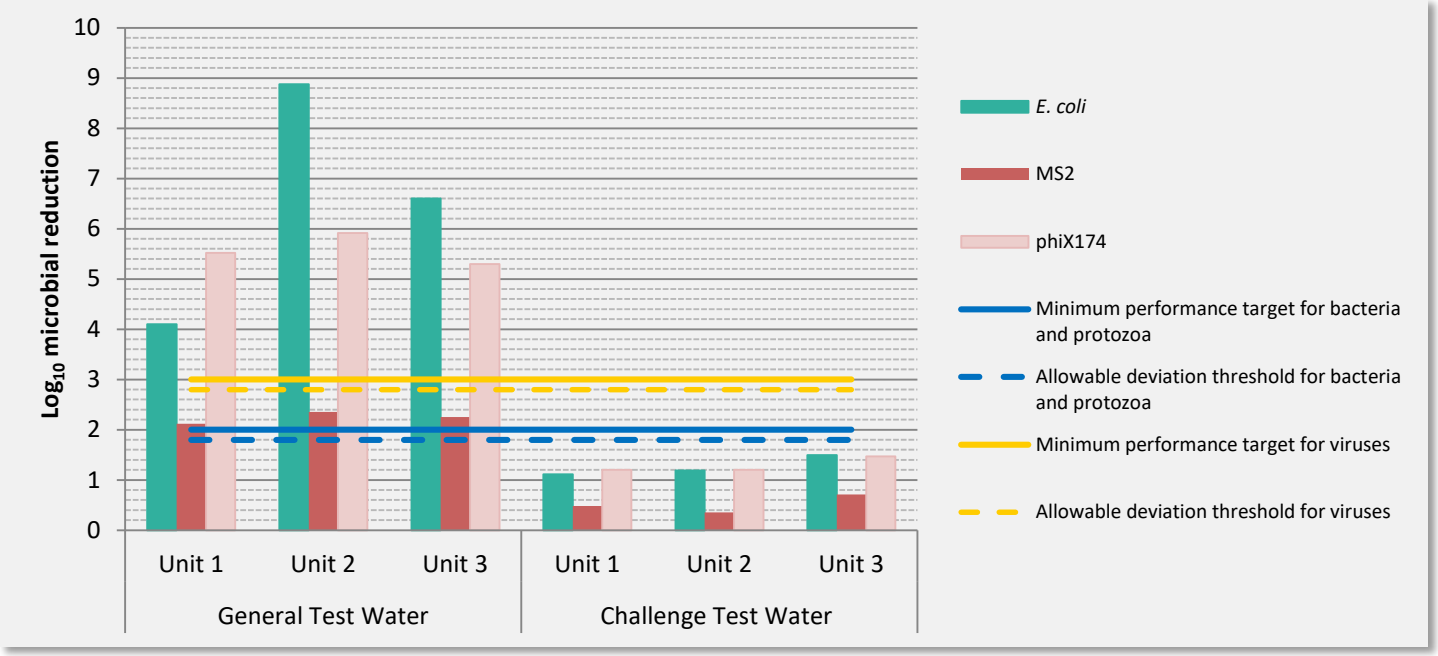


Key takeaway 3: Chlorination is not just a drop in a bucket!



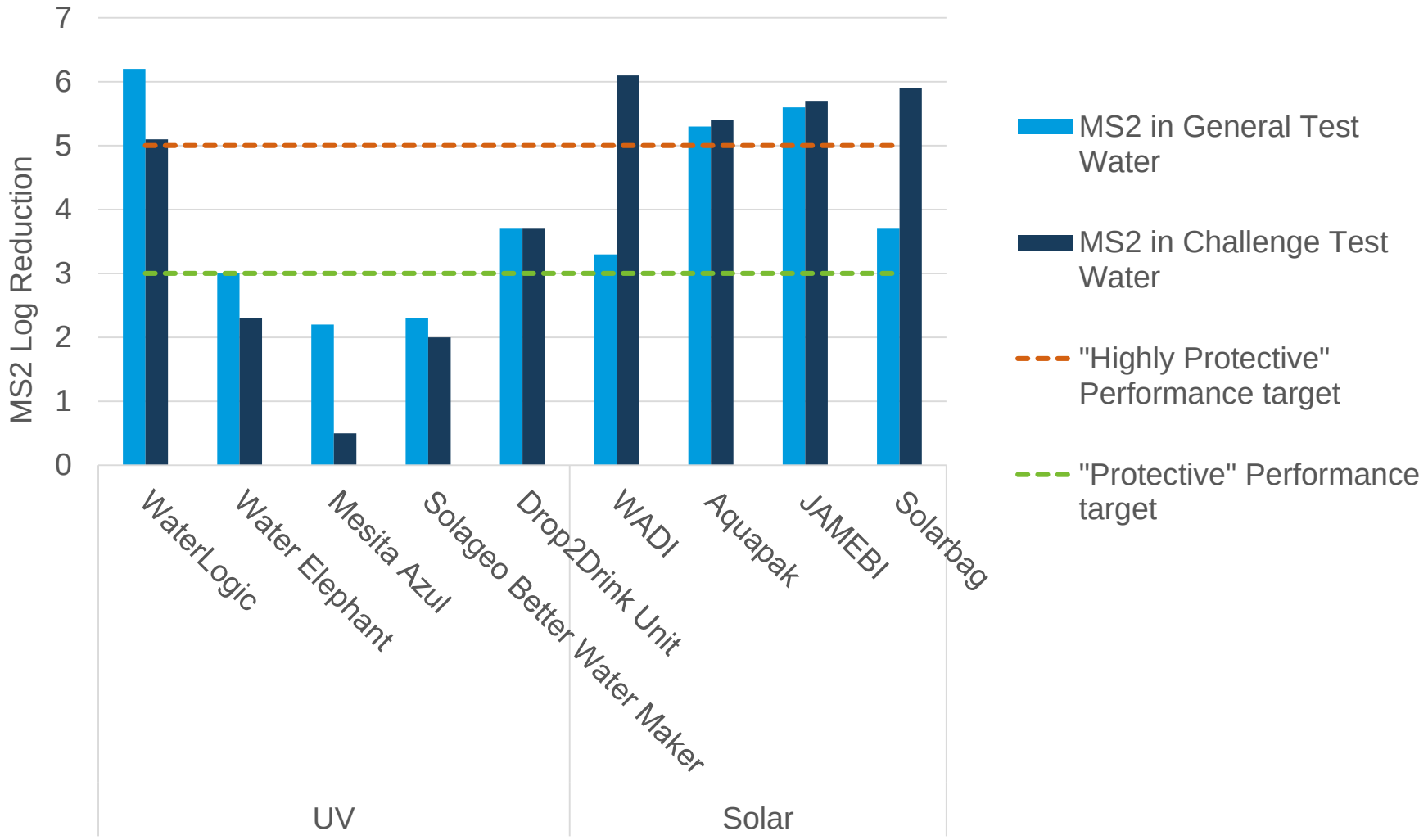
- Effective chlorination depends on a number of factors: water quality characteristics such as chlorine demand, efficacy of chlorine product, contact time, etc.
- It's not just about turbidity- Round II testing highlighted impact of natural organic matter on chlorine disinfection
- Regular check of chlorine residual important - essentially requires technical know-how and access to test kits

Key takeaway 4: Understand water quality + technology limitations!



- Technologies have different capabilities and weakness.
- Example: Performance of UV technologies suffers in turbid conditions

Key takeaway 4: Understand water quality + technology limitations!



Key takeaway 5: Use Instructions need to reflect best practices

- Use instructions in multiple languages with pictorial steps are advantageous
- Order of operations for multi-stage treatment products must be specific and easy to use
- Strong impact to log-reduction performance based on instructions for similar products

Thank you!

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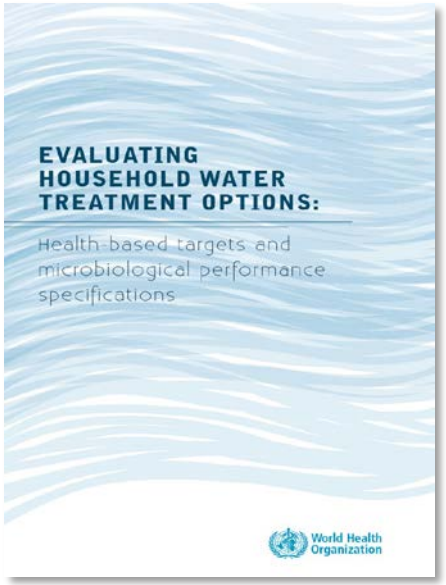

Additional information and resources can be found at:

- https://www.who.int/tools/international-scheme-to-evaluate-household-water-treatment-technologies
- hhwater@who.int