Challenge Candidate List - Water Treatment in Emergencies

This working document is a summary of the key challenges presented in the WASH Problem Exploration Report on Water Treatment in Emergencies.

Topic	The Challenge	Innovation Needed	Type of intervention	Who will use it?	Existing Work
STRATEGIC PLANNING					
	Improve decision-making processes to support agencies in assessing a new emergency situation or select context-specific water treatment interventions. Local context is often not taken into consideration when designing and launching safe water interventions.This leads to poor intervention performance and /or wasted resources. It can also lead to the proliferation of contradictory information concerning best practices in the field.	Better Operational Tools that can help responders incorporate contextual information into the design of appropriate safe water strategies. this should avoid 'the tyranny of check-lists'. Ensure that the proposed interventions are effective and fully carried out.	• Research focused on integrating lessons learned from past implementations in varied contexts - inform algorithms that move through a series of steps to guide operational decisions. • Catalogue of different filter media and coagulants, or materials that can handle chemical contaminants. • Adequate systems for knowledge management and preserving institutional memory. Something that is able to record what worked in a set context.	Emergency responders WASH agents who design and set up safe water interventions	Research is already being carried out in this area. There is a huge volume of written information - mostly in grey literature - but there is a general lack of clarity. Existing guidance is basic and somewhat decontextualised, existing decision support tools should be improved by bringing in field effectiveness data and further decision criteria from real-world implementations.
	D**evelop clear and contextual information on water supply before an emergency occurs to help ensure a successful water treatment response.** Certain areas of the world are more prone to emergencies (e.g. natural disasters). It would be useful to have clear, context specific guidelines for these areas to improve the response.	Pre-prepared contextual guidelines or information sheets that can provide emergency responders with basic, key water-supply related information. This information will promote the design and deployment of safe water interventions that can better suit the local context.	Research should be carried out to investigate what is currently happening to assure adequate supplies of safe water, who are the primary actors in the arena, and what technologies are already familiar to the stakeholders.	WASH agents in the case of an emergency	
	Develop an emergency specific Water Safety Plan. The focus of water treatment is currently at the point of distribution. This is a problem in the context of an emergency as the risk of water recontamination from catchment (point of distribution) to point of consumption (e.g. household) is high.	Ameliorative strategies should be developed to look at how to reduce the risk of water contamination throughout the 'Safe Water Chain'. Water Safety Plan (WSP) approach should be adapted for the emergency context. The WSP is a comprehensive risk assessment and management approach that examines all possible points of recontamination from catchment to consumer. There should be a shift from monitoring quality to managing risks. This will help practitioners make informed decisions about priorities and assess where water treatment measures are needed and where they are not.	At a broad level there should be operational research to bring development-oriented WSPs into emergency contexts. A specific innovation could be the design of water collection/storage containers with narrow mouths and covers that are easy to clean.	WASH agents, Local users	Little work has been done in this area It would be especially valuable following the acute phase as emergencies transition to a stabilised or sustained situation. Research is required to review previous field experiences and identify which emergencies present the greatest waterborne disease threats and the opportunities for water treatment interventions.
BUILDING AN EVIDENCE BASE					
	Develop an evidence-base for commonly applied Water Treatment interventions. There is very little evidence-based decision making, as most practice follows individual practitioner experience and institutional norms.	A robust evidence-base on the effectiveness of commonly used water treatment technologies.	Blinded field research measuring incidence rather than surrogates. There should also be epidemiological studies on local populations.		
	Develop an evidence-base for commonly applied Household Water Treatment interventions in emergency contexts. While the technical efficiency of currently available HHWT systems has been well established in laboratory studies, there is little rigorous evidence on the effectiveness of HHWT in emergencies.	A robust evidence-base on the effectiveness of household water treatment technologies.	Blinded field research measuring incidence rather than surrogates. There should also be epidemiological studies on local populations. Field implementations.	WASH agents to decide on the most relevant water treatment strategy for the given emergency.	Proliferation of lab-based studies assessing the water treatment efficacy of traditional and novel HHT; numerous field-based RCT and quasi-experimental studies to assess HHWT's epidemiological and water quality effects. Meta-analyses, systematic reviews, summaries. Conflicting reviews about the impact. Many of these trials are unblinded (biased research). Blinded studies are required. The IFRC has published a manual on HHWT and storage in emergencies that describes popular, simple HHWT approaches and includes a simple decision tree on how to choose the best approach in a given context. This takes into account factors such as the water source and the available resources. The Sphere Guidelines now also include a similar decision tree.
	Develop a common understanding of appropriate levels of chlorination of water. There are discrepancies in advice on what the right dose of chlorine should be at a water source in order to achieve adequate protection at the household level. This which is often many hours-post distribution.	An approach to inform about the amount of chlorine needed based on the volume and type of water, as well as it's stage in the water supply cycle. Could be used both at household level, but also at a centralised approach (e.g. tankers).	Additional research to build evidence base on the effectiveness of bucket chlorination to reduce turbidity and bacteria, as well as the relevant concentration needed based on contextual factors.	Households (e.g. families, individuals) Community (e.g. trained individuals - bucket chlorination) Centralised (e.g. tankers)	Chlorination is widely used, but limited evidence on the effectiveness. No peer-reviewed papers on whether this approach actually works or not to deliver residual chlorine at the point of consumption. Existing guidance states a uniform rule which is unlikely to be effective in treating water from source to consumption (e.g. stability of the chlorine products, effective strength, container volume, quality of water to make the chlorine solution, turbidity and chlorine demand).
	Overcome the tyranny of emergency for research studies. There is a tension between conducting research and accomplishing operational goals. Current institutional structures make rigorous research difficult in emergency settings, as filed staff are regularly stretched beyond their limits. As a result, insufficient time is available for practitioners to engage in research with long-term benefits.	A need to design creative mechanisms for the inclusion of academic-quality research in field settings without compromising operational priorities.	Creative mechanisms, processes or Protocols that allow for robust research studies to be carried out during emergencies, without compromising the response.	Practitioners working in the field who could also collect valuable ground information	Difficult to conduct field research during an emergency. Existing research is either not conducted during an emergency, or has a limited replicability because methods used to collect data are not up to academic standards.
TECHNOLOGICAL INNOVATION					
	Develop better package water treatment units (WTUs) Existing package water treatment units (WTUs) are too large, not portable, take a long time to set up, run in batches, and result in water with a high turbidity level.	Improved solutions for assisted sedimentation and disinfection.	Research and development into new technologies.	WASH agents Trained local people	

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	Improve semi-centralised assisted sedimentation and chlorination. Existing solutions lead to high residual quantities of iron and aluminium.	Technologies able to provide a continuous flocculation-sedimentation-disinfection process would improve the usability of commonly implemented systems.	Research and development into new technologies.	WASH agents Trained local people	Already a lot of technological innovations in the area of water treatment. Research would primarily focus on making existing solutions more relevant and effective in an emergency setting.
	Improve Mechanical Separation solutions. Existing solutions result in a water with high turbidity, still in need of disinfection.	Improved solutions for mechanical separation.	Research and development into new technologies.	WASH agents	
	Improve Membrane Filtration systems. Existing solutions are fragile (with spare parts difficult to find) and imply a high chemical input, the use of electric pumps, and no residual protection.	Improved solutions for membrane filtration.	Research and development into new technologies.	WASH agents	
	Develop solutions to combat water pollution that are emergency specific. Existing solutions to combat chemical water pollution such as Reverse Osmosis (RO) are high tech and expensive. RO also requires a full profile of the chemical water quality to design a custom system. This means that such a solution would not be rapidly deployable in an emergency.	Alternative technologies which could be used to filter out salinity and play a role in chemical water treatment. There should be research into different media types, activated carbon, different coagulants etc. Solutions should continue to be effective if water is turbid, and be simple enough to use in the field.	Research and development into new technologies.	WASH agents	
	Understand appropriate contexts for direct well chlorination. Turning direct well chlorination into a genuine solution rather than a political spectacle.	Robust operational procedures that take into account local politics.		WASH agents	Some research but with mixed results.
OTHER					
	Improve HHWT compliance through behavioural innovations. While HHWT solutions such as chlorination have high levels of efficacy in lab trials, their field effectiveness is much lower due to challenges with incomplete compliance. High adherence is required in order for HHWT solutions to be effective.	Training materials to help facilitate behavioural change (adherence to chosen HHWT approach).	Field research into developing solutions on how to encourage user adherence and uptake. Comprehensive guidelines and manuals, intensive house-to-house training, house promotion.	WASH hygiene promotion experts Trained locals	Research has shown that training is key to adherence, but there are no studies looking at what the best approach to achieving this adherence would be. Other approaches such as that of going home-to-home to train people about the use of bed nets for malaria has proven very effective. Research could see to what extent the same approach would work for promoting water treatment methods.
	Make use of existing infrastructure in urban settings. There is little documented experience and guidance on how to respond in situations where high-level municipal infrastructure already exists but has failed.	Guidelines on how to make use of existing water infrastructure in the case of an emergency.	Field research.	WASH agents to decide how to best make use of existing infrastructure	Little documented experience and guidance. Basic guidelines exist (WHO), but more research is needed.
	Make use of existing infrastructure in camp settings. There is little guidance on how to take advantage of infrastructure that has been set up in a camp setting, or how to respond when it fails.	Guidelines on how to make use of existing water infrastructure in the case of an emergency.	Research into alternative approaches (e.g. kiosk systems).	WASH agents to decide on what the best water treatment approach would be for the given context	There is limited research that was conducted during an acute emergency.
	Develop innovations that go beyond Water Treatment. Water quality needs to be considered as part of a wider challenge that includes sanitation and water provision.	Solutions in water treatment that take into account the interrelationship between water, sanitation, hygiene and behaviour change are likely to be effective. Therefore it is important that there is communication between stakeholders and experts in each of these areas.	Quarterly workshops that include experts in water provision, water treatment and sanitation in which a broad common understanding of issues and solutions are discussed, and goals aligned.	WASH agents	