

## Lecture 9 - ENV 402 **Humanitarian WASH**

**Dr Karin Gallandat  
Eawag-Sandec**



Water bladder in a refugee settlement in Sudan

Source:

# ENV 402 – Group work: reminder

- Groups of 5 students
- One group member communicates members + student ID# to Christoph Lüthi ([Christoph.Luethi@eawag.ch](mailto:Christoph.Luethi@eawag.ch))
- *Please fill out sheet in class*
- Final report to be submitted **by 18th December 2025** as PDF file by email
  - 1 report (max. 13 pages, Arial 10, single lined).
- 30% of your final grade



# Course Overview

**Lectures:** Thursdays at 10:15

**Group work:** ~1 hour/week

No.	Date	Topic	Lecturer
1	11 Sept	Intro to ENV 402, overview, SDGs, public health	J. MacArthur
2	18 Sept	Water treatment and safe storage	L. Fache
3	25 Sept	Water supply from source to consumer	M. Boller
4	2 Oct	Municipal solid waste management	D. Tosi
5	9 Oct	Sanitation systems and technologies Part 1	A. Narayan / P. Reymond
6	16 Oct	Sanitation systems and technologies Part 2	K. Coppens
	23 Oct	Semester break	
7	30 Oct	Guest lecture: Innovations & WASH	Michael Kropac – Co-Director Cewas
	6 Nov	Group work	
8	13 Nov	WaSH in humanitarian settings	K. Gallandat
9	20 Nov	Becoming a WASH and Solid Waste Management Researcher	F. Suter / Velasquez L. / Peguero D.
10	27 Nov	Environmental sanitation planning	A. Narayan
11	4 Dec	Innovative Sanitation Planning in practice	A. Narayan
	11 Dec	Group work Q+A (on-line: 10:15 – 11:00)	C. Lüthi
	18 Dec	Mock exam, career prospects	C. Lüthi
	Winter Break		
	15 Jan	Final written exam	C. Lüthi

## Today's Objectives

- Define humanitarian emergencies and the “humanitarian-development-peace nexus”
- Understand the relevance of water, sanitation and hygiene (WASH) in humanitarian crises
- Explore how WASH interventions are delivered in humanitarian crises and which standards apply
- Identify relevant resources and tools to design WASH interventions in humanitarian contexts



Survey enumerator in Uvira, DRC

Source: Gallandat, 2021

Part 1

# Background & definitions

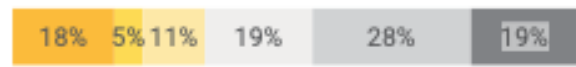
# Getting started

(1) Which picture or location do you think of when you hear “humanitarian”?

(2) Do you know of any synonym for “humanitarian”?

**PEOPLE IN NEED**

**305.1 million**



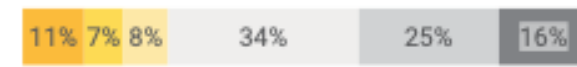
**PEOPLE TARGETED**

**189.5 million**



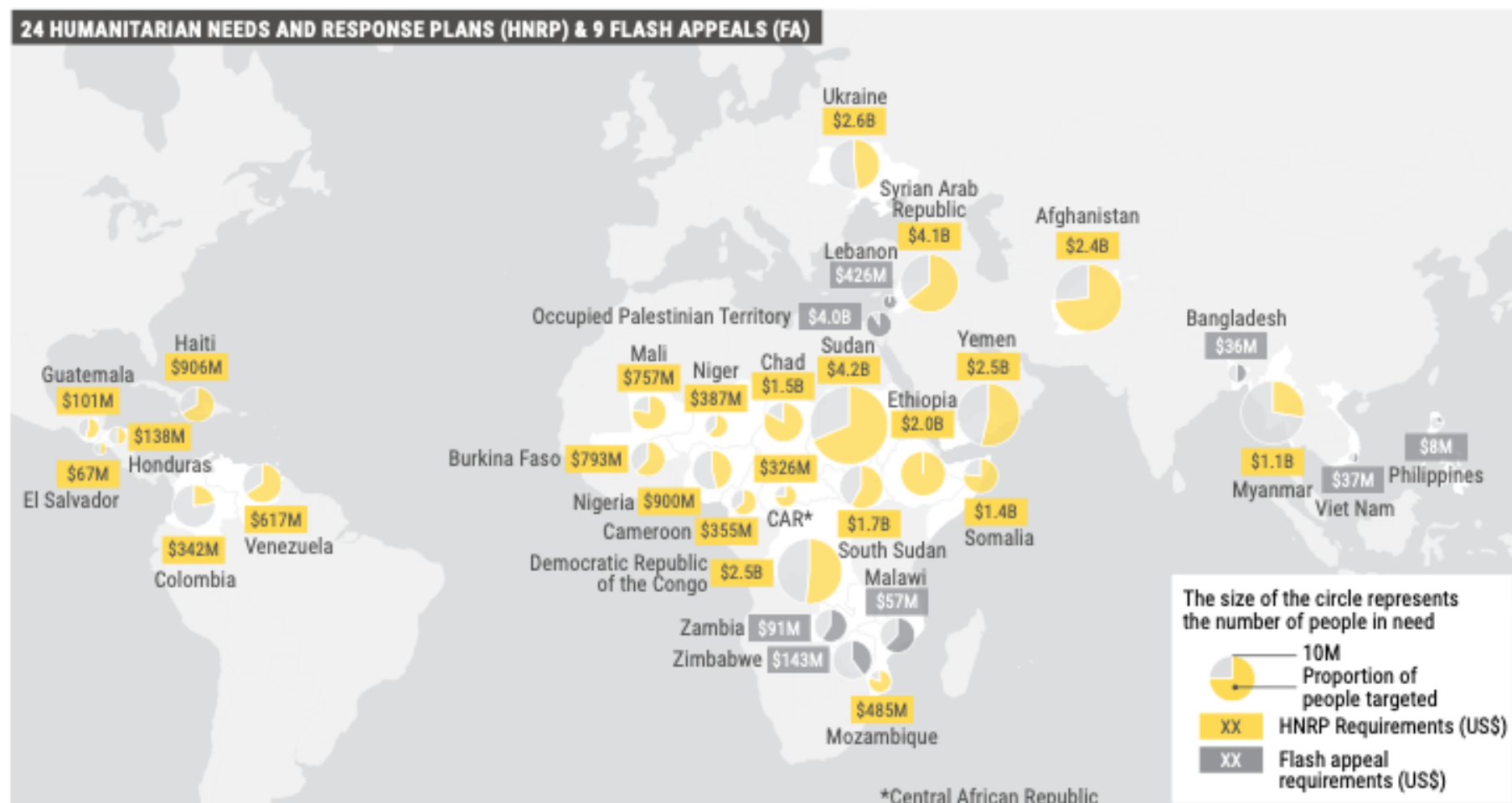
**REQUIREMENTS (US\$)**

**\$47.4 billion**



■ Asia and the Pacific 
 ■ Europe 
 ■ Latin America and the Caribbean 
 ■ Middle East and North Africa 
 ■ Southern and Eastern Africa 
 ■ West and Central Africa

**PEOPLE IN NEED, PEOPLE TARGETED AND FINANCIAL REQUIREMENTS IN 2025**

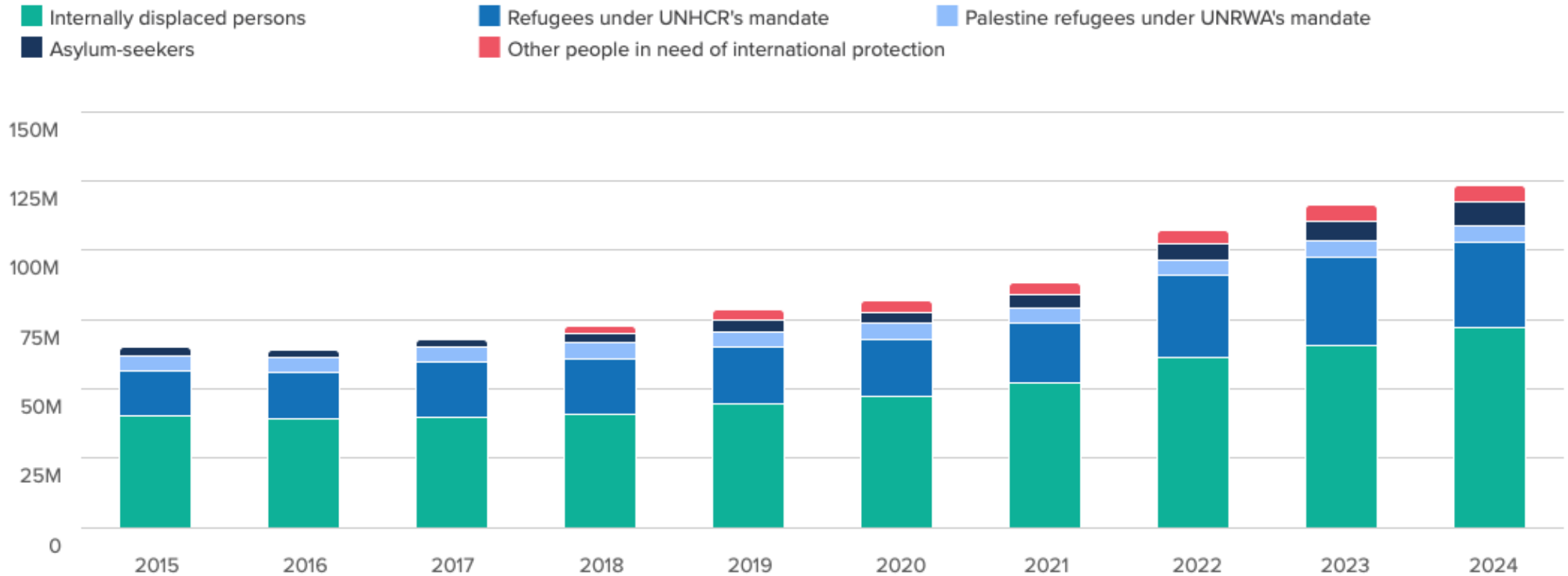


**Humanitarian needs**

- ↑ Conflict
- ↑ Climate extremes

Source: [UN OCHA, 2025](#)

# Forced population displacements worldwide



Some Palestine refugees under UNRWA's mandate in Gaza have also been internally displaced in 2023 (1.2 million) and 2024 (1.4 million). In this graph, these internally displaced refugees under UNRWA's mandate are only counted once, under the figure for 'Palestine refugees under UNRWA's mandate'.

# Humanitarian emergencies

Event or series of events (or disasters) that represents **a critical threat to the health, safety, security or wellbeing of a community** or large group of people and creates a **need for humanitarian assistance**

Natural Disasters	Man-made Disasters
<b>Sudden Impact</b> – earthquakes, tropical storms, tsunamis, volcanic eruptions, etc.	<b>Industrial/Technological</b> –pollution, fires, spillages, explosions, etc.
<b>Slow-Onset</b> – drought, famine, pest infestation, deforestation, etc.	<b>Complex Emergencies</b> – wars, civil strife, armed aggression, etc.
<b>Epidemic Diseases</b> – water-borne, food-borne, vector-borne, etc.	

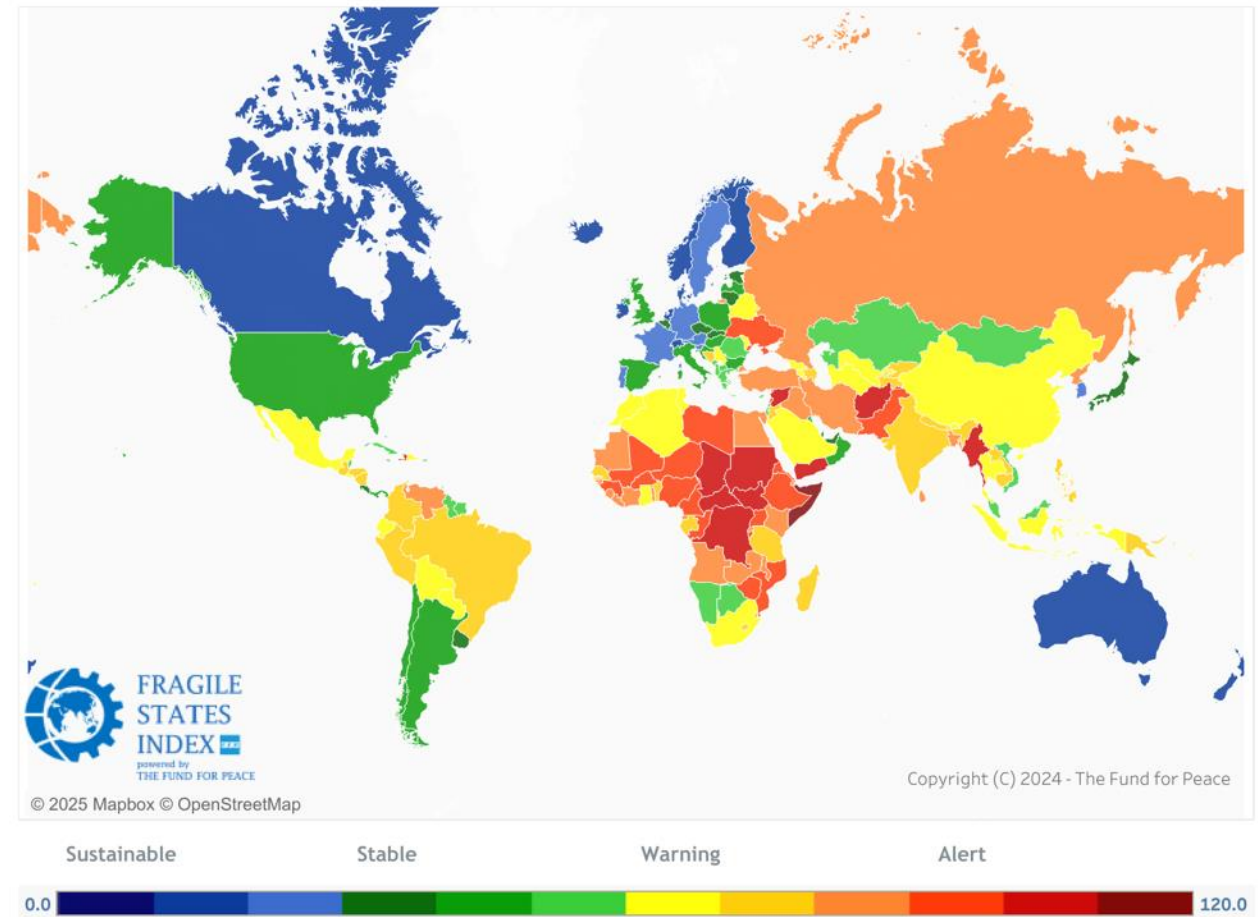
Multiple disasters & pre-existing vulnerabilities → **“complex emergency”**

# Fragile, Conflict and Violence (FCV)

**Fragility:** systemic institutional and governance weaknesses

**Conflict:** situation of acute insecurity driven by the use of deadly force

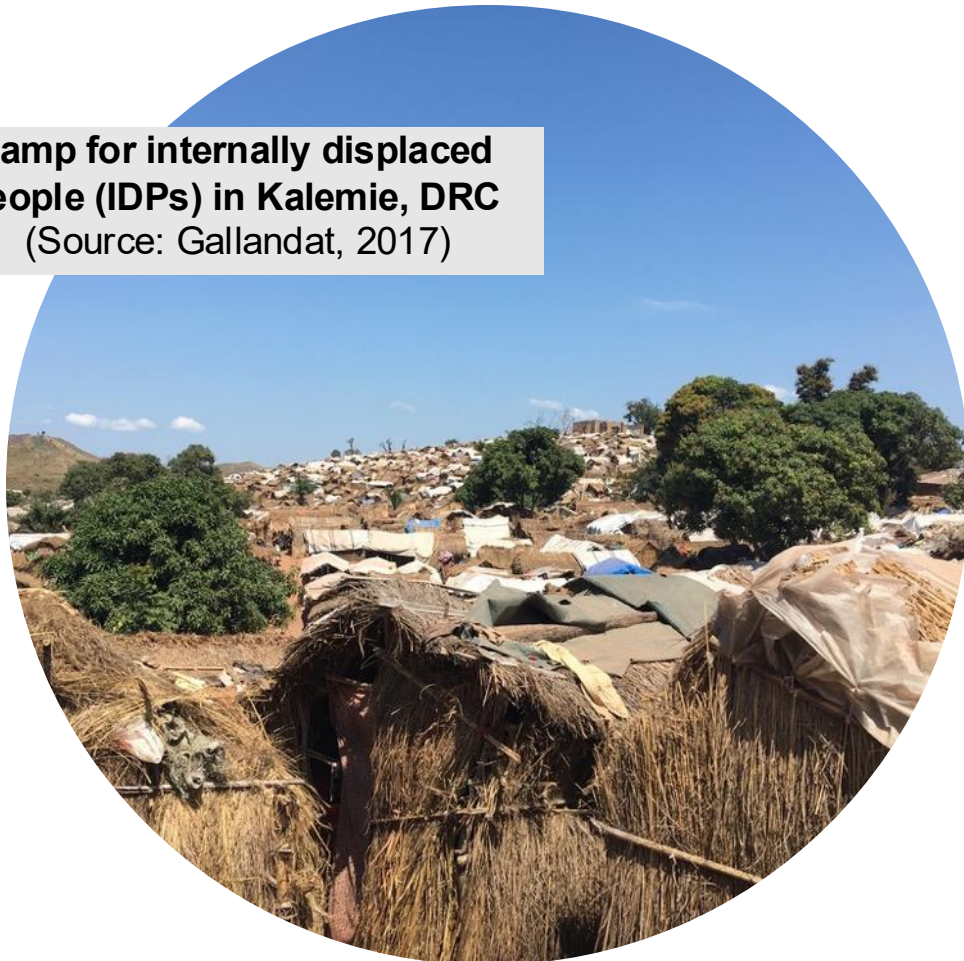
**Violence:** high level of interpersonal and/or gang violence



Sources: [World Bank, 2020](#); [The Fund for Peace, 2025](#)

## Humanitarian contexts (1/2)

**Camp for internally displaced people (IDPs) in Kalemie, DRC**  
(Source: Gallandat, 2017)



**Temporary cholera treatment facilities in Mbjui-Mayi, DRC**  
(Source: Gallandat, 2018)

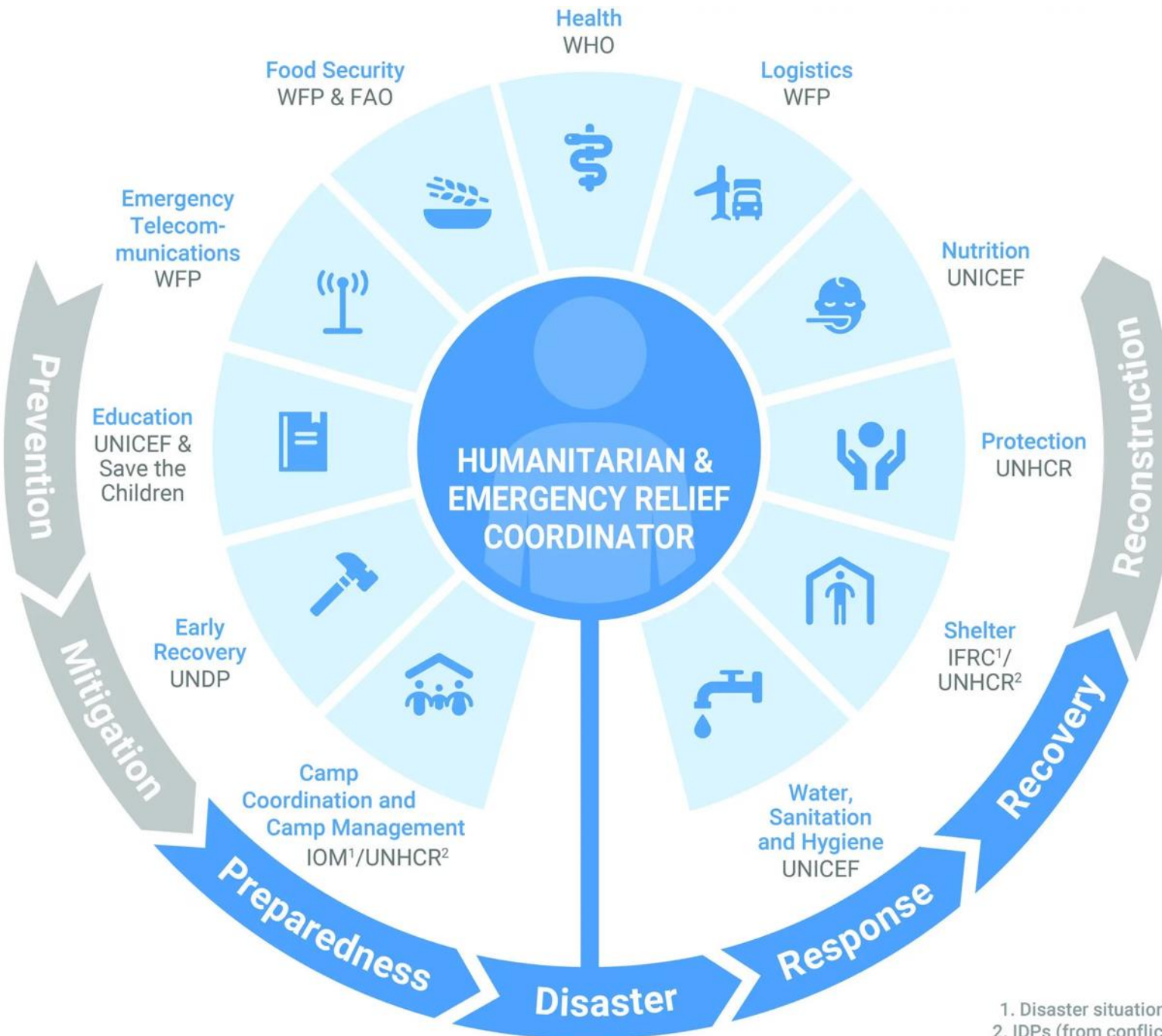
## Humanitarian contexts (2/2)

**Refugee settlement in Arua district, northern Uganda**  
(Source: [UN](#), 2017)



**Building where refugees live in Kuala Lumpur, Malaysia**  
(Source: [Cultural Orientation Centre](#))

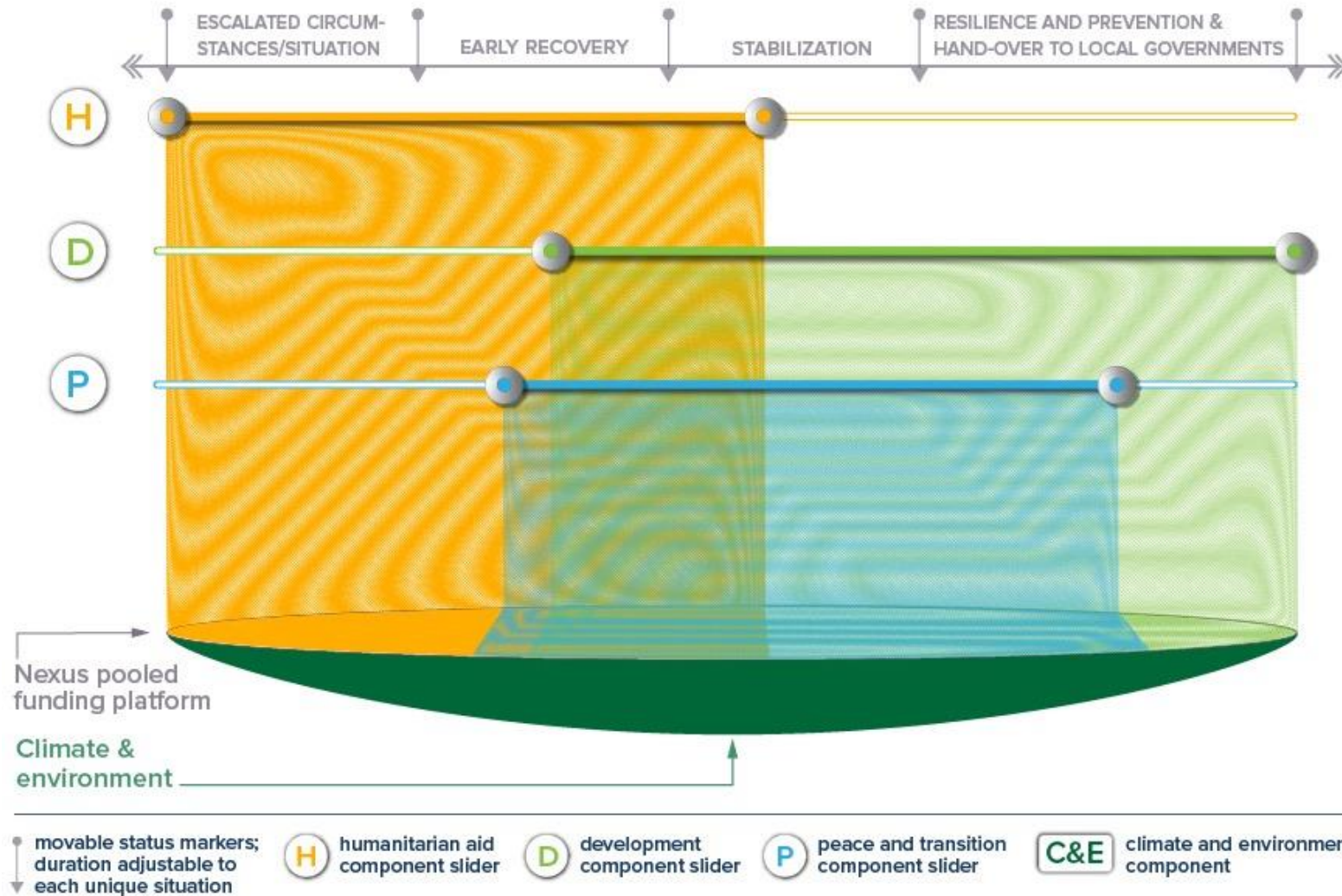




## Phases and coordination of humanitarian crises

1. Disaster situations  
2. IDPs (from conflict)

# Humanitarian-Development-Peace (HDP) Nexus



<https://www.youtube.com/watch?v=IL5M-e-kbhs>

Source: [UN MPTF](#)

## Part 2

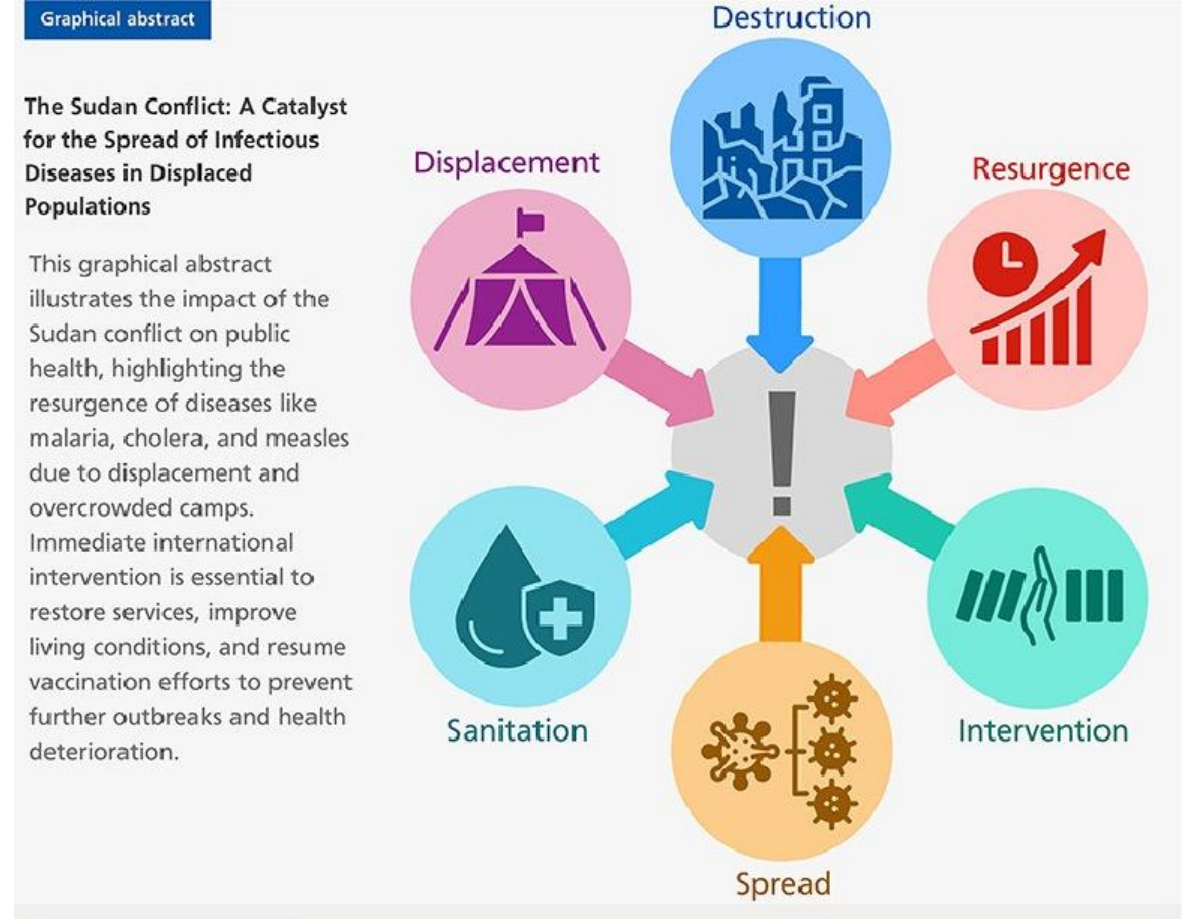
# What role for WASH in emergencies?

# What do you think?

Why are **WASH services** important  
in humanitarian crises?

## Reason #1: protecting public health

- Mortality during conflict and displacement: primarily due to **indirect causes**
- **Mortality rates** due to infectious diseases: **2-10 times higher** in emergencies compared to non-crisis settings
- **364 outbreaks** registered in camps managed by UNHCR between 2009-2017
- **66%** of cases: measles, cholera, influenza
- **Mental health** consequences
- Approx. **1 in 5 people** affected by conflict suffer from a mental disorder



Sources: [Altare et al., 2019](#), [Hassan et al., 2025](#), [Charlson et al., 2019](#)

## Reason #2: protecting dignity

Providing WASH services in emergencies can...

- Fulfil a fundamental **human right**
- Enable **safe hygiene practices** (personal, domestic, and food hygiene)
- Prevent **gender-based violence** (e.g. through access to safe, private sanitation facilities)

Example:

- UNICEF **“WASH & Dignity” kit** includes menstrual hygiene supplies, a torch and a whistle for safety


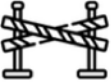




“WASH & Dignity” kit distribution

Source: [UNICEF](#)

# Reason #3: strengthening resilience

WASH services  
can help prevent  
recurrent crises  
or amplified impacts  
of successive shocks

Pathway	Empirical examples
 <p>Emerging and aggravated health risks in post-disaster contexts</p>	<ul style="list-style-type: none"> <li>• Overcrowding in shelters after typhoon Goni led to a surge in COVID-19 cases (Philippines, 2022);</li> <li>• Tuberculosis outbreak among evacuees after the Great East Japan earthquake (Japan, 2011);</li> <li>• Ebola transmission worsened by displacement following floods (Sierra Leone, 2015);</li> <li>• Emergency personnel brought COVID-19 to Tonga after volcanic eruption and tsunami (Tonga, 2022);</li> <li>• COVID-19 and flood-related disruptions of vaccination programmes led to measles and polio outbreaks (Pakistan, 2022);</li> <li>• Poor WASH conditions after cyclones Idai and Kenneth resulted in a cholera outbreak (Mozambique, 2019).</li> </ul>
 <p>Existing health crises as barriers to effective disaster response and recovery</p>	<ul style="list-style-type: none"> <li>• Response and recovery after disaster events (cyclone Amphan in India, wildfires in the U.S., and earthquakes in Greece) were incompatible with COVID-19 pandemic-related restrictions (India, 2020 / U.S., 2020 / Greece, 2020-2021).</li> </ul>
 <p>Challenges in disaster-health crises coordination</p>	<ul style="list-style-type: none"> <li>• Healthcare workers were 21 to 32 times more likely to have been infected during the Ebola epidemic than the general adult population (Guinea, Liberia, and Sierra Leone 2014-2015).</li> </ul>
 <p>Mental health implications of repeated disaster exposure</p>	<ul style="list-style-type: none"> <li>• <i>China (2008)</i>: Adolescents affected by the Wenchuan earthquake experienced PTSD, depression, and sleep disturbances (China, 2008);</li> <li>• People affected by hurricane Harvey in 2017 experienced more anxiety due to the COVID-19 pandemic (U.S., 2017-2022).</li> </ul>

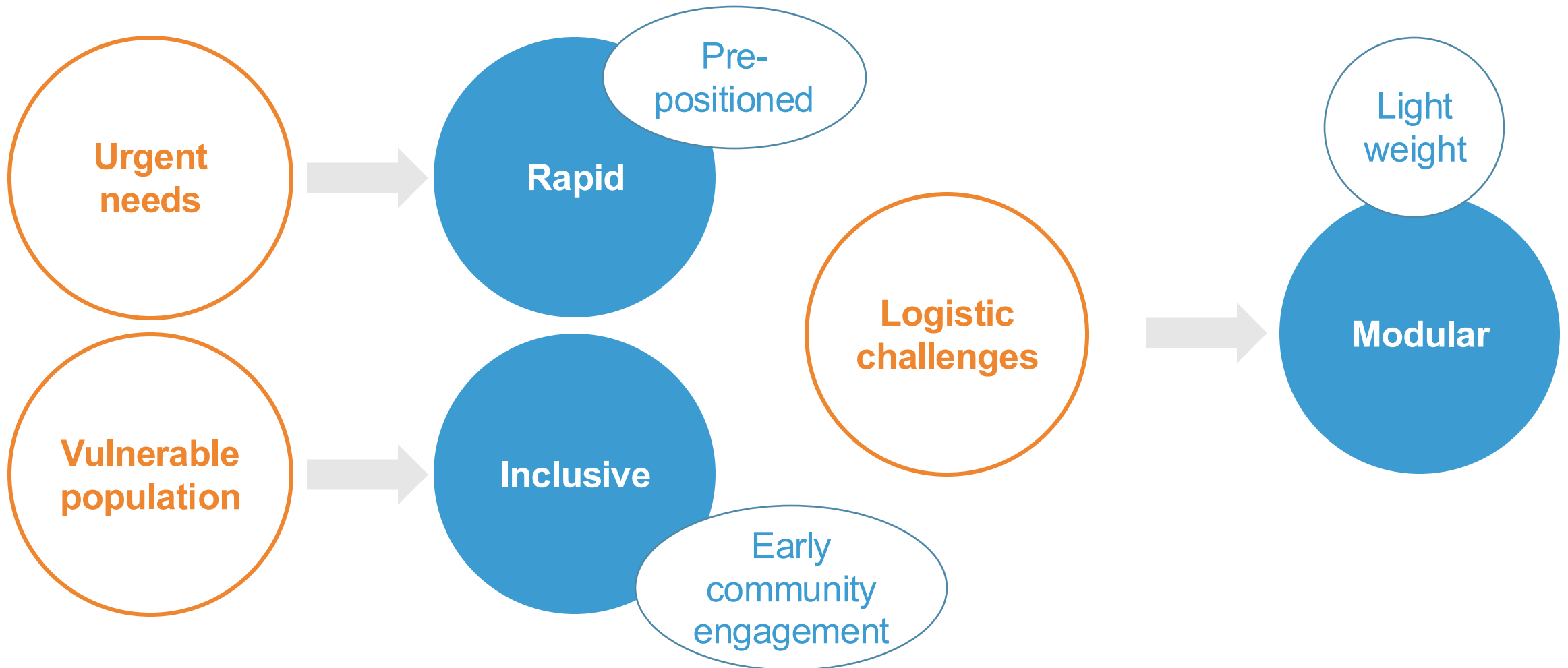
Source: [Buijs et al., 2025 \(pre-print\)](#)

**Questions?**

## Part 3

# What is WASH like in emergencies?

## What is WASH like in emergencies?



# What is water supply and treatment like in emergencies?



**Water trucking in Kenya**  
(Source: [WorldVision, 2019](#))



**Supply of water bottles in Delcevo, Ukraine**  
(Source: [UNICEF, 2015](#))

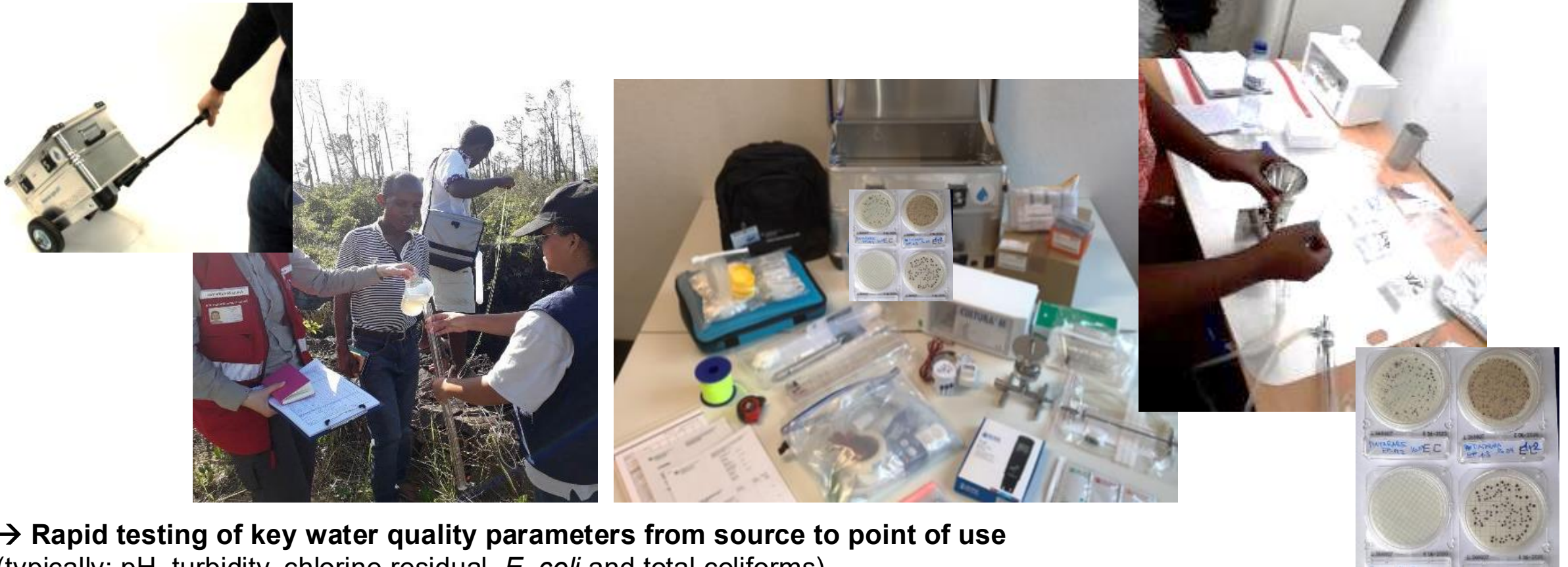


**Tap stand in a refugee camp in western Ethiopia**  
(Source: [OXFAM, 2022](#))

**Chlorine tablets for point-of-use water treatment**  
(Source: [Aquatabs](#))



# Swiss Humanitarian Aid (SHA) field lab for water quality testing



→ **Rapid testing of key water quality parameters from source to point of use**  
(typically: pH, turbidity, chlorine residual, *E. coli* and total coliforms)

# SHA module for emergency water supply

## Main components:

- Bladder tanks: 2 x 10'000 l, 4 x 5'000 l
- Bottling racks (tap stands): 8 tap stands with 4 Evenflow taps each
- 2 clean water pumps
- Pressure and suction hoses
- Accessories and toolbox



# SHA module for disinfection / on-site chlorine generation



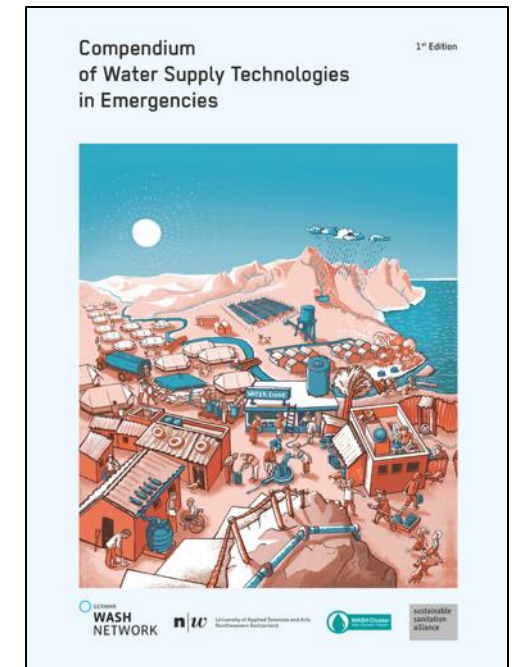
## SHA module for emergency **energy** supply



**Keep in mind: power supply  
is (often) essential to deliver  
WASH services**

# Water service chain

Source	Intake	Abstraction	Treatment	Distribution/Transport	HWTS
<b>Water Source</b>					
S.1 Rainwater	I.1 Rainwater Harvesting: Raised Surface Collection	A.1 Hydraulic Ram (Impulse) Pump	<b>Pre-Treatment</b> T.1 Roughing Filtration	D.1 Household Water Container	H.1 Safe Water Storage
S.2 Rivers and Streams	I.2 Rainwater Harvesting: Ground Surface Collection	A.2 Piston-Plunger Suction Pump	T.2 Rapid Sand Filtration	D.2 Water Vendor Cart	H.2 Handwashing Facility
S.3 Ponds, Lakes and Reservoirs	I.3 River and Lake Water Intake	A.3 Direct Action Pump	T.3 Microfiltration (MF)	D.3 Water Trucking	<b>Household Water Treatment</b>
S.4 Brackish Water, Seawater	I.4 Protected Spring Intake	A.4 Deep Well Piston Pump	T.4 (Assisted) Sedimentation	D.4 Water Kiosk	H.3 Ceramic Filtration
S.5 Groundwater	I.5 Groundwater Dam	A.5 Deep Well Progressive Cavity Pump	T.5 Assisted Sedimentation with Filtration	D.5 Water Storage Tank (Transportable)	H.4 Membrane Filtration
S.6 Spring Water	I.6 Riverbank Filtration	A.6 Diaphragm Pump	<b>Treatment (Microbiological Contaminants)</b> T.6 Chlorination	D.6 Water Storage Tank (Long-Term Locally Built)	H.5 Biosand Filtration
<b>Energy Source</b>					
S.7 Gravity	I.7 Protected Dug Well	A.7 Rope Pump	T.7 Onsite Electro-Chlorination	D.7 Community Distribution System	H.6 Point-of-Use Chlorination
S.8 Human-Powered Energy System	I.8 Protected Borehole	A.8 Radial Flow Pump	T.8 Ultraviolet (UV) Light	D.8 Large-Scale Distribution System	H.7 Point-of-Supply Chlorination
S.9 Wind-Powered Energy System	I.9 Seawater Intake	A.9 Axial Flow Pump	T.9 Slow Sand Filtration		H.8 Coagulation, Sedimentation and Chlorination
S.10 Solar-Powered Energy System		A.10 Pumping Station	T.10 Ultrafiltration (UF)		H.9 Boiling
S.11 Electric-Powered Energy System			<b>Treatment (Chemical Contaminants)</b> T.11 Fluoride Removal Technologies		H.10 Pasteurisation
S.12 Diesel- and Gasoline-Powered Energy System			T.12 Arsenic Removal Technologies		H.11 Ultraviolet (UV) Lamp
			T.13 Granular Activated Carbon (GAC)		H.12 Solar Disinfection (SODIS)
			T.14 Ozonation		H.13 Fluoride Removal Filter
			T.15 Nanofiltration (NF) / Reverse Osmosis (RO)		H.14 Arsenic Removal Filter



Cross-Cutting Issues			
Initial Situation	Monitoring and Quality Control	Conceptual Aspects	Design and Social Considerations
X.1 Assessment	X.5 Monitoring	X.10 Resilience, Preparedness and Disaster Risk Reduction	X.15 Inclusive and Equitable Design
X.2 Area- and Situation-Specific Conditions	X.6 Groundwater Monitoring	X.11 Exit Strategy and Hand-Over	X.16 Hygiene Promotion and Working with Affected Communities
X.3 Institutional/Regulatory Environment and Coordination	X.7 Water Quality Monitoring	X.12 Water for Multiple Use and Water Reuse	X.17 Market-Based Programming
X.4 Community Engagement and Accountability	X.8 Water Safety and Risk Management	X.13 Urban Water Supply in Protracted Crises	
	X.9 Data Flows, Information and Communication Technology	X.14 Cholera Prevention and Epidemic Management	

**emergency-wash.org**

## What is sanitation like in emergencies?



**Latrine in IDP camp in Kalemie, DRC**  
(Source: Gallandat, 2017)



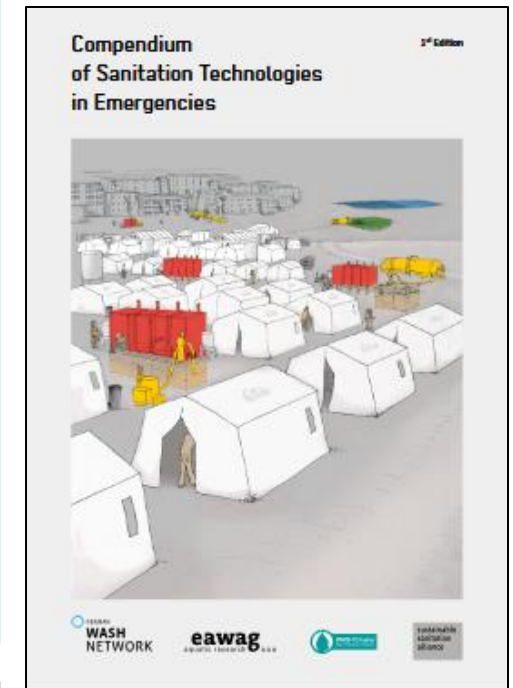
**Latrines in a refugee camp  
in South-East Turkey**  
(Source: ECHO, 2014)



**Dewatering bed in a Rohingya  
refugee camp, Bangladesh**  
(Source: OXFAM et al., 2019)

# Sanitation chain

ON-SITE				TRANSPORT			OFF-SITE				
Input Products	User Interface	Input / Output Products	Collection and Storage / Treatment		Input / Output Products	Conveyance			(Semi-) Centralised Treatment	Input / Output Products	Use and /or Disposal
			Collection / Storage	(Pre-) Treatment		Emptying	Transport	Intermediate Storage			
Urine	U.1 Dry Toilet		S.1 Deep Trench Latrine	S.17 Hydrated Lime Treatment (E)		C.1 Manual Emptying & Transport		C.6 Transfer Station & Storage	PRE PRE-Treatment Technologies		D.1 Application of Stored Urine
Faeces	U.2 Urine Diverting Dry Toilet		S.2 Borehole Latrine	S.18 Urea Treatment (E)		C.2 Motorised Emptying & Transport			T.1 Settler		D.2 Application of Dried Faeces
Anal Cleansing Water	U.3 Urinal		S.3 Single Pit Latrine	S.19 LAF Treatment (E)		C.3 Simplified Sewer			T.2 Anaerobic Baffled Reactor		D.3 Application of Pit Humus & Compost
Dry Cleansing Materials	U.4 Flush Toilet		S.4 Single Ventilated Improved Pit (VIP)	S.20 Caustic Soda Treatment (E)		C.4 Conventional Gravity Sewer			T.3 Anaerobic Filter		D.4 Application of Sludge
Flushwater	U.5 Controlled Open Defecation					C.5 Stormwater Drainage			T.4 Biogas Reactor		D.5 Fill & Cover
Greywater	U.6 Shallow Trench Latrine								T.5 Waste Stabilisation Ponds		D.6 Surface Disposal & Sanitary Landfill
Stormwater	U.7 Handwashing Facility		S.5 Twin Pit Dry System						T.6 Constructed Wetland		D.7 Use of Biogas
Organics			S.6 Twin Pit with Pour Flush						T.7 Trickling Filter		D.8 Co-Combustion of Sludge (E)
Menstrual Hygiene Products			S.7 Raised Latrine						T.8 Sedimentation & Thickening Ponds		D.9 Leach Field
			S.8 Single Vault UDDT						T.9 Unplanted Drying Bed		D.10 Soak Pit
			S.9 Double Vault UDDT						T.10 Planted Drying Bed		D.11 Irrigation
			S.10 Container-Based Toilet						T.11 Co-Composting		D.12 Water Disposal & GW Recharge
			S.11 Chemical Toilet						T.12 Vermicomposting (E)		D.13 Fish Ponds
			S.12 Worm-Based Toilet (E)						T.13 Activated Sludge		
			S.13 Septic Tank						PO ST Tertiary Filtration & Disinfection		
			S.14 Anaerobic Baffled Reactor								
			S.15 Anaerobic Filter								
			S.16 Biogas Reactor								



CROSS - CUTTING ISSUES		
Initial Situation	Conceptual Aspects	Design & Social Consideration
X.1 Assessment of the Initial Situation	X.5 Resilience and Preparedness	X.10 Inclusive and Equitable Design
X.2 Rehabilitation of Existing Infrastructure	X.6 Exit Strategy, Hand-Over and Decommissioning of Infrastructure	X.11 Child Excreta Management
X.3 Soil and Groundwater Assessment	X.7 Urban Settings and Protracted Crisis Scenarios	X.12 Hygiene Promotion and Working with Affected Communities
X.4 Institutional and Regulatory Environment	X.8 Solid Waste Management	X.13 Market-Based Programming
	X.9 Cholera Prevention and Epidemic Management	

**emergency-wash.org**

# Wastewater / faecal sludge management in emergencies

**Table 1:**  
Comparison matrix of key indicators

**Assess:** technology, process robustness, O&M, cost, env. & social aspects



		Decentralised biological and/or mechanical treatment				Decentralised biological treatment				Decentralised chemical treatment					Centralised biological treatment	
		Upflow Filters	Upflow Filters with pre-settlement (metal/ tarp tanks)	Upflow filter with pre-settlement (plastic tanks)	GeoTubes	Constructed Wetlands 1	Constructed Wetlands 2	Biogas Plants	Septic/retention-tanks/ABR	Lime 1 Lagoon Lime treatment with dewatering bed	Lime 2 Lagoon Lime treatment with dewatering bed	Lime 3 Lagoon Lime treatment with dewatering bed	Lime 4 In barrel treatment with dewatering beds	Lime 5 3 tank Lime system	Anaerobic Lagoons	Aerobic Treatment
Technology	Scale	1	1	1	1	3	3	4	4	2	2	3	2	4	5	2
	Complexity of technology & equipment	2	2	2	1	2	2	3	2	3	2	3	3	2	2	5
	Layout and footprint area	3	3	5	2	4	3	1	1	4	2	3	3	3	3	1
	Speed of construction & set up	2	2	1	2	3	3	3	2	1	1					

Source: OXFAM / UNHCR / ARUP, 2015

## Sanitation resources

SANIHUB

# Sanitation Solutions for the Humanitarian Context

The Humanitarian Sanitation Hub is a joint sector effort of Global WASH Cluster (GWC) members bringing together all available knowledge on planning and implementing sanitation and faecal sludge management in emergencies on one single platform. It enables and guides humanitarian WASH practitioners with easy access to contextualised and relevant guidance, resources, tools and further support services and aims to continuously fill existing knowledge gaps for improved humanitarian sanitation services.

[sanihub.info](https://sanihub.info)

# What is hygiene like in emergencies?



**Chlorine solution preparation in a cholera treatment facility**  
(Source: Gallandat, 2018)

**"Surprise soaps" to incentivize handwashing among children**  
(Source: Engineering for Change)

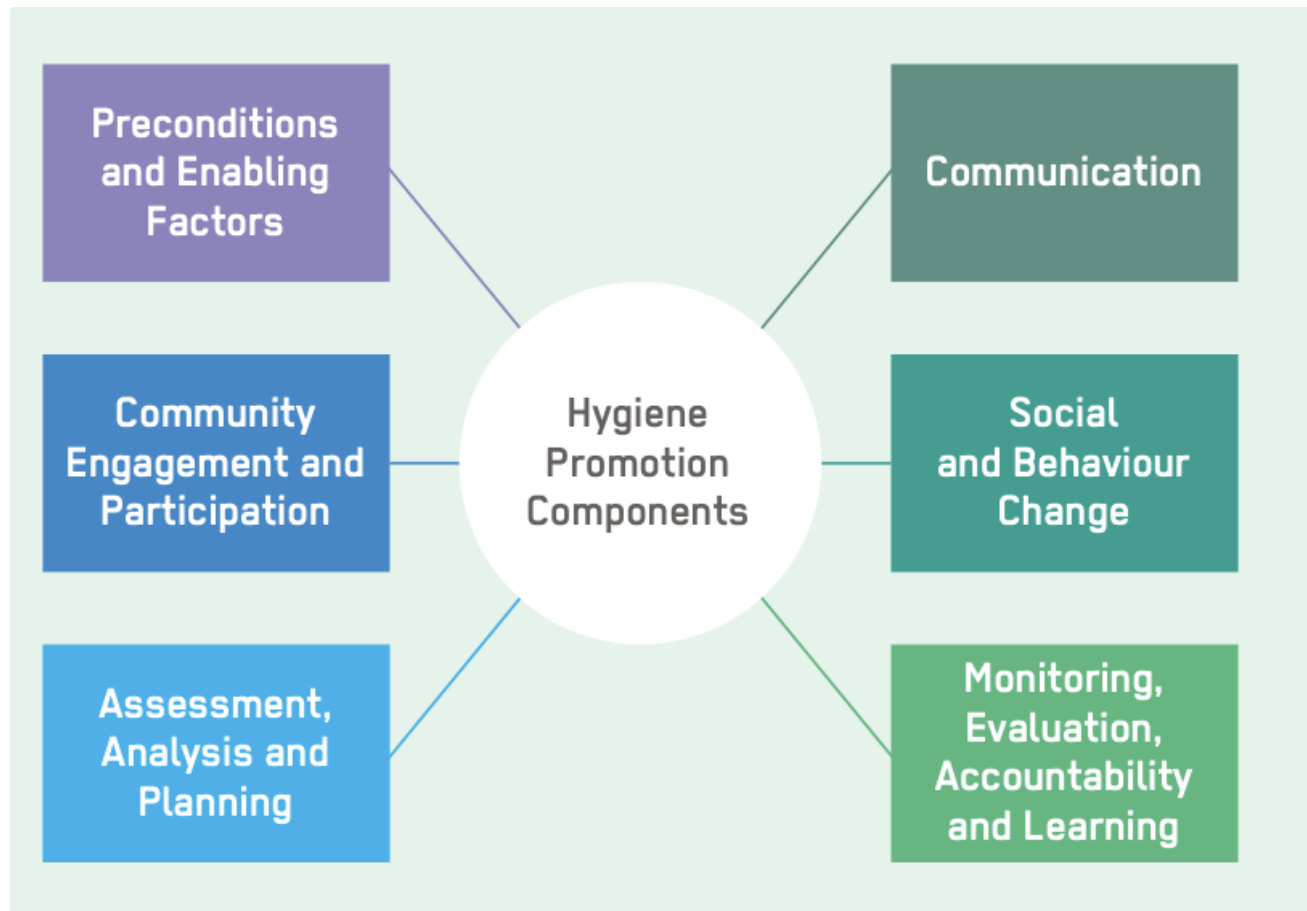


**Trial by Watson et al., 2023:**  
<https://gh.bmj.com/content/8/10/e012633>

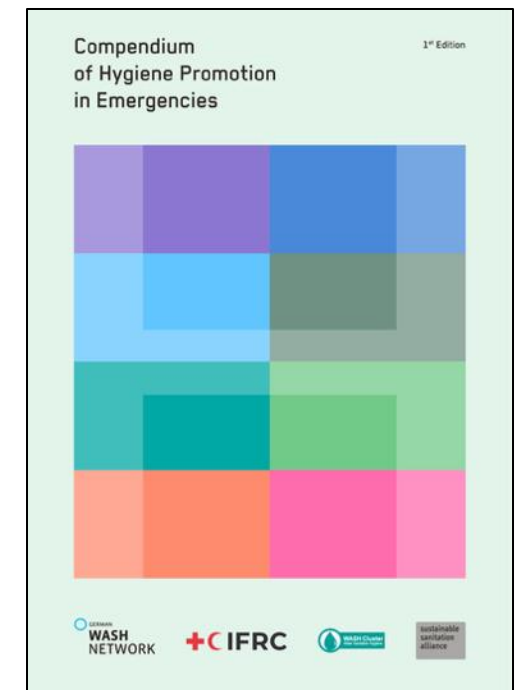


**Kits for distribution to mothers of malnourished children in Northern Senegal**  
(Source: Gallandat, 2020)

# Hygiene promotion components



- "HYGIENE"**
- Personal hygiene
  - Water treatment
  - Sanitation behavior
  - Domestic hygiene
  - Food hygiene
  - Vector control
  - Solid waste
  - ....



[emergency-wash.org](http://emergency-wash.org)

# What is solid waste management like in emergencies?



Increased level of control

No control

Limited control

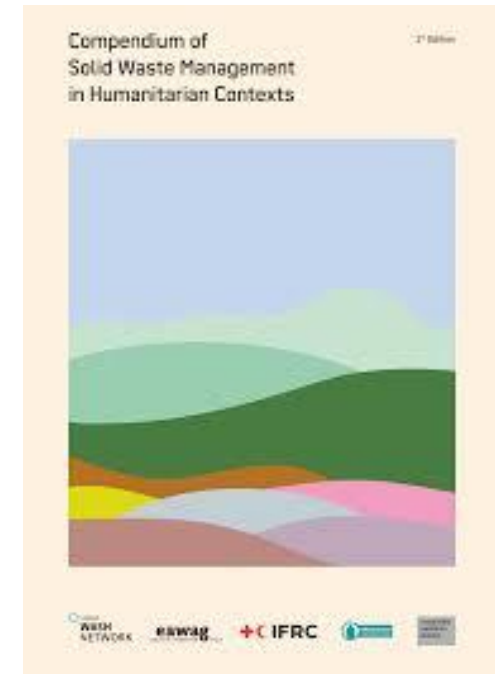
Basic control

Improved control

Full control

# Solid waste management chain

Storage <sup>i</sup>		Collection and Transport <sup>i</sup>		Treatment and Recycling <sup>i</sup>		Use and Disposal <sup>i</sup>	
S.1	Individual/Household Storage ☆	C.1	Manual Transport ☆	T.1	Composting ☆	U.1	Sale of Recyclable Materials ☆
S.2	Community/Shared Storage ☆	C.2	Animal Transport ☆	T.2	Vermicomposting ☆	U.2	Reuse of Waste Materials ☆
S.3	Public Litter Storage ☆	C.3	Motorised Transport - Smaller Vehicles ☆	T.3	Anaerobic Digestion ☆	U.3	Consumer Goods ☆
		C.4	Motorised Transport - Larger Vehicles ☆	T.4	Black Soldier Fly (BSF) Waste Processing ☆	U.4	Construction with Waste Materials ☆
		C.5	Transfer Station ☆	T.5	Making Fuel From Biomass ☆	U.5	Use in Agriculture ☆
				T.6	Plastic Recycling ☆	U.6	Use of Biogas ☆
				T.7	Plastic Upcycling ☆	U.7	Use of Fuel from Biomass ☆
				T.8	Plastic Downcycling ☆	U.8	Controlled Waste Pit ☆
						U.9	Controlled Disposal Site / Landfill ☆
						U.10	Open Dumping 🚫 ☆
						U.11	Open Burning 🚫 ☆
						U.12	Contained Burning 🚫 ☆

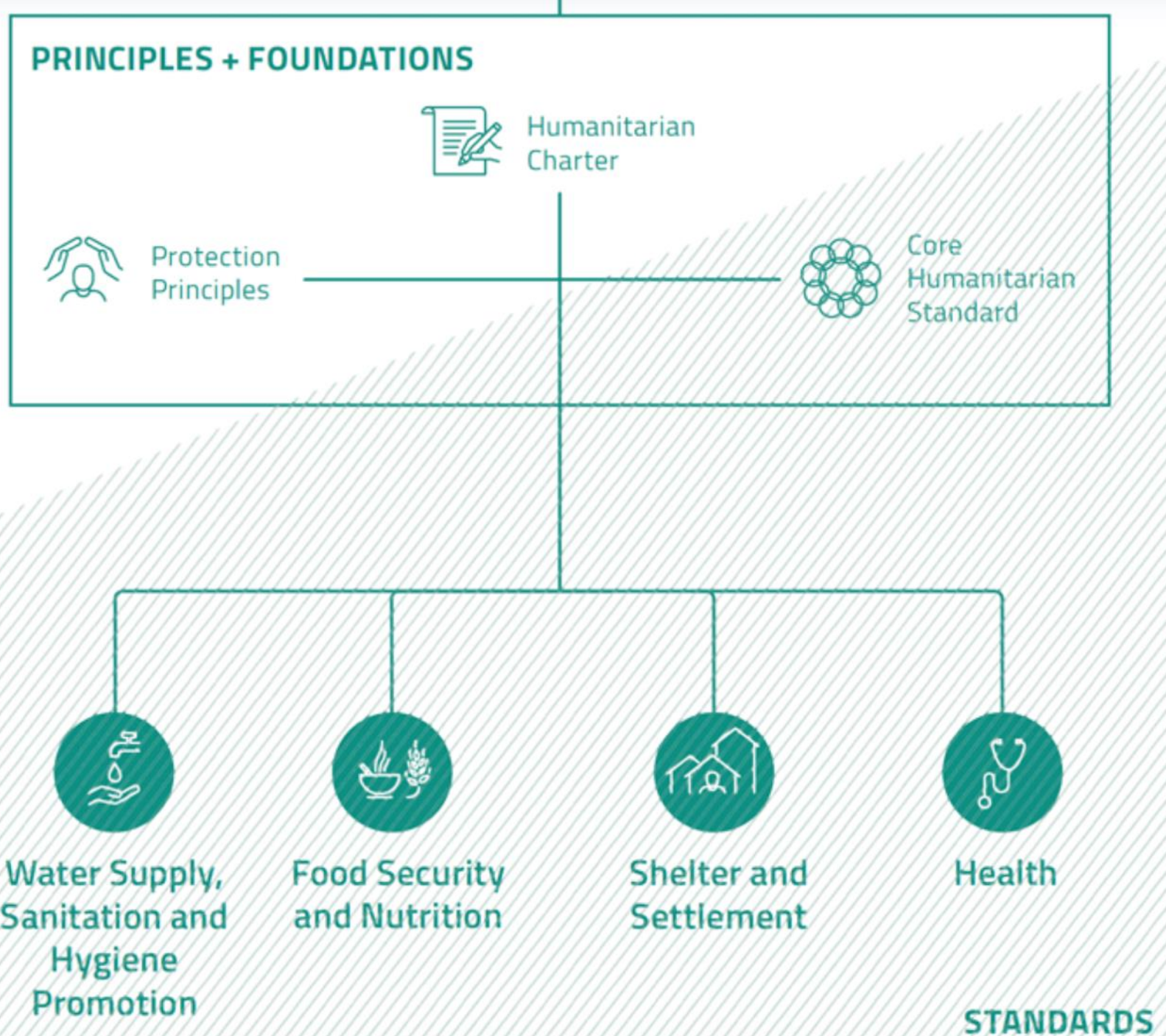


[emergency-wash.org](https://emergency-wash.org)

**Questions?**

Part 4

**Which standards apply?**



## SPHERE Standards

### Assess current situation and trends over time

- |   |   |   |   |
|---|---|---|---|
| <ul style="list-style-type: none"><li>– Who is affected?</li><li>– Needs and vulnerabilities</li><li>– Coping strategies and capacities</li><li>– Displaced? Mobile?</li><li>– What are affected people's priorities?</li></ul> | <ul style="list-style-type: none"><li>– Protection threats and risks</li><li>– Security situation and rule of law</li><li>– Access to assistance</li><li>– Access to people in need?</li><li>– Seasonal variations in hazards</li></ul> | <ul style="list-style-type: none"><li>– Stakeholders and power relationships</li><li>– Capacity and intent of responders</li><li>– Response plans of authorities and other actors</li><li>– Role of host population</li></ul> | <ul style="list-style-type: none"><li>– Available goods and services</li><li>– Market systems and supply chains</li><li>– Capacity of infrastructure</li><li>– Service providers (financial and others)</li><li>– Logistics capacities, constraints</li></ul> |
|---|---|---|---|



### Analyse and prioritise

What problems must be addressed? For which groups of people? In what geographic area? Over what timeframe? Against which standards?

## SPHERE Steps #1, 2

## Review options and decide how the response will be delivered

### Consider available options in your context:

- Direct service delivery
- Commodity distribution
- Technical assistance
- Market-based programming
- Cash-based assistance

### From these, select response options based on your assessment of:

- Urgency and timeliness
- Feasibility
- Capacities
- Dignity
- Protection threats, risks
- Efficiency, cost-effectiveness
- Resilience
- National ownership
- Government policy



## Design a programme built on quality and accountability

### Essential lenses

- Disaggregate data by sex, age and disability
- Vulnerabilities and protection
- Sustainability or transition

### Communication and accountability

- Feedback and complaints mechanisms
- Coordination
- Systematic community engagement

### Monitoring context, process, progress and results

- Selection of indicators
- Appropriate data disaggregation

### Transition and exit strategies

- Local engagement and ownership
- National systems and ownership
- Partnerships

## SPHERE Steps #3, 4

## **In-class exercise: applying SPHERE standards**

- **Individually (10')**
  - Read the situation description
  - Skim the SPHERE standard for your group
- **In your group (15')**
  - Discuss the 3 questions:
    - > Design & organization process
    - > Compliance with SPHERE: challenges
    - > Information needs
- **In plenary (10')**: feedback – max. 2 highlights per group

Herzlichen Dank !

**Thank you!**

**[karin.gallandat@eawag.ch](mailto:karin.gallandat@eawag.ch)**