

Water quality and analysis

A INDICATORS NOT COVERED BY WHO

Several chemical elements are not covered by WHO guideline values, as their toxicity has not been established (phosphate, potassium, calcium, magnesium and others). In some countries these elements are subject to standards issued from national directives e.g. the AEP (*Alimentation en eau potable*) directives (1989) for France.

A humanitarian programme should conform to WHO guideline values, but a reference to national directives (which are broadly the same from one European country to another) may also be indicative.

FRENCH AEP DIRECTIVES

Parameters	AEP Directives	Interpretation
Calcium (Ca ²⁺)	Nil	O: rocks H: no direct problem, scaling (incrustation) in pipes
Magnesium (Mg ²⁺)	50 mg/l	O: rocks (clays, basalt) H: bitter taste, laxative effect
Sodium (Na ⁺)	150 mg/l	O: natural (Triassic context) H: laxative effect, pollution indicator
Hardness (Ca ²⁺ + Mg ²⁺)	No standard	O: hardness = calcium and magnesium H: no problem; taste, furring when C > 200 mg/l
Phosphate (PO ₄ , P ₂ O ₅)	5 mg/l P ₂ O ₅	O: organic matter, natural (calcic phosphates), faecal contamination, fertilisers, chemical industry, polyphosphates used against scaling, detergents H: detergent, fertiliser indicator, and faecal indicator
Potassium (K ⁺)	12 mg/l K	O: fertiliser, rock leaching H: no problem, radioactivity from ⁴⁰ K isotope
Oxidability	No standard	O: evidence of organic matter
Dissolved oxygen (O ₂)	No standard	O: atmospheric oxygen, photosynthesis H: no problem
pH	No standard	O: hydrogen ion H: significant parameter for treatment
Conductivity	No standard	O: matter in solution in the water H: acceptance

O: origin. H: health.

B WATER POINT SANITARY SURVEY

1	Sanitary inspection forms for different types of water point	682	1.4	Water trucking	684
1.1	Groundwater: open well, well/borehole with handpump, well/borehole with motorised pump system	682	1.5	Piped supply	684
1.2	Protected spring	683	2	Water quality form for different points in a water system	685
1.3	Roof rainwater harvesting	683	3	Risk analysis: assessment of priorities for remedial actions (selection of water points)	685

1 Sanitary inspection forms for different types of water point

Adapted from WHO Guidelines for drinking-water quality, Volume 3, Annex 2.

Different sanitary inspection forms can be developed depending on the water system. Forms can be adapted to specific situations and contexts.

1.1 Groundwater: open well, well/borehole with handpump, well/borehole with motorised pump system

	No	Yes	Recommended action
Is there a latrine or any source of pollution within 30 m of the well?			
Does the fence around the well allow animals in?			
Is the drainage channel less than 2 m long, broken or dirty?			
Is there stagnant water close to the well?			
Is the apron less than 1m wide all around the well?			
Are there any cracks in the well apron and headwall?			
Is the cover of the well unsanitary and closed?			
Is the well poorly sealed for 3 m below ground level?			
Is the water point dirty?			
Is the lift system in bad condition / are ropes and buckets dirty?			
TOTAL SCORE OF RISK (number of "yes" points)			

1.2 Protected spring

	No	Yes	Recommended action
Is there a latrine or any source of pollution within 30 m uphill of the spring?			
Does the fence around the spring allow animals in?			
Is the drainage channel blocking the flow and allowing stagnant water?			
Is the spring open to surface water contamination?			
Is the spring box cracked?			
Is the inspection cover cracked or unsanitary?			
Is the overflow pipe screen missing or unsanitary?			
Is the cut-off ditch above the spring blocked or non-existent?			
Is the water point dirty?			
Is there standing water at the collection point?			
TOTAL SCORE OF RISK (number of "yes" points)			

1.3 Roof rainwater harvesting

	No	Yes	Recommended action
Is the roof area dirty?			
Are the gutters that collect water dirty?			
Is there absence of a filter box at the tank inlet or is it not working well?			
Is there any other point of entry to the tank that is not properly covered?			
Are there cracks in the wall of the tank?			
Is the inside of the tank dirty or not periodically cleaned and disinfected?			
Are the taps leaking?			
Is the concrete apron near the tank absent or broken or dirty?			
Is the drainage in bad condition and the water inadequately drained?			
Is there any source of pollution around the tank or water collection area?			
TOTAL SCORE OF RISK (number of "yes" points)			

1.4 Water trucking

	No	Yes	Recommended action
Is the water point where the truck collects the water unsanitary?			
Is there no, or inadequate, chlorination of the water during the trucking process?			
Is the pipe used to fill and empty the water in the truck unsanitary or dirty?			
Is the tanker ever used for transporting other liquids besides drinking water?			
Is the filler hole of the truck unsanitary or is the lid missing?			
Are any parts of the system (water tank of the truck, storage tank in the community, distribution point) not periodically cleaned and disinfected?			
Is the storage tank / distribution point unsanitary and dirty?			
Is there no chlorination of the water at the storage tank / distribution point?			
Is the storage tank at the distribution point badly covered?			
Is there stagnant water around the water tank / distribution point?			
TOTAL SCORE OF RISK (number of "yes" points)			

1.5 Piped supply

	No	Yes	Recommended action
Is the source well protected?			
Is there any point of leakage between the source and the reservoir?			
Is there any point of leakage between the source and the reservoir?			
If there are any break-pressure tanks, are their covers unsanitary?			
Is the storage tank cracked or leaking and the inspection cover or the air vent unsanitary?			
Is the storage tank dirty or not regularly cleaned?			
Are there any leaks in the distribution system?			
Are the areas around the taps unfenced or allowing access to animals?			
Is there inadequate drainage and standing water around the taps?			
Are the surroundings of the taps dirty and with possible contamination sources (excreta, refuse etc.)?			
Is the water not chlorinated?			
TOTAL SCORE OF RISK (number of "yes" points)			

2 Water quality form for different points in a water system

Water quality information is also needed to do a proper analysis of the risks of contamination and disease transmission. Water quality analysis should be done at all points along the water system as shown in the form below.

Water point		General perception			Bacteriological		Other parameters outside WHO guideline values
Samples		Colour	Odour	Taste	N° faecal coliforms /100 ml	Possible source of contamination	
Part of the water system	Catchments Storage tank Distribution line Distribution point						
Family storage	Transport Household						

3 Risk analysis: assessment of priorities for remedial actions (selection of water points)

A complete risk analysis would require consideration of the different factors related to vulnerability to water-borne disease: primarily population size, followed by health issues, nutrition status, food availability, environmental factors, the water and sanitation situation etc. To standardise this complete analysis in one tool is difficult because factors can have different impacts depending on contexts and reference indicators can also be different depending on the situation. However, it is easier to do a more specific risk analysis by crossing only some parameters, as is the case in the example below where the analysis focuses on the risk of contamination of the water point and the bacteriological water quality.

This risk analysis combines measurement of actual contamination at one moment in time (done by the bacteriological analysis) and future points of risk (through the sanitary survey score). The result is a table where water points are placed in order to determine the priorities for action as shows the table below.

Normally, greater risks of contamination are associated with bad water quality and present an urgent priority for action, but low level faecal contamination will also require urgent action if sanitary scores are high.

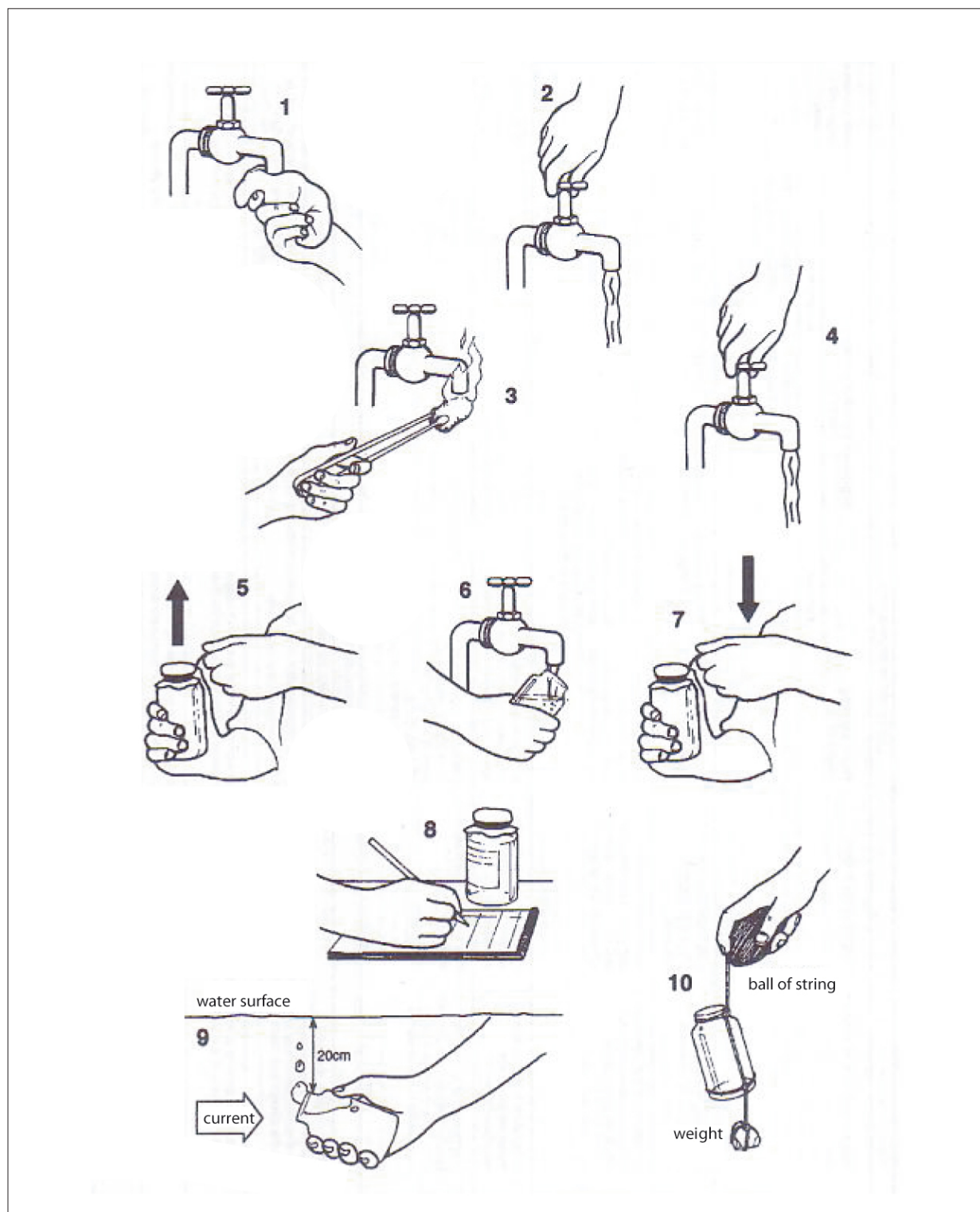
Faecal coliforms/100 ml	Sanitary inspection risk score										
	0	1	2	3	4	5	6	7	8	9	10
> 100											
11 – 100											
1 – 10											
0											
Action required	A	B			C			D			

A: no action required. B: low action priority. C: higher action priority. D: urgent action priority.

C SAMPLING PROCEDURES

PROPER SAMPLING METHOD FROM TAP AND STREAM

(Public health engineering in emergency situation, 1994, MSF)



D DELAGUA KIT

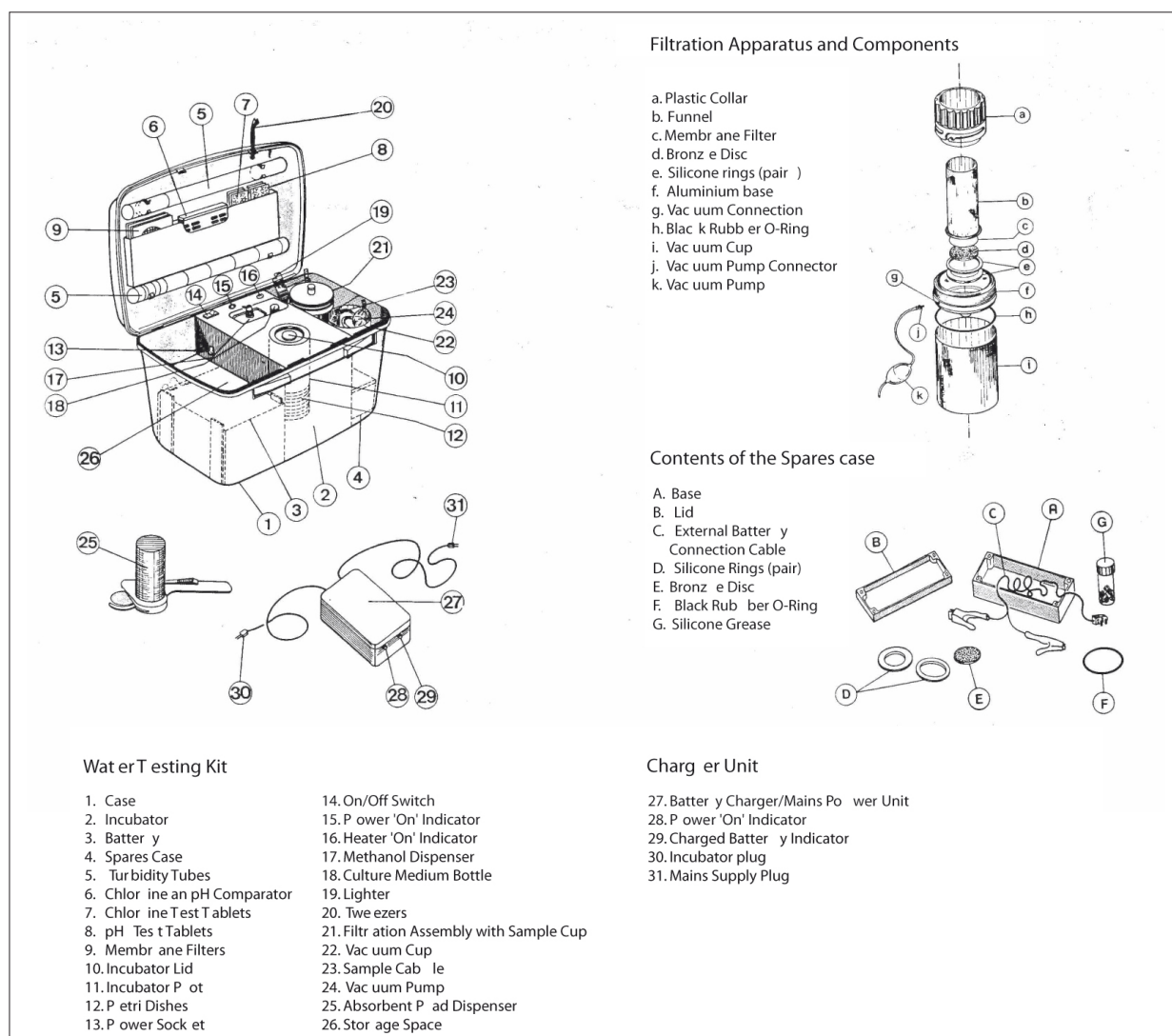
PORTABLE KIT FOR BACTERIOLOGICAL ANALYSIS (DELAGUA KIT)

Composition of the kit

- 4 boxes containing 50 ampoules of culture medium for faecal coliforms
- 200 filters (45 µm)
- 200 absorbent pads
- 500 sampling sachets (180 ml)
- 1 DELAGUA kit

Culture media used by ACF

- Ready-to-use Millipore-brand culture medium, available in 2-ml plastic ampoules, for faecal coliforms. Incubation time: 18 to 24 h at 44° C.
- Faecal coliforms develop blue colonies. Other bacteria form colonies in other colours (yellow, pink, grey).



E WATER-ANALYSIS FILE

SINGLE WATER QUALITY ANALYSIS REPORT SHEET

Site identification:

Sampling officer:

General location:

Sampling date:

Water source type:

Analysis date:

Characteristics	Parameter	Formula	Recommendation WHO 2003	Health-based guideline WHO 2003
Organoleptic	Colour	—	15	No
	Smell	—	Acceptable	No
	Taste	—	Acceptable	No
	Turbidity	—	≤ 5	No
Physicochemical	Temperature	—	Acceptable	No
	pH	—	—	No
	Conductivity	—	Acceptable	No
	Sulphates	SO ₄ ⁻	< 250	No
	Sodium	Na ⁺	< 200	No
	Aluminium	Al	< 0.2	No
	Chloride	Cl ⁻	< 250	No
Undesirable chemical	Nitrates	NO ₃ ⁻	—	50
	Nitrites	NO ₂ ⁻	—	3
	Ammonium	NH ₄ ⁺	< 1.5	No
	Manganese	Mn	—	0.4
Toxic elements	Fluorine	F	—	1.5
	Arsenic	As	—	0.01
	Lead	Pb	—	0.01
Disinfecting products	Chlorine	Cl ₂	—	5
Organic	<i>E. coli</i>	—	—	0

Recommendation from the Analysis officer:

Recommendation from the Project manager:

Unit	Sample 1	Sample 2	Sample 3	Mean	Standard deviation	Maximum value
TCU						
—						
—						
NTU						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
mg/l						
Colonies/100 ml						