Annex 4

Checklist for Environmental Health Needs Assessment

Water

How is water supplied to the population (standpipe, tanker)?

What is the source of the water (river, well, cistern, rain)?

Is the source safe to drink and likely to remain so?

Can the source provide sufficient water immediately?

Will the source provide sufficient water in all seasons?

Is the source adequate in all seasons?

How close is the supply to the refugees' shelters?

What is the current consumption of water and is it adequate for all purposes?

Is there evidence of a severe water-related disease problem (skin disease, typhoid, diarrhoea)?

Is there any danger of the source being contaminated from latrines, livestock or (in the case of rivers) other camps and settlements upstream?

Is there any danger of contamination to settlements downstream?

Is the water tested regularly? Is it tested at source, during distribution, or at household level?

Is there any system of water treatment?

Is the method of treatment sustainable?

If a pump is used, how is it serviced and what contingency plans are there if it breaks down?

Are washing facilities provided? If so, where, and is there privacy for women?

Where are animals watered?

How is water stored in dwellings? Are there enough containers for water collection and storage? Are containers clean and covered?

Sanitation and vector control

Is there evidence of high incidence of disease which could be related to poor sanitation (diarrhoea, worms)?

What is the normal practice of defecation of the refugee population (note that women's practices may be different from those of men)?

How are excreta disposed of (family or communal system, pit latrines, water-borne system, cartage, random)? Is there a designated defecation area?

Is there sufficient space for defection fields/trench latrines/pit latrines?

Is water available for handwashing close to the defecation area?

How close is the water source to the excreta disposal point?

Is there a problem with the accumulation and disposal of solid waste?

Is there an obvious problem with flies, rodents, cockroaches, mosquitoes, fleas, lice or bedbugs?

How is solid waste and rubbish disposed of (collection system, burning, burial)?

Is the watertable high or low?

What is the soil structure (rocky, sandy)?

How will different seasons affect existing sanitation systems (flooding)?

How is waste water drained off the site? Are there pools of standing water?

Hygiene promotion

What are the accepted beliefs and practices among the refugees? Are there cultural sensitivities, or taboo subjects?

How much do people understand about the relationship between water, sanitation, shelter, vectors, and disease?

Do the refugees have previous experience of communal living?

What are the common hygiene practices among the refugees (washing hands after defecation, storage and covering of cooked food, disposal of children's faeces)?

Is hygiene promotion integrated both with technical work on water and sanitation and also with the health services?

Has any agency accepted responsibility for hygiene promotion activities?

Source: Adapted from Mears and Chowdury, 1994.

Annex 5

Practical Ways to Prevent the Spread of Cholera

There are many practical steps that can be taken to contain cholera and limit its spread.

Cholera is transmitted by the faecal-oral route. People can be infected but not show any signs of sickness. Their faeces will contain the cholera vibrio. Therefore, take firm action to implement the normal measures to control the transmission of faecal-oral diseases:

Safe food

- Monitor the supply and preparation of food.
- Wash your hands before preparing food and especially after using the toilet.
- Cook food thoroughly.
- Eat cooked food immediately. If cooked food has to be stored, boil or re-heat it thoroughly before eating it.
- Fruits and vegetables should be cooked and peeled. Raw, unpeeled fruit should not be eaten.

Safe drinking water

Wherever possible obtain drinking water from a safe, uncontaminated source such as a sealed well, a borehole, rainwater, or a well-maintained piped water supply. If you are not sure that the water is safe:

- Disinfect it with alum, potash or chlorine.
- Bring the water to the boil, then boil it vigorously for one minute before using.

- Store water in a clean, covered container. Use a ladle with a long handle to take water out, so that your hands do not come into contact with the water.

Hygiene and waste disposal

- If possible, wash kitchen dishes with soap, rinse with clean water, and use a clean cloth to wipe dishes dry (or leave dishes to dry in sunlight in a clean place).
- Dispose of all stools and faecally contaminated materials in a latrine, or bury them if latrines are not available.
- Provide safe excreta-disposal facilities, ensure they are used and prevent indiscriminate defecation.

Public health measures

If an epidemic occurs, local authorities should take the following actions:

- Provide and maintain safe and adequate community facilities for excreta disposal.
- Ensure an adequate supply of safe drinking water.
- Prevent the use of contaminated drinking sources.
- Provide information about how people can purify water at home.
- Ensure the immediate and hygienic disposal of dead bodies.
- Discourage large gatherings, such as feasts or funerals.
- Establish emergency treatment centres with sufficient amounts of essential supplies, such as oral rehydration salts and intravenous rehydration solution.
- Train medical personnel, if necessary, so that they can identify patients early and treat them correctly.
- Treat cholera patients in a separate area and disinfect contaminated materials, such as bedding and drinking vessels.

Common sources of infection

- Water contaminated at its source (for example, by faeces leaking into an incompletely sealed well) or during storage (perhaps by contact with faecally contaminated hands).
- Contaminated foods that are eaten raw or undercooked, or stored at a temperature at which bacteria can rapidly multiply.
- Raw vegetables that have been washed with contaminated water.

This extract is a modified version of the reprint which appeared in the spring 1993 issue of Dialogue on Diarrhoea.

Annex 6
A Gender Checklist for Environmental Health Actions

Unless women are consulted and the participation of women of all socio-economic classes is facilitated, the impact of a project will be minimal. This list is intended to provide useful questions to address:

Assessing needs and priorities

1. What baseline data have been collected? Has a picture of environmental health needs been collected from all sectors of the community? Have current patterns of water collection been fully understood?

2. What measures have been taken to ensure women's participation in the project? Do women participate in setting priorities and objectives? Do men and women identify needs and priorities differently? Who makes the final decisions? Are there mechanisms for representing the views of women?

3. Are women specifically mentioned in the objectives? Are targets gender-specific?

4. What are the requirements for sanitary privacy?

5. What will women do with the additional facilities and with any free time released by the project, particularly if it results in a substantial reduction in workload and working hours? Will there be any negative impact?

Accessibility and acceptance of water/sanitation facilities

1. Have women participated in decisions such as:

    - design and location of water points?
    - selection of latrine designs and sites?
    - design of additional provisions for washing, bathing, livestock watering, waste disposal and waste water drainage?
    - timing of operations?
    - timing and content of hygiene promotion activities?
    - timing, location and content of training activities?
    - selection of local people for maintenance/management of the project? (Are women themselves encouraged to play this role?)

2. Are the technologies used suitable for women? Is the engineering design appropriate for women's use? Does the structure of latrines ensure privacy and conform to cultural rules? Can women repair the facilities? Can women afford to maintain them?

3. Are women's attitudes and beliefs taken into account in devising hygiene promotion? Are hygiene activities geared towards 'mothers' only? Are fathers and other women taking care of children also included?

Project personnel

1. What is the proportion of women staff in the programme?

2. Is there special recruitment of women as programme managers, water and sanitation engineers, extension workers and programme promoters?

3. Are women represented in decision-making positions?

4. Are the staff on the programme sensitive to implementing programmes with a gender perspective?

Programme training

1. Do programme training activities give equal opportunities to women?

2. What is the proportion of women in training activities? What special efforts are being made to involve more women?

3. Do educational and promotional materials show women as sanitation engineers, as programme workers? Are men shown using the facilities?

Community involvement

1. Have women's organisations been identified, notified and involved in the programme?

2. Do plans of work exist for the involvement of women's organisations?

3. What kind of support is being given directly to women's organisations?

Programme effects, monitoring and evaluation

1. How will the programme affect women's workload, hygiene, health or other benefits? To what extent do women attribute changes in these areas to the project?

2. How will the programme affect women's access to water and use of water? How will it affect women's work in cleaning the house, clothes, children, food preparation and cooking?

3. What changes are expected or have occurred in women's use of time (e.g. number of hours worked) and what were the hours saved for?

4. How will the programme affect women's income? Do changes cost women more or less money than before? Do women use time saved to make more money?

Adapted from Checklist for Gender Planning (J Cleeves Morse 'Gender and Health'; comments arising from NGO proposals and reports, paper at JFS/NGO workshop on gender and development, University of Wales, Swansea July 1993 ; The Tribune Development Quarterly, International Women's Tribune, Newsletter 43 1989).

Annex 7

Chlorine as a Water Disinfectant

Why do we need to disinfect water?

Dirty and polluted water can contain many organisms that are harmful to humans if they drink it. The disease-causing organisms (pathogens) include bacteria, bacterial spores, viruses, cysts, protozoa and helminths. These can cause diseases like cholera, bacillary dysentery, typhoid, infectious hepatitis and diarrhoea. Disinfection of water aims to kill these pathogens without leaving any harmful chemical substances in the water.

Water treatments such as sedimentation and filtration can significantly reduce the number of pathogens in water. However, there is still likely to be a need to kill the remaining and subsequent pathogens. It is at this point that chlorine is used as a chemical disinfectant.

Why use chlorine?

Chemical disinfectants for water should have the following attributes:

- destroy all pathogens present in the water within an acceptable length of time
- be able to perform within the range of temperatures and physical conditions encountered
- disinfect without leaving any harmful effects for humans
- permit simple and quick measurement of strength and concentration in water
- leave sufficient active residual concentration as a safeguard against contamination that might occur after the water has been collected, e.g. in containers
- be readily and reliably available at a reasonable cost

Chlorine is the chemical most widely used as it fulfils the above criteria and is widely available in one form or another (see section below)

How does chlorine work?

The precise way in which chlorine kills pathogens is not known. It is believed that the compounds formed when chlorine is added to water interfere with the chemical processes which ensure the pathogens' survival.

When a suitable chlorine compound is added to water, only a part of it becomes effective in killing pathogens. This part is called 'Free Active' or 'Active' chlorine (AC). AC is very good at invading the cells of pathogens. It is, therefore, a very efficient killer of pathogens. As a result, only small amounts of chlorine are required to disinfect polluted water.

What affects chlorine's efficiency?

After it has been added the active chlorine needs a certain amount of time to kill the pathogens in the water. This is called the 'contact time'. This amount of time must be allowed after adding chlorine before people drink the water. How much contact time is required for the active chlorine to be fully effective depends upon many factors. However, the most important are pH (level of acidity/alkalinity) and water temperature.

Most raw water sources have a pH value within the range 6.5 - 8. As pH levels rise the disinfecting properties of chlorine start to become weaker and at pH 9 there is very little disinfecting power. WHO guidelines recommend that drinking water should therefore have a pH in the range of 6.5 - 8.5. pH can have a significant influence on the performance of chlorine in water which we are likely to be working with for drinking water supplies.

The temperature of the water to be disinfected can have a significant effect on chlorine efficiency. The time needed for disinfection becomes longer as the temperature of the water gets lower. There is a noticeable difference in the killing rate of bacteria between 2 and 20°C.

If the water to be disinfected contains a lot of suspended solids and/or organic matter (i.e. is highly turbid), it will have a high chlorine demand. It is, therefore, desirable to clean the water as much as possible before the chlorination process begins. This will significantly reduce the amount of chlorine needed and improve its efficiency as a disinfectant.

If iron and manganese are present in the water to be disinfected a substantial amount of chlorine may combine with them to form compounds which are insoluble in water. It is, therefore, beneficial to remove the iron and manganese before chlorination. This may not always be possible, although simple aeration systems may be appropriate. It is important that the person responsible for disinfection is aware of the influence that the presence of these metals can have on chlorine demand.

How long does it take to kill the pathogens?

The disinfecting effect of chlorine is not instantaneous. The amount of pathogens killed depends upon the 'contact time' between the dosing and the drinking. For our purposes, a minimum contact time of 30 minutes is essential. However, when considering this, account must be taken of the pH, temperature and turbidity of the water. For example, a turbid water with a pH of 7.5 - 8 and a temperature of 10°C will require a longer contact time than a clear water with a pH of 6.5 - 7 and a temperature of 20°C.

MINIMUM CONTACT TIME MUST ALWAYS BE 30 MINUTES.

Types of chlorine

Chlorine gas and chlorine dioxide are widely used in water treatment. However, their handling and transport are considered too hazardous for the sorts of projects OXFAM or its partners are likely to be involved in.

CHLORINE IS DANGEROUS. THE SAFETY RULES CONCERNING ITS HANDLING MUST ALWAYS BE FOLLOWED.

Calcium Hypochlorite - Ca $(OCl)^2$

Calcium hypochlorite, also widely known as bleaching powder or chlorinated lime, comes as a powder containing approximately 33% available chlorine. It is stored in corrosion-resistant containers. Once the container is opened, the powder quickly loses its strength. This can be very significant, e.g. about 5% in 40 days if the container is opened for as little as 10 minutes per day, or approximately 20% if left open for the whole period.

The powder is not added directly to the water to be disinfected. The usual method is to make a solution of 1% available chlorine and to add this to the water.

Solutions of chlorine are more prone to loss of strength than bleaching powder. Sunlight and high temperatures can speed the amount of active chlorine lost. To minimise such losses, the solution should be stored in a dark dry place and at the lowest possible temperature. The solution should be stored in dark corrosion-resistant containers (glass, plastic, wood, ceramic) which must be securely closed.

More stable bleaches are available on the market. They are more expensive to buy but, because they last longer in store, can prove to be more economical in the long run. High Test Hypochlorite (HTH) is one such stabilised form of calcium hypochlorite. It contains between 60% and 70% available chlorine and with suitable storage will maintain its initial strength with little loss. It is available in tablet or granular form. Other prepared solutions include ICI Tropical bleach - 34% available chlorine and Stabochlor - 25%.

Sodium Hypochlorite (NaOCL)

Sodium hypochlorite is generally available as a solution commonly known as bleach. Typical available chlorine contents range from 1 to 5% but can be as high as 18%. Before using these solutions, the available chlorine content should be checked. The solutions become less stable as the chlorine content rises. As with all chlorine disinfecting compounds, extreme care should be used when handling these solutions.

Buying solutions of sodium hypochlorite is not economic for large-scale use, as the transport costs associated with it are high, because of the volume and weight to be transported. It is far better to buy powdered forms of chlorine and prepare solutions for addition to the water on site.

Slow dissolving Trichloroisocyanuric Acid

This form of chlorine is used extensively to disinfect swimming pools. The chlorine, which comes in various sized tablets, is supplied by OXFAM as part of its emergency water supply packs. The compound dissolves very slowly in water and so is suitable for disinfecting drinking water which is stored in large capacity tanks as used in an emergency. It is recommended that this form of chlorine should not be used in drinking water supplies for more than 3 months in one year. As such, this compound is ideal for use during the first three months of disinfection or whilst another source of chlorine is being found locally. It should be noted that the health risks (which are not certain or proved at the time of writing) associated with prolonged use of the tablets are much less than the risks ensuing from drinking non-disinfected water.

This form of chlorine is relatively stable and, if stored in non-humid conditions at temperatures below 25°C, can retain its full strength for 2 years. OXFAM supplies these tablets with a small plastic basket which floats inside the reservoir or tank. The basket should be placed near the inflow of the tank so that the incoming water flows over the tablets. This is the best way of ensuring good contact between the water and the chlorine. When using the 45m³ OXFAM storage tank, initially use 3 tablets (4 for the 70m³, 5 for the 95m³). The residual chlorine will need to be checked daily (see section below) and the number of tablets adjusted accordingly. The tablets should last between 7 and 14 days.

Use of chlorine

How to make chlorine solutions

As we have already said, the most stable solution is 1% available chlorine, and it is recommended that this should be the strength of solution to be prepared. The following tables give an approximate guide to producing 1% solutions from various chlorine compounds. It should be stressed that the strength of the solution will be dependent upon the chlorine content of the chemical used to make the solution.

Table 1 - Quantities of Chemical Required to Make 1 Litre of 1% Chlorine Solution

Source of Chlorine	Available Chlorine %	Quantity Required (g)
Bleaching powder	34	30 - 40
HTH	70	14
Tropical bleach	34	25

Stabilised bleach (stabochlor)	25	40
Bleach (some forms eg. Milton)		1% solution

These quantities of chemicals should be added to 1 litre of water in the following way. In the case of bleaching powder, the amount of chemical needed to make a 1% solution is placed in a suitable vessel and sufficient water is added to make a smooth cream. It is best to use a wooden stirrer to break up the lumps. When all the lumps have been broken, the cream should be diluted to the required amount using more water and thorough mixing. The sediment should be allowed to settle out, and then the clarified liquid can be taken off to be used as the disinfecting agent in the water to be treated. For granular forms, such as HTH, adding the required quantity to 1 litre of water and agitating will be sufficient to ensure good mixing.

The 1% solution is used as the means of disinfecting larger quantities of water.

How much chlorine to use?

When using chlorine to disinfect drinking water the aim is to kill off all the pathogens and then to leave a small amount of active chlorine in the water. This remaining chlorine is called the 'residual chlorine'. The residual chlorine is desirable as it can disinfect further contamination of the water once it has been collected e.g. dirty water containers. It is desirable to have a residual chlorine level of 0.3 - 0.5 milligrams per litre (mmg/l). This can be measured quite simply (see below).

The chlorine demand of water will vary greatly from one location to another. It is important therefore that the person responsible for the chlorination process is able to calculate the actual chlorine demand of the water to be treated.

This is a simple process of trial and error. Specific quantities of a chlorine solution can be added to litre samples of the water to be treated, e.g. sufficient to give 3, 4 or 5 mg/l. The residual chlorine can then be tested after a minimum of 30 minutes contact time. The chlorine demand can then be determined by deducting the residual from the amount of chlorine added.

Chlorine demand = known dose = residual chlorine

When the chlorine demand has been calculated, the desired residual level can be added arithmetically to give the required chlorine dose per litre of water, e.g. chlorine demand = 3.5 mg/l, desired residual = 0.5 mg/l, chlorine dose = 4 mg/l. This figure is then used to calculate the amount of solution to be added to the volume of water to be treated.

For reference ***When in water 1 mg/l = 1 part per million (ppm)***

Table 2

Chlorine dose required	Volume of 1% solution to be added to		
	10 litres	100 litres	1000 litres
1 mg/l	1 ml	10 ml	100 ml
5 mg/l	5 ml	53 ml	533 ml
10 mg/l	10 ml	100 ml	1 litre

ml = millilitres

Using these figures to give a 5 mg/l dose of chlorine to a reservoir of 45,000 litres will require 22.5 litres of 1% solution.

Measuring the residual chlorine

It is very important that the residual chlorine is able to be measured as this can tell the person responsible how effective the chlorination process has been. A very simple test involves the use of a kit designed for measuring the chlorine levels in swimming pools. It is called a 'pool test kit'.

A sample of the water to be tested is placed in the kit and a DPD No. 1 tablet is dropped into it. The chlorine in the water reacts with the DPD tablet to give a level of coloration in the water.

This colour is compared directly against the colour chart on the kit. The strength of colour then tells the operator the level of residual chlorine. The same kit can also measure the pH of the water sample in a similar comparative manner.

Simple chlorination rules

- pre-treatment is important to get water as clean as possible before chlorination
- do not chlorinate before filtration
- check pH and temperature to help assess contact time
- ensure that minimum contact time is always permitted
- always test for residual chlorine levels
- follow the storage guide for the particular chemical being used

Safety rules

All forms of chlorine used as water disinfectants can be dangerous if not stored and handled in the correct manner.

The following simple rules must always be followed and any particular advice and precautions supplied with a specific product should likewise be closely followed.

- Only authorised personnel should be allowed into the chlorine store.
- Chlorine is caustic i.e. can cause burning and must not come into contact with skin, eyes or clothing. Use of protective clothing including gloves, goggles and overalls or apron is advisable.
- Avoid breathing chlorine dust as it is an irritant to the nose and lungs.
- Chlorine should be stored under dry, cool and dark conditions, preferably raised above the ground. Keep all containers closed and covered when not in use.
- Follow the instructions supplied by the manufacturer of the particular chlorine compound being used.

This was prepared as an information note by the Oxfam Public Health Team.

Relief and Rehabilitation Network

The objective of the Relief and Rehabilitation Network (RRN) is to facilitate the exchange of professional information and experience between the personnel of NGOs and other agencies involved in the provision of relief and rehabilitation assistance. Members of the Network are either nominated by their agency or may apply on an individual basis. Each year, RRN members receive four mailings in either English or French. A Newsletter and Network Papers are mailed to members every March and September and Good Practice Reviews on topics in the relief and rehabilitation field every June and December. In addition, RRN members are able to obtain advice on technical and operational problems they are facing from the RRN staff in London. A modest charge is made for membership with rates varying in the case of agency-nominated members depending on the type of agency.

The RRN is operated by the Overseas Development Institute (ODI) in conjunction with the European Association of Non-Governmental Organisations for Food Aid and Emergency Relief (EuronAid). ODI is an independent centre for development research and a forum for policy discussion on issues affecting economic relations between the North and South and social and economic policies within developing countries. EuronAid provides logistics and financing services to NGOs using EC food aid in their relief and development programmes. It has 25 member agencies and four with observer status. Its offices are located in the Hague.

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