Water, sanitation & hygiene in Emergencies
for the
WHO Subregional Public Health and Emergency Management for Asia & the Pacific (PHEMAP)
Training Course
Tanoa International Hotel, Nadi, Fiji
20 November – 01 December 2006

Steven Iddings
Environmental Engineer
WHO South Pacific Office, Suva

Presentations:
Overview WS&S systems & realities (20')
Assessing water quality (10')
  • H2S water test
Making water safe (30')
  • Dosing with chlorine + demo
  • Household chlorination (SWS)
Coping with the environment
Environmental health response case study
  Rabaul volcano slide case study (30')
  + exercise (30')
Objectives
of emergency water supply & sanitation

• Prevent any additional loss of life
• Break the transmission routes of disease
• Help people to restore their lives in dignity
• Restore ‘normal’ services

‘Waterborne’
and
‘water related’ diseases

Typhoid
Diarrhoeal diseases including Cholera
Hepatitis ‘A”
food, water, sanitation, hygiene-related
Overview of drinking water sources

Rural water supply in Pacific island countries
  types of systems
  water quality problems
  definitions of access, safe water, etc

Surface water
Stream water
Spring water

Shallow wells
Fresh water lens
Wells with electric pumps
Rainwater collection systems

Rainwater
Roof catchment

Roof Catchment System
Summary of rural water supplies:

- rural water from varied sources
- limited options for treatment
- impractical to assume treatment
- most realistic:
  - find cleanest source
  - keep it clean
Water supply in emergencies
Trucked water
Desalinated Water
‘SPHERE’

MINIMUM STANDARDS FOR WATER AND SANITATION IN DISASTER RESPONSE

WWW.sphere
Hierarchy of standards

To prevent additional loss of life
SURVIVAL STANDARDS
To break transmission routes of disease
To help people to restore their lives in dignity
MINIMUM STANDARDS
To restore ‘normal’ services
NORMAL STANDARDS

Priority is often to provide a short-term ‘survival’ solution while working on longer term answer

Water Supply

1. Access & quantity
All people have safe access to sufficient water for drinking, washing and cooking and domestic hygiene...

Indicators
• 15 liters per capita day
• One water point serves a maximum of 250 people
• Maximum 500m distance from water point to shelter
• Flow at each water point at least 0.125 liters per sec
2. Water Quality

Water palatable, safe for consumption and without a significant health risk

Indicators
- < 10 E-coli per 100ml at point of delivery (undisinfected)
- Sanitary survey indicates low risk
- For 10,000 or more population or diarrhea epidemic risk, treat with residual disinfectant... (e.g chlorine)
3. Water use

Adequate facilities to collect, store & use water for drinking, cooking & personal hygiene, and ensure it stays safe until consumed.

Indicators

- Two collecting vessels of 10-20 litres, plus 20 liters storage
- 250 gram soap per person per month
- Where communal bathing necessary, separate cubicles for bathing at an acceptable frequency and time. Men and women have separated bathing cubicles
- Where communal bathing necessary, one washing basin per 100 people, private laundering facilities for women

Reminders on SPHERE

SPHERE identifies minimum not survival standards
SPHERE gives no instruction on how standards can be achieved
SPHERE standards are globally relevant, indicators may not be
SPHERE has the potential to improve policy and practice - or to further complicate the sector if misused
Excreta disposal options

Overview

types of systems
Excreta disposal

1. Access...

Sufficient toilets close to people's dwellings to allow rapid, safe and acceptable access at all times

Indicators

- Maximum of 20 people per toilet
- Use arranged by households or sex segregated
- Toilets <50 m from dwelling place or <1 minute walk
- Separate toilets for men and women in public places
### Excreta disposal

#### 2. Design...

People have access to toilets which are well designed, constructed and maintained as to be comfortable, hygienic and safe.

**Indicators**

- Technically sound, approved by users
- Cleaning and maintenance routines in place
- Toilets easy to clean, accessible to all, lit at night (if nec.), near hand washing facilities, ‘fly proof,’ ‘women friendly’, and provide sufficient privacy to users
- Latrines and soak-aways normally >30m from groundwater sources and pit bottom >1.5 m above water table. No contamination risk to surface or shallow ground water.

### Excreta disposal summary:

*(in order of sophistication)*

- open (sea or bush) defecation
- crude trenches
- crude pit latrines
- improved pit latrines
- *water seal latrines (pour flush)*
- *flush toilets*
- *portable chemical*
  *caution on water-dependant designs*
- men & women separate
- refer to “SPHERE” standards
Assessing water quality

Laboratory (quantitative) analysis:

1. Must have sterile bottles & collection
2. Must transport to lab within 6-12 hours
3. Must keep chilled
4. Must share results back to the client
   (NOT worthwhile if chlorine is present..)
What do we look for in water?

- Indicator organisms
- Pathogens
- Chemical and physical contaminants

Water Quality Analyses

- Colour
- Odour
- Temperature
- Conductivity
- Turbidity
- Chlorine
- pH
- Faecal coliforms
- Total coliforms
Chlorination test kits:

- A digital photometer type
- A basic ‘pool chlorine tester’

Water quality testing – low cost
**Implications for emergencies?**

*water quantity?*

*water quality & source protection?*

...emergencies often expose pre-existing poor systems operations, maintenance and management...

---

**H2S Paper strip test for bacteria**

“Presence/absence” test only,

NOT quantitative

Easy to use,

Suitable as “screening test”

Most useful for raising awareness
WATER QUALITY TESTING DATA SHEET

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>METHOD</th>
<th>CONCENTRATION (ppm)</th>
<th>STANDARD</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TDS</td>
<td>342</td>
<td>500</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>pH</td>
<td>6.8</td>
<td>7.2</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>COD</td>
<td>200</td>
<td>250</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>BOD</td>
<td>700</td>
<td>800</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Turbidity</td>
<td>80</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Nitrate</td>
<td>10</td>
<td>50</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>Ammonia</td>
<td>1</td>
<td>2</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>Copper</td>
<td>0.3</td>
<td>0.5</td>
<td>+</td>
</tr>
</tbody>
</table>

The results indicate that some samples exceed the standard limits, particularly in TDS and BOD.
Community awareness support materials for ‘H2S’ test

What is the test for contaminated water...

We can test if our drinking water is safe enough to drink by using the HYDROGEN SULPHIDE (H2S) Paperstrip Test.

The H2S Test uses a paperstrip to test for H2S contamination in our drinking water.
When do we need to test our drinking water?

Whenever we get our water from streams, wells, water tanks or any other source other than a government monitored water treatment plant, the water needs to be boiled or tested.

Otherwise it would be the same as taking our water out of our toilet.

The water may look clean, but it is in fact contaminated by dangerous bacteria including the coliform type which can cause the spread of water-related diseases like diarrhoea, typhoid and many more.

I am Sam...

This is 'Smart Sam'. He is a healthy living family man.

Heheats the danger tanks in the river near his house.

And lures in dirty water tanks.

And around dirty open toilets.

So he gets his family to boil all their tanks and river water and cover all their food.

He also cleans the water tank regularly during the rainy season and cleans up all the rubbish on his property.

He also keeps his toilet clean and gets his family to wash their hands after using it.

That is why his family is healthy and excel at sports and school.

Good on you Sam!
Summary:

Fiji’s drinking water standards need to:

• support community-based activities
• monitoring should take advantage of cheap screening tests
• offer guidance for real-world situation
• recognize limited rural capacities and special circumstances
Making water safe

Making water safe to drink

**Boiling** (one minute ‘vigorous, rolling boil’ is enough)

**Store and settle, decant**

**Filters:** Many types exist, with many pros & cons:

- e.g. ‘Candle’ filter
- Reverse osmosis

**Disinfection**  e.g. Chlorination: tablets, powder (HTH) liquid (HOCL or liquid bleach)
Filtration

‘Candle-type’ Water filter
Desalination plants produce drinking water from unsafe sources, even seawater, but they are very expensive to operate and maintain.
Chlorine disinfection
Sources of chlorine:

Water purification tablets

Calcium hypochlorite ‘HTH’ powder 60-70% active Cl

Sodium hypochlorite ‘HOCL’ liquid 12-15% active Cl

Liquid bleach = weak sodium hypochlorite; 3-6% active chlorine

On-site generated ‘HOCL’ liquid; 0.6% active chlorine
Household bleach

..many uses for disinfection & found everywhere
Water purification tablets

Instructions essential!

HOW TO USE WATER PURIFICATION TABLETS

1 TABLET = 1 LITRE CORDIAL CONTAINER FILLED WITH WATER
2 TABLETS = 2 LITRE CORDIAL CONTAINER FILLED WITH WATER

1. ALLOW 30 MINUTES BEFORE DRINKING
2. USE AS CLEAN WATER AS POSSIBLE
3. ALLOW DIRT AND MUD TO SETTLE FIRST
4. IF POSSIBLE BOIL WATER INSTEAD OF TABLETS
5. DO NOT USE MORE TABLETS THAN REQUIRED
6. DO NOT WASTE TABLETS (DRINKING WATER ONLY)

Use bottles such as 2 litre cordial container to measure water for purifying in the bucket, pots, drums etc.
Guidelines for use of water purification tablets
1. Find water that is as clean as possible
2. Let dirty or cloudy water settle first
3. Boiling is the first choice for making water safe to drink.
4. (Bring water to a boil, then let it boil for one (1) minute)
5. Use tablets according to instructions (illustration)
6. Let water stand for 30 minutes before consumption
7. Do not swallow or eat the tablets. Take only as instructed.
8. Use this safe water for drinking or cooking only, not for washing or cleaning food and vegetables
Another free chlorine residual test kit

‘comparator’ type

Dosing in simple terms

<table>
<thead>
<tr>
<th></th>
<th>ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swimming pool</td>
<td>3.0</td>
</tr>
<tr>
<td>Emergency tanker truck</td>
<td>2.0</td>
</tr>
<tr>
<td>Drinking water at plant</td>
<td>1.0</td>
</tr>
<tr>
<td>Annoyance threshold</td>
<td>0.8</td>
</tr>
<tr>
<td>Drinking water at tap</td>
<td>0.2</td>
</tr>
<tr>
<td>Taste threshold</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Chlorination demonstration

- Adding chlorine with water purification tablets
- Adding chlorine with household bleach
- Measuring results

Delivery and storage issues

**Carting water** (by truck or by ship)
- Chlorinated source if possible
- Chlorinate to 2.0ppm residual if possible

**Water containers in an emergency**
- Jerry-can style with spigot
- More than one to ‘decant’ from turbid source
- Deliver with tablets, deliver full if by ship
Summary:

Implications for emergencies..

*guidelines for carted water?*

*guidelines for chorine levels?*

*'boil water' notices?*

*field tests (lab, field kits & H2S)*

How to mix chlorine solutions and disinfect:

- water tanks
- water trucks
- water pipelines
- water systems
- wells
- etc
New emphasis on safe household water..
Sodium hypo-chlorite generator

..makes HOCl from saltwater
Coping with environmental conditions
Community and household mobilization

Encourage ‘coping’ mechanisms

Reinforce traditional knowledge and abilities
  e.g. Traditional safe water sources
       use of coconuts,
       extra water containers to help ‘coping’

Communicate clear messages on water & food hygiene

Remember: In the event of cholera or other diarrhoea diseases, give Oral Rehydration Therapy (ORT) and contact the nearest health center.
Community and household mobilization

We cannot assume that water is safe just because it is clear because many contaminants, including bacteria and heavy metals, are either microscopic or dispersed in the water making them invisible to our naked eyes.

Coliform bacteria, commonly found in fecal matter, are often associated with pathogenic organisms. Coliform bacteria lives in the intestines of both human and animals and discharged in the urine and feces. This is why we need to test our drinking water regularly.

Why we need to test our drinking water:

Coliform Bacteria... 

lives in the intestines of both humans... 

and animals.

The bacteria is discharged... 

through feces into streams... 

and if the water is drunk... 

that person becomes infected too and may contact serious health problems.
Reinforce traditional coping mechanisms
Summary:
Practical tools for rapid assessment

Clear water, sanitation & hygiene messages

Support & encourage “coping”
(e.g. extra water containers)

Choose disinfection method to suit:
(e.g. boiling or Chlorine tablets)

Environmental health response - books
Thank you!

Documents to share:

WHO ‘WSH’ CD

H2S Paper Strip Test sample bottles, instructions

Sample proposals for WS&S response

Group work:

Assessing environmental hazards

Rabaul Volcano Case Study: (slideshow)

Use the matrix and scenario provided
Each group to fill-in the matrix listing environmental problems
then the needs and possible players
(30 minutes)