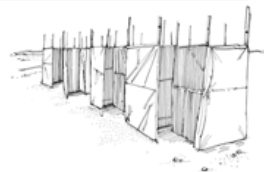


Technical Briefing for Emergency Response: *Sanitation*



Sanitation in Urban Flood Settings

This Technical Brief looks at the key sanitation issues affecting populations in urban flood settings, including excreta disposal, vector control, waste management, major clean-ups, drainage and the disposal of dead bodies

People affected by floods in urban areas can be susceptible to illness and death from disease related to inadequate water supplies, sanitation and poor hygiene. The most significant diseases are infectious diseases transmitted by the faecal-oral route (such as diarrhoea). Other water and sanitation-related diseases include those carried by vectors associated with solid waste and water. The main objective of any WASH programmes in a urban flood setting is to reduce the transmission of faecal-oral and vector borne by promoting good hygiene practices, providing safe drinking water and by reducing environmental health risks through the **provision of sanitation services**.

It will be necessary to establish the conditions that allow people to live with good health, dignity, comfort and security. The term 'sanitation', refers to excreta disposal, vector control, solid waste disposal and drainage. However, in flood situations, the factor of dead bodies (human + animal) must also be considered.

The Urban Flood Phenomena

Flood hazards are natural phenomena, but damage and losses are very often the consequence of human activities. Urbanisation aggravates flooding, by blocking the flow of drainage water, covering large areas with hard surfaces (pavements & roads), dense dwelling areas, and by obstructing natural drainage channels. On top of this, many people are found to be living in inappropriate areas, such as

floodplains, steep unstable hillsides, former mangrove swamps and reclaimed tidal lands. Urban flooding is very often due to drainage systems being overwhelmed by heavy rainfall. Climate change is making weather less predictable, more uncertain and heavy storm rainfalls more likely.

Types of Urban Flooding

Four major types of flooding are identifiable:

Localised flooding, which may happen many times a year in slum areas because there are few drains, the ground is highly compacted, pathways and alleys become streams after heavy downpours and existing drainage channels/culverts are often blocked by refuse.

Small urban streams rise quickly after heavy rain, passing through small culverts under roads. When originally designed, such engineering works were adequate, but changes in urban development and in storm intensity now produce higher flows that exceed capacity. Streams are also often blocked by large amounts of refuse.

Major rivers flowing through urban areas are affected by land use changes and engineering works upstream. Dams very often modify river flow patterns, resulting in higher flows during high rainfall. Urban growth has often happened on floodplain areas, with some areas below the flood level. Flood embankments often protect

such areas, but there is a high risk that these are breached, causing devastating urban flooding.

Wet season flooding, in lowland and coastal cities may affect some areas for two or more months, because rain and river water combine to raise levels in former swamp areas. Reclamation of land in such areas tends to exasperate rises in levels. Such areas are also at high risk of storm surges.

Responding to Urban Floods

Flash floods in urban areas are often characterised by mass population displacements in a short period of time.

Brazil Floods 2009

Floods and mudslides in northern eastern Brazil killed at least 15 people and left 180,000 homeless. **About 70,000 of the homeless are currently residing in public shelters.** Heavy rains affected more than 190 cities in seven states. *Relief Web, 08/05/09*

Shelter and access to adequate WASH facilities are frequently inter-linked, and many public shelters are ill equipped to cope with large influxes in a short time period. In situations of displacement, women and adolescent girls may be vulnerable to sexual violence or exploitation, especially when housed in public shelters. To minimise such risks, and to ensure a quality response, the participation of man, women and children in the planning, decision-making and management processes is critical. The responsible role of state actors, such as municipal authorities, armed forces and/or police forces in responding to the flood situation is equally critical in managing a response to the floods and in ensuring the safety of those affected.

1. Excreta Disposal in Urban Flood Situations

Excreta Disposal Options

The priority of any immediate options is the speed of response, and it is essential that 1st phase technologies to contain excreta can be installed quickly, particularly in public shelters

(official or unofficial), that are cramped and over crowded. Typical options include

- **Excreta clean up campaigns**
- **Chemical "Portaloo" toilets**
- **Packet latrines (with or without enzymes)**
- **Bucket latrines with close fitting lids**
- **Rapid kit (type) latrines**
- **Repairs to existing sanitation facilities**

Support may also be necessary for families who stay in their homes, and for those hosting other families. Traditional excreta disposal technology, such as pit latrines, pour-flush toilets and raised UD toilets, can be slow to implement quickly. Urban responses may typically include a both 1st and 2nd phase options:

Category	Immediate Response	2 nd Phase Response	General
Those who stay in their own homes	Use of existing latrines or toilets	Repair & clean existing facilities.	Chemical, packet or bucket latrines will require a collection and disposal service to safely dispose of sludge.
	Packet latrines	Rebuild destroyed latrines or toilets.	
	Bucket latrines	Promote latrines or toilet facilities for those without	
Those who stay with host families	Use of existing latrines or toilets.	Repair & clean existing facilities.	Chemical, packet or bucket latrines will require a collection and disposal service to safely dispose of sludge.
	Packet latrines.	Rebuild destroyed facilities	
	Bucket latrines with lids	Promote latrines for those families without them	

Those who relocate to official shelters	Excreta clean up	Repair & clean existing facilities	Keep facilities clean and well maintained
	Repair existing facilities	Rapid kit (type) latrines	. Sludge from chemical, packet or bucket latrines will require a safe collection and disposal service
	Rapid kit latrines	Provide facilities to non-equipped shelters	
	Chemical toilets		
	Packet latrines		
Those who relocate to unofficial shelters	Bucket latrines		
	Excreta clean up	N/A	Keep facilities clean and well maintained
	Rapid kit latrines		. Sludge from chemical, packet or bucket latrines will require a safe collection and disposal service
	Chemical toilets		
	Packet latrines		
	Bucket latrines		

- Fully understanding the community's preferences regarding excreta disposal practices and facilities. Are there any strongly held beliefs or taboos about urine or faeces?
- Being aware of the availability and cost of excreta disposal hardware & services and the quality of those hardware & services.
- Understanding the needs of men, women, children and those with special needs

Chemical Toilets

Also known as Portalooos, are portable sanitation units that are placed above watertight excreta holding tanks. Portalooos come in either sit-down or squatting pan format, depending on cultural preference. During usage, a chemical solution is added to the holding tank to reduce odours and facilitate the emptying process. The units are generally housed in a single pre-fabricated plastic cabin with a lockable door, though standards will vary from country to country. The units are generally rented for a specified period of time from a "service provider", who should also be responsible for the regular cleaning and maintenance of the units.

The advantage of Portalooos is that they can be deployed quickly in sufficient numbers to be able to respond to a sudden on-set situation. The disadvantage is that this is an expensive option and impractical if a reliable local service provider is not available.

Packet Latrines

These are plastic packets, similar in appearance to a plastic bag. They generally contain enzymes, which help to desiccate the contents and to assist breaking down the excreta. The bags may or may not be biodegradable, and a number of options are available commercially. The bags must be disposed of in a safe place.

On-site, the bags may be disposed of in a suitable pit. Alternatively, they may be treated as solid waste and collected in a suitable container, which will require emptying on a regular basis. People involved in collecting and handling packet latrines will require suitable protective clothing such as gloves, boots and overalls. A safe location for final disposal must be identified immediately, and in consultation

The choice of the option will depend on a number of factors, and a decision should be based on a solid assessment of the situation (Excreta Disposal in Emergencies Manual). Consultation with the affected community is an essential part of this assessment process, and a number of parameters must be considered. These include:

- Are there any existing sanitation facilities in the public shelters that could be either cleaned or rehabilitated for the displaced population?
- The physical constraints (rocky ground, sandy soils, high water table, flood plain, etc.) existing in the target location?
- How long will the communities remain in public shelters? Will it be days or months?

with the communities and local authorities. Users may object to using packet latrines, so consultation with the community is crucial. This should also be accompanied by appropriate hygiene promotion, and by implementing a suitable management system for the bags.

The advantage of Packet latrines is that they can be deployed quickly in sufficient numbers to be able to respond to a sudden on-set situation. They are also cheap. The disadvantage is that there may be objections to their use, and management of the waste stream can be problematic, and this should only be considered a short-term option.



Figure 1: A biodegradable packet latrine (peepoople)

Existing Urban Sewer Systems

If there is an existing urban sewerage system, and it is still operational, a quick emergency option is to install temporary latrine structures directly over the sewer inspection covers. Alternatively, temporary latrines/toilets can be built close by and connected to an existing sewerage system. Care should be exercised to provide sufficient capacity for the displaced population, using SPHERE Guideline indicators.

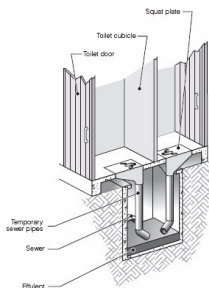


Figure 2: Latrines installed over an existing sewer (WEDC)

In an urban setting, given the space constraints, it is most likely that any excreta disposal system that is set up will be communal. Schools, markets and other communal buildings may already be equipped with some form of excreta disposal system, and it may be simply a case of cleaning or rehabilitating such facilities. Again, SPHERE Guidelines indicators will assist in ensuring adequate levels of safety and coverage.

Repairing Existing Excreta Disposal Facilities

Where possible, public shelters that have existing sanitation facilities should always be selected to house displaced communities, even if the facilities are damaged or not working. Repairs should be undertaken to rehabilitate broken facilities as quickly as possible. This may require such actions as re-connecting water supplies, repairing broken sanitary wares, or emptying pits/septic tanks that are full. Such actions should be done in collaboration with the displaced community, and the owners of the facilities. Care should be exercised to ensure that the needs of special groups (women, children and the disabled) have been taken into account. It may also be necessary to supplement existing facilities with new units in order to meet SPHERE Guideline indicators.



Figure 3: Repairs to existing facilities may provide a quick solution (Alcade, 2004)

Desludging Existing Excreta Disposal Facilities

Where existing facilities have been identified, and and such facilities require emptying to make them serviceable again, a number of options exist, including:

- By hand, using shovels and buckets
- With a manual desludging pump
- With a motorized vacuum truck

Whatever the technique chosen, care must be exercised to ensure that the pit/septic tank being desludged is fully lined, or this may lead to collapse. It may also be necessary to liquefy the sludge by adding water, as both sludge and pit contents tend to solidify in hot climates.

Health & Safety Issues

If manual latrine emptying is the only method available, care must be exercised during the emptying process. The removal of pit/septic tank contents is extremely hazardous to health (and safety). Workers involved in pit emptying should never enter the pit, and should wear protective clothing such as rubber boots, overalls, rubber gloves and facemasks. On completing the work, hands must be washed thoroughly with soap, and the protective clothing should also be washed and disinfected.

Faecal sludge removed from pits/septic tanks must be disposed of in a safe and appropriate manner. Indiscriminate dumping of faecal sludge into watercourses and onto agricultural land should be avoided. This is bad both for the

environment and a health risk. Ideally, the sludge should be disposed of in a functioning sewer or wastewater treatment plant, and where possible, this should be discussed with the relevant authorities.

Assisting the Return Home

Support should be provided for families returning to their own homes, through the provision of materials for repairs or by providing assistance to empty flooded latrines.

2. Vector Control in Urban Flood Situations

Vectors carry disease-producing parasites from one host to another. These potential disease carriers are capable of rapidly reproducing and dispersing within favourable environments. Floods in urban areas often result in overcrowded, cramped and unsanitary living conditions in public shelters, and displacement from one location to another. Contact between vectors and humans may be increased.

Flood conditions do not automatically result in outbreaks of vector-borne diseases, and some flood-associated diseases may appear several weeks or months after the event. However, in the post-flood period, it is a priority to assess the risk of vector-borne disease transmission, as quickly as possible. The principal vector transmitted diseases include:

Vector	Disease/Condition
Mosquitoes	Dengue, Malaria, Yellow Fever, West Nile Fever, Filariasis, etc.
Rats	Leptospirosis, Hanta virus, Bubonic plague, Typhus, etc.
Flies & Cockroaches	Diarrhoeal diseases
Ticks, Fleas, Lice	Typhus

Responding to vector problems

In a post-flood situation, people need to have the knowledge and the means to protect themselves from disease and nuisance vectors that are likely to represent a significant risk to health or well being. In overcrowded, cramped and unsanitary public shelters, vector control

measures may be required to prevent disease outbreaks. Potential urban flood vector related problems include:

- The creation of new breeding sites due to poor drainage near shelters (official & unofficial)
- Poor sanitary conditions in shelters and overcrowded areas
- Accumulation of solid waste in or near shelters, and in the streets
- The disruption of on-going vector control programs
- An increase in the number of vector host species present
- Displacements from one location to another and an increase in vector and human contact

Vector control responses

The control of a vector-borne disease can be achieved by various means in emergencies. Risks must be kept to an acceptable level. Measures include:

- Medical diagnosis and treatment
- Vector control using chemical/biological means
- Environmental sanitation
- Promoting personal protection

Medical diagnosis and treatment are outside the scope of this paper, and should be undertaken by the competent authorities.

Chemical vector control measures should be undertaken in a way, which ensures the staff, those affected by floods and the local environment, are all adequately protected. The use of chemicals should be done in a way that avoids creating resistance to that particular substance. Application methods include:

Equipment	Application method
Dusting	Hand-held dusters, manually operated or mechanized.
Residual Insecticide Spraying	Knapsack sprayers with special nozzles.
Ultra-low volume spraying	Low-dosage applications to large areas from fixed-wing aircraft or helicopters.

Space spraying	Interior or exterior applications with pesticide aerosols dispersed under pressure from vaporizers
Impregnation	The treatment of materials such as bedding, clothing and mosquito nets with pesticides in emulsion or solution (by dipping and drying, or by spraying with knapsack sprayers).

Where possible, the vector control activities should be coordinated with the local authorities and the relevant public health body.

Environmental sanitation measures include; draining standing bodies of water; removing vector breeding sites (such as piles of rubbish, old tyres, water jars, bamboo poles, etc.); setting traps (rats & flies); etc.

Personnel protection measures include; the distribution of insect/mosquito repellent; promoting using long sleeves & trousers; fitting houses/shelters with mosquito/fly netting on windows & doors; distributing insecticide treated bed nets (ITNs); and wearing Wellington boots.

In an urban context, a combination of good environmental sanitation (good drainage and waste management), residual insecticide spraying, distributing ITNs and insect repellent are amongst the most effective ways of controlling vector problems in public shelters.

3. Waste Management in Urban Flood Situations

When large numbers of people have been forced into public shelters, waste management will quickly become a major issue. The first priority is to analyze the emergency context and the nature of waste being generated. Following this, a waste management system should be quickly put into place in a safe and environmentally friendly manner.

A decision must be taken if the waste will be dealt with on-site (burial), or whether it is necessary to transfer to a remote site (landfill)? The key steps in WM are:

- Collection, containment & storage
- Waste transfer
- Final waste disposal

For on-site disposal (burial in pits), waste transfer is not necessary. If disposal is off-site, a means of collection, transportation and a final disposal site must be identified.

Sphere standards: Key waste indicators

- People should be involved in the design and implementation of the solid waste programme
- Household waste is put in containers daily for regular collection, burnt or buried in a specified refuse pit
- All households have access to a refuse container and/or are no more than 100 meters from a communal refuse pit
- At least one 100-litre container is available per 10 families where domestic refuse is not buried on site
- Refuse is removed from the settlement before it becomes a nuisance or a health risk

The municipal authorities and other relevant authorities should be consulted. It may also be necessary to provide transport and manpower to provide the service. All personnel working in collecting and handling the waste should be given the relevant protective clothing. The communities themselves should be consulted about locating and managing communal waste collection points.

Waste Reduction

It may be possible to reduce waste and to identify opportunities for the re-use and recycling by raising the awareness and influencing the behaviour of those living in public shelters. Beneficiaries should be engaged and take a lead in the process. Messages need to be developed so people are aware of how they can reduce waste generation, and be involved in recycling. Opportunities for creating livelihood activities through recycling should be identified.

4. Drainage in Urban Flood Situations

Surface water in or near by public shelters will invariably be contaminated by wastewater from septic tanks, toilets and/or latrines. The main health risks are the possible contamination of water supplies, damage to dwellings, vector breeding and drowning. To reduce potential health risks to the population, it will be necessary to unblock existing drainage to help drain the site. People should have an environment in which the health and other risks posed by water erosion and standing water, including storm water, floodwater, domestic wastewater and wastewater from medical facilities, are minimised. Communities can be mobilised to clear drainage channels and to repair small breaches in flood defences using a "Cash-for-Work" approach.

5. Post-flood Clean ups

A number of post flood problems will need to be solved by collective action between the affected communities and the local authorities. Typical problems include:

- Blocked urban drainage systems, which prevent the evacuation of flood waters and pose a risk in the event of new rainfall events
- The accumulation of mud and flood related debris in the streets, which block access and prevent effective clean-up activities.
- Flooded homes containing silt and flood related debris, which may have been contaminated with biological matter.
- Household possessions (mattresses, fridges and household appliances, etc.), which have been destroyed and require collection & safe disposal.

Mass Clean up Campaigns

In urban flooding, flood related debris such as sediment, silt, and organic material will have affected drainage channels, public roads, public thoroughfares and houses. In some instances, cars, lorries and industrial equipment will be transported and deposited by the floods. In such circumstances, it will be necessary to organise a mass clean up campaign, not only assist with draining floodwaters, but also to open up access and to assist the community to return home. The use of "Cash-for-Work (CFW)"

campaigns, in conjunction with local authority rehabilitation plans, offers an effective mechanism for collective action.

An initial assessment will assist in highlighting the volume of waste to be dealt with, options for removal, transport needs, possible temporary storage needs, pre-treatment requirements and final disposal options.

Community Mobilisation

Communities can be mobilised by loudspeaker cars passing through the target areas, prior to CFW teams going into the area. In the event of vulnerable groups being identified (elderly, disabled and women headed households), CFW teams can be instructed to assist such people by removing flood debris directly from their properties. Permission to undertake such measures must be obtained from the beneficiaries prior to the physical removal happening.

Community based activities are best coordinated by area coordinators, trained in the waste management process and with knowledge of the areas to be cleaned. CFW teams will in general be selected from the target communities, based on specific criteria. Typically, one supervisor may coordinate around 10 – 15 people. CFW teams should be rotated on a periodic basis to provide an opportunity for a number of different people to participate in the scheme. Typically, CFW teams may be employed for a maximum of two weeks in one area, before rotating to give others an opportunity.

The provision of tools, such as picks, shovels and wheelbarrows will be essential, and it may be necessary to organise trucks and mechanical diggers to evacuate the debris, depending on the volume that has been deposited. Protective clothing such as boots, overalls and gloves should be provided to all those involved in mass clean up campaigns.

During the emergency period

Urban floodwaters are invariably contaminated with biological matter and chemicals of some description. Although skin contact with floodwater itself may not pose a serious health risk, there is some risk of disease from eating or drinking anything contaminated by floodwater. Hand washing with soap and clean water is one of the most effective ways of protecting against disease.

Open cuts or wounds coming into contact with floodwater may result in people becoming infected with diseases such as leptospirosis. Personal protection and personal hygiene are essential in such situations, and children should be prevented from playing in the floodwater. Their toys and possessions should be disinfected.

Re-entering a flooded home

Homes that have been flooded have invariably been contaminated with biological matter. There is also a risk of mould as the house dries out. In both cases, it is important to ensure doors and windows are fully open after entering the house for the first time. Doors and windows should be open for at least 30 minutes before cleaning activities are started. Floodwater outside the house should be prevented from re-entering the house. Good clean up practice includes:

- Wearing rubber boots, gloves and goggles
- Cleaning all hard surfaces with clean water and a disinfectant
- Washing hands with soap and clean water after the clean up activities.
- Disinfecting cuts and wounds if they come into contact with floodwater. Medical attention should be sought if people become ill.
- Washing and disinfect clothes worn for clean up campaigns. Clothes salvaged from the flooded home should also be washed and disinfected.
- Items such as mattresses, cushions and other such items that cannot be cleaned should be disposed of.
- Ensuring the house is fully dried before resettling

Cleaning and disinfecting with bleach

Wherever possible, an unscented proprietary liquid bleach (Sodium Hypochlorite) of between 4 – 6 % should be used. The safety instructions on the bleaches container should be carefully read and closely followed. Rubber boots, gloves and goggles should be used when handling the solution and it should never be used in a closed space.

Activity	Application method
Cleaning water storage containers	<ul style="list-style-type: none"> - Mix soap and clean water in container - Shake to clean inside of container - Rinse container - Mix 20ml bleach per litre water and pour into container - Shake the container so solution touches all surfaces - Cover and leave for 30 minutes - Rinse with clean water
Food contact surfaces	<ul style="list-style-type: none"> - Wash with soap and clean water - Rinse with clean water - Mix 5ml bleach per litre water and clean the surface - Allow to air dry
Hard surfaces and other household items	<ul style="list-style-type: none"> - Wash with soap and clean water - Mix 5ml bleach per litre water and clean the surface - Allow to air dry
Cleaning mould growth	<ul style="list-style-type: none"> - Mix 50ml bleach per litre water and clean/wash the item/surface with the solution - Scrub rough surfaces with a brush - Rinse with clean water - Dry the item/surface or leave it to air dry

6. Disposal of Dead Bodies in Flood Situations

Health risks

There is a widespread belief that corpses pose a risk of communicable diseases after a flood. Such beliefs are frequently mistaken, especially if death has been caused by trauma or drowning. Dead bodies are unlikely to cause outbreaks of diseases such as typhoid fever, cholera or plague, though there may be a risk of water sources becoming contaminated.

Recovering Dead Bodies

In the event of human deaths in an urban flood, the local authorities will undoubtedly be responsible for recovering dead bodies.

Further information

Excreta Disposal in Emergencies, a field manual – Harvey, P. (an Inter-agency publication, 2007)

Sanitation in Emergencies, Assessment and Programme Design – Harvey, P., Baghri, s., Reid, R. (WEDC, 2002)

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OXFAM TBN 7 - UD Toilets and Composting Toilets in Emergency Settings

http://www.oxfam.org.uk/resources/learning/humanitarian/tbn_drafts.html#eco

Environmental Health in Emergencies & Disasters: A practical guide – Wisner, B., Adams, J. (WHO, 2003)

Solid waste management in emergencies - WHO Technical Note no. 7 (Jan 2005)

http://wedc.lboro.ac.uk/WHO_Technical_Notes_for_Emergencies/7_-_Solid_waste_management_in_emergencies.pdf

OXFAM TBN 15 – Domestic and Refugee Camp Waste Management Collection and Disposal

http://www.oxfam.org.uk/resources/learning/humanitarian/downloads/TBN15_domestic_refugee_waste.pdf

OXFAM TBN 16 – Composting of Organic Materials and Recycling

http://oxfam.org.uk/resources/learning/humanitarian/downloads/TBN16_composting_recycling.pdf

Oxfam TBN 8 – Low cost drainage for emergencies

http://www.oxfam.org.uk/resources/learning/humanitarian/downloads/tbn8_drainage.pdf

Further information cont.

OXFAM TBN 17 – Large Scale Environmental Clean up Campaigns

http://www.oxfam.org.uk/resources/learning/humanitarian/downloads/TBN17_large-scale_environmental_cleanup.pdf

Re-entering your flooded home – CDC (Emergency Preparedness & Response)

<http://www.bt.cdc.gov/disasters/mold/reenter.asp>

Cleaning & sanitizing with bleach after an emergency – CDC (Emergency Preparedness & Response)

<http://www.bt.cdc.gov/disasters/bleach.asp>

After a hurricane or flood: cleanup of flood water – CDC Emergency Preparedness & Response

<http://www.bt.cdc.gov/disasters/floods/cleanupwater.asp>

Disposal of dead bodies in emergency conditions - WHO Technical Note no. 8 (Jan 2005)

http://wedc.lboro.ac.uk/WHO_Technical_Notes_for_Emergencies/8-Disposal_of_dead_bodies.pdf

The Global WASH Cluster Technical Learning Project, led by ACF-UK

<http://www.humanitarianreform.org/Default.aspx?tabid=347>

Author: Tim Forster

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Contact: l.boughen@aahuk.org or v.fuchs@aahuk.org