Republic of Liberia

Ministry of Health

WASH and Environmental Health Package in Health Facilities

Program for Early Recovery and Resilience Building from EVD Outbreak in Liberia

Monrovia, Liberia

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Acknowledgement

On behalf of the Government and people of Liberia, the Ministry of Health (MOH) acknowledges with profound gratitude all institutions and individuals, including the MOH programs and staff, who participated in the development and review of the Environmental Health (EH) and Water Sanitation and Hygiene (WASH) Package for healthcare facilities in Liberia. Specifically, the MoH Division of Environmental and Occupational Health, MoH Division of Infrastructure, County Heath Teams (CHTs), Ministry of Public Works (MPW), Ministry of Lands Mines and Energy (LME), Ministry of Finance and Development Planning, Environmental Protection Agency (EPA) and Liberia Water and Sewer Corporation (LWSC).

We express appreciation to the United Nations International Children's Emergency Fund (UNICEF) and World Health Organization (WHO) for providing both the necessary technical and financial support needed to undertake this task. We also appreciate various contributions by the United States Centres for Disease Control and Prevention (US CDC), Oxfam, Water Aid, and the Liberia WASH Consortium.

This document has been developed through consultative and participatory processes in several stages aimed at identifying minimum recommended EH and WASH requirements for healthcare facilities as part of the program for Early Recovery and building of a Resilient healthcare system as we transition from the Ebola Virus Disease (EVD) outbreak in Liberia towards improving quality of care within routine health care services. The developed EH and WASH package adheres to the Liberia Ministry of Health infrastructure standard; the most recent WHO/UNICEF recommendations/guidelines on WASH interventions and Environmental Health Standards and Infection Prevention and Control measures in health facilities. Extensive consultation and experience sharing on the contents of the EH and WASH package has been undertaken with stakeholders at the country (both national and sub national) level, as well as with subject matter / technical experts at regional and global level.

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Table of Content

I. Introduction

This document contains minimum requirements for Water, Sanitation and Hygiene (WASH) and Environmental Health (EH) in healthcare facilities as part of the program for Early Recovery and Resilience Building from Ebola Virus Disease (EVD) Outbreak in Liberia. WASH services in healthcare facilities include availability of safe and adequate water, presence of hand washing stations with running water and soap or alcohol-based hand rub, availability of toilets, wastewater collection system and health care waste management (HCWM) facilities, and functional storm water drainage system.

Ministry of Health aims at improving quality of heathcare services in health facilities by implementing interventions highlited in the WASH health facility Package. As such, this document included minimum recommended WASH requirements that adhered to the Liberia Ministry of Health infrastructure standard and most recent WHO/UNICEF recommendations on WASH interventions[1] and environmental health standards in health facilities[2].

II. Components of WASH & EH Package and Objectives

WASH in the healthcare facility package includes both hardware and software components. Quality improvement in health facilities depends on the availability of sustainable WASH services at facility level. Therefore, hardware and software WASH interventions aims at improving quality of care that Ministry of Health aims to achieve. Below are the specific objectives of hardware and software components of WASH & EH package in healthcare facilities.

I. Hardware component: Aims at improving the quality and quantity of WASH facilities in healthcare settings. It includes the construction and rehabilitation of water points; toilets and wastewater collection system; hand washing facilities; storm water drainage system; laundry facilities; mortuary; HCWM facilities including collection, storage, and disposal facilities such as ash pits for the final disposal of incinerated ash, burial pits for the disposal of autoclaved waste and placenta pits for the disposal of placentas and other body tissues.

II. Software component: Aims at improving and managing WASH facilities in healthcare facilities to avoid nosocomial infections among healthcare workers, patients and the general community. It includes hygiene practices; behavioural change and communication; Infection Prevention and Control measures including PPE use, decontamination, processing linen and housekeeping; management of health care waste; wastewater treatment; analysis of water quality and quantity to ensure access to safe water, safe excreta disposal and other environmental health issues.

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[1] *WHO/UNICEF (2015). Water, sanitation and hygiene in healthcare facilities: Status in low-and middle-income countries and way forward.*

[2] *WHO. (2008). Essential environmental health standards in health care.*

III. Management Structure for Monitoring Implementation of WASH Interventions in Healthcare Facilities

Implementation of WASH interventions in healthcare settings is the responsibility of the Government of Liberia. At the national level, it involves the Ministry of Health (MOH), Ministry of Public Works (MPW), Ministry of Lands Mines and Energy (LME), Ministry of Finance, Environmental Protection Agency (EPA) and Liberia Water and Sewer Corporation (LWSC). At the county level, this is led by the County Heath Teams (CHTs) with support from the above mentioned institutions and assisted by local and international non Governmental organizations. Ministry of Health through department of Environmental Health and in collaboration with the Infrastructure unit are directly involved in the implementation of WASH interventions in healthcare facilities. Figure 1 below indicates the planned hierarchy in monitoring WASH implementation for Early Recovery and Resilience Building from EVD Outbreak in Liberia.

Figure 1: Planned Management structure for Monitoring the Implementation of WASH Interventions in Healthcare Facilities.

IV. Implementation of Hardware Component of WASH & EH Package in Healthcare Facility

Hardware component of WASH in healthcare facilities shall be done by constructing and rehabilitating WASH facilities based on the specifications issued by the Infrustructure Unit under MOH. The minimum standards for WASH facilities are discussed below.

A. Water Supply

Box 1. Water Supply: *Water for drinking, personal hygiene _ and medical activities is safely treated, reliable and sufficient. Ensure on-site water collection points that are functional with water safety plans.*

Required Minimum Standards

1. **Water quantity:** There should be 5-400 liters/person/day[3] depending on the level of healthcare facility and nature of healthcare service delivery. Underground, surface and elevated water storage tanks including piping should be constructed and installed based on the guidelines issued by MOH to allow sufficient water supply in healthcare facilities. Table 1 below indicates the WHO recommended minimum water quantities required for different stations in healthcare settings.

Table 1: Minimum Water Quantities Required in the Healthcare Facilities.

Different Stations in Healthcare Facility	**Minimum Water Requirement**
Out patients	5 litres/consultation
In patients	40–60 litres/patient/day
Operating theatre or maternity unit	100 litres/intervention
Dry or supplementary feeding centre	0.5–5 litres/consultation (depending on waiting time)
Wet supplementary feeding centre	15 litres/consultation
Inpatient therapeutic feeding centre	30 litres/patient/day
Cholera treatment centre	60 litres/patient/day
Severe acute respiratory diseases isolation centre	100 litres/patient/day
Viral Haemorrhagic Fever isolation centre	300–400 litres/patient/day

Source: WHO. (2008). Essential environmental health standards in healthcare pg 29.

The above minimum required volumes include water used for drinking, cleaning, bathing, cooking, laundry and hand hygiene. Although the estimates can be used for planning purposes, other factors such as local water use practices, type of WASH facilities and level of care should be considered. MOH in Liberia used these figures to quantify the average water demand for different levels of healthcare facilities for planning purposes as indicated in Table 2 below.

Table 2: Water Demand Estimates for Different Levels of Healthcare Facilities.

Levels of Health Facility	**Average Water Demand per day**
Level 1 (Clinics)	2688 liters ~ (710 gallons)
Level 2 (Health Centers)	6057 liters ~ (1600 gallons)
Level 3 (Hospitals)	23470 liters ~ (6200 gallons)

[3] *WHO/UNICEF (2015). Water, sanitation and hygiene in healthcare facilities: Status in low-and middle-income countries and way forward.*

Source: Ministry of Health. (2013). Infrastructure standards in Liberia pg 228.

2. **Water quality:** Water should be free of faecal contamination (0 fecal coliform counts /100ml), turbidity level should be < 5 nephelolometric turbidity units (NTU), and chlorine residue should be 0.5 – 0.7 mg/l. In addition, water quality should adhere to Liberia water quality standards which comply with the recommended guidelines for drinking water issued by WHO specifically for chemical, microbial and physical parameters. Mini Water Quality laboratories in each county should be equipped with the required reagents, tools and equipment to facilitate regular sampling of water from all healthcare facilities and water quality analysis. Results of water quality analysis should be made available to the respective healthcare facility and MOH. Chlorine disinfectants should be readily available to facilitate water treatment.

3. **Water access:** Onsite water supply is recommended, and thus running water should be available in all outpatient and inpatient treatment locations. A reliable point for drinking water should be made available to staff, carers and patients at all times[4].

B. Toilets, Bathrooms and Wastewater Collection System

Box 2. Toilets, Bathrooms and: *Toilets and bathrooms should be accessible, gender separated, user friendly, disability friendly and sufficient to all users including staff, patients and visitors. Wastewater generated in healthcare facilities should be disposed of promptly and safely to avoid contamination. Wastewater collection facilities can be onsite or off-site. Availability of such facilities.*

Required Minimum Standards

1. **Sanitation facility quantity:** There should be sufficient toilets for staff, patients and visitors. Minimum requirements are 1 toilet for every 20 inpatient users and at least 4 toilets for outpatient users[5] mainly female and male staff, visitors, patients and children. At least one shower should be available for 40 inpatient users including patients, staff and carers. In each healthcare facility, there should be separate toilets and bathrooms for the patient and staff with clear symbols and signs on the proper use of such facilities.

   Septic tanks and leach fields should allow proper collection, on-site treatment and percolation of wastewater. In areas where off-site waste treatment is available, septic and holding tanks should be desludged by LWSC when they are ¾ full. Effluents with radioactive materials (if any) should be stored in the retention tank to allow the decay of radioactive materials. Table 3 below indicates wastewater flow estimates for different levels of healthcare facilities.

[4] *WHO. (2008). Essential environmental health standards in health care.*
[5] *WHO/UNICEF (2015). Water, sanitation and hygiene in healthcare facilities: Status in low-and middle-income countries and way forward.*

Table 3: Wastewater/Graywater Flow Estimates for Different Levels of Health Facilities.

Levels of Healthcare Facility	Average Quantity of Wastewater per day
Level 1 (Clinics)	2177 liters ~ (575 gallons)
Level 2 (Health Centers)	5451 liters ~ (1440 gallons)
Level 3 (Hospitals)	21388 liters ~ (5650 gallons)

Source: Ministry of Health. (2013). Infrastructure standards in Liberia pg 263.

2. **Sanitation quality:** Toilets and wastewater collection facilities including septic tanks, leach fields and holding tanks should be constructed according to the specifications issued by MOH to ensure that excreta and wastewater are safely managed. These facilities should be located at least 30 meters from water sources and 2 meters above the ground water table. In addition, sanitation facilities should be cleaned and maintained regularly to ensure that clean and functioning toilets are readily available.

3. **Sanitation access:** Onsite sanitation facilities are recommended. Sanitation facilities should be accessible to female and male staff, patients and visitors including children and people with reduced mobility. Toilets should be easily accessible (within 30 metres from all users[6])

C. Hand Washing Facilities

Box 3. Hand Washing Facilities: *There should be sufficient and well-designed hand washing facilities with soap and running water at critical areas. _. Information, Education and Communication (IEC) materials should be available in areas with hand washing facilities to remind users of proper hand washing and its importance.*

Required Minimum Standards

1. **Quantity of hand washing stations:** Hand washing facilities should be conveniently located throughout the healthcare facility including consultation rooms where healthcare procedures are performed and in areas with toilets or latrines facilities (5 meters within toilets or latrines). Patient's wards with more than 20 beds should be provided with at least two hand washing basins[7]. In case of absence of such facilities, waterless antiseptics should be readily available (wall-mounted) or other alcohol hand rub in small bottles depending on the availability. Antiseptics such as povidone-iodine scrub and chlorhexidine gluconate scrub are recommended

[6] *WHO. (2008). Essential environmental health standards in health care.*
[7] *WHO. (2008). Essential environmental health standards in health care.*

for use in higher risk areas including operating rooms, neonatal departments and intensive care units[8].

2. **The quality of hand washing facilities:** Hand washing facilities should be constructed according to the specifications issued by MOH to ensure that facilities are user friendly and safely managed. Hand washing facilities should be cleaned, maintained and provided with good drainage. Correspondingly, there should be clear signs, symbols and health messages to encourage the use of hand washing facilities. Regular monitoring of chlorine solution (0.05%) should be conducted where such solution is used.

3. **Access:** Hand washing facilities should be accessible and easy to use by every person visiting a healthcare facility.

D. Storm Water Drainage System

Box 4. Storm Water Drainage System: *There should be adequate and well-designed storm water drainage system in all healthcare facilities. The system should ensure that unblocked storm water channels exist and are properly sized and functional. It should also ensure that rain water does not flood or carry potentially infectious agents to nearby residents or communities. Rain water should not be directed into septic tanks to avoid overspill in case wastewater collection facilities cannot absorb it.*

Required Minimum Standards

1. **The quantity of storm water channels:** There should be enough storm water canals to contain and direct movement of storm water runoff in each healthcare facility.

2. **Quality:** Storm water channels should be constructed according to the specifications issued by MOH to ensure that rain water is safely managed.

E. Laundry Facilities

Box 5. Laundry Facilities: *There should be at least one laundry facility in each hospital and healthcare centre. Laundry facilities should be well-designed with enough space to allow sorting, washing and temporary storage of clean linen. Good drainage system should be in place and all laundry facilities should be kept dry to avoid the accumulation of moisture. Proper electrical wiring should be done in case laundering is done by machines.*

[8] *The United Republic of Tanzania. Ministry of Health. (2004). National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania.*

Required Minimum Standards

1. **The quantity of laundry facilities:** At least one laundry facility should be available in each healthcare facility especially hospitals and health centers. Where possible, machine laundering should be prioritized for the occupational safety of laundry workers.

2. **The quality of laundry facilities:** Laundry facilities should be constructed or rehabilitated in accordance with the specifications issued by MOH to ensure that facilities are well-located, safe, user friendly and are safely managed. Adequate water supply, soap or detergent, disinfectant and hand washing facilities should be made available in a laundry facility[9] with disposable towels.

3. **Access:** The main entry to the laundry facility should allow smooth movement of handcarts or containers carrying both clean and soiled linen. Access limitation or control should apply to non-laundry staff and other unauthorized personnel[10].

F. Mortuary

Box 6. Mortuary: *Mortuary should consist of clean and dirty areas with sufficient and well-designed hand washing and wastewater collection facilities. Mortuary should have proper drainage, adequate water supply, and hand washing facility with sufficient diameter to avoid blockages.*

Required Minimum Standards

1. **Quantity:** At least one mortuary should be available in each hospital and health center.
2. **Quality:** Mortuary should be constructed or rehabilitated in accordance with the specifications issued by MOH to ensure that it is well-located, safe, user friendly with required temperatures and safely managed. Adequate water supply, waste collection and hand washing facilities should be made available in a mortuary with disposable towels.
3. **Access:** The main entry to the mortuary should allow smooth movement of handcarts carrying dead bodies. Access limitation or control should apply to non-mortuary staff and other unauthorized personnel.

G. Healthcare Waste Management Facilities

Box 7. Health-care Waste Management. *Health-care waste should be properly segregated at the point of generation, collected in leak proof and puncture-resistance containers, transported to treatment sites, stored safely prior to treatment, treated and disposed of safely. The healthcare facility surroundings should be free from uncontrolled HCW. Waste handlers should strictly adhere to the MOH IPC protocol and waste management guidelines.*

[9] *WHO. (2008). Essential environmental health standards in health care.*
[10] *The United Republic of Tanzania. Ministry of Health. (2004). National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania.*

Required Minimum standards

1. **Segregation:** Segregation of HCW should be done at the point of generation according to "Three-Bin System" for sharps, non-sharps infectious HCW and general or domestic waste[11]. Color-coded HCW containers should be used with clear signs and symbols as per HCWM guidelines issued by MOH in Liberia. Recommended color-coding system is yellow for infectious sharps and non-sharps waste and black for general or domestic waste. Pharmaceutical waste generated in pharmacies should be collected in brown containers.

   Additional segregation categories shall be done depending on the level of healthcare facility, and may include pathological waste in maternity wards and surgical rooms, hazardous waste such as batteries, fluorescence lamps and dental amalgam, radiological and chemical from laboratory. Domestic or general waste can be segregated to facilitate the recycling of papers, cardboards, plastics, glass and metal waste depending on the availability of recycling opportunities. Figure 2 and 3 below indicate "Three-Bin System" of segregating HCW according to the guidelines for the safe management of HCW in Liberia.

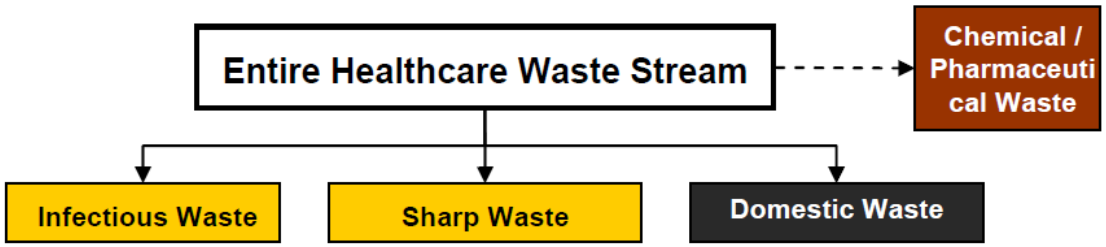


Figure 2: Color-Coding System for HCW.
Source: Guidelines for the safe management of HCW in Liberia. Final Draft, November 2009.

[11] *Ministry of Health & Social Welfare. (2009). Guidelines for the safe management of health care waste in Liberia. Final Draft.*

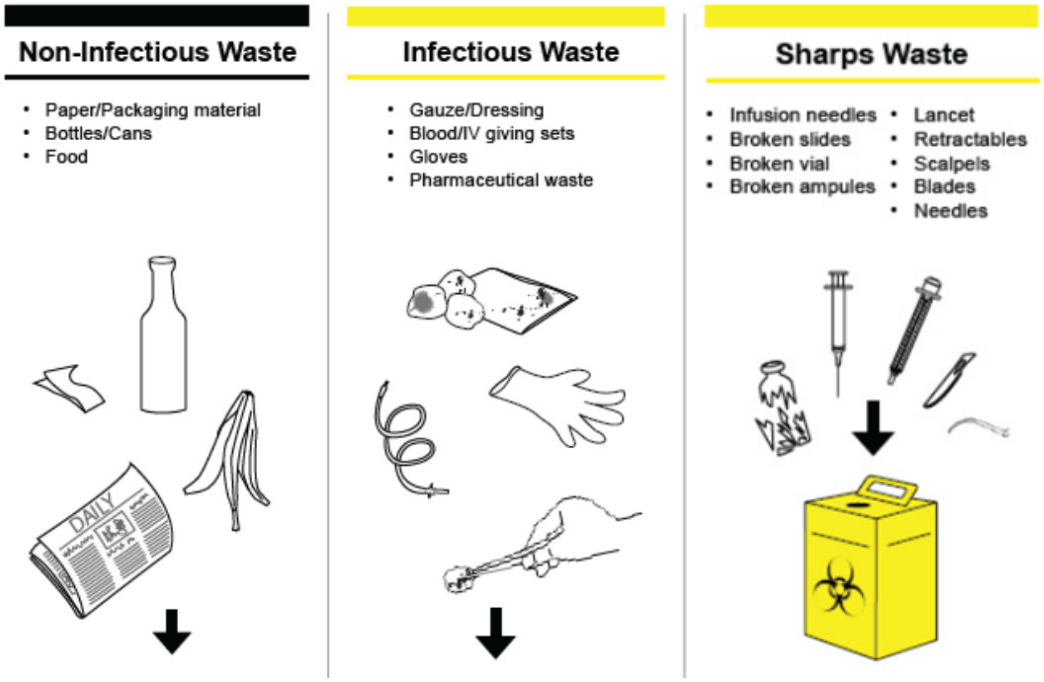


Figure 3: Example of Three-Bin System with Color-Coding Segregation categories of HCW.

2. **Collection of HCW in leak proof and puncture-resistance containers:** HCW collection containers should be in accordance to the approved color-coded containers with clear labels indicating the contents for safe handling. Color-coded containers facilitate easy segregation of HCW, treatment and final disposal options. In addition, clearly marked and color-coded containers enhance the occupational health of waste handlers by providing understandable and easy-to-follow identification of types of HCW. Color- coding system should be maintained throughout HCWM chain including segregation, collection, transport, storage, treatment, and final disposal.
    - Recommended sharps containers are cardboard yellow safety boxes where treatment and final disposal option is incineration in order to reduce black carbon emissions[12], and reusable metal containers for autoclaving disposal method. Sharps containers should be located within arm's reach of HCW generation points (injection rooms, laboratories and patients wards) and filled up to ¾ full level. If possible, a safety box and infectious waste container can be hanged on a trolley used for ward rounds. Needle removers are not recommended and also needle recapping should not be done.
    - Recommended non-sharps containers are yellow and black paddle-operated plastic containers for infectious and general waste respectively. Yellow containers should be 15-40-litre capacity whereas black containers can be up to 60-litre capacity. HCW containers should be leak-proof, lined with plastic bags of similar color, provided with covers and placed within arm's reach (for yellow containers). At least one set of black and yellow containers should be allocated per 20 beds in each ward, in patient's waiting areas and consultation rooms. Note: pathological waste should be disposed of immediately in a placenta pit.

[12]*Raila, E. (2015). Climate change implications for health-care waste incineration trends during emergency situations.*

- Once containers are ¾ full, waste handlers should remove waste bags and replace with new liner bags. Bags should be tied and handled carefully by the neck. In the event where there is leakage, HCW containers should be removed, cleaned and disinfected before replacing with a new liner bag. All HCW containers should be removed for a thorough cleaning and disinfection on a weekly basis.

Figure 4: Recommended Paddle-Operated Plastic Container and Cardboard Safety Box for collection of infectious sharps and non-sharps HCW.

3. **Transportation of medical waste: Transfer of healthcare waste should be in line with the Ministry of Health HCW management guidelines.** Onsite transportation of HCW from the point of collection to storage, treatment or final disposal facility should be done by using leak proof metal handcarts or trolleys. Designated trucks should be used for off-site transportation of HCW where applicable. Each truck should have a sealed body with lockable compartment doors and marked with appropriate hazard symbols.

   Both onsite and off-site transport equipment should allow easy loading and unloading of HCW. Waste handlers should be careful not to tear the bags or cause any leakage while transferring waste bags into trolleys, handcarts and trucks. Infectious yellow HCW bags and safety boxes should be transported to the storage or treatment facility. Black bags should be transferred to a collection facility for the general waste. Trolleys, handcarts and HCW trucks should be cleaned and disinfected as frequently as possible and should not be used for any other purpose.

Figure 5: Recommended onsite and off-site transport equipment for HCW

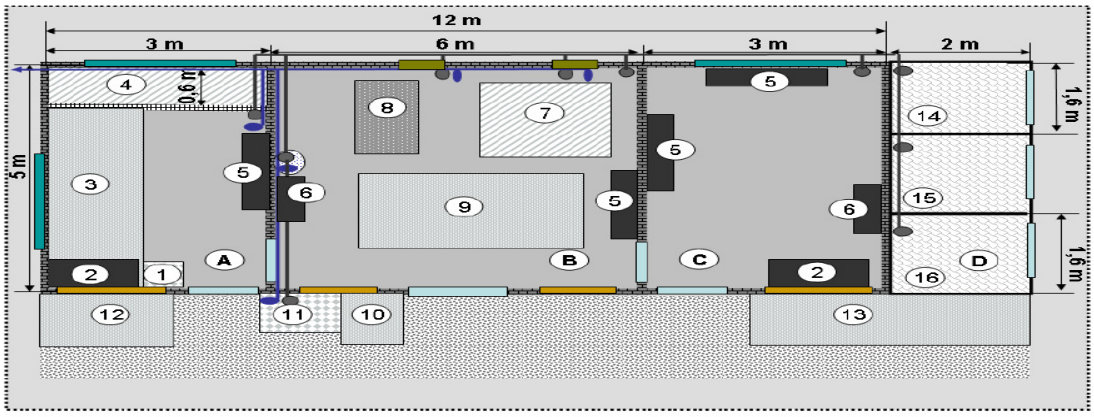
4. **Storage:** HCW should be stored in designated storage facilities as per the guidelines issued by MOH. The storage facilities should be provided with access limitation, cleaned and maintained to avoid risks of infections to waste handlers. Storage facility should be large enough to cater for the treatment breakdown and kept dry and pest free.

   Main Storage Requirements[13]

   - The storage facility should be located within healthcare facility premises. The facility should be near the treatment unit where applicable and away from the kitchen or designated food preparation areas.
   - The storage facility should be designated for healthcare waste only with access limitation to non-waste management staff.
   - The storage facility should be well ventilated with mechanical ventilators.
   - The floor surfaces and walls in a storage facility should be tiled for easy cleaning and disinfection.
   - Healthcare waste should not be stored longer than 48 hours (2 days). Organic waste should be disposed of daily.
   - Segregation must be maintained throughout until final disposal.
   - Radio-active waste should be stored to allow decay in designated receptacles or drums. Drums should be labelled with the radiation symbol indicating radionuclide's activity on a given date, the period of storage required and marked "Caution" Radioactive Waste as per the guidelines issued by EPA in Liberia.
   - There should be a scale for weighing HCW and waste management staff should weigh and keep record by filling-in the monitoring form.
   - The size of the storage room should be large enough to accommodate treatment facilities if required.

[13] *Ministry of Health and Social Welfare Tanzania. (2006). Healthcare waste management national standard operating procedures. Health Education Unit, Dar es Salaam, Tanzania.*

Figure 6 and 7 below indicate the recommended HCW function and storage facilities for hospitals and health centers.



1	Ground scale	9	Loading/Unloading area
2	Office Desk	10	Contaminated container area
3	Storage area for domestic hazardous waste	11	Container washing & disinfection
4	Storage area for liquid hazardous waste	12	Container pick up area
5	Storage shelves	13	Parking station for hospital trolleys
6	Medium height cabinets	14	Storage area – glass
7	Incinerator	15	Storage area – plastic
8	Space for possible future waste treatment (autoclave)	16	Storage area – paper/cardboard

Figure 6: Storage Facility for Hospitals.
Source: Ministry of Health & Social Welfare. (2009). Guidelines for the safe management of health care waste in Liberia. Final Draft.

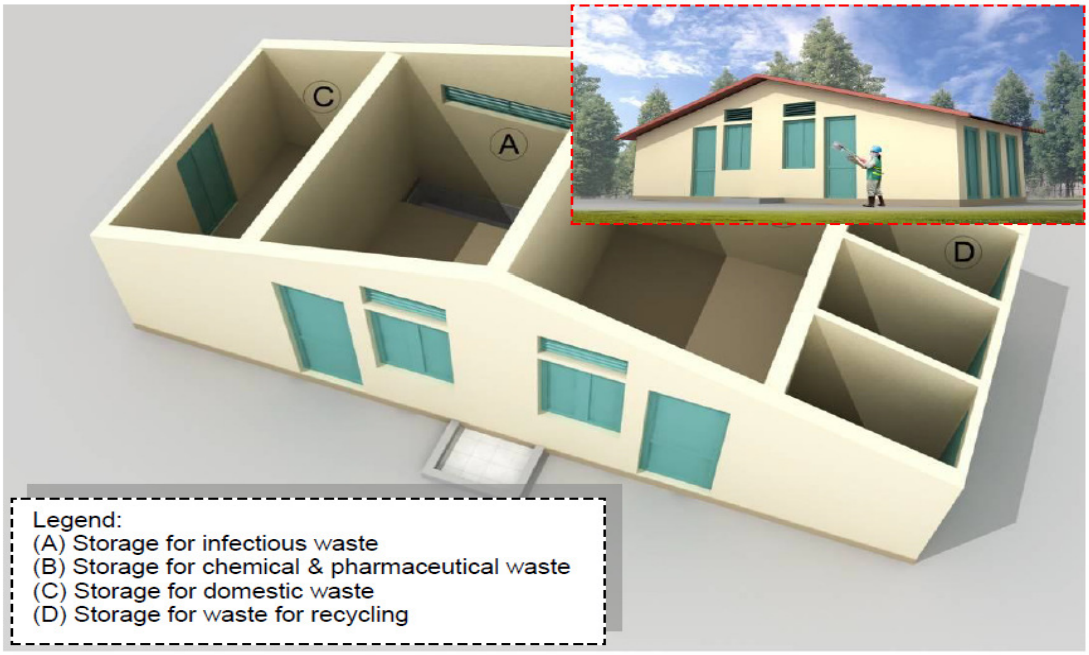


Figure 7: Storage Facility for Health Center (Refer source document for Specific dimensions). Source: Ministry of Health & Social Welfare. (2009). Guidelines for the safe management of health care waste in Liberia. Final Draft.

5. **Treatment:** HCW should be treated prior to the final disposal. Incineration treatment method through pyrolytic incinerators is recommended for hospitals. Autoclaving technology is recommended as a pilot treatment method. De Montfort incinerators can only be used in health centers and clinics where HCW generation rate is low. "Burning of the infectious waste in primitive incinerators or barrels shall only allowed on an exceptional, temporary basis with the written permit of the local Environmental Protection Agency, issued in consultation with the County Health Officer. The disposal of infectious waste and sharps mixed together with the domestic waste shall be in no way allowed"[14]. Incinerators must be located 61 meters away from habitable buildings, 46 meters from water sources and 300 meters from agricultural site[15]. Off-site treatment facilities are recommended in urban areas and in counties where onsite treatment is not possible due to lack of space.

Figure 8: Pyrolytic Incinerator, Autoclave and De Montfort Incinerator for treatment of HCW

[14] *Ministry of Health & Social Welfare. (2009). National Policy on Management of Healthcare Waste in Liberia.*
[15] *Ministry of Health. (2013). Infrastructure standards in Liberia.*

Note: Pyrolytic incinerators are double-chambered medium temperature incinerators operating at temperatures between 850 – 1200 degrees Celsius by using fuel and electricity with a controlled-air mechanism. De Montfort incinerators are double-chambered brick incinerators operating at low to medium temperatures by using firewood with low moisture content <15. An autoclave produces steam that kills infectious agents in HCW without releasing pollutant emissions.

World Health Organization has identified the best incineration practices to be followed during incineration in order to reduce toxic emissions[16] (dioxins and furans) in both fly and bottom ashes. Healthcare facilities should practice proper segregation of HCW to avoid the incineration of the following materials[17]:

- Halogenated plastics such as polyvinyl chloride (PVC) equipment including intravenous (IV) bags, tubes and other plastic materials.
- Waste materials containing mercury such as thermometers, dental amalgam waste and used batteries.
- Sealed ampoules, cytotoxic waste and vaccines.
- X-ray films.

6. **Final disposal:** Treated HCW should be disposed of in a safe manner not to cause environmental contamination. Lined-Ash pits should be used for disposal of incinerated ash which is normally 5 -10 % of incinerated waste to avoid contamination from dioxins and furans. Autoclaved material should be shredded and disposed of as general waste in a landfill or waste pit using burial method. Disposal of untreated sharps in sharps pit is not recommended, and thus sharps pits should not be used. In case Incinerators or HCW autoclave will not be operational for few days beyond the capacity of storage facility, HCW can then be disposed of by burning in primitive incinerators, barrels or pits under EPA and CHT supervision, and ash disposed of in ash pit. Placenta and body tissues should be disposed of in lined placenta pits. Figure 9 below indicates sample placenta pit with two loading points to allow rotation of waste disposal for decomposition.

Figure 9: Placenta pit for disposal of placenta and other body tissues

[16] *WHO. (2014). Safe management of wastes from health-care activities (2nd edition). ISBN 978 92 4 154856 4*
[17] *WHO. (2001). Best practices for incineration. Retrieved http://www.who.int/water_sanitation_health/medicalwaste/en/smincinerators3.pdf.*

V. Implementation of Software Component of WASH & EH Package in Healthcare Facility

The scope of software component of WASH & EH package in healthcare facilities falls in the domain of WASH safety plans. Water supply, sanitation and hygiene are directly linked to health. The greatest impacts on public health are provided through actions that include improvements in sanitation and hygiene. Adequate WASH services are essential to minimize the risk of health care acquired infections but also for improving staff morale, patient dignity, uptake of services and can reduce the cost of healthcare.

Software component of WASH in health care facilities shall be done by building the capacity of healthcare workers to properly manage WASH facilities. Division of Environmental Health under MOH will conduct training, supportive supervision and monitoring of the implementation of interventions in collaboration with county and district health teams. The scope of software component of WASH & EH package in healthcare facilities include:

- Formulating IPC-WASH committee in each healthcare facility to plan and guide the implementation of software components of WASH interventions in a healthcare facility.
- Capacity building to ensure that there are enough resources and personnel to operate and maintain WASH facilities and enable healthcare staff to perform supportive supervision and deliver behavioural change messages. It covers the following parts:
  - Availability of equipment and supplies to support IPC-WASH interventions.
  - Practicing IPC activities including routine cleaning and disinfection of beds, walls and floors, showers and toilet facilities; disinfection of hands; proper management of linen; proper use of toilets and showers, etc.
  - Training of all healthcare workers and CHTs in the management of software components under part II above.
  - Behavioural change and communication on proper use of WASH facilities by healthcare workers, patients and the general community.
  - Supportive supervision of all healthcare workers by IPC-WASH committees.
- Routine maintenance of WASH facilities.
- Decommissioning HCW pits and latrines (if required) based on the guidelines issued by WHO.
- Enhancing occupational health and safety of healthcare workers including waste management staff.
- Develop, review, endorse and disseminate Essential Environmental Health Standards in healthcare facilities and HCWM documents (SOP, guidelines and training manuals).
- Enhancing sustainability and resilience by integrating WASH interventions into regular healthcare facility programs.
- Monitoring, Reporting and Operational Research by healthcare facilities, CHTs, MOH and implementing partners. MOH and CHTs will maintain a database.

A. Formulating IPC-WASH Committees

Each healthcare facility will formulate an Infection Prevention and Control-WASH committee. This committee will plan and lead the implementation of the software component of WASH interventions in a given healthcare facility. Also, the members will work as facility Trainer of Trainers (ToTs) and will train all healthcare workers on IPC-WASH interventions including health care waste management. Below are the composition and job responsibilities of the members.

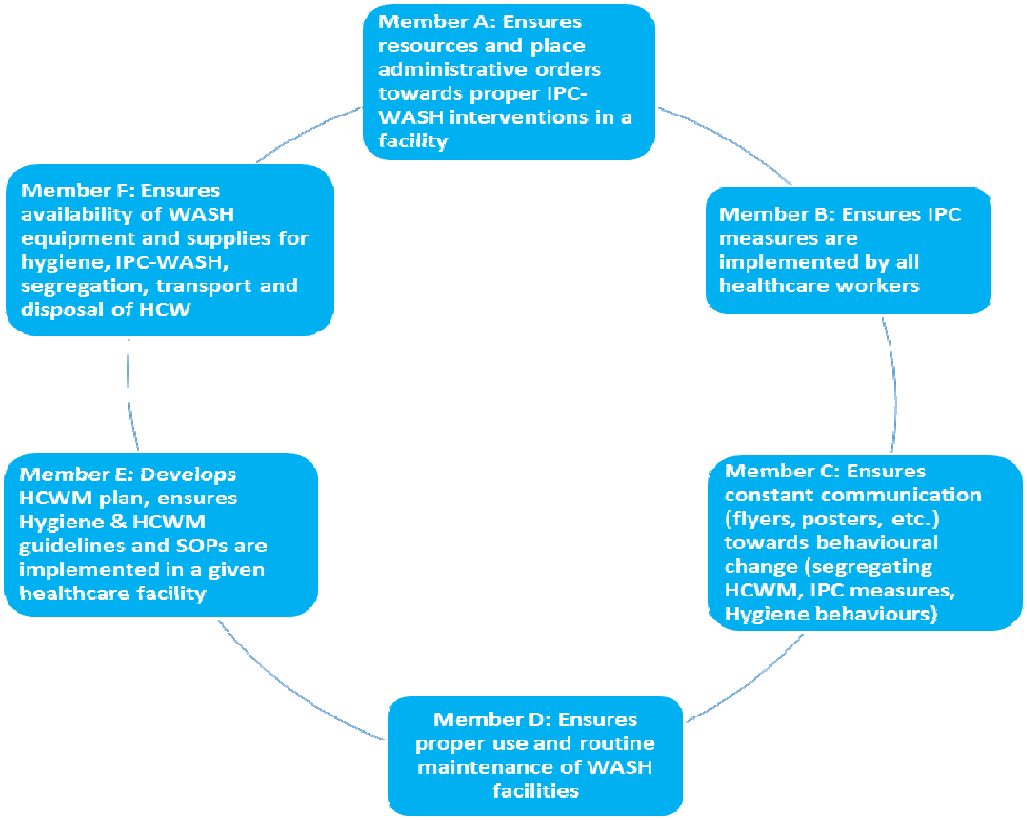


Figure 10: IPC-WASH Facility Committee.

B. Capacity Building

Ensures that there are adequate resources and personnel to operate and maintain WASH facilities and enable healthcare staff to perform supportive supervision and deliver behavioural change messages.

- **Availability of IPC-WASH equipment and supplies:** Equipment and tools are critical components of IPC-WASH interventions. Annex 2 indicates the minimum required tools, equipment and supplies.
- **Training approach and areas:** Each healthcare facility should provide training for All healthcare workers in the management of software component. MOH with technical support from partners will train 6 master trainers from each of 15 CHTs. These should include CHOs, CHSAs, CHDDs, EHTs coordinators, Resident Engineers and county clinical supervisors. MOH in collaboration with County master trainers will then train facility staff/healthcare workers responsible for

environmental health interventions i.e hygienist, waste handlers, morticians etc. CHTs and MOH will backstop facility training for quality assurance and provide any additional clarification and inputs. Training should be done based on the number of healthcare workers and other facility demands. The purpose will be to conduct on-job training without interfering with the normal facility activities. (*For example, if facility X has 120 healthcare workers, 6 training sessions will be done with 20 participants each*).

- **Training areas:** Areas of training for implementation of this package include:

    a. Infection Prevention and Control (IPC) including IPC on Ebola sharing facts and preparation of cholrine solutions.
    b. Occupational health and safety.
    c. Hand hygiene and hygiene promotion in healthcare settings.
    d. Water supply, chlorination and storage in a healthcare facility including maintenance of water points and distribution lines
    e. Hygiene Promotion in healthcare Settings
    f. Decontamination and environmental cleaning
    g. Healthcare Waste Management, operation and maintenance of Incinerators/autoclaves, HCWM planning for healthcare facilities
    h. Behavioral Change Communication (BCC) in IPC/WASH
    i. LOGISTICS/WASH Supplies Management
    j. WASH Safety Plans
    k. Propoer use, maintenance and decommission of sanitation facilities in healthcare settings (toilets, shower facilities)
    l. Environmental management and Energy

    Behavioural change and communication (BCC): WASH interventions will emphasize effective communication to allow behavioural change towards the proper use of WASH facilities by healthcare workers, patients and the general community. IEC materials including fliers and posters will be produced and posted at strategic locations such as inpatient wards, reception and waiting rooms for outpatients, waste collection points, etc. BCC staff will conduct routine awareness meetings with patients and healthcare workers, and deliver hygiene behaviour change messages. (*Note: IEC materials will be required at each waste collection point*).
- **Supportive supervision:** County health teams and IPC-WASH facility committees will be trained in supportive supervision. IPC-WASH committees will perform planned and ad-hoc supportive supervision and share reports with CHTs and MOH for follow up.

A. Routine Maintenance of WASH Facilities and Decommissioning HCW Pits and Latrines

Health facilities will ensure routine maintenance of WASH facilities. Decommissioning activities for filled HCW pits and latrines will be performed as recommended by WHO.

B. Enhance Occupational Health and Safety

MOH with support from partners will ensure occupational health and safety of healthcare workers including healthcare waste management staff through the availability of PPEs, disinfectants and by vaccination against waste-related diseases. The MoH occupational health guidelines for health care settings should be followed.

C. Documents to Streamline WASH Interventions

MOH with technical support from partners will develop, review, endorse and disseminate Essential Environmental Health Standards in healthcare facilities and HCWM documents (SOP, guidelines and training manuals).

D. Enhancing Sustainability and Resilience

IPC-WASH interventions will be integrated into regular healthcare facility programs.

E. Monitoring, Reporting and Operational Research

Monitoring, reporting and operational research will be conducted by healthcare facilities, county health teams, MOH and implementing partners.

VI. WASH Safety Plans

WASH (Water, Sanitation & Hygiene) Safety Plans have been developed to provide a holistic approach to protecting public health through the assessment and management of risks from insufficient or unsafe water supply, inadequate sanitation and poor hygiene practices. WASH Safety Plans are a powerful tool which quantifies the risks posed to the community and strengthens the decision making process in order to justify that interventions are targeted towards specific needs[18].

A WASH Safety Plan strives to help achieve these aims by providing the following stages of systematic assessment:

- Create a team which includes all relevant stakeholders such as the community, municipality and land owners etc.;
- Identify all the hazards and hazardous events that can affect the safety or security of a water supply from catchment through to the consumer's point of use, as well as any activities which enable the transmission of pathogens through faecal-oral routes
- Assess the risk presented by each hazard and hazardous event;
- Consider if controls or barriers are in place for each significant risk and if these are effective;
- Validate the effectiveness of controls and barriers;
- Demonstrate that the system is consistently safe;
- Regularly review the hazards, risks and controls;
- Keep accurate records for transparency and justification of outcomes

F. Benefits of WASH Safety Plans in HCFs

This field guide is a practical tool for improving water, sanitation and hygiene (WASH) services in health care facilities in order to ensure clean and safe facilities for patients and staff.

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[18] *Sanderson, R. & McKenzie, N. (2011). "WaSH Safety Plans: A Risk-Based Approach to Protecting Public Health". In: Water Practice and Technology. 6 (2).*

Adequate WASH services are essential to minimize the risk of health care acquired infections but also for improving staff morale, patient dignity, uptake of services and can reduce the cost of healthcare.

Figure 11: Benefits of WASH safety Plan in a healthcare facility

It is primarily designed to be used by a member of staff in a healthcare facility. It may also be useful for members of community health or water committees, local government authorities, nongovernmental organizations (NGO) or other community-based organizations that supports provision of healthcare. Finally, the guide can help inform district or regional health sector planners and donors seeking to understand the inputs required to improve and maintain WASH services.

The field guide explains what a safety plan (SP) is and provides a range of ready-to-use templates to develop your own WASH Safety Plan for a health facility, in order to help improve the WASH services and related safety aspects in a health care facility. Although this requires dedicated staff and resources, even small, incremental improvements can improve the cleanliness and safety of a facility, which can result in improved health outcomes.

G. The Eight domains of a Safety Plan

Domains 1-7 are adapted from the WHO 2008 Environmental Health Standards while Domain 8 is about facility management (see the table below)[19]. Each domain incudes sub-domains and indicators to work towards - these are considered the minimum standards for maintaining a safe,

[19] Note: the eight domains do not include WHO's Environmental Standards on laundry, food preparation or building. These are important but often do not present the most serious risks, nor are they always relevant, in smaller (tertiary) facilities where this tool is first being applied. These may be included at later stages.

clean and hygienic environment, which enables staff to provide quality care to patients and a safe environment to work in. All of the standards ought to be achievable, but many will require incremental improvements before reaching the ultimate standards.

Figure 12: Main domains of WASH Safety Plan

Table 4: The eight domains and their sub-domains

Domain	**Sub-domain**
1. Water	Treatment, supply, storage, (energy[20]), Water quality testing
2. Sanitation	Latrine maintenance, access, cleaning showers
3. Healthcare waste management	Waste sorting, waste disposal, waste transport equipment, waste storage, waste treatment, Final disposal
4. Cleaning and disinfection	Cleaning medical equipment, surfaces, toilets; protective measures
5. Hand hygiene	Infrastructure- hand washing stations, behavior
6. Hygiene promotion	IEC Materials, messages
7. Environmental management and energy	Vector control, general appearance
8. Facility management	Staffing, problem reporting, accounting/book keeping

[20] Energy may be necessary for heating water and is mentioned in Domain 1. However, it is not generally considered a priority for immediate improvements in this guide as most tertiary facilities are only open in the daytime.

The WASH SP approach emphasizes prevention. It helps you to identify, prioritize and manage risks that could threaten a facility, for example water shortages or improper management of healthcare waste, thereby protecting patients and staff before problems occur. A WASH SP also helps staff to take steps, to improve the facility over time using available resources.

The WASH SP should not be viewed as "something extra" that increases the burden on health care staff. The SP process will be most effective if it becomes an integral part of the on-going day-to-day operation, maintenance and management of the facility and is part of broader quality, and people-centred, care efforts. Provided everyone who works in or accesses services at the facility are committed to improving and maintaining environmental standards, it will be seen that a WASH SP is an effective supporting tool that makes it easier to achieve this goal.

The specific benefits of a WASH SP include:

- Improves understanding of all the aspects required to provide quality healthcare. In particular, one will better understand the risks that may affect patient and staff safety in a facility.
- Improves the day-to-day management and operation of a health care facility.
- Encourages a team-based approach by bringing together all those who share responsibility for providing services at the facility, including authorities such as the district health officers or community WASH groups.
- Engages community members, leading to improved hygiene awareness within the community and triggering positive changes in sanitary behaviour.
- Facilitates identification of improvement needs and opportunities for "quick wins" – potential improvements that can be achieved with your facility's own resources and efforts.

WASH SP provides a platform to develop an incremental improvement plan. Particularly when resources are limited, this plan supports in providing the evidence for the improvements required. With a clear and sound facility WASH SP in hand, government, NGOs and other financial supporters may be more inclined to consider supportive funding.

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Annexes

A. Minimum WASH/Environmental Health Package for Different Levels of Healthcare Facilities.

WASH Services/Facilities	Primary Healthcare Facility	Secondary Healthcare Facility	Tertiary Healthcare Facility
Water Supply			
Minimum water supply per day	2688 liters~710 gallons	6057 liters ~ 1600 gallons	23470 liters ~ 6200 gallons
Water reservoir capacity	5376 liters ~ 1420 gallons	12114 liters ~ 3200 gallons	46940 liters ~ 12400 gallons
Regular water testing	YES	YES	YES
Preparation of water safety plan	YES	YES	YES
Sanitation			
Minimum toilets cubicles	2	8	16
Flush toilets connected to septic tank/sewer line	NO	YES	YES
Flush toilet (Biofil)	YES	NO	NO
Bathing facilities	NO	YES	YES
Minimum number of bathing facilities	-	1 in each inpatient ward	1 in each inpatient ward 2 in each operating theater
Hygiene			
Hand washing stations	YES	YES	YES
Staff training in WASH & Environmental Package	YES	YES	YES
Healthcare Waste Management			
Color-coded segregation according to “Three-Bin System”	YES	YES	YES
Healthcare waste transport equipment	YES (wheelbarrow)	YES (handcart for onsite transport)	YES (handcart for onsite transport; truck for off-site transport if required
Healthcare waste storage facility	YES (within Incineration facility)	YES (Refer Figure 10)	YES (Refer Figure 9)
De Montfort incinerator	YES	NO YES (as a back-up)	NO YES (as a back-up)
Pyrolytic incinerator	NO	YES	YES
Healthcare waste Autoclave	NO	YES (for pilot)	YES (for pilot)
Placenta pit	YES	YES	YES
Ash pit	YES	YES	YES
Infection Prevention and Control			
Laundry Facility	YES (bucket washing)	YES (Machine)	YES (Machine washing)
Mortuary	NO	YES	YES

B. Construction of De Montfort Incinerators

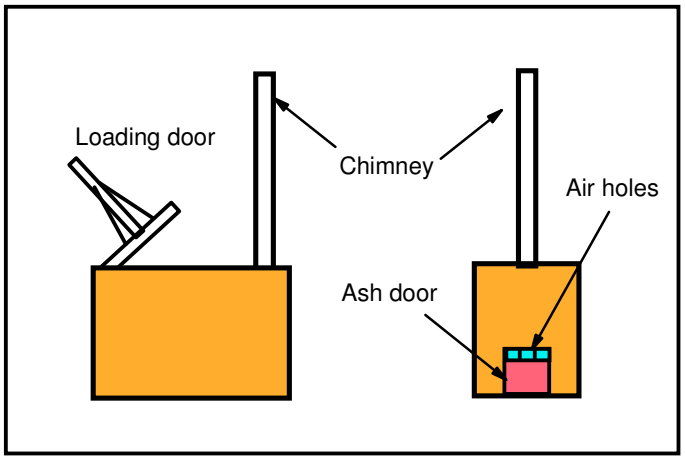


Figure 1: General view of the De Montfort incinerator (Mark III) Model

The steps to follow during the construction of an incinerator[21]:

1. Select the site and ensure that it is level for 3 m x 4 m. Lay out the base in firebricks as in the Figure 2. The diagram is based on approved standard firebricks (23 cm x 11.5 cm x 7.5 cm) and is approximately 1370 mm long by 686 mm wide. For any other size of firebrick, make up the nearest possible overall dimensions.

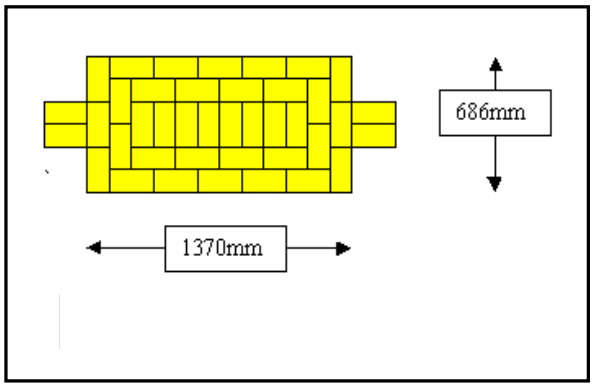


Figure 2: Laying down of the firebrick base

2. Build the firebrick inner core as in Figure 3. Again, with standard firebricks there are 14 layers of bricks including the base, giving an approximate height of 900 mm. With any other size of brick, build to at least this height. A steel tunnel to fit the ash door frame (230 mm approx.) is incorporated at either end as in diagram stage 2, and air pipes to give an air intake area of about 6200 mm2 are built in at the primary combustion chamber end. Air pipes of about 1000 mm2 are built in at the other end. Note that no mortar or fireclay is used in this construction, if the firebricks are regular in shape. Fire cement (3:1 mixture of high alumina cement and sand) may be used if the firebricks will not meet properly leaving air gaps.

[21] *Ministry of Health and Social Welfare Tanzania. (2006). Healthcare waste management national standard operating procedures. Health Education Unit, Dar es Salaam, Tanzania.*

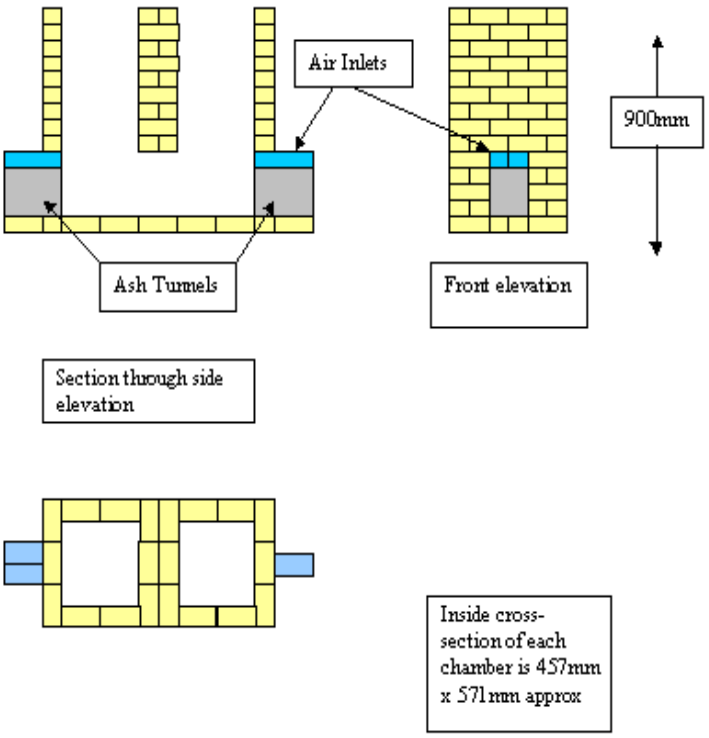
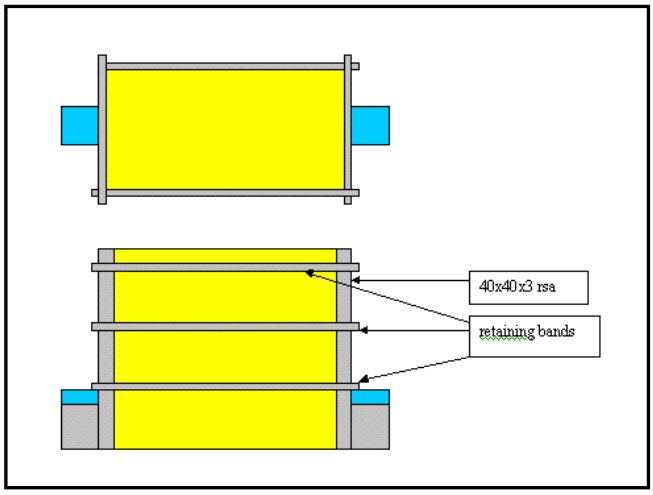


Figure 3: Construction of firebrick core

3. Fit 4 lengths of rolled steel angles (40 mm x 40 mm x 3 mm approx), one along each corner of the firebrick construction, and tightly strap them together to force the firebricks together as shown in Figure 4. The strap may be either steel cable tightened by a turnbuckle arrangement or steel bars with screwed ends. One strap shall be at the top layer of bricks, one at the centre, and one at the base layer. (This step may be omitted if fire cement has been used).



F*igure 4: Rolled steel angle bound to hold the firebricks together*

4. Lay out a single layer of common bricks around the whole construction, allowing space for mortar between the bricks, and about one brick thickness between the common bricks and the firebrick

core. The outer dimensions of the incinerator can now be measured so that a start can be made on the steel top plate.

5. Build up the outer frame using ordinary building mortar, and taking care to keep to the measured dimensions. The final height of the outer case must match the inner core, but final adjustment can be made with mortar and/or fire cement when the top plate is fitted as shown in Figure 5.

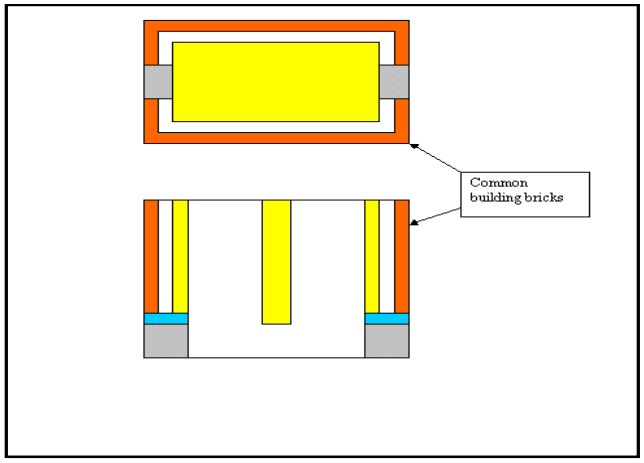


Figure 5: Building the outer insulation wall

6. Mark out the steel top sheet as in Figure 6. The length and the width shall each be 20 mm less than the corresponding length and width of the brick surround. The circular cutout for the chimney shall be slightly less than the chimney inner diameter. There is considerable latitude in the chimney diameter, which can be between 100 and 150 mm. It is thus necessary to choose the chimney before cutting the hole. Note that the loading door hole shall be the cross section of the combustion chamber, and that both the chimney hole and the smoke door hole shall be within the secondary chamber.

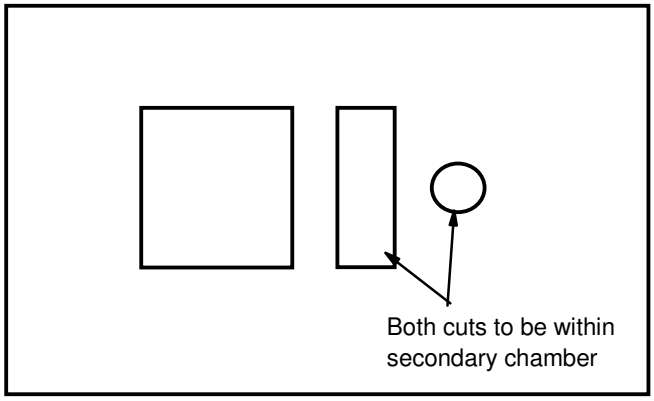


Figure 6: Cuts/openings on the top-plate for the De Montfort incinerator

7. Rolled steel angle (rsa) of approximate size 40 mm x 40 mm x 5 mm is now attached to the top plate as in Figure 7. These are intended to provide a frame for a sand bed around both doors and the chimney spigot. The inner frames are around the door apertures, and the outer frame is about 70 mm further out. Note that the outer frame of the loading door carries the brackets for the door pivot. The centre brace is about 80 mm shorter than the width of the top plate. Attachment may be

by welding or steel rivets. Rolled steel angle stiffeners are then attached to the underside of the top plate as in Figure 7.

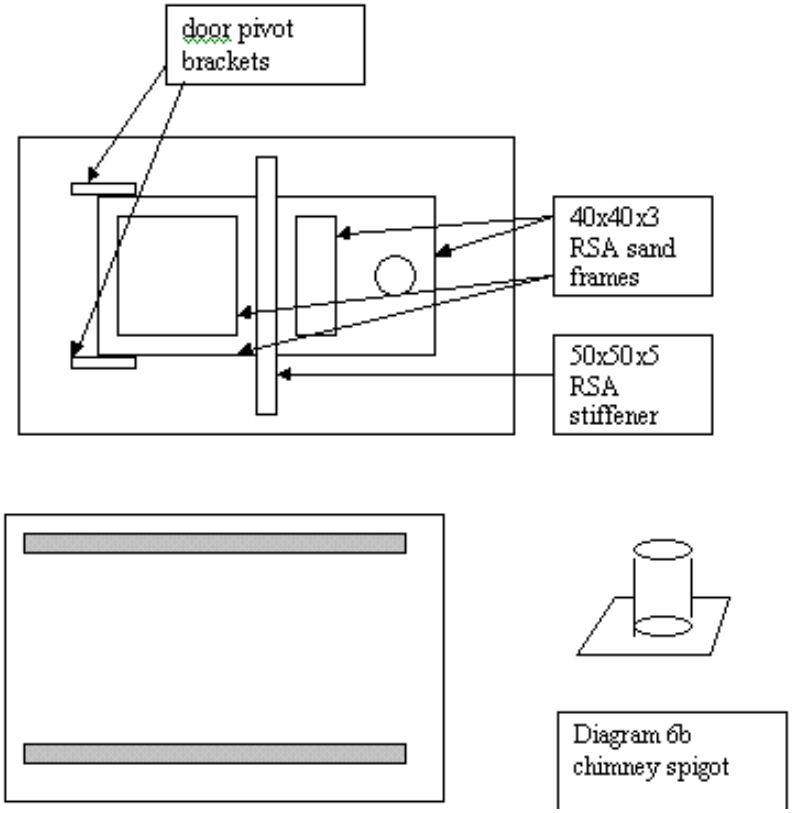


Figure 7: Details of the top plate

8. The loading door can be made at the same time (Figure 8). The frame is made from 40 mm x 40 mm x 5 mm rolled steel angle, and the size adjusted so that the lower edge of the angle fits into the centre of the sand bed of the frame. The hinge support brackets on both the door and the frame can be made so that the door rests parallel with the frame when suspended (by sand) about 10 mm above the base of the channel. The door is completed by welding or riveting on a top of 5 mm plate, and attaching a handle at the pivot end to make opening and closing easier. The handle shall be about 450 mm long.

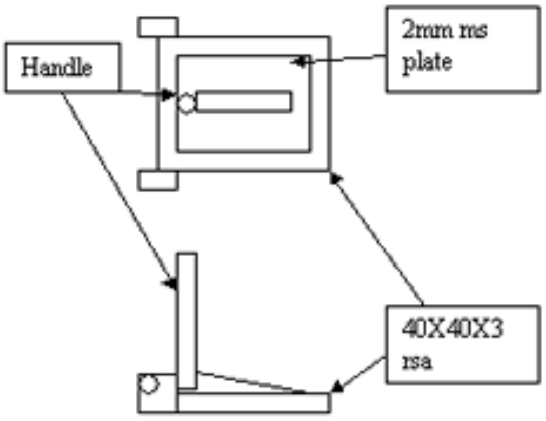


Figure 8: Details of the primary chamber door

9. The steel top is then fitted over the brick construction in the following manner. A layer of fire cement is laid on to the firebrick inner core. The top plate is then placed on top and maneuvered so that it sits firmly on the cement over the whole surface. Ordinary mortar or fire cement can then be pushed between the top plate and the outer bricks to make a seal.

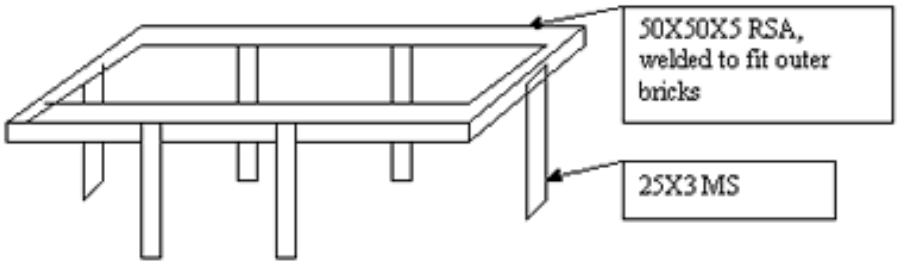


Figure 9: Details of the top plate retaining frame

10. The steel top is now secured to the brick walls by the steel frame shown in Figure 9. This is designed to pull the top plate down to the bricks, with sufficient mortar and/or fire clay to make sure that the plate fits evenly on both the inner and outer walls.
11. Ash doors can now be made from steel plate to hinge on to the ash tunnels. These doors shall be latched closed when they are not being used to remove ash.
12. The 4-meter steel chimney can now be fitted over the spigot and secured by steel ties reaching either to the ground or to the sides of the outer case.
13. For the oil fired version, a fuel tank with a capacity of between 2 and 5 litres shall be fitted to the front of the incinerator at approximately 500 mm above the top of the incinerator. A 6 mm hole shall be drilled through both walls of the combustion chamber, and a steel tube inserted to project about 10 mm into the chamber to carry fuel from the tank via a simple on/off tap.
14. The secondary combustion chamber shall be loosely filled with wire mesh. This will serve to stabilize secondary combustion, and prevent any light solids reaching the chimney stack.
15. Fine dry sand can now be placed in the loading door frame and the sand seal for the smoke door and chimney.
16. A simple grate shall be made to fit below the primary combustion chamber. It is constructed using the following dimensions: 44 cm x 44 cm square and 15 cm high, with the gaps between the grids not less than 50 mm. The legs shall be 80 mm long. This shall be inserted from above through the fire door.

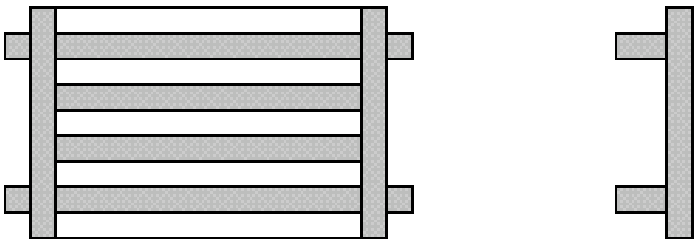
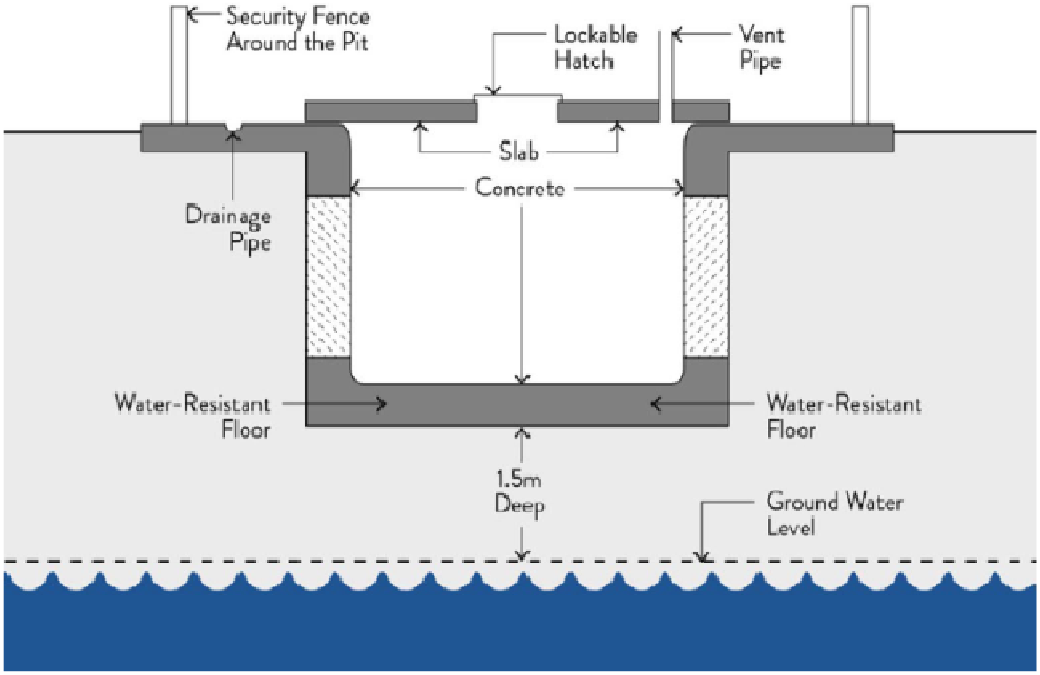


Figure 10: Details of the fire grate

C. Design Criteria and Specifications for Placenta Pit



Source: Ministry of Health. (2013). Infrastructure standards in Liberia pg 311.

Once a pit is filled, it must be closed, marked and location recorded.

The site of the pits must be as far away as possible from publicly accessible areas and from hygienically critically areas (e.g. water wells, kitchens).

Placenta pits must not be built close to buildings due to possible odors.

The bottom of the pit must be at least 5ft (1.5m) above the highest anticipated groundwater level.

The top 20in (50.8cm) or more of the pit must be reinforced with concrete to prevent surface water infiltration.

The base of the pit must be made from concrete to stabilize the structure and to slow the downward movement of liquid towards the water table.

Placenta pits can also be constructed from a standard concrete ring with a diameter of about 3ft (91.4cm).

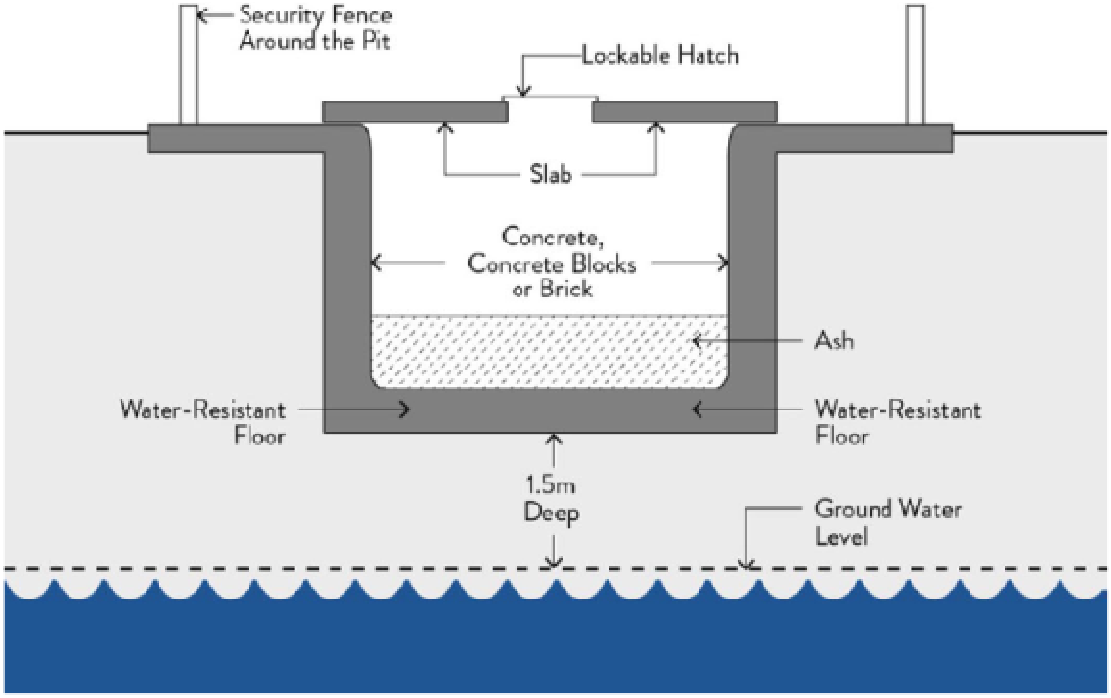
The top slab must be above ground level and made from watertight concrete to prevent surface water infiltration.

The top must be closed by a lockable hatch and a vent pipe installed to ensure that the generated gases can escape and air can get in.

Where soil is particularly sandy, extra precautions must be taken to protect the water table and to prevent the pit from collapsing.

The sides should be reinforced with bricks, laid with gaps between them so that liquids can escape.

D. Design Criteria and Specifications for Ash Pit



Source: Ministry of Health. (2013). Infrastructure standards in Liberia pg 312.

All sites using incineration must be equipped with an ash pit that has sufficient capacity to store ash for a period of at least 5 years.

The bottom of the pit must be at least 5ft (1.5m) above the highest anticipated groundwater level.

The pit must be positioned to prevent risk of flooding.

The pit must be constructed of concrete, concrete blocks, or brick, with a water-resistant floor to ensure the pit will not collapse.

There must be provisional access to the pit for purposes of leveling or removal of accumulated waste and subsequent transfer to a municipal landfill.

The pit must be protected from access by unauthorized persons.

The pit must be located in the immediate proximity of the incinerator to ensure the convenient transfer of ash.