REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH

INFECTION PREVENTION AND CONTROL
WATER SANITATION AND HYGIENE
IN HEALTH CARE FACILITIES

THE MINIMUM STANDARDS

2018

FOREWORD

The Ministry of Health recognises the importance of water, sanitation and hygiene in the delivery of maternal, neonatal child and nutrition health care. Infection prevention and control is a critical component of patient safety and quality health services, yet it has been neglected.

The rates of nosocomial infections related to poor prevention and control are relatively high. In Zambia, white laboratory coats were found to be highly contaminated with *S aureus* and *K. pneumonia* pathogens which exhibit high resistance to most antibiotics. The high burden of highly infectious disease demands that special attention be placed on infection prevention and control practices.

The Ministry of Health in its quest to improve patient safety and quality of care has prioritised infection prevention and control as a critical component of quality health care. The Millennium Development Goal initiative for Maternal Neonatal Child Health and Nutrition is a project derived through the United Nations (UN) supporting Water Sanitation and Hygiene (WASH) related Infection Prevention and Control (IPC) aimed at strengthening health care delivery. The priority focus of WASH related Infection Prevention and Control (IPC) are: access to safe and adequate water, hand washing, appropriate sanitation, solid waste management, cleaning and sterilization.

The document therefore, proposes minimum standards and guidelines for water, sanitation and hygiene in health facilities for IPC. It will serve as a guide to staff in implementing IPC-WASH as well as a reference for standards in planning and implementation.

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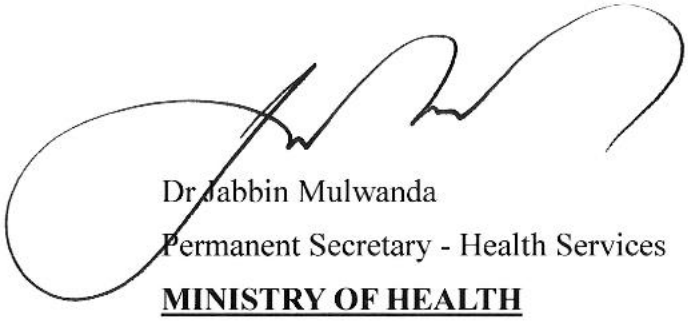
MINISTER OF HEALTH

ACKNOWLEDGMENT

This document is the product of many individuals and stakeholders whose invaluable contributions have provided the technical, financial and material support that made its development possible. The integration of infection prevention and control (IPC) in water, sanitation and hygiene (WASH) is designed to provide health care providers and supervisors with a tool that enables them to implement effective interventions aimed at protecting health care providers and patients.

The Ministry of Health would like to thank the European Union (EU) through the Millennium Development Goal Initiative for providing financial support towards the development of this IPC-WASH standard package for health facilities and to United Nation Children's Fund (UNICEF) for technical support.

Further, gratitude goes to all members of staff in all the 11 MDGi districts and 51 Health facilities for their instrumental contribution towards the development of this document. Additionally, the Ministry wishes to acknowledge the following Institutions for their technical support, World Health Organization (WHO) Zambia Office, Ministry of Works and Supply, Ministry of Local Government and Zambia Environmental Management Agency.



Dr Jabbin Mulwanda
Permanent Secretary - Health Services
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CONTENTS

ACRONYMS

CIDRZ	Centre for Infectious Disease Research in Zambia
DHMT	District Health Management Team
EHT	Environmental Health Technician
GLASS	Global Analysis and Assessment of Sanitation and Drinking Water Survey
HAI	Health Acquired Infection
HLD	High-Level Disinfection
IPC	Infection Prevention and Control
MCDMCH	Ministry of Community Development, Mother and Child Health
MDGi	Millennium Development Goal initiative
MLG	Ministry of Local Government
MNCH	Maternal, Neonatal and Child Health
MOH	Ministry of Health
MTC	Ministry of Transport and Communications
PPE	Personal Protection Equipment
PMO	Provincial Medical Officer
SOPs	Standard Operating Procedures
UN	United Nations
UNICEF	United Nations Children's Fund
VIP	Ventilated Improved Pit
WASH	Water, Sanitation and Hygiene
WHO	World Health Organisation
ZEMA	Zambia Environmental Management Agency

ADVOCACY AND EVIDENCE FOR WASH IN HEALTH

Many health facilities in developing countries do not have adequate facilities for water supply and sanitation. Water supply, sanitation and hygiene (WASH) in health facilities has not received the importance warranted from the development community and governments.

Primary health care facilities and hospitals are the first points of care for sick and vulnerable populations and are critical to responding to public health emergencies and outbreaks. Patients are highly susceptible to infections and rely on a safe and clean environment. A lack of appropriate WASH services increases exposure of infection to patients and health care workers. When patients attend a health facility, they expect that health care providers respect the long recognised maxim—"first, do no harm". Nevertheless, millions of preventable infections—including neonatal infections—occur every year within the health care environment because of inadequate attention to WASH[1]. Infection acquired at health settings contribute to morbidity and mortality and to a loss of health-sector resources worldwide. Five to thirty per cent of patients a year develop one or more infections during a hospital stay[2].

In a 2015 World Health Organisation (WHO) study[3], data from 54 countries representing 66,101 facilities showed that less than half of health care facilities provided safe and reliable water, sanitation and hygiene services. Inadequate access to water, sanitation and hygiene services will only exacerbate the disease burden associated with unsafe health settings. For instance, *Legionellosis,* a bacterium often found in infected water sources and well-established risk associated with health care facilities, makes up close to 10% of nosocomial infections found at health care facilities; if left untreated, it can cause pneumonia, respiratory failure, shock and acute kidney and multi-organ failure.

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[1] Rehfuess E, Bruce N., & Bartram J. More health for your buck: health sector functions to secure environmental health. Bulletin of the World Health Organisation 2009

[2] World Health Organisation. *Preventing environmental health-related disease in health care and other settings*. Geneva, WHO Press, 2002.

[3] World Health Organisation. *Water, sanitation and hygiene in health care facilities: Status in low- and middle-income countries and way forward. WASH in Health Care Facilities for Better Health Care Services.* Geneva: WHO Document Production Services, 2015.

Quality WASH services have the potential to increase the ability of health care workers and auxiliary hospital staff (cleaning, maintenance) to carry out effective infection prevention and control measures and play an important role in improving WASH within the entire community, by contributing to the promotion of hygiene behaviour change.

1. WASH EVIDENCE IN THE TRANSMISSION OF DISEASES

Poor hand hygiene is the key contributor of transmission, which includes no or inadequate hand washing before and after patient contact or after using the toilet[4]. Hand washing with soap is advocated as the single most important practice to reduce the transmission of infections in health care settings. Globally, however, hand washing compliance rates in health care facilities are poor.

Unsafe water undoubtedly is an issue, particularly in remote rural health care facilities. Countries reported drinking water coverage rates in rural facilities lagging nearly 20% behind those of urban hospitals. [5] Even for those facilities for which countries reported near universal coverage (e.g. urban hospitals), continuous vigilance is required to reduce risks to water quality. Based on the 60% rate of non-response, the majority of countries reporting to the UN-Water Global Analysis and Assessment of Sanitation and Drinking Water Survey (*GLAAS*) appear to lack monitoring systems to track sanitation and drinking water in health care settings.[6]

A lack of sanitation in health care facilities appears to be an even more serious matter than a lack of water supply. The small proportion of countries that did provide data to *GLAAS* reported that up to 25% of rural health care facilities lacked improved sanitation facilities. Nearly two-thirds of countries could not report on sanitation coverage in health care centres. If one accounts for non-responders, the situation is likely to be significantly worse (WHO, 2014).

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[4] World Health Organisation. *WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge: Clean Care is Safer Care*. Geneva: WHO Press, 2009

[5] World Health Organisation. *Investing in Water and Sanitation: Increasing Access, Reducing Inequalities. UN-Water Global Analysis and Assessment of Sanitation and Drinking Water*. GLAAS 2014 Report. Geneva: WHO Document Production Services, 2014

[6] World Health Organisation. *Investing in Water and Sanitation: Increasing Access, Reducing Inequalities. UN-Water Global Analysis and Assessment of Sanitation and Drinking Water*. GLAAS 2014 Report. Geneva: WHO Document Production Services, 2014

Waste generated by health care facilities range from excreta of patients, staff and visitors, to highly infectious wastes, including needles and blood. Safe segregation, disposal and destroying waste are essential to disease prevention. From a sample of 24 countries only 58% of health care facilities had adequate systems for the safe disposal of health care waste (*WHO, 2015*).

Contaminated needles and syringes represent a particular threat because they are sometimes scavenged from waste areas and dump sites and reused. Poorly managed, they may expose health care workers, waste handlers and the community to infections. In 2000, the WHO estimated exposure to contaminated syringes caused 21 million hepatitis B virus (HBV) infections (32% of all new infections), two million hepatitis C virus (HCV) infections (40% of all new infections), and 260,000 HIV infections (5% of all new infections)[7].

During c*rises or in precarious situations,* infections can increase and worsen patient's state. In some circumstances people may choose not to seek care because the nearest facilities are not functioning properly or because they know that treatment is uncertain due to shortages of staff, supplies, water or electricity.

Therefore, the importance of *leadership in the health sector* should bring Health Ministries to set "a statutory requirement that all health care facilities have adequate and safe WASH, and that coverage and maintenance of WASH is monitored in health care facilities".[8]

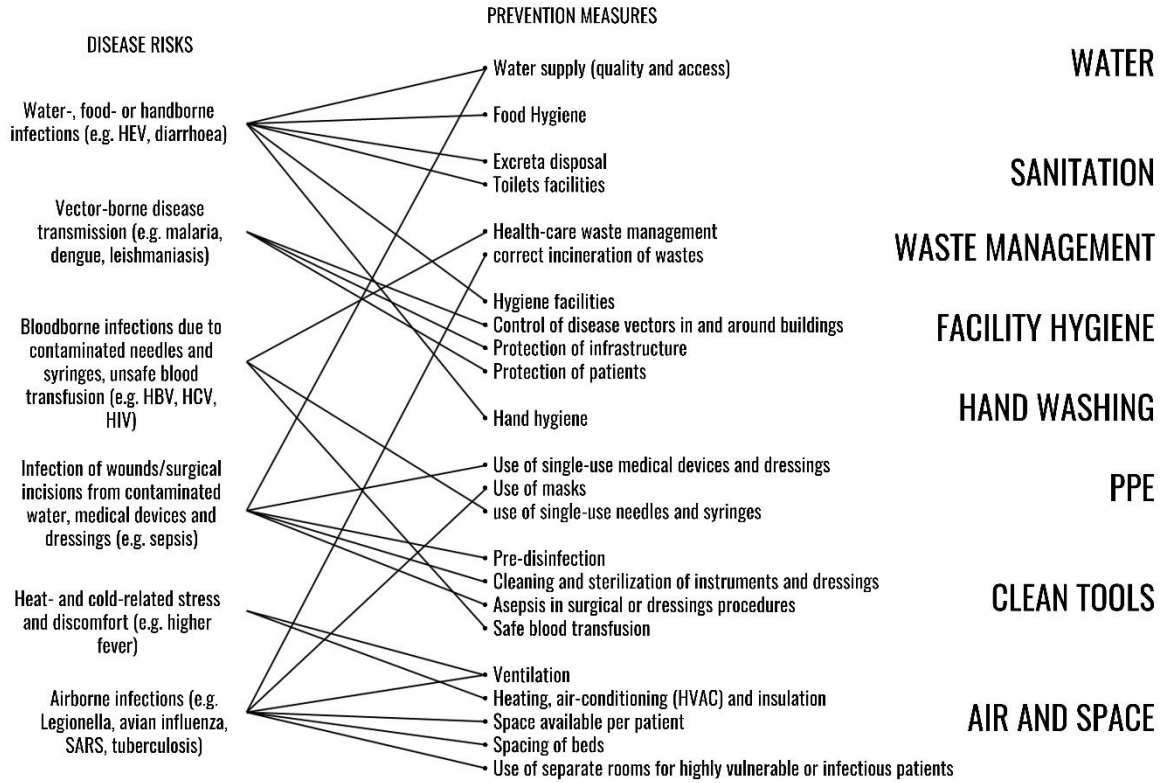
Primary prevention is a key pillar of any effective public health strategies and should be the first consideration in designing health sector infrastructure. Ministerial decrees, internal regulation and independent quality control can ensure rapid improvement to reduce the numbers of patients who attend health facilities seeking treatment and then fall ill due to health facility acquired infections. The early integration of WASH indicators in Health Management Information System and the digitalization of patients' book are essential in the monitoring and supervision of status and progress in the matter. Health sector professionals are well placed to lead by example and to demonstrate appropriate practices for the patients they treat, as well as

[7] Hauri, A., Armstrong, G. and Hutin, Y. (N/A): *Contaminated Injections in Health Care Settings*. Chapter 22. Pg. 1

[8] Bartram J, Cairncross. *Hygiene, Sanitation and Water: Forgotten Foundation of Health*. PLoS Med 7(11): e1000367. Doi:10.1371/journal.pmed. 2010.

to promote hygiene messages to patients (WaterAid, 2011)—preventing disease spread to their patients as well as themselves and their family.

The graphic below describes the connection between a list of most frequent diseases usually transmitted in health facilities, and the very simple prevention measures that could avoid them. Most measures are related to WASH, underlining the importance of implementing a package targeting Infection Prevention and Control in health facilities with WASH.



Adapted from: WHO 2008[9]

2. SPECIFIC BURDEN FOR MATERNAL, NEONATAL & CHILD HEALTH

The connection between WASH and Maternal, Neonatal and Child Health (MNCH) is well-established. Already in 1795, Alexander Gordon (1752–1799) asserted that deaths from puerperal fever could be prevented with greater cleanliness and that "nurses and physicians

[9] *WHO, Essential Environment Health Standards in Health Care. Edited by John Adams, Jamie Bartam $ Yves Chartier*

ought carefully to wash themselves" after contact with an infected patient[10]. Ignaz Semmelweis (1819–1865) later achieved a dramatic reduction in maternal deaths by requiring doctors to wash their hands in chlorine solution before examining women in labour[11].

In more recent times, evidence to quantify the effectiveness of WASH interventions on MNCH is still largely unavailable. While many studies and reviews show an association between poor water and sanitation access to increased levels of maternal mortality[12], none were intervention studies. Nevertheless, in the research that was available, results showed that:

- Unimproved household water access was an important risk factor for pregnancy related mortality in Afghanistan[13].
- "Clean birth practices" in both homes and facilities was associated with reduced all-cause sepsis and tetanus neonatal deaths[14].
- Hand washing practices by birth attendants and mothers were protective against neonatal mortality, with a 41% (95% CI 6%–63%) lower mortality rate among neonates exposed to both practices[15].

While the importance of hygiene is increasingly recognised, far less consideration has been given to the role of *a complete WASH package* in relation to improving MNCH outcomes in both homes and facility birth settings. A recent WHO rapid assessment of WASH coverage in health care facilities in 54 low-income countries found that 38% of the health facilities lacked an available improved water source (WHO, 2014). Countries including Bangladesh, India, Malawi, and Tanzania were shown to have the lowest levels of WASH coverage and highest

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[10] Gordon, A. *Insights into medical thinking in the late eighteenth century, 1795*

[11] Semmelweis, I., (1819–1865), "*From Joint Thinking to Joint Action: A Call to Action on Improving Water, Sanitation, and Hygiene for Maternal and New-born Health*" PLOS Medicine, A Peer Reviewed Access Journal. Pg 1 - 8

[12] Gon G., Monzon-Llamas L., Benova L., Willey B. & Campbel O (2014). *The contribution of unimproved water and toilet facilities to pregnancy-related mortality in Afghanistan: analysis of the Afghan Mortality Survey.* Available at: http://onlinelibrary.wiley.com/doi/10.1111/tmi.12394/full, accessed on: 21/09/15

[13] Gon G., Monzon-Llamas L., Benova L., Willey B. & Campbel O (2014): *The contribution of unimproved water and toilet facilities to pregnancy-related mortality in Afghanistan: analysis of the Afghan Mortality Survey.* Available from: http://onlinelibrary.wiley.com/doi/10.1111/tmi.12394/full

[14] BMC Public Health (2011): *Clean birth and postnatal care practices to reduce neonatal deaths from sepsis and tetanus: a systematic review and Delphi estimation of mortality effect.* Available from: http://www.biomedcentral.com/1471-2458/11/S3/S11

[15] World Health Organization (2009): *WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge; Clean Care is Safer Care*. 2009

maternal and neonatal disease burden (sub-Saharan Africa and South Asia). In all four countries, many births occur at home and only a minority occur in environments where adequate water and sanitation are available. This is of major importance in low-income settings where the burden of health care associated infections is potentially much higher[16], as is maternal and newborn mortality.

Efforts to improve birth conditions in low-income countries largely focus on specific measures for maternity care, health system strengthening, and increasing women's demand for giving birth in health care facilities. Yet little attention has been paid to the conditions in which births take place, and increasing the use of health care facilities for childbirth without considering the availability and quality of WASH in these facilities may limit potential health gains.

Currently, the WHO 2014 recommendations on postnatal care for mothers and newborns include only one reference to WASH, which relates to the need for counselling women on hygiene and guidelines for the Standards for Maternal and Neonatal Care while the encouragement of WASH practices include no specific recommendations on WASH service provision. Inevitably, health care facilities are often managed around the provision and improvement of diagnostic and treatment services, and WASH may seem to be an obvious requirement that it is insufficiently emphasised in national health standards and monitoring instruments. This neglect is compounded by the lack of clarity on who—within the overall structure of the health system and in individual health care facilities—should be responsible for ensuring adequate WASH provision.

A lack of drinking water or availability of safe sanitation facilities in hospitals and clinics may compound the situation; discouraging women from giving birth in facilities, contribute to delays in seeking care and contribute to staff absenteeism. Further, as noted in the 2006 World Health Report, “no matter how motivated and skilled health workers are, they cannot do their jobs properly in facilities that lack clean water”.

While the MDGs—especially MDG5 on improving maternal health—have emphasised the need for explicit programmes to improve maternal health, their siloed nature has left little room

[16] Semmelweis, I., (1819–1865): *From Joint Thinking to Joint Action: A Call to Action on Improving Water, Sanitation, and Hygiene for Maternal and Newborn Health*. PLOS Medicine, A Peer Reviewed Access Journal. Pg. 2 - 8

for a much needed intersectoral collaboration, and to comprehensive, integrated programming across the continuum of care. The absence of targets on water and sanitation services in strategies for achieving MDGs 4 and 5 has constrained progress on reducing maternal and newborn mortality, and benefits for MNCH are compromised if these cannot provide even minimum sanitary and hygiene standards.

Enabling *stronger integration* between WASH and health sectors has the potential to accelerate progress on MNCH and should be accompanied by improving monitoring of WASH in health care facilities providing MNCH services as part of routine national level monitoring, and at the global level through international instruments. Global and national efforts to reduce maternal and newborn mortality and morbidity should adequately reflect WASH as a prerequisite for ensuring the quality, effectiveness, and use of health care services.

The Post-2015 development framework is an opportunity for a stronger, more intersectoral response to the MNCH challenge. The goals and targets aimed at maximising healthy lives and increasing access to quality health care should adequately embed WASH targets and success indicators. Further implementation research is still needed to identify effective interventions to improve WASH at home and in health care facilities, and to impact on MNCH in different health system contexts. The following is one attempt into this direction.

3. OTHER CONSIDERATIONS

Environment

Waste in health facilities is a particularly difficult issue to manage due to the variety and type of waste to be segregated, stored and disposed of. Each step requires intensive training and sensitisation for staff to ensure individual, environmental and public health safety. Improper management of solid waste, such as storage or burning in an unprotected waste disposal pit, can create dangerous pollution particularly where medical and hazardous waste are concerned. This may be exacerbated when fumes are not treated before emission, as is the case with some incinerators. Weather changes, such as extreme heat and rain can increase bacteria growth, attract flies and insects and can contaminate ground water. Wastewater is also at risk if the distance between septic tank/latrine and the borehole is too short; precautions, regular monitoring and maintenance is required to avoid blockages and leaks in pipes and to ensure septic tanks are water tight.

Community impact

Health Facilities are generally integrated into a surrounding community, and poor WASH standards can impact public health in the community nearby. Pollution and smell from poor waste management practices, contaminated water from poor water supply and maintenance practices, and health staff without access to safe WASH standards places a heavy burden on the community and health facility.

Yet on the positive side, the facility is an important convening point for the community, making it easier to gather people, promote hygiene practices, and sensitise on sanitation issues. But these can only be done if and when the health facility is leading by example.

Human cost / Financial Cost

The human cost is evident—health facility acquired infections in health care leading to disease and death. Patient safety is a serious global public health issue. Estimates show that of every hundred (100) hospitalised patients, ten (10) will develop an infection from the health facility in developing countries, and 7 will in developed countries. Hundreds of thousands of patients are affected by this worldwide each year. Safety studies show that additional hospitalisation, litigation costs, infections acquired in hospitals, disability, lost productivity and medical expenses cost some countries as much as US$19 billion annually. About 20%–40% of all health spending is wasted due to poor-quality care[17]. The economic benefits of improving patient safety are therefore compelling.

There is a strong conviction that the situation can be solved with simple management solutions and cost-effective equipment and supplies—both constituting a WASH package. Management solutions are composed of better trained staff, better compliance to simplified operation procedures, and a dedicated management team at facility level who monitors these activities. As for implementation of the WASH package equipment, upgrades and accessibility to WASH tools is the first step. For instance, many facilities don't have any drinking water points but this can easily be supplied with simple water station stands fabricated from locally available materials, rather than a costly refrigerated water dispenser. Where flush toilets are unavailable, the construction of a range of ventilated improved pit (VIP) latrines already represents an

important improvement in term of comfort and hygiene for patients and staff. Hand washing equipment starts with the installation of simple “tippy taps” or hanging water containers with soap. Solutions should be adapted to each and specific situation depending on water accessibility, space, affluence, cultural habits and availability of materials. In the context of developing and transitional countries, it is important to set priorities in term of interventions according to IPC efficiency and cost. This is the purpose of the table below based on experience, reviews and assessments.

Barriers to disease transmission	Interventions	Efficiency	Cost
Disinfection	Liquid chlorine production units + training (including potential income generating activities)	+ + + + +	+
Hand washing	Supply hand washing stations and sanitizers + training	+ + + + +	+
Sanitation - liquid wastes	Build latrines, flush toilets, septic tanks	+ + +	+ + +
Sanitation - solid wastes	Equipment for medical and non-infectious waste collection + storage and treatment (burning pits, incinerators…), disposal (collection, transport, dump site)	+ +	+ + + + +
Functional Standard Operating Procedures	Develop simple standards + capacity building + monitoring and supervision	+ + + + +	+
Safe drinking Water	Water supply development and maintenance, minimum daily storage, quality monitoring	+ + +	+ + +

Without waiting for any international accord, Zambia thrive to be at the forefront of the battle for universal access to basic WASH in health care facilities.

RECOMMENDED MINIMUM ZAMBIAN INFECTION PREVENTION & CONTROL WASH STANDARDS

WASH related Infection Prevention and Control (IPC) focuses on the following priority areas:

- Access to adequate and clean water
- Hand hygiene
- Access to basic sanitation
- Solid waste management
- Cleaning, decontamination and sterilisation

The mechanisms for coordination of Infection Prevention and Control and to implement the Standard Operating Procedures should be put in place to ensure the operation and maintenance of infrastructure and routine minimum IPC practices. This includes the orientation and training of staff and routine monitoring within each health facility. The IPC Committees at each facility will monitor IPC with WASH practices through the SOP and tools. The recommended minimum IPC WASH Standards are meant to be simple, comprehensible and usable.

I. ACCESS TO ADEQUATE AND CLEAN WATER

The first prerequisite in a health facility is the provision of adequate and clean water from either a protected groundwater source (spring, well or borehole) or from a treated (municipal or other piped water) supply that flows directly or is stored safely until consumed or used otherwise. Untreated water from unprotected sources can be made clean by simple means such as boiling, filtering or disinfecting. Water storage options should be considered where continuous water availability is not assured (e.g. in case the water supply is intermittent in time or in quantity/flow).

Water usage: water should be available for drinking water supply, medical use, infection control activities, personal hygiene, food preparation, laundry and cleaning.

Ensuring continuous and convenient access to clean water involves *quantity, accessibility* and *quality* related standards.

STANDARDS AND GUIDELINES

Water quantity and access

Sufficient and *continuous*[18] water is available and distributed to collection points and water-use facilities.

- Water points are available in the health facility to allow *convenient access* for the following uses: drinking water, medical use, infection control activities, personal hygiene, food preparation, laundry and cleaning. In health facilities receiving outpatients, access to drinking water points and hand washing points should be provided for in the waiting area.
- Drinking water and hand washing points are adequately signposted.
- Mobile water points can be used at low-cost to complement fixed water points

Water quality

Clean water quality considerations include physical (turbidity), microbiological and chemical criteria. Clean water implies no colour; water is free from foul smells, free from dissolved and suspended impurities and free from microorganisms.

- *Physical water quality: turbidity* (amount of cloudiness) should be less than 1 Nephelometric Turbidity Units (NTU) and less than 5 NTU in resources limited settings[19]
- *Chemical water quality: Arsenic and Fluoride. M*aximum values of 10 µg/l arsenic and 1.5 mg/l fluoride in drinking water[20]. Arsenic and Fluoride testing should be done in area with contamination risk

[18] *Continuous* implies all year round, 24 hours a day.

[19] World Health Organisation, UNICEF: *A toolkit for monitoring and evaluating household water treatment and safe storage programmes.* WHO Press, 2012. WHO recommends that water should have a turbidity of less than 5 NTU and, if possible, less than 1 NTU. NTU can be measured with an electronic turbidity meter or turbidity tube (measuring limit of minimum 5 NTU)

[20] World Health Organisation, UNICEF: *A toolkit for monitoring and evaluating household water treatment and safe storage programmes.* WHO Press, 2012.

- *Microbiological water quality: Less than 1 Escherichia coli or thermo-tolerant coliform bacteria per 100 millilitre sample of drinking water at the health-care facility*[21].
- *Other water quality considerations*
    - *Each step in the water chain (from water supply point to water distribution/water use point) indicates low risk of faecal contamination.*
    - *There are no tastes, odours or colours that would discourage its usage.*
- Water quality tests are conducted quarterly to identify actual and potential water contamination risks.

If the health facility does not have the possibility or capability to bring all supplied water to drinking water standards, the provision of potable (clean) water should be provided through drinking water points. Water made available through drinking water points can be provided by appropriate treatment (e.g. using UV or chlorine to reach between 0.5 and 1 mg/l free residual chlorine).

II. HAND HYGIENE FACILITIES AND PROTOCOLS

Hand hygiene is considered an effective barrier to bacteria and disease transmission[22]. Having a sufficient number of hand washing utilities at appropriate locations will facilitate health workers to wash their hands at appropriate time. Patients would also benefit from those utilities and advised to clean their hands while entering and living the premises. For all, the promotion of good practice, with soap or hand rub, is essential in creating long term behaviour change.

Hand washing stations can be fixed or portable basins. Maintenance and functionality of hand washing facilities are required.

[21] World Health Organisation, UNICEF: *A toolkit for monitoring and evaluating household water treatment and safe storage programmes.* WHO Press, 2012. The WHO Guidelines for Drinking-water Quality state that E. coli and thermotolerant coliform bacteria "must not be detectable in any 100 ml sample" of water intended for drinking.

[22] World Health Organisation: *WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge; Clean Care is Safer Care.* WHO Press, 2009

STANDARDS AND GUIDELINES

- Reliable hand washing facilities with clean water and soap or hand sanitisers are available in all treatment areas, waiting rooms and near toilets / latrines for patients and staff.
- Hand washing facilities and surrounding areas should be cleanable (nonporous surfaces).
- Hand washing points, which do not provide potable water should be signposted accordingly (for example with a pictogram indicating that the water cannot be used for drinking).
- Hand washing guidelines (SOP) to be available and observed by staff. Staff members have been oriented on hand washing practices.

The use of Personal Protection Equipment (PPE) and gloves are not an alternative to washing hands.

The use of Personal Protection Equipment (PPE) such as gloves should not be considered an alternative to hand washing practice. Disposable gloves should be disposed of after use; reusable gloves should be disinfected regularly to avoid infection transmission.

III. ACCESS TO MINIMUM SANITATION

Provide even basic sanitation facilities that enable patients, staff and carers to go to the toilet[23] without contaminating the health care settings or resources such as water supplies. Sufficient numbers of adequate, accessible, appropriate and safe toilets are provided for patients, staff and visitors.

STANDARDS AND GUIDELINES

Sanitation quantity and access indicators

- 1 toilet for every 20 users for inpatient setting; this ratio includes inpatient, as well as staff. 1 toilet per 75 average daily female outpatients. For males, the minimum toilet: outpatient (average daily male outpatient) ratio is 1:100, where urinals are available.
- Water borne flushing toilets should be provided for when both sufficient and continuous running water is available and a septic system with adequate septic

[23] *The word toilet can refer to both flushed toilet and latrine.*

system management is available (including regular cleaning/pumping of the septic tank).

- When VIP latrines are constructed with provision for adequate aeriation/ventilation
- Separate toilets for patients and staff; signposted accordingly.
- Separate male and female toilets; signposted accordingly.
- Provision for people with disabilities: provision of access ramp, toilet space and entrance allowing wheelchair mobility, wall mounted handles; signposted accordingly.
- Toilets have convenient hand washing facilities inside or right outside the block if shared, and signposted.
- Provision for Menstrual Hygiene Management (MHM): Provision of a washing room in a private setting for women (can be bathroom or water point in toilet with adequate washing and drainage facilities), provision of a bin for disposing of pads in all female toilets
- Premises should be kept clean at all times. Cleaning schedule to be wall mounted.
- Certain areas might need posters to guide patients in properly using the new utilities, avoiding damages on the goods, accidents but also acts of theft.

Recommendation: in certain environments, to cater for the needs of specific religious or cultural values, the provision of squat-pan toilets with tap for anal cleaning can be considered

Sanitation quality indicators

- Appropriate for local technical and financial conditions, safe (includes lockable from inside and outside), clean, accessible to all users including those with reduced mobility.
- Toilets should be built according to technical specifications to ensure excreta are safely managed.
- Adequacy of toilets at all times should be observed: toilets are functional, accessible, safe to use, surfaces are cleanable (non-porous). There is a cleaning and maintenance routine in operation that ensures that clean and functioning toilets are available at all times.

IV. SOLID WASTE MANAGEMENT

Waste segregation is the first step in the waste management line. It should be properly handled with protective equipment and properly stored before disposal, collection, disposal, removal or destruction.

Hazardous medical waste (Infectious waste, pathological/anatomic waste, sharps) should be incinerated. Non-hazardous / non-risk waste should be adequately disposed of (using public or private waste collection services).

STANDARDS AND GUIDELINES

Waste segregation is performed at the point of generation through appropriate colour coded containers or plastic garbage bags as well as through the use of sharps boxes. In the case where colour coded containers or plastic garbage bags are unavailable, the containers should be labeled. The personnel involved in health care waste management shall ensure that the waste bags are removed and sealed when they are not more than three-quarters full. If segregation has not occurred, personnel shall not attempt to correct the error, but treat the mixed waste as hazardous HCW[24]. The colour coding should be done as follows:

Waste Type	Types of Waste	Colour Code	Type of Receptacle
A	General Waste	Black	Plastic bag of appropriate size
B	Infectious Waste		
B1	Sharps	Yellow	Puncture-resistant containers
B2	Patient Waste		Plastic bags and containers
B3	Culture/Specimen		Plastic bags and containers
C	Pathological/Organic Human Waste	Yellow	Plastic bags
D1	Pharmacological Waste	Brown	Plastic bags and containers
D2	Photographic Chemical Waste • Photographic developer • Fixer solution • X-ray photographic film		• Plastic containers to be recycled/reused. • To be neutralized
D3	Radiographic Waste	Yellow	Container with radioactive symbol
	• Solid combustible/ compactable		Durable plastic bag which can be sealed

[26] Zambia Environmental Management Agency (ZEMA). Technical Guidelines on the Sound Management of Health Care Waste 2007.

Waste Type	Types of Waste	Colour Code	Type of Receptacle
	• Noncombustible/ non compactable		Puncture-resistant containers (metal)
	• Liquid-Aqueous		Thick walled polythene bottles or organic glass containers but should have secondary containers to prevent them from breaking
	Spent sealed sources		Container in which the source was originally received
D4	Laboratory Waste	Brown	Containers with appropriate labels
D4.1	Acids		Acid label
D4.2	Alkalis		Alkali label
D4.3	Solvents		Solvent label
D4.4	Organic substances		Organic substance label
D4.5	Heavy metal (mercury)		Heavy metal label
E	Incinerator Ash /Sludge	Yellow	Metal containers labeled "Ash/Sludge"

Adequate spill kit including absorbent materials disinfectant buckets, shovels for staff to clean up spills must be easily accessible. Protective clothing such as gloves, overalls, and nose mask must be provided for personnel handling waste. Specific protective equipment is available for the manipulation of each type of waste.

Labelling is important in order to identify the source of health care waste to ensure that the personnel involved in handling the waste understands how to dispose of it. Labelling also allows medical departments to gather data on the amount of waste produced in each department.

- All waste receptacles shall be labelled with basic information of their content
- Labels shall be permanent and legible for the entire storage period; information on labels should include, waste type and source of waste.

Waste storage:

- Waste segregated storage should be available for:
  - Non-hazardous/ non-medical waste (domestic)
  - Medical waste including; Infectious, pathological and anatomic waste (leak-proof containers)
  - Sharps (sharps boxes)
  - Pharmaceutical/chemical waste
- The hazards of the different types of waste will determine what storage room and containers should be used for its safe storage of the waste for transport until it has

been treated or disposed of. Examples are: ventilated rooms for waste that produces odours; protection from rodents and rain; cold storage for anatomic waste such as placentas; leak proof containers when presence of fluids

- Surfaces are cleanable (non-porous). There is a cleaning and maintenance routine in operation that ensures that clean storage spaces are available at all times.
- Waste generated inside the facility should be removed to onsite storage within 24 hours.
- The storage points or hazardous and non-hazardous waste shall be located separately.
- The storage facility shall be enclosed and surrounded by an impervious wall of appropriate height and provided with a gate and a lock.
- Waste bins shall be washed and disinfected each time they are emptied.
- Radioactive waste containers must be brightly coloured and clearly labelled "Radioactive Waste".
- Radioactive waste should be adequately packaged and contained for transport by licensed companies and managed in accordance with the Ionising Radiation Act (number 16 of 2005).

Waste incineration: Medical waste is incinerated, either on-site or off-site.

- Technical specifications for on-site incinerator should correspond to the health facility needs, and comply with Zambian standards25, its human resource capacity, availability of appropriate training and an SOP should be available.
- If no on-site incineration is provided, safe and adequate medical waste transportation will be provided and collection of waste should be organised for at an off-site incineration facility.

Disposal of domestic waste

- Protocols should be in place for regular collection or disposal of domestic waste.
- Collection and Transportation of health care waste from facilities shall dovetail into the general waste management plan of the local authority.
- Storage of waste must be segregated and colour coded if possible, to allow for easy identification and prevent careless handling and the risk of secondary infection.

Other waste disposal options: in resources limited environments or rural health care facilities without incineration option nor with a frequent, reliable and safe medical waste transport solution, land disposal such as refuse and *protected placenta pits* can be used to safely dispose of wastes and placentas. Placenta pits should allow decomposition of the

[25] *Environmental Council of Zambia, year unknown, Minimum Specifications for Health Care Waste Incineration, Lusaka, Zambia*

placentas without contamination risk. Therefore, it is advised to consider water tight bio-digestive pit with concrete cover and screen.

  - The selected site should be located at sufficient distance[26] to minimize contamination risks of the water table / water supply points (see chapter on access to adequate and clean water).
  - The site shall have proper drainage, be located downhill from any wells, free of standing water and not in an area liable to floods.
  - Use of land disposal shall only be practical for only limited periods of time (1-2 years), and for relatively small quantities of waste until a better, permanent method for waste disposal can be found.
    (ZEMA, 2007)
- Waste collection and transport: non-medical, non-hazardous waste is collected in a timely manner and transported safely
- SOPs exist on the Waste Management process for handling, segregation, storage, collection, disposal, incineration are available and observed by staff. Staff members have been oriented on SOP and accountable for SOPs implementation.
- Waste management plan including risks and mitigation measures is available.

V. CLEANING, DECONTAMINATION AND STERILISATION

Cleaning, decontamination and sterilisation are highly effective infection prevention measures that minimise the risk of transmission of harmful micro-organisms and chemical exposure to the health workers, cleaning staff patients and the surrounding environment.

DECONTAMINATION STANDARDS AND GUIDELINES

Decontamination is the process of cleansing an object or substance to remove contaminants such as micro-organisms or hazardous materials, including chemicals, radioactive substances, and infectious diseases. Decontamination is the first step in processing soiled (contaminated) surgical instruments, reusable PPE and other items.

- Appropriate PPE and cleaning supplies available.
- SOPs for decontamination step-by-step should be available at HF, including chlorine dilution (e.g. soak contaminated items for 10 minutes in 0.5% chlorine solution).

[26] The Zambia Environmental Management Agency (ZEMA) through the *Technical Guidelines on the Sound Management of Health Care Waste 2007* recommend 50m.

- SOPs include checklist at each decontamination station with information about the used decontaminants (e.g. when chlorine was produced and person responsible).

CLEANING STANDARDS AND GUIDELINES

- Cleaning is the process, which physically removes all visible dust, soil, blood or other body fluids from inanimate objects as well as removing sufficient numbers of microorganisms to reduce risk for those who touch the skin or handle the object. It consists of washing with soap or detergent and water, rinsing with clean water and air drying.27
- Appropriate PPE and cleaning supplies available.
- SOPs for cleaning step-by-step available at health care facility, including chlorine dilution.

HIGH-LEVEL DISINFECTION (HLD) STANDARDS AND GUIDELINES

- Although sterilisation is the safest and most effective method for the final processing of instruments, when sterilisation is not possible or not indicated, High-Level Disinfection is the only acceptable alternative for processing instruments or PPE that will be reused. HLD destroys all microorganisms except some bacterial endospores.
- 3 methods: Boiling, steaming, soaking in chemical disinfectant (see SOPs for more details)
- SOPs for HLD step-by-step available at health care facility.
- Appropriate PPE, supplies and equipment available.
- Logbook available for HCW performing task.

STERILISATION STANDARDS AND GUIDELINES

- Sterilisation is the process that eliminates all microorganisms (bacteria, viruses, fungi and parasites) including bacterial endospores from inanimate objects.
- 3 methods: high-pressure steam (autoclave), dry heat (oven), chemical sterilants or radiation
- SOPs for sterilisation step-by-step available at HF.
- Appropriate PPE, supplies and equipment available.
- Logbook available for HCW performing task.
- Ensure proper maintenance of equipment, including autoclave.
- All instruments/equipment shall be decontaminated, cleaned & dried prior to sterilisation.

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[27] *If available water is contaminated, use water that has been boiled for 10 minutes and filtered to remove particulate matter (if necessary), or use chlorinated water—water treated with a dilute bleach solution (sodium hypochlorite) to make the final concentration 0.001%.*

Method	Effectiveness (Kill or remove micro-organisms)	End point
Decontamination	Kills most microorganisms	10 minute soak in chlorine solution
Cleaning (water only)	Up to 50%	Until visibly clean
Cleaning (soap & rinsing with water)	Up to 80%	Until visibly clean
High level disinfection	Up to 95%	Boiling, steaming or chemical for 20 minutes
Sterilization	Up to 100%	High pressure steam, dry heat or chemical for recommended time

GENERAL CLEANING STANDARDS AND GUIDELINES

General cleaning refers to the cleaning of the clinic environment, which includes floors, walls, tables as well as other surfaces, as well as to keep the outside of the clinic clean. Cleaning methods should be determined by the type of surface, the amount and type of organic matter present, and the purpose of the area.

- Surfaces that come in contact with clients, such as examination tables and patient beds, must be kept clean and decontaminated to avoid cross-contamination of patients and staff.
- All surfaces, which may come in contact with blood, body fluids, secretions or excretions (e.g., pelvic examination tables or operating tables) must be decontaminated by wiping them with a disinfectant solution (0.5% chlorine solution) after every client, regardless of whether it is visibly contaminated.
- Any surface, which is visibly contaminated, must be decontaminated by wiping with a disinfectant solution (0.5% chlorine solution) immediately after the procedure.
- Spills of blood, body fluids, secretions or excretions:
- Small spills must be decontaminated by wiping with a cloth soaked in disinfectant solution (0.5% chlorine solution).
- Large spills should be flooded with disinfectant solution (0.5% chlorine solution); if feasible, allow to sit for 10 minutes before mopping up, but do not create a hazard where someone might slip and injure themselves.
- Always wear gloves (utility gloves are recommended) when cleaning surfaces that may have come in contact with blood, body fluids, secretions or excretions

- Remove covered contaminated waste container and replace it with a clean container. Take waste to the waste storage area immediately for appropriate disposal.
- Waste water used for cleaning should be discarded in the main sewer drainage system to avoid contaminating the environment.
- Close and remove sharps containers when three quarters full.
- Remove soiled linen in closed leak proof containers.
- Soak a cloth in disinfectant cleaning solution and wipe down all surfaces, including counters, table tops, sinks, lights, vents, etc. Wash from top to bottom, so that any debris that falls on the floor will be cleaned up last.

General cleaning reminders:

- Appropriate PPE, supplies and equipment must be available.
- SOPs for cleaning specifications available at HF (e.g. larger surfaces cleaned with 0.5% chlorine solution; linen soaked in 0.5% chlorine solution).
- Daily cleaning schedule available, includes specific tasks and person responsible.
- Cleaning logs posted in an easily accessible location.
- Ground staff monitored for regular waste pick-up and Health Facility surroundings.

Recommendations for Chlorine Production Units:

Chlorine production machines are a low cost and sustainable solution for health care facilities in resource limited settings. This technology uses a simple, manageable process of electrolysis to convert a measure of household salt and water into sodium hypochlorite. The resulting solution can be used for drinking water chlorination or as a disinfectant for use in households, hospitals or community clinics. With this system, health care facilities can produce locally and quickly available chlorine to protect communities from nosocomial infections and implement broader Infection Prevention and Control (IPC) measures (see Annex 3 for more details).

VI. STANDARD OPERATING PROCEDURES AND COORDINATION OF INFECTION PREVENTION AND CONTROL

The sustainable and effective implementation of a comprehensive WASH package at health care facility level requires a coordination of Infection Prevention and Control (IPC) practices and following clear and simple Standard Operating Procedures (SOPs).

Zambian Infection Prevention and Control (IPC) guidelines specify*: There shall be an active and effective Infection Prevention and Control Committee in each health care facility, with clear terms of reference and clearly defined responsibilities.*

IPC Committee terms of reference should include the following WASH related activities:

(i) On-going education of health care personnel, client/patients and visitors focusing on risk of infection and practices (standards and additional precautions) to decrease the risk, e.g.; reinforcing hand hygiene practices, availability of reports/record on hand washing training/orientation

(ii) Monitoring IPC: Ensure availability and access to personnel of IPC policy, guidelines, standards, and practices when performing procedures e.g.; clean environment; surfaces, equipment, material, availability of PPE and hand hygiene equipment and supplies

(iii) Provide appropriate personal protective equipment (PPE) for personnel and client/patients to be used during procedures.

(iv) Operation and maintenance of WASH infrastructures (water supply/distribution, basic sanitation/toilets, incinerators, chlorine production units, etc.)

Chlorine production units

Chlorine production units are a cost effective way of providing chlorine for disinfection purposes for drinking water chlorination, disinfection of wounds or cleaning. These units produce chlorine – up to 0.5% concentration – based on the simple and manageable

CENTRAL, PROVINCIAL AND DISTRICT TECHNICAL SUPPORT AND MONITORING

As per the Zambian Infection Prevention Control Guidelines the on-going training and capacity building of health facility staff and Ministry regulatory bodies is essential to ensure the

sustainability and effective implementation of the WASH package. A national training package for IPC and hand washing management is strongly recommended.

All health facilities shall in conjunction with MCDMCH, MOH and other regulatory bodies receive on-going IPC and Hand Washing training for both medical and non-medical staff. Regular IPC meetings are to be held at Health Facility level, staff is to receive advocacy skills to raise issues with district health teams and policy makers on addressing the risks identified at health facility level and responsibilities in relation to IPC and hand washing.

Training on IPC/Hand washing

- The DHO through certified trainers with support from PHO and the central level and other stake holders will conduct IPC with WASH and Hand hygiene trainings.
- Support all IPC WASH activities in health facilities including the IPC committees.

Capacity Building on Operation and Maintenance

- The DHO and PHO, through their EHOs and Medical Equipment officers will provide support on the operation and maintenance of equipment such as Incinerators and Bleach Production Units.

Monitoring/Supervision on IPC practices and IPC committees.

- This will be done mainly by the DHO, PHO and stakeholders.
- Reports of monitoring and supervision activities will be written and sent through the existing channel up the central level.

Role of District/Province/Central level

- Central level and PHO- these will conduct performance assessment and technical support to the DHO and health facilities.
- DHO will conduct monitoring and supervision and provide support and mentoring to health facilities.

Evidence based IPC implementation (Microbiology; water quality, hand touch sites testing etc.)

Quarterly microbiological and water testing results from health facility will be incorporated into the IPC Committee reviews with feedback and recommendations at each health facility.

HMIS and DHIS

- It is strongly advised to incorporate WASH IPC indicators into the DHIS and HMIS (data collections and database) to monitor trends of infections in the framework of disease surveillance and early outbreak signals.
- The computerization and digitalization of patients' book would also be an essential component to allow identification, quantification, and location of nosocomial diseases.

ANNEXES

ANNEX 1: LIST OF CONTRIBUTORS TO THE DEVELOPMENT OF MDGI-IPC/WASH PACKAGE

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ANNEX 2: ZAMBIAN AND INTERNATIONAL STANDARDS

The Zambia Infection Prevention Guidelines published by the Ministry of Health (2010) outlines standards, guidelines, measures and Standard Operating Procedures (SOPs) for infection prevention, though its focus is much broader than Water, Sanitation and Hygiene (WASH). Similarly, the National Health Standards (MOH 2010) were developed to improve the quality of service delivery in health facilities, but they also do not provide explicit standards for WASH.

These simplified minimum standards for WASH were developed from an analysis of the existing Zambian Infection Prevention Guidelines, International and National WASH in Health guidelines from India, Kenya, South Africa, Zimbabwe and Tanzania, as well as of global documentation such as publications done by the World Health Organisation (WHO) and UNICEF.

1. ACCESS TO ADEQUATE AND CLEAN WATER

At the health facility level, the use of clean water is crucial. Water is needed for drinking, cleaning surfaces, linens and clothes, cleaning hands, cleaning bodies during surgery or after giving birth, and cleaning medical tools and instruments, as well as food. The provision of water and its definition in terms of quantity and quality should be properly detailed and guaranteed as a minimum requirement.

The reference to clean water is made in the Zambian Infection Prevention Guidelines[28] in terms of use for: rinsing objects such as tools and instruments, after having them washed with soap or detergent (p.33, p.34, p.46, p.82, p.83, p.95); toys (p.64); hands and skin (p.74, p.92); and waste containers (p.85, p.89).

In the guidelines of the United Republic of Tanzania and the Republic of Zimbabwe, access to adequate and clean water is mentioned for hand hygiene practices and for cleaning purposes. The Republic of South Africa mentions access to water in its guidelines to ensure environmental safety outside the hospital premises. In Kenya, the guidelines clearly state that "facility design and planning should ensure the adequate supply of safe water" as a top requirement; they also mention the need of "clean running water" in the Routine Hand Washing section, as well as for washing instruments.

[28] Ministry of Health, Zambia: *Zambian Infection Prevention Guidelines, second edition*. 2010

The provision of water in sufficient quantity and following minimum quality standards (chemical and physical quality, the latter referring to clear water) is a pre-requisite in health facilities. In quantity implies water availability throughout the health care facility at all times for drinking water supply, infection control, medical activities, cleaning, laundry, personal hygiene and food preparation. Quality control should be ensured with regular microbiological testing of the water (on a quarterly basis), and if necessary appropriate water treatment should be done.

2. APPROPRIATE HAND HYGIENE PRACTICES

Failure to perform appropriate hand hygiene is considered to be a leading cause of nosocomial (hospital-acquired) infections and the spread of multi-resistant microorganisms, and has been recognised as a significant contributor to outbreaks of disease[29] Hand hygiene is considered a top priority in terms of IPC, and today is well documented in terms of preventing infection transmission, as well as the appropriate way to wash and disinfect hands with soap and water, waterless antiseptic agents, or even wood ash.

Hand hygiene is extensively documented in the Zambian Infection Prevention Guidelines (2010), as well as in regional and international guidelines.

The Zambian Infection Prevention Guidelines (2010) indicate that, "proper hand hygiene includes simple hand-washing, hand antisepsis, hand scrub and the use of waterless hand rub as key components in minimising the spread of disease." The guidelines focus on increasing the number of health care personnel who are washing hands formulating specific measures to ensure the:

- Availability of hand hygiene guidelines;
- Presence of hand hygiene equipment and supplies; and
- Availability of reports/records on hand washing training/orientation.

Hand hygiene practices are described for: (i) *hand washing using water and soap*; (2) *hand washing using water-based antimicrobial agents*; (3) *antiseptic hand rub;* and (4) *surgical hand scrub*.

[29] Boyce D, Pittet D: *Guidelines for Hand Hygiene in Health-Care Settings.* 2002 Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm

International hand hygiene guidelines include both hardware (hand washing facilities) and software (hand washing practices and operational procedures). Hand washing protocols have been developed for specific departments, staff and patients, including functional and reliable hand washing stations with access to soap, ash or alcohol based sanitizers (Kenya, India, Tanzania). Hand washing facilities must be factored into infrastructural and construction planning (Kenya, South Africa), hand washing practices are strongly recommended after use of toilets, before having a meal and before and after performing health care.

3. ACCESS TO BASIC SANITATION

It is internationally recognised that toilets should be made available for staff, inpatients and outpatients, while avoiding contamination of the health care setting or its water supply. The number of toilets should be sufficient, separated by sex and provisions should be made for disabled people. The location of toilets is also crucial in terms of accessibility, visibility, usage and maintenance, and special attention should be paid to securing the facilities to avoid acts of theft or any other damage.

The Zambian Infection Prevention Guidelines (2010) mention the need for toilets and latrines to be properly cleaned. No provision is made for quantities nor for the location of the sanitation facilities. There are no existing guidelines specifically for Health Care Facilities to indicate a set toilet to user ratio for staff, inpatients and outpatients, as well as differentiating between male and female users, as well as within health facility departments.

International guidelines on sanitation include ensuring that basic sanitation facilities are available, accessible and appropriate for patients and staff without contamination to the health facility (India, Kenya). The World Health Organisation (2015) set ratio standards as 1 toilet for every 20 users for an inpatient setting, and at least 4 toilets per outpatient, as well as to separate toilets for patients and staff.

4. SOLID WASTE MANAGEMENT

A lack of awareness on health hazards related to health care waste, inadequate training on proper waste management, absence of waste management and disposal systems, insufficient financial and human resources and the low priority given to waste management are the common problems connected with appropriate handling and disposal of health care waste.

Health care waste includes all waste generated by health care establishments, research facilities, and laboratories. In addition, it includes waste originating from “minor” or “scattered”

sources—such as waste produced in health care undertaken at home (dialysis, insulin injections, etc.).

According to the World Health Organisation, between 75% and 90% of waste produced by health care providers is non-risk or "general" health-care waste, comparable to domestic waste. It comes mostly from the administrative and housekeeping functions of the health care establishment and may also include waste generated during maintenance of health care premises. General waste should be dealt with by the municipal waste disposal mechanisms. The remaining 10–25% of healthcare waste is regarded as hazardous waste and may create a variety of health risks. Hazardous waste includes infectious waste, pathological waste, sharps, cytotoxic waste, chemical and pharmaceutical waste, waste with heavy metals (mercury from broken thermometers, blood pressure gauges, cadmium from discarded batteries), and non-recyclable and discarded pressurized containers.

Type of Waste	Details	Disposal
General Waste	Kitchen waste, paper, packaging, etc.	• On site pit disposal • Burning • Sanitary landfill
Pathological and Infectious Waste	Blood, placenta, lab cultures, human tissues, body parts, urine, sputum and other body fluids	• Incineration/burning • Placenta burial pit
Sharps	Syringes, needles, disposable scalpels and blades	• Incineration at sufficient temperature (>1000C) • Sharp pits
Liquid waste (corrosive and non-corrosive)	Solvents and disinfectants	• Non corrosive: can be disposed of through a closed sewage or septic system • Corrosive: carefully poured out in a rubbish pit and covered with fresh soil
Pharmaceutical and chemical waste	Can, bottles or boxes contained expired drugs/vaccines Laboratory reagents and disinfectants Organic solvents	Several options exist for small quantities: • Return expired pharmaceuticals to donor or manufacturer • Encapsulation and burial in a sanitary landfill • Chemical decomposition in accordance with manufacturer's recommendations if

Type of Waste	Details	Disposal
		chemical expertise and materials are available • Dilution in large amounts of water and discharge into a sewer for moderate quantities of relatively mild liquid or semi-liquid • Place in chemical resistant containers and send to specialised treatment facilities
Cytotoxic waste	Any medical product or chemically contaminated biological waste the possess properties of carcinogenic, toxic for reproduction or mutagenic	• Disposal options include: • Return to the original supplier • Incinerate at high temperature • Chemical degradation in accordance with manufacturers' instructions
Radioactive Waste	Glassware contaminated with radioactive diagnostic material or radio-therapeutic materials	• Encapsulation-lead box
Heavy Metals Waste	• Mercury from broken thermometers • Blood pressure gauges • Dentistry materials • Cadmium from discarded batteries	• Encapsulation
Non-recyclable/ Discarded pressurised containers	Spray cans	• Ensure containers are empty/depressurised before disposal • Containers with content should be returned to the manufacturer

The Zambian Infection Prevention Guidelines (2010) describe waste management as waste handling, segregation, storage, collection, transportation and disposal.

Adequate waste management requires that clear procedures and protocols be in place to ensure:

- Reduction in the quantity of health care waste generated;
- Appropriate point-of-generation identification and segregation of waste; and
- Correct handling, storage, and packaging of the different types of waste before their elimination, disposal or collection.

The following are key topics associated with appropriate waste management.

A) WASTE SEGREGATION AND STORAGE

Waste management starts with segregation of waste at the point of generation. Each health facility should have appropriate supplies to separate each type of waste, including infectious waste such as blood, human tissues, sharps and needles. It is recommended that colour-coded bins or plastic garbage bags be used—or at least labelled, as well as the use of sharps boxes. Waste coding should be done as follows:

- Yellow: Pathological and infectious waste
- Brown: Pharmaceutical, chemical
- Black: General waste

Storage and disposal are central issues. Waste should be properly stored in a well-ventilated enclosed shelter, protected from rain and rodents.

Specific storage spaces should be dedicated to *medical waste to be incinerated* (infectious waste, sharps and laboratory waste) and *non-hazardous waste to be collected.* Placentas, as human remains, are often subject to traditional beliefs and ceremonial practices, but are a primary source of infection transmission and a health risk. Placentas should be quickly removed from the facility and stored in a watertight container or plastic bags before being incinerated. Sharps, syringes, needles also represent a risk of infection and should be properly segregated and stored in dedicated sharp boxes before incineration.

All waste handling should be done using appropriate Personal Protection Equipment (PPE), such as gloves, safety boots, heat resistant overalls, respirators for breathing, facemasks and ear protection. The following segregation scheme could be recommended.

Type of Waste	Colour of Container and Markings	Type of Container
General Waste/Domestic	*Black*	Plastic bag
Pathological and Infectious Waste	*Yellow* marked “INFECTIOUS” with biohazard symbol	Strong, leak proof plastic bag or container capable of being autoclaved
Sharps	Marked ”SHARPS” with biohazard symbol	Puncture proof container, maximum ¾ full
Chemical and Pharmaceutical Waste	*Brown* labelled with appropriate hazard symbol	Plastic bag or rigid container
Radioactive Waste	Labelled with radiation symbol	Lead box

B) HAZARDOUS WASTE INCINERATION

The Zambian Infection Prevention Guidelines (2010) defines protocols for each type of waste management method, with an important focus on incineration. Most incineration in Zambia is done on-site. The concept of centralised (off-site) incineration, widely practised in higher income countries, is practiced in Zambia to a lesser extent, where hazardous waste produced at a small health facility will be transported to and disposed of by a larger incinerator at the District level.

Current challenges faced are the absence of incineration options at all health facilities, and where they do exist, often the incinerators are old or have been poorly maintained and therefore are not functioning properly. In addition, older models are generally less environmentally friendly (burning at lower temperatures, more smoke development) and less effective (one burning chamber instead of two, providing increased safety, fuel efficiency and plant productivity).

The advantages of a centralised incinerator system where multiple health centers share the incinerator are:

- Better value for money: Invest in fewer high performance incinerators with a larger capacity.
- Professionalised staff: Professionalise operation and maintenance of the incinerator with dedicated and trained staff.
- More effective use of the incinerator: An incinerator performs optimally if it is operated at a set temperature; cooling down and heating up reduces the lifespan of an incinerator significantly.
- Reduces pollution.

Newer, more effective models of incinerators have appeared on the market and should replace, older ones still in use in certain health facilities. For the acquisition and installation of new incinerators, it is necessary to define specifications and to guide in the choice of new models. Installation of incinerators at health facilitates should be needs-based and consideration of technical options such as on-site versus off-site, type and capacity of incinerator, appropriate staffing and cost effectiveness should all be taken into account.

Following an assessment of incineration processes conducted by UNICEF in February 2015, additional recommendations have been made:

- Define *technical specifications* to provide guidance in the choice of new models.
- Define and standardise the operation and maintenance of the equipment. This will ensure that the composition of each load is adequate, and that the right temperature and

burning duration are used. *Simplified Operating Procedures (SOP)* should be developed accordingly by the supplier to reduce misuse including issues with quantity, mix, temperature and duration.

- For the SOPs to be implemented correctly, training and guidance by the Ministry should be provided. Trainings should be provided to as many operators and staff as possible to ensure adequate staff are available for operation and to limit challenges associated with staff retention A monitoring team should be put in place to ensure that this costly equipment is properly used, effectively maintained and the waste efficiently burnt.

C) NON-HAZARDOUS WASTE DISPOSAL

Non-hazardous domestic waste are considered “safe” and should be collected by garbage collection contractors or services.

ANNEX 3: REVIEW OF INTERNATIONAL STANDARD OF WASH FOR HEALTH CARE FACILITIES

SOURCE OF INFORMATION	ACCESS TO SAFE & SUFFICIENT WATER
Essential environmental health standards in health care, Edited by John Adams, Jamie Bartram, Yves Chartier. WHO 2008. (p.26) WASH in Health Care Facilities. Status in low- and middle-income countries and way forward. WHO-UNICEF 2015	Provide safe drinking water from a protected groundwater source (spring, well or borehole), or from a treated supply, and keep it safe until it is drunk or used. Untreated water from unprotected sources can be made safer by simple means such as boiling or filtering and disinfection. **Water quantity**: 5–400 litres/person/day. Outpatient services require less water, while operating theatres and delivery rooms require more water. The upper limit is for viral haemorrhagic fever (e.g. Ebola) isolation centres. **Water access**: On-site supplies. Water should be available within all treatment wards and in waiting areas. **Water quality:** Less than 1 Escherichia coli/ thermos-tolerant total coliforms per 100 ml. Presence of residual disinfectant. Water safety plans in place. **Drinking water**: All health care facilities provide all users with basic drinking water supply.
Monitoring matrix for health officers on WASH, Rajasthan, India, 2014	Potable water for personal hygiene, medical activities, cleaning and laundry safe for the purpose intended. Water quantity Sufficient water is available throughout the health-care facility at all times for infection control, medical activities, cleaning, laundry, personal hygiene, and drinking and food preparation purposes. Sufficient water-collection points and water-use facilities are available in the health-care facility to allow convenient access to water for medical activities, infection control activities, drinking, personal hygiene, food preparation, laundry and cleaning.
National Infection Prevention and Control Guidelines for Health Care Services in Kenya. Ministry of Public	Clean running water in Routine Hand Washing section p. 18 with an end-page note detailing the definition of clean running water: Clean water refers to natural or chemically treated and filtered

SOURCE OF INFORMATION	ACCESS TO SAFE & SUFFICIENT WATER
Health and Sanitation and Ministry of Medical Services, Republic of Kenya. December 2010	water that is safe to drink and use for other purposes (washing hands and cleaning medical instruments). Clean water has zero level of microorganisms, including bacteria, viruses, and parasites; has low turbidity; and has a minimum level of disinfectants, disinfectant by-products, and organic materials. If running water is not available, a bucket with a tap or a bucket with a pitcher can be used. Handling utensils section on the needs to wash. (p. 48) In the Environmental Management Practices section 7 (p.51) , it is specifically stated that facility design and planning should ensure the adequate supply of safe water as number one of the list.
The National Infection Prevention and Control policy & strategy, Health department, Republic of South Africa. April 2007	First and only mention of water is about ensuring environmental safety outside the hospital. (16.20.4, p.26)
National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania, The United Republic of Tanzania, Ministry of Health, July 2004	Improving hand hygiene practice in section 7.4 (p.22) mentions the need for the provision of water supply, provision of facilities for running water. Good water supply to clean waste storage. (p.45) Clean water supply for Central sterilization supply department. (p.61)
National Infection Prevention and Control Guidelines, Ministry of Health and Child welfare, Zimbabwe. May 2013	Water supply for hand washing (p.49), for cleaning purpose (p.109)
Essential environmental health standards in health care, Edited by John Adams, Jamie Bartram, Yves Chartier. WHO 2008. (p.26) WASH in Health Care Facilities. Status in low- and middle-income countries and way forward. WHO-UNICEF 2015	Provide water for hand washing after going to the toilet and before handling food, before and after performing health care. This may be done using simple and economical equipment, such as a pitcher of water, a basin and soap, or wood ash in some settings. A reliable water point with soap or alcohol based hand rubs available in all treatment areas, waiting rooms and near latrines for patients and staff.

SOURCE OF INFORMATION	ACCESS TO SAFE & SUFFICIENT WATER
	All health care facilities provide all users with hand washing and menstrual hygiene facilities.
Monitoring matrix for health officers on WASH, Rajasthan, India, 2014	Sufficient functional hand washing facilities are available in the health-care setting and correct hygiene is encouraged by hygiene promotion activities and by management of staff, patients and carers.
National Infection Prevention and Control Guidelines for Health Care Services in Kenya. Ministry of Public Health and Sanitation and Ministry of Medical Services, Republic of Kenya. December 2010	In case of unavailability of hand washing facilities (p.25): Make running water available. Make hand-washing facilities available in rooms where health care procedures are performed. Make soap and disposable towels available in adequate and continuous supply. Make waterless antiseptic agents available in wall-mounted dispensers. In the Environmental Management Practices section 7 (p.51), it is specifically stated that facility design and planning should ensure adequate hand-washing facilities as number 4 of the list behind space issues. Hand washing Basins Health care facilities must have adequate hand-washing basins, with a minimum of one per patient room, procedure room, and exam room. Each six-bed cubicle must have at least one sink. Each sink should be large enough to avoid splashing and prevent contamination by bacteria that are resident in the drain. Sinks must be sealed to the wall or placed far enough from the wall to allow effective cleaning. They should be located near the entrance or exit for easy access by HCWs. The surrounding area must be nonporous to resist growth of fungus. Taps and soap dispensers should be fitted with hands-off controls, that is, controls that can be operated by elbow, knee, or foot. Elbow-operated systems are preferable because they are less prone to breaking down. Where resources allow, electronically generated systems should be considered.

SOURCE OF INFORMATION	ACCESS TO SAFE & SUFFICIENT WATER
THE NATIONAL INFECTION PREVENTION AND CONTROL POLICY & STRATEGY, Health department, Republic of South Africa. April 2007	13.2 (p.15) Sufficient hand washing facilities have to be ensured by the Department of Public Works in the planning and construction process. 16.13 (p.21) The role/ responsibility of the (health care facility) Infection Prevention & Control Committee: 6. Identify structural needs for infection prevention and control and make related inputs into plans for new buildings and renovations in collaboration with the facility's Management and/or Maintenance Unit. The related inputs will amongst others, include the location of suitable hand washing basins, soap and alcohol dispensers, intermediate and central waste storage facilities, isolation rooms, food handling areas, and clean and dirty linen areas.
NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES FOR HEALTHCARE SERVICES IN TANZANIA, The United Republic Of Tanzania Ministry Of Health. July 2004	Hand washing is present in the Standard Precautions section 6.0 (p.16) defining protocols. And section 7.0 on Hand hygiene: Hand washing includes care of hands, nails, skin, and the use of lotions and surgical scrub. Failure to perform appropriate hand hygiene is considered to be a leading cause of nosocomial (hospital-acquired) infections and the spread of multi-resistant microorganisms, and has been recognized as a significant contributor to outbreaks of disease (Boyce and Pittet 2002).
NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES, Ministry of Health and Child welfare, Zimbabwe. May 2013	Hand washing as Standard precautions p.7 In engineering controls: Hand washing facilities, readily accessible to staff wherever occupational exposure may occur (soap, running water, paper towels, bin for disposal of used towels) p.33 Annex 1: Organization of IPC in HCF: It is the responsibility of the IPC committee to verify whether recommended practices are being adhered to, i.e. hand washing, decontamination, disinfection and sterilization. Annex 2: Hand washing guidelines (SOP) p.40

SOURCE OF INFORMATION	ACCESS TO BASIC SANITATION
Essential environmental health standards in health care, Edited by John Adams, Jamie Bartram, Yves Chartier. WHO 2008. (p.26) WASH in Health Care Facilities. Status in low- and middle-income countries and way forward. WHO-UNICEF 2015	Provide basic sanitation facilities that enable patients, staff and carers to go to the toilet without contaminating the health-care setting or resources such as water supplies. This may entail measures as basic as providing simple pit latrines with reasonable privacy. **Sanitation quantity**: 1 toilet for every 20 users for inpatient setting. At least 4 toilets per outpatient setting. Separate toilets for patients and staff. **Sanitation access**: On-site facilities. Sanitation facilities should be within the facility grounds and accessible to all types of users (females, males, those with disabilities). **Sanitation quality**: Appropriate for local technical and financial conditions, safe, clean, accessible to all users including those with reduced mobility. Toilets should be built according to technical specifications to ensure excreta are safely managed.
Monitoring matrix for health officers on WASH, Rajasthan, India, 2014	Sufficient numbers of adequate, accessible, appropriate and safe toilets are provided for patients, staff and carers
National Infection Prevention and Control Guidelines for Health Care Services in Kenya. Ministry of Public Health and Sanitation and Ministry of Medical Services, Republic of Kenya. December 2010	In the Environmental Management Practices section 7 (p.51), it is specifically stated that facility design and planning should ensure Adequate sanitary facilities as number 5 of the list.
THE NATIONAL INFECTION PREVENTION AND CONTROL POLICY & STRATEGY, Health department, Republic of South Africa. April 2007	Sanitation only appears once in the Section 2 concerning the strategy, in the introduction part. Toilets are never mentioned!
NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES FOR HEALTHCARE SERVICES IN TANZANIA, THE UNITED REPUBLIC OF TANZANIA MINISTRY OF HEALTH, JULY 2004	Nothing on sanitation 10.3.11 Waste water >Effluents of all medical analysis laboratories shall always be neutralized in a buffer tank before being drained off into the sewer. >Radioactive effluents of isolation wards shall be discharged

SOURCE OF INFORMATION	ACCESS TO BASIC SANITATION
	into the sewer or into a septic tank only after it has decayed to background level in adequate retention tanks. Toilets are only mentioned to be cleaned.
NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES, Ministry of Health and Child welfare, Zimbabwe. May 2013	No mention of sanitation hands to be washed after toileting (p.40, 41) toilet facilities to be separate from affected patients (p.63) toilets to be cleaned (p.87, 91...) PPE and cleaning solutions for toilets (p.88, 89)
Essential environmental health standards in health care, Edited by John Adams, Jamie Bartram, Yves Chartier. WHO 2008. (p.26)	Provide safe health-care waste management facilities to safely contain the amount of infectious waste produced. This will require the presence of colour-coded containers in all rooms where wastes are generated
Monitoring matrix for health officers on WASH, Rajasthan, India, 2014	Health-care facility wastewater is disposed of rapidly and safely. Health-care waste is segregated, collected, transported, treated and disposed of safely.
National Infection Prevention and Control Guidelines for Health Care Services in Kenya. Ministry of Public Health and Sanitation and Ministry of Medical Services, Republic of Kenya. December 2010	In the Environmental Management Practices section 7 (p.51), it is specifically stated that facility design and planning should ensure Appropriate facilities and practices for waste management at the end of the list. Health care waste is a potential reservoir of pathogenic microorganisms and requires appropriate, safe, and reliable handling. Safe management of health care waste is a key issue in controlling and reducing HAIs. There should be a person or persons responsible for the organization and management (collection, storage, and disposal) of waste. Waste management should be conducted in coordination with the infection-control team. (p.58)

THE NATIONAL INFECTION PREVENTION AND CONTROL POLICY & STRATEGY, Health department, Republic of South Africa. April 2007	Wastes are mentioned many times but just to say that they should be well manage, (i.e. handling, treatment, conditioning, storage, transportation and disposal) (p.9, for instance) Appropriate handling and disposal of wastes by food services p.24 Develop, in collaboration with the facility's Waste Manager and the Infection Prevention & Control Team, policies for collection, transport and disposal of different types of waste (e.g. containers, frequency).
NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES FOR HEALTHCARE SERVICES IN TANZANIA, THE UNITED REPUBLIC OF TANZANIA MINISTRY OF HEALTH, JULY 2004	Waste management at health facility level Safe management of healthcare waste (HCW) is a key issue to control and reduce nosocomial infections inside a hospital and to ensure that the environment outside is well protected. Wastes from hospitals and healthcare facilities may be contaminated (potentially infectious) or non-contaminated. Approximately 85% of the general wastes produced by hospitals, clinics and other health facilities is non-contaminated waste and poses no infectious risk to the person who handles it. Some wastes from healthcare facilities, however, are hazardous (intrinsic potential properties or ability of any agent, equipment, material or process that can cause harm). If not disposed of properly, contaminated waste may carry microorganisms that can infect people who come in contact with it, as well as the community at large. Healthcare waste management procedures -Minimization of the quantity of HCW generated by the HCF -Segregation and identification of hazardous HCW from non-risk HCW -Adequate packaging and safe storage of the different HCW -Proper treatment and disposal of hazardous and non-risk HCW (intentional burial, deposit, discharge dumping, placing or release of any waste material into the air, or on land or water. Disposal is undertaken without the intention of retrieval)
NATIONAL INFECTION PREVENTION AND CONTROL	Section I: Organization of IPC at HF: IPC team to ensure sound management of medical waste (p.2).

GUIDELINES, Ministry of Health and Child welfare, Zimbabwe. May 2013	Standard Precautions: waste disposal p.6 Medical waste disposal p.11 Section VII: Healthcare facility waste management p.29: The guidelines outline procedures for the classification, segregation, safe packaging (containment), labelling, storage, transport and disposal of clinical and related waste. They are intended to assist authorities and practitioners as well as other people involved (whether directly or indirectly) in determining an appropriate waste management strategy. The unique and specific factors applicable to each situation, the local conditions, requirements and regulations, the type and the volume of waste generated should all be taken into account when formulating facility based standard operating procedures. Annex 10: HCF Waste Management Procedures p.101

ANNEX 4: CHLORINE PRODUCTION UNITS (CPU)

The operation of the units to produce bleach is based on the simple and manageable process of electrolysis to convert a solution of salt and water into sodium hypochlorite (6g/l of active chlorine).

This technology is considered a good value for money, as it only needs clear water, kitchen salt and a source of electricity, and eventually this technology will be made available through solar panels. This local production will meet the health facility's demand for drinking water, disinfection and cleaning and will make it independent from external suppliers. Moreover, the extra production can always be distributed in an afterbirth package to promote hygiene, or even be sold at low price to the community generating income for the facility at the same occasion (when bottled appropriately).

A training session will be conducted by the manufacturer to train health facility workers, Environmental Health Technicians and other related staff who will be able to cascade train other staff.

Examples of use:

- *Disinfect wounds: At 6g/l, the concentration is equivalent to a Dakin's solution, an antiseptic developed to treat infected wounds.*

  Stronger germicidal solutions, such as those containing carbolic acid (phenol) or iodine, either damage living cells or lose their potency in the presence of blood serum. Dakin's solution has neither disadvantage; its solvent action on dead cells hastens the separation of dead from living tissue.

- *Disinfect soiled materials: At full concentration, the solution can also disinfect soiled materials like linen or laboratory instruments from faeces and vomit.*

  Material should be soaked during 30minutes before rinsing and drying.

- *Disinfect the water supply:* With a sodium hypochlorite solution of 6g/l concentration, only 2,5ml is necessary to treat 10l of water to make it safe to drink.

	Volume of water to be treated		
	10l	**20l**	**100l**
6g./l.	2,5ml	5ml	25ml

After 30mn, this treated water has to be tested to detect residual chlorine.

- ***Floor cleaning:*** For cleaning surfaces like floors, bathrooms and latrines, a ratio of 1 volume of chlorine for 3 volumes of water is necessary.

  Delivery needs: 5l of sodium hypochlorite is estimated to be necessary[30] in the whole process of giving birth.

Testing solution concentration:

The testing protocol is to mix 5ml of the treated water with a drop of reactive liquid (provided with the electro-chlorinator) and to check the colour. The colour should show a rate between 0.5 to 1ppm, enough to kill microbes but not too much for human consumption, in accordance with WHO recommendations.

If the colour is too light, it means that the concentration is not strong enough. Chlorine should be added and the test re-done after 30mn.

If the colour is too dark, it means that the concentration is too strong. Reduce the quantity of chlorine and re-do the test after 30mn.

Summary of Applications and Adapted Concentration

(ex. of WATA Chlorine Production Unit producing 6g/l)

[30] *Based on experiences in Burkina Faso (Antenna)*

ANNEX 5: SIZING AND SPECIFICATIONS OF INCINERATORS

The most important element when choosing an incinerator is the burning rate. Needs are to be determined by the amount of waste produced/to be incinerated per day—specifically medical waste including sharp boxes and placentas.

Recommended incinerator specifications following Zambia Environmental Management Agency [31]

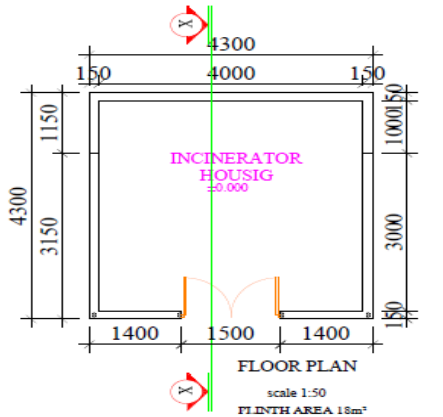
Combustion efficiency (CO2x100)/(%CO2+%CO)	99%
Single Chamber	Minimum of 1100C
2 Chambers	Minimum of 800C in 1st Chamber & 1100C in 2nd Chamber
Temperature monitoring	Must have temperature control & Temp monitor
Feed Mode (Manual)	Feed ram for safety operation and more efficiency for each loading process
Smoke Filter	Must have smoke filter Chamber
Chimney Type	clear of highest point of building by 6 m for flat roofs and 3 m for pitched roofs
Chimney Height	9m minimum from ground level
Emission limits proved with certified test results	✓ Opacity of the smoke shall not exceed 20%.
	✓ All the emissions to air other than steam or water vapour shall be odorless and free from mist, fume and droplets.
	✓ All pollutants concentrations shall be expressed at 273K, (0 C) and 101.3kPa (1 atmosphere) dry gas and 11% oxygen.
	✓ ECZ shall require that the holder of a licence to emit air pollutants carries out tests to determine stack and/or ground level concentrations of the following substances:
	✓ Maximum of 0.05mg/m (as measured in the chimney) for:
	❖ Cadmium and compounds
	❖ Mercury
	❖ Thallium
	✓ Maximum of 0.5mg/m (as measured in the chimney) for:
	❖ Chromium
	❖ Beryllium
	❖ Arsenic
	❖ Antimony
	❖ Barium
	❖ Lead,
	❖ Silver
	❖ Cobalt
	❖ Copper
	❖ Manganes
	❖ Tin
	❖ Vanadium
	❖ Nickel
Power	Electric & Diesel

[31] *Environmental Council of Zambia, year unknown, Minimum Specifications for Health Care Waste Incineration, Lusaka, Zambia*

Brick-type small-scale incinerator (example Montfort type)

Small Scale Incinerators (SSIs) are designed to meet an immediate need for public health protection where there is no access to more sophisticated technologies. This type of incinerators has little or no pollution control and should be used only in response to an immediate need to destroy infectious waste and be viewed as a short-term interim solution until cleaner state-of-the-art technologies are available. Nevertheless brick-type SSIs are relevant for those HFs where there is no real other alternative besides dumping. The main issue associated with this type of incinerators is that it is difficult to meet the Zambian environmental standards regarding air emissions. A commonly seen type of brick-type SSI is the De Montfort SSI, which is a simple two-chamber natural-draught incinerator designed to be operated at temperatures of 800 C and higher. The performance of the incinerator will vary depending on the moisture content of the medical waste but a throughput of up to 15kg/hour can be achieved.

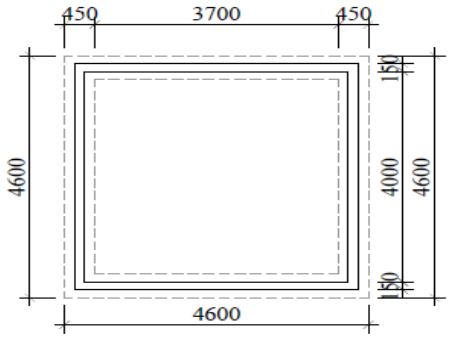
ANNEX 6: INCINERATOR HOUSING AND SOLID WASTE STORAGE: EXAMPLE OF DESIGN



FLOOR PLAN

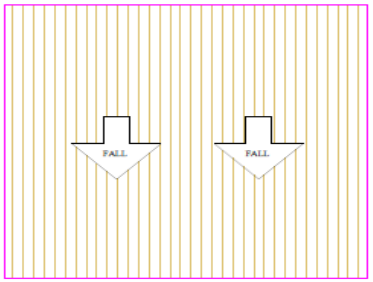
scale 1:50

PLINTH AREA 18m²



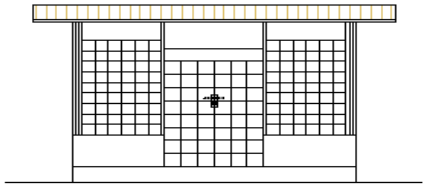
FOUNDATION PLAN

scale 1:50



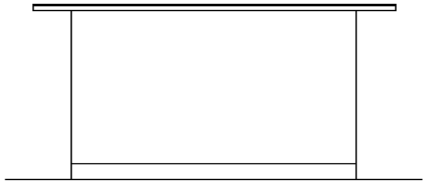
ROOF PLAN

scale 1:50



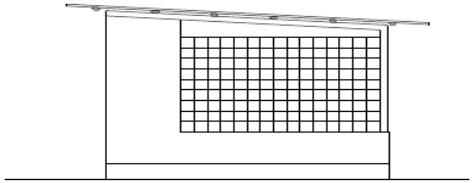
FRONT ELEVATION

scale 1:50



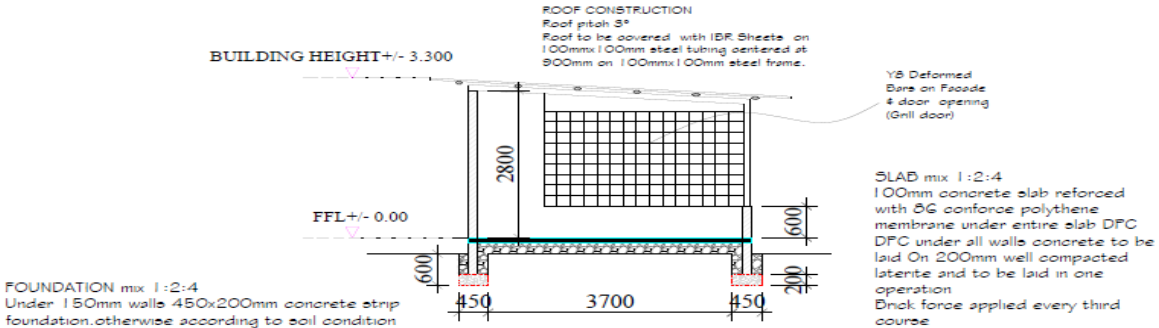
REAR ELEVATION

scale 1:50

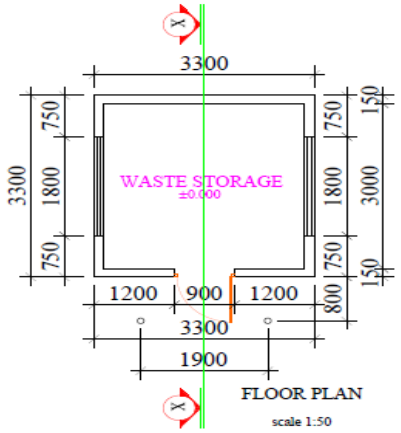


TYPICAL SIDE ELEVATION

scale 1:50



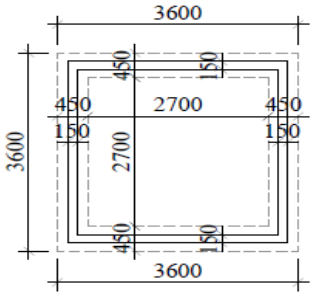
SECTION X-X
scale 1:50



FLOOR PLAN

scale 1:50

PLINTH AREA 11m²



FOUNDATION PLAN

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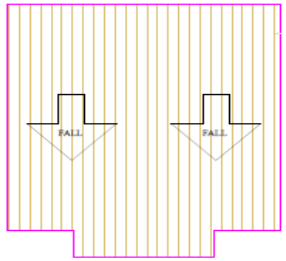
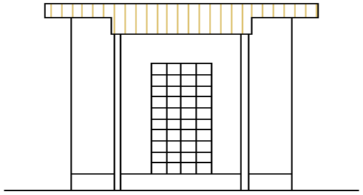


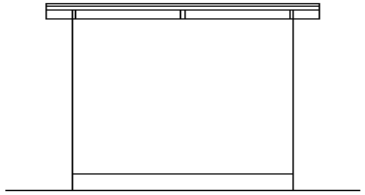
ROOF PLAN

scale 1:50



FRONT ELEVATION

scale 1:50



REAR ELEVATION

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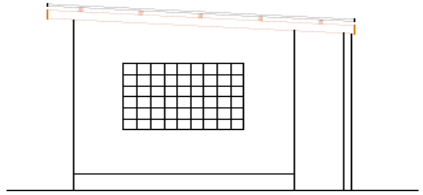
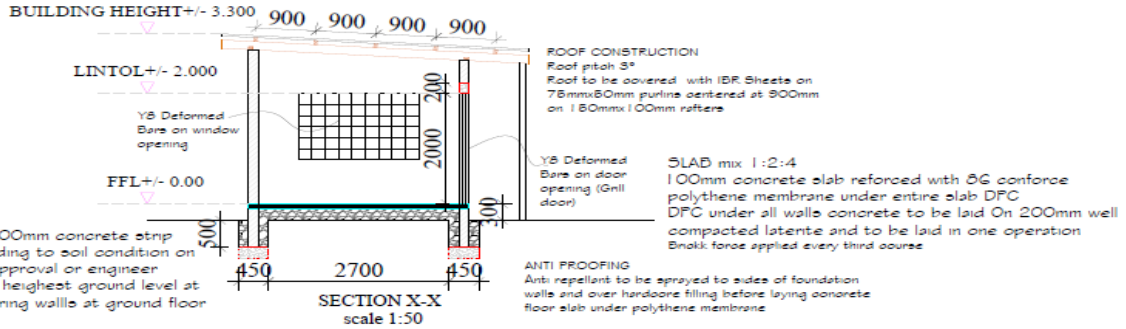


TYPICAL SIDE ELEVATION

scale 1:50



SECTION X-X

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Millennium Development Goal Initiative

Accelerating the Reduction of Maternal, Neonatal and Child Mortality

MDGi: A Joint Programme of the Government of the Republic of Zambia – European Union – United Nations