



Sanitation Safety Plan for the Collection and Transportation of Faecal Sludge from Kamwokya II Ward, Kampala Capital City Authority, Uganda.



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Abbreviations

CIDI:	Community Integrated Development Initiatives
FSM:	faecal Sludge Management
GIZ:	Deutsche Gesellschaft für Internationale Zusammenarbeit
KCCA:	Kampala Capital City Authority
MakSPH:	Makerere University School of Public Health
NEM:	National Environment Management Authority
NGOs:	Non-Governmental Organizations
NWSC:	National Water and Sewerage Corporation
PPE :	Personal Protective Equipment
RRR:	Resource Recovery and Reuse
RUWASS:	Reform of the Urban Water and Sanitation Sector
SDC:	Swiss Development Co-operation
SSP	Sanitation Safety Planning
UBOS:	Uganda Bureau of Statistics
VHTs	Village Health Teams
WFP:	Water for People
WHO:	World Health Organization
WSP:	Water and Sanitation Program

Executive Summary

Introduction

Sanitation issues are some of the most significant development challenges for Kampala City, Uganda. Like many other capital cities in developing countries, Kampala is experiencing rapid population and economic growth. However, provision of key services including adequate sanitation for the city population has not been in tandem with these developments. Kampala Capital City Authority (KCCA) with support from the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH GIZ Reform for the Urban Water And Sanitation Sector (RUWASS) programme aims to improve faecal sludge management (FSM) and implement a number of economically viable “Resource Recovery and Safe Reuse” (RRR) business models while public health and environmental implications are properly addressed.

Methodology

The Sanitation Safety Planning (SSP) identifies health risks associated with collection and transportation of faecal sludge using cesspool emptier and gulpers, and identifies what control measures are needed for safeguarding the health of the workers and community members. We followed the steps for developing the SSP as recommended in the Sanitation Safety Planning Manual (WHO, 2015). In collecting the required information, a combination of methods were used which included; desk review of literature, field observations, Focused Group Discussions.

Key findings of the risk control measures

Workers involved

Most of the identified risks to workers can be minimized by: providing appropriate Personal Protective Equipment (PPE); sensitization of workers on hygiene and work place safety, provision of key hygiene facilities (Soap dispenser, Hand washing facility), appropriate equipments or tools and supplies like detergents and soap and enforcement

Community members, users and children

Sensitization of community members, users, children on hygiene, proper use, maintenance and construction of appropriate sanitary facilities, extending distribution of piped water, programmes in schools highlighting maintenance and safety of sanitary facilities, restricted entry during emptying and enforcement

Sanitation Safety Plan for Collection and Transportation of Faecal Sludge from Kamwokya II Ward, Kampala Capital City Authority, Uganda.

1. Introduction and Background

Sanitation issues are some of the most significant development challenges for Kampala City, Uganda. Like many other capital cities in developing countries, Kampala is experiencing rapid population and economic growth. However, provision of key services including adequate sanitation for the city population has not been in tandem with these developments. KCCA with support from the RUWASS programme aims to improve faecal sludge management (FSM) and implement a number of economically viable “Resource Recovery and Safe Reuse” (RRR) business models while public health and environmental implications are properly addressed. At the same time, KCCA seeks to strengthen the legal and institutional framework for sanitation management including private sector engagement in faecal sludge collection and transport (FS C&T) in the city. The interventions focus on 3 primary results:

1. The legal and institutional framework for private sector engagement in Kampala’s sanitation sector is strengthened;
2. Safe and financially sustainable RRR business pilots are established in Kampala:
 - a. Coaching 1 – 2 existing businesses to extend their current business scope with a RRR business component,
 - b. Coaching 2 – 3 start-up entrepreneurs to establish a RRR business;
3. SSP (as described in “Sanitation Safety Planning” and the 2006 WHO Guidelines) is put in practice by businesses and the knowledge of the responsible authorities of SSP is strengthened.

The overall goal of the SSP component is twofold:

- SSP becomes one of the standard management and monitoring tools in the sanitation sector in Kampala.
- Risk control measures (treatment and non-treatment barriers) along the sanitation value chain are in place in Kampala in order to:
 - (i) reduce exposure during, use of sanitation facilities, collection handling and disposal of faecal sludge and,
 - (ii) minimize contamination of fresh water resources.

To work towards these objectives, the project is going to support KCCA and local government personnel to put SSP into practice in a minimum of 1 but up to 5 pilot wards in Kampala, in order to get familiar with the concept as well as recognize its added value to sanitation safety

planning. Furthermore, all selected businesses that are supported in the framework of this project are going to integrate SSP into their planning process. The project intends to implement its objectives mainly through long-term advisory services, coordination of actors and processes within the sector as well as capacity building and piloting of RRR business models.

Therefore a consultant was out sourced to develop the SSP and also support KCCA in its implementation in order to ensure safe handling and reuse of wastewater, excreta and grey water in RRR businesses and projects.

The assignment had two key objectives:

1. **Objective No. One:** To develop and implement sanitation safety plans in one pilot ward in Kampala. The aim here is to promote SSP awareness, determine the applicability of SSPs at parish level and establish whether it is relevant for community health and development
2. **Objective No. Two:** Assessment of the current Environmental and Public Health inspection tools used by KCCA, identify ways of improving them to incorporate the core SSP aspects into the KCCA's day to day processes.

This report is focusing on Objective No. One of this assignment.

Specific objectives under Objective one include:

- Support KCCA, GIZ RUWASS and parish leaders in the selection of suitable members of the SSP Task teams in one of the selected parish.
- Support KCCA, GIZ RUWASS and the established SSP Task Teams in the development of appropriate SSPs for the different sanitation systems in one of the selected pilot parish in Kampala.
- Support GIZ RUWASS in implementing SSP in one of the selected pilot parish in Kampala.
- Serve as a link between GIZ RUWASS, WHO and the selected SSP Task Teams in order to ensure the successful implementation of SSP in the selected pilot parish.
- Support the SSP Task Teams of the selected pilot parish in conducting SSP (e.g. support analysis, in development of work-plans, follow-up on scheduled meetings, deliverables etc.).

Financial support and other resources

The cost of developing and implementing Sanitation safety plan (SSP) has been covered by Swiss Development Cooperation (SDC) and the Germany cooperation. The implementation of

the sanitation safety will be financed mainly by Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH-GIZ.

2. Steps for developing a Sanitation Safety Plan (SSP)

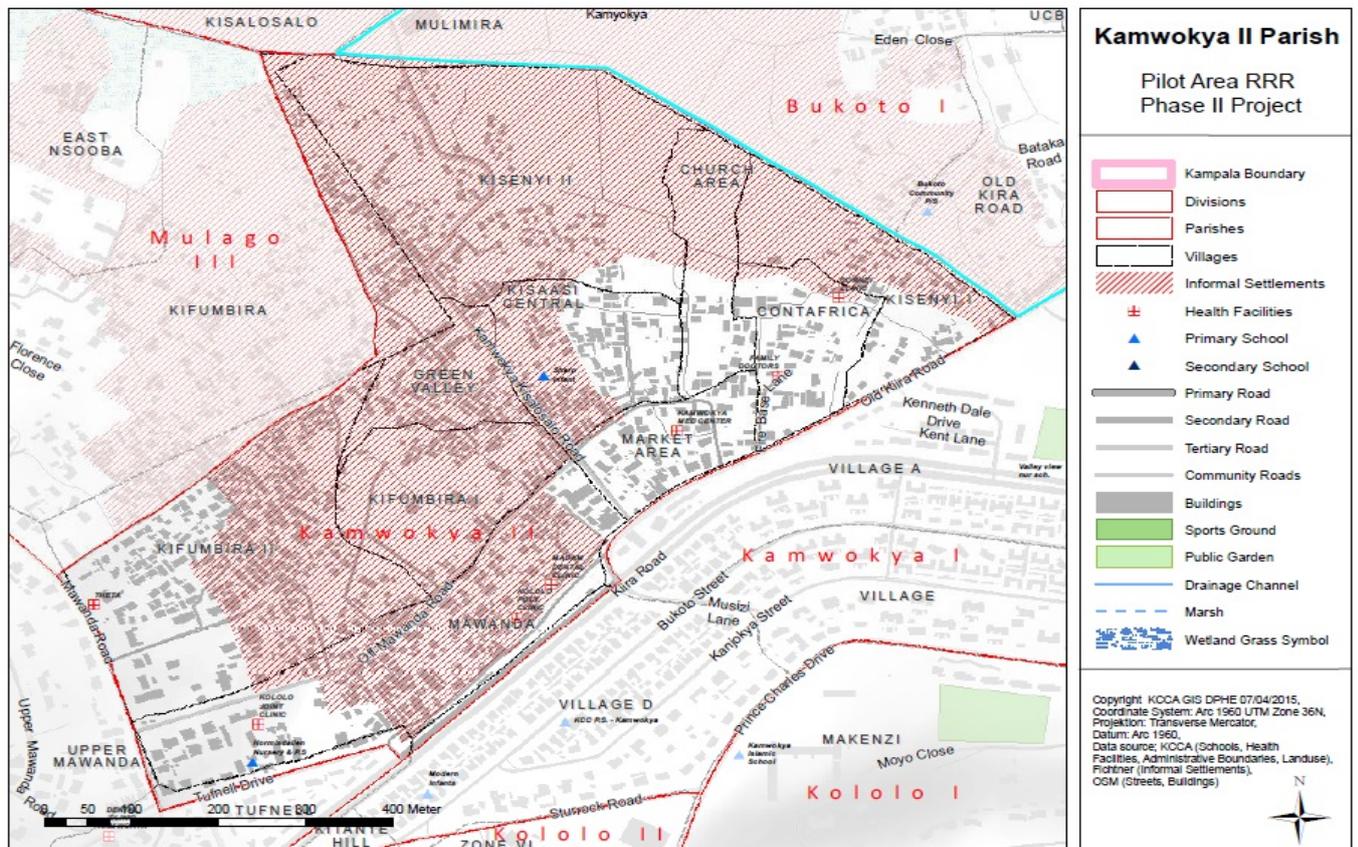
- Step1. Preparing for sanitation safety planning (Priority area, steering committee, specific objectives etc.)
- Step2. Describe the sanitation system
- Step3. Identify hazardous events; assess existing control measures and exposure risks
- Step4. Develop and implement an incremental improvement plan
- Step5. Monitor control measures and verify performance
- Step6. Develop supporting programmes and review plans

Step 1: Preparing for sanitation safety planning.

1.1 Priority area

Location: Kamwokya II parish (Figure 1) was selected. It is a peri-urban town found in central division, Kampala city, Uganda. It was selected because it is an informal settlement with a low lying area mainly in a reclaimed wetland with a high water table. The area is also densely populated, congested and characterized with poor sanitation (KCCA/GIZ, 2016). Most of the residents are of poor economic status. Kamwokya II parish or ward has a total of 10 villages with a projected population of 23,466 people and an estimated number of 6,705 households (UBOS, 2014). Access to emptying services is very low. Therefore, it is one of the highest risk areas and most in need of immediate action and lessons learnt can largely be applied to other towns. The zones (villages) in Kamwokya II are; Green Valley, Market area, Church area, Contafrica, Kisenyi I, Kisenyi II, Kifumbira I, Kifumbira II, Mawanda and Kisasi Central

Figure 1: Map of Kamwokya II Parish or Ward



Key challenges faced with emptying onsite sanitation systems in kamwokya II Parish include:

- Faecal sludge collection is poorly regulated
- Unsanitary facilities
- Most pit latrines are unlined,
- Latrines are filled with solid wastes
- The water table is high
- Unhygienic manual emptying and overflows to drainage systems are widespread
- Illegal dumping into storm water drains and open areas is common
- Abandoned (full) sanitary facilities
- The construction (and/or design) of most toilets does not cater for the latrine emptying process.
- Rapid filling of pit latrines

- Indiscriminate disposal of solid waste
- Open defecation
- Lack of suitable access in sanitary lanes for latrine emptying equipment.
- Workers involved in the emptying services rarely wear personal protective equipment.
- Low awareness levels of community members and workers involved in emptying services on sanitation and hygiene (PPE).

Steering committee: The steering Committee comprised of representatives from Kampala capital city Authority (KCCA), National water and sewerage corporation (NWSC), local leaders or Village Health Teams (VHTs) from each village in Kamwokya II Parish, faecal sludge emptying Associations (gulping, cesspool emptiers), National Environment Management Authority (NEMA), Local NGOs involved in faecal sludge management, GIZ and a consultant from Makerere University school of public health (MakSPH).

1.2 The set objectives of the SSP.

1.2.1 General objective

To improve public health outcomes from the collection, treatment, reuse and/or disposal of human wastes

1.2.2 Specific objectives

1. To ensure safe and sanitary collection, transport and disposal of household faecal sludge in Kamwokya II parish.
2. To protect the health of informal and formal municipal sanitation workers involved in collection and transport of faecal sludge.
3. To protect the local community members from getting exposed to hazardous events related to improper collection and transport of household human waste.
4. To promote and apply safe use of sanitation facilities (technical and behavioural component)
5. To assist in prioritizing occupational health related investments in Kamwokya II Parish.

1.3 Define the Sanitation safety plan boundary and Lead organisation:

Administratively, the plan covers all the zones (villages) in Kamwokya II parish but may include surrounding downhill area of Kyebando and the entire sewerage system.

Operationally, it will cover faecal sludge containment, collection and transport from on-site facilities. Final disposal and treatment is already being handled by another SSP developed by National Water and Sewerage Corporation (NWSC). The lead organization will be Kampala Capital City Authority (KCCA)

1.3.1 Scope and extent of this SSP

This SSP will cover users of the sanitary facilities, the emptying and transportation process (including any illegal dumping along the way) up to the transfer stations. Final disposal and treatment is already being covered by another SSP developed by National Water and Sewerage Corporation (NWSC).

1.4 Assemble the team.

Key stakeholders;

The lead organization will be Kampala Capital City Authority (KCCA) in collaboration with GIZ. It is the regulatory Authority mandated with provision of services in the city.

Table 1 shoes other important stakeholders who need to be part of the SSP team and their respective roles

Table 1: Key Stakeholders and their roles in SSP

Key Organizations/stakeholders (representatives of :	Main role in the sanitation safety planning team	Names of the representatives and contact information
Kampala Capital City Authority (KCCA)	Team leader	Dr.Najib Lukooya (Environment manager), Mr. Byansi Jude Zziwa (Sanitation Supervisor), Mr. Richard Mutabazi (Waste and Sanitation Officer), Mr. Oporia Frederick (Health Inspector) and Ms. Beatrice Nakibuka (KCC Ward Administrator)
National Water and Sewerage cooperation (NWSC)	Sewage collection and treatment	Mr. Enos Malambala
Water for People (WFP) project (NGO working with people affected by the system)	Faecal sludge collection, transportation and awareness creation	Ms.Cate N. Nimanya
CIDI (NGO working with people affected by the system)	Marketing and Creation of awareness regarding SSP and RRR Project.	Ms. Hellen Kasirye and Mr. Muwonge Mubiru
Operators of Cesspool/latrine emptier (affected by the actions taken)	Faecal sludge collection, transport and disposal	Mr. Matovu Jafari
Local community representatives or Local leaders from each Village within Kamwokya II Parish]	Gives information on management of human waste and monitoring of SSP implementation	Ms. Tebandeke Jennifer (Kamwokya Central), Ms. Namuyomba Haawa (Kamwokya Market), Mr. Waigolo Francis (Church zone), Ms. Nyangoma Teddy (Kifumbira II), Mr. Ddamulira Paul (Green Valley), Mr. Nsungwa Charles (Kifumbira II), Ms. Nyangoma Teopista (Kifumbira I), Kasule Rashid (Mawanda), Nabukenya Aisha (Mawanda), Ms.Katana Goretti (Kisenyi I), Mr. Musaazi Edward (Kisenyi I)
Local consultant from Makerere university, school of Public health	Risk assessment, monitoring and evaluation Education, training	Mr. Abdullah Ali Halage

Step 2: Describe the sanitation system

2.1 Map the system

Figure 2 shows a flow diagram of the system. Table 2 summarises the exposure groups.

Figure 2: Process flow diagram for faecal sludge collection, transport and disposal using guplers and mechanical vacuum Cesspool trucks. Schematic diagram

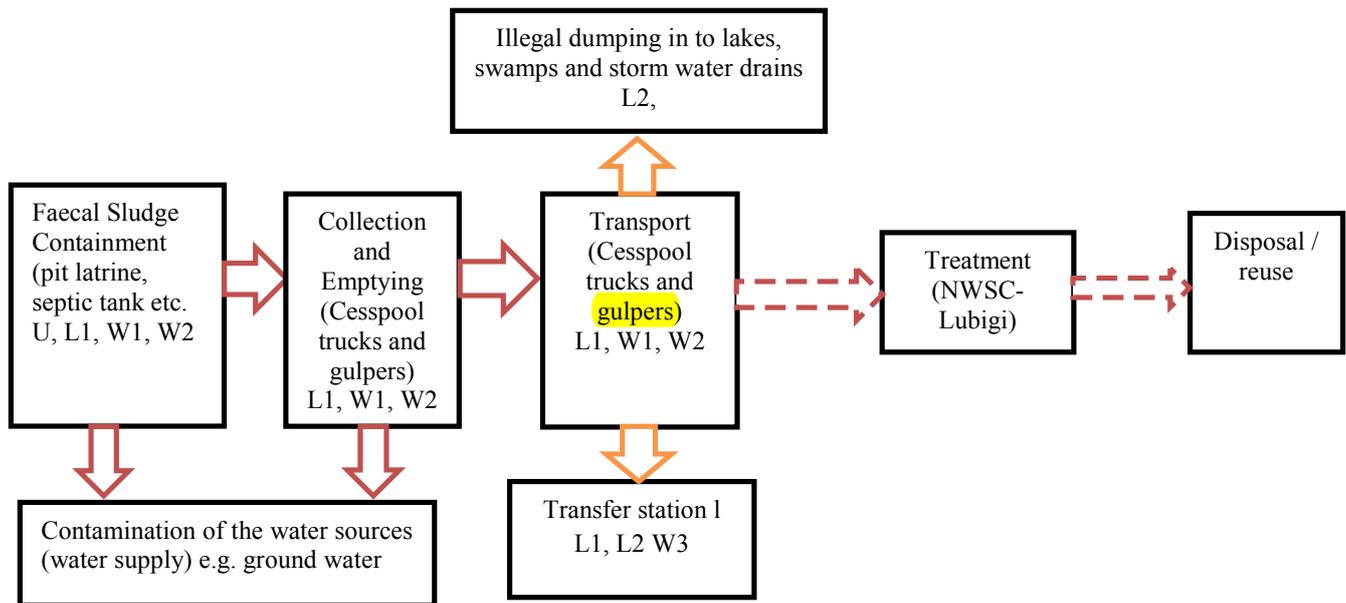


Table 2: Exposure Groups

W1	Workers involved in collection of Faecal sludge using Cesspool trucks
W2	Workers involved in collection of Faecal Sludge using guplers
W3	Workers involved in maintenance of the transfer stations
M	Residents or people involved in manual emptying
L1	Local community Living adjacent to the latrines being emptied
L2	Neighbouring community
U	Users of the facilities

Waste generation

It is estimated that more than 90% of Kampala's population relies on on-site sanitation facilities (WSP, 2014). In Kamwokya II parish, 65% of the households share latrines 24% use septic tanks, 18% use lined traditional pit latrine, 28% use unlined pit latrine, 24% use lined VIP latrine and 6.0% use unlined VIP latrine (KCCA/GIZ, 2014). Pit latrines are filled with solid wastes, and hard to access for emptying services, ultimately leading to filled-up facilities that are either abandoned or directly emptied into the environment, posing health and environmental risks for the city and its people (KCCA/ GIZ, 2014). About 900m³ of FS is generated in Kampala every day, of which only 390m³ is collected, representing a collection rate of 43% (KCCA; 2014). When some of these onsite facilities are full (depth<1 meter), some are abandoned, however the majority are emptied by vacuum tankers (cesspool trucks) and some gulpers belonging to Kampala Capital City Authority (KCCA) and other private companies. Many households empty their toilets at least once or twice a year but many risks are involved in this process.

Faecal sludge from toilets emptied by a mechanical vacuum emptier or gulper is sucked into the Vacuum (tankers) trucks of varying capacities. From here, faecal sludge is transported to treatment sites in Lubigi or illegally dumped in to lakes, swamps or storm water drains. From the treatment plants, sludge is dried and some farmers use this dried sludge as fertilizer in their gardens.

2.2 Characterize the Waste Fractions

The waste stream from onsite sanitation systems is generally and mainly composed of:

- Faecal sludge effluent: This contains faecal matter, urine, anal cleansing materials (mainly paper), solid waste and sharp objects e.g. razor blade and a few have water. All microorganisms including pathogenic and non-pathogenic bacteria, protozoa, viruses and helminths are found in this waste stream. Faecal sludge at the bottom of the containment facilities is in most cases too thick and may require water in order to pump it out. Table 3 summarises the faecal sludge characteristics.
- Septic tank sludge: This is the solids and water which settle at the bottom of the septic tank and has the potential to contain some anal cleansing material, and feminine

hygiene products, sharps and other foreign material. Solid waste is also dumped in the containment facility. Most collection and transport vehicles have insufficient pumping capacity to remove all solids that have settled at the bottom of the tank.

Table 3: Characteristics of Faecal sludge from cesspool trucks

Parameters	Min	Mean	Max
pH	5.00	7.48	8.22
Total Suspended Solids (mg/L)	140	3435	40656
BOD5 (mg/L)	109	1035	4950
COD (mg/L)	260	3217	33711
Faecal Coliform (CFU/100 mL)	2.80x10 ⁴	1.95x10 ⁷	2.91x10 ⁸

Source NWSC, 2014

Disease characterization was done through:

- Literature review on already done work such as *Risk of Intestinal Parasitic Infections in People with Different Exposures to Wastewater and Faecal Sludge in Kampala, Uganda* (Furimann et al, 2016), *Sanitation Status in 5 pilot wards of Kampala* (KCCA/GIZ, 2016) the *Microbial and industrial contamination of water and soil in the Nakivubo wetland* (Furimann et al, 2015).
- Literature on disease associated with faecal sludge, *Health Risk Assessment of the potential Resource Recovery and Reuse business Models in Kampala City, Uganda.* (Mirko et al,2015)

Table 4: Showing health risks, route of infection and the most common factors associated with the risk

Health Risk	Common route of Infection	Causes of the risk
Gastroenteritis (Bacteria), Typhoid fever (Bacteria), Cholera (Bacterial)	Ingestion, Inhalation	Poor hygiene and bad practices while handling and working with faecal sludge
Helminths <i>Ascaris lumbricoides, Taenia solium/saginata, Trichuris trichiura</i> , Hookworm <i>Shistosomiasis spp</i>	Ingestion or skin contact	Poor hygiene , poor practices and lack of PPEs
Polio, Hepatitis A, Hepatitis C (Viral), Hepatitis B	Ingestion either directly or Hand to Mouth or via broken /damaged skin	Poor hygiene
Tetanus (Bacteria)	via broken /damaged skin and open wounds	Injuries as a result of bad work practices
Skin Infections	Any broken or damaged skin or skin which has been punctured by	Improper handling of tools or indiscriminate handling of solid

Health Risk	Common route of Infection	Causes of the risk
	sharp objects	wastes from faecal sludge
Eye Infections	Either directly or through transmission from hands (e.g. rubbing eyes)	Direct splashes of sewage to the face or by indirect contamination from hands Poor and unhygienic work practices
Respiratory Illness	Through inhalation of fine mists and aerosols or dust from dried sludge. There are also risks from inhalation of harmful gases present or from oxygen deficiency	Poor work practices i.e. failure to use dust and chemical masks. Improper ventilation and failure to provide oxygen gas in oxygen deficient environment.

Source: Rob Gwyther (2006), SSP, 2015 for NWSC

2.3 Identify Potential exposure groups

Exposure groups and associated diseases are summarised below.

❖ Cesspool Emptier , gulper, transfer station workers (W1, W2, W3,M)

- Diarrhoeal diseases
- Typhoid fever
- Hepatitis A
- Hepatitis B
- Hepatitis E
- Helminths (*Ascaris lumbricoides*, *Taenia solium/saginata*, *Trichuris trichiura*, Hookworm, *Shistosomiasis spp*)
- Protozoa infections
- Tetanus.
- Protozoa infections
- Tetanus.

❖ Communities and users in Kamwokya II (L1, L2, L3,M)

- Diarrhoeal Diseases
- Malaria from mosquito bites
- Helminths (*Ascaris lumbricoides*, *Taenia solium/saginata*, *Trichuris trichiura*, Hookworm, *Shistosomiasis spp*)
- Protozoan infections
- *Tetanus*.

Note: In a study conducted in Kampala, Uganda, it was found out that the highest point-prevalence of intestinal parasite infections was found in urban farmers (75.9%), whereas lowest point-prevalence was found in workers managing Faecal sludge (35.8%). Hookworm was the predominant helminth species (27.8%). In urban farmers, the prevalence of *Trichuris trichiura*, *Schistosoma mansoni*, *Ascaris lumbricoides*, and *Entamoeba histolytica/E. dispar* was 15% and above (Furimann et al, 2016).

The most important findings for the different types of hazards that can exist in handling of faecal sludge are summarized below:

Physical hazards

- Mal-odours deriving from the different waste fractions
- Low bearing capacity of the soil surrounding an unlined pit can lead to the collapse of its sidewalls during emptying (in particular for manual emptying)
- Slips, trips and falls;
- Exposure to sharp objects contained in the sludge (e.g. sharps, glass, metals);
- Carrying heavy loads (e.g. containment structure cover or sludge-filled containers)

Biological hazards

- Direct and indirect oral, nasal and dermal exposure to different species of pathogens is of concern for the solid and liquid waste fractions in faecal sludge (e.g. bacteria, viruses, protozoa, and helminthes – for more information refer to Table 4).

Chemical hazards

- Direct and indirect oral, nasal and dermal exposure to chemicals e.g. working in confined spaces in the presence of harmful gases (e.g. methane, ammonia, sulphur dioxide), in an oxygen depleted environment (in particular during manual emptying).

Psychosocial / Other hazards

- Alcohol consumption during emptying

2.4 Validate the system description

Focus Group Discussion (FGDs), Key Informant Interviews (KIs) with community members, Workers involved and some experts were conducted to validate the process and information.

Step 3: Identify hazardous events; assess existing control measures and exposure risks

Steps 3.1 and 3.2

Identify hazard and hazardous events (details given in Table 5) and refined exposure groups and exposure routes

Table 5: Showing the identified exposure groups and major exposure routes

Exposure groups	Who	Number of individuals	Major exposure routes
W1	Workers involved in collection of Faecal sludge using Cesspool trucks	Over 100	Inhalation Ingestion Skin contact and penetration
W2	Workers involved in collection of Faecal Sludge using gulpers	Over 10	Inhalation Ingestion Skin contact and penetration
W3	Workers involved in maintenance of the transfer stations	About 10	Inhalation Ingestion Skin contact and penetration
M	Residents or people involved in manual emptying	About 5	Inhalation Ingestion Skin contact and penetration
L1	Local community Living adjacent to the latrines being emptied	Approx 23,500 people, 6,700 households	Inhalation Ingestion Skin contact and penetration
L2	Neighbouring community	Approx 30,000, 5000 households	Inhalation Ingestion Skin contact and penetration
U	Users of the facilities	Approx 23,500 people	Inhalation Ingestion Skin contact and penetration

3.3 Identify and assess existing control measures.

Table 6: the control measures that are currently available with comments on some of the measures

Sanitation step	Type of control measure	Example of control measure currently being employed and comments
Transportation and collection of faecal sludge using cesspool trucks or Gulpers	Non- technical	Some PPE is provided like the gumboots, overalls and gloves. However most of them do not have face masks used during the emptying. It was also observed that most of the PPEs are in poor condition and offer little protection. Generally the problem is sometimes people do not put on these PPEs and also have one set of PPEs yet they always work in pairs.
		Personnel generally wash their hands without detergent after emptying, Spillage is rarely cleaned and if cleaned it is without any form of detergent or disinfectant, community members rarely supervise the emptying exercise, access to the site being cleaned is unrestricted, however, the equipment and the vehicle cleaning is rarely done. The solid waste residues from the emptying exercise is not being well managed.
Transfer station (disposal)		There is need to reduce on mal-odours, fence the site and practice safe procedures.

Task 3.4 Assess and prioritize the exposure risk

A semi-quantitative risk assessment process was adopted using the matrix shown in Table 7 and following the definitions in Table 8. This is in accordance with suggestions in Sanitation Safety Planning Manual (WHO, 2015). Table 9 shows the risks assessment. In some cases, scores were awarded following a team based risk assessment based on observation, focused group discussions and literature review.

Risk priority matrix according to the number of points achieved

Table 7: Risk Ranking Matrix

RISK= Likelihood x Severity		Severity				
		Insignificant	Minor impact	Moderate impact	Significant impact	Catastrophic impact
Very high risk=>32		1	2	4	8	16
High risk =13-32						
Medium risk =7-12						
Low risk=< 6						
Probability	Very unlikely 1	1	2	4	8	16
	Unlikely 2	2	4	8	16	32
	Possible 3	3	6	12	24	48
	Probable 4	4	8	16	32	64
	Almost certain 5	5	10	20	40	80

Source: SSP manual, WHO, 2015

Table 8: Definitions for likelihood and severity

Descriptor		Description
LIKELIHOOD Or frequency (L)		
1	Very Unlikely	Has not happened in the past and it is highly improbable it will happen in the next 12 months.
2	Unlikely	Has not happened in the past and/or may occur in exceptional circumstances .
3	Possible	May have happened in the past and/or may occur at some time in the next 12 months under regular circumstances
4	Likely	Has been observed in the past and/or is likely to occur in the next 12 months.
5	Almost Certain	Has often been observed in the past and/or will almost certainly occur in most circumstances in the next 12 months.
SEVERITY (S)		
1	Insignificant	Negligible health effects or impacts on normal operations or health consequences in excess of background levels.
2	Minor impact	Minor health effects or impact on normal operations or health consequences in excess of background levels. Easily manageable disruptions to operation; No rise in complaints anticipated.
4	Moderate impact	Impact will lead to moderate health effect (e.g. fever, headache, diarrhoea, small injuries) or unease (e.g. noise, mal-odours); Complaints or community annoyance; Operations may be disrupted for short duration.
8	Major or significant impact	Impact will result in injuries, acute and/or chronic illness . May lead to legal complaints and concern; Operations could be significantly affected by the impact.
16	Catastrophic impact	Serious injuries, illness, or even loss of life can be the consequence of the impact. Major investigation by regulator with prosecution likely; Can lead to

**Table 9: Showing Risk assessment
Risk assessment for the different toilet facilities/ User interface technologies/ emptying activities**

Toilet type	Hazard identification			Existing control (s)			Risk assessment L=Likelihood, S= severity, R= Risk Level			Comments justifying assessment or effectiveness of the control	
	Hazardous event	Hazard	Exposure route	Exposure groups	Description of existing control	Validation of control	L	S	Score		R
Dry toilet	1. Ingestion of excreta or sludge due to improper hand washing	All microbial pathogens	Ingestion,	W1, W2, M, U	Hand washing without soap or detergent	Observation, literature review	4	4	16	H	High risk for users and workers Standard hygiene behaviour and practices are not followed
	2. Stepping on faeces with bare foot	All microbial pathogens, especially helminths	Dermal	W1, W2, M, U	Use of Shoes, Gum boots	Observation, literature review	3	8	24	H	High risk for users Inconsistent use of shoes and gum boots
	3. contact with flies	All pathogens	Contact, ingestion	W1, W2, M, L1, U	Nil	Observation, literature review	5	4	20	H	High risk for users Dirty toilet
	4. Falling in to the pit	All pathogens, Injuries	Contact, ingestion, falling in to the pit	W1, W2, M, L1, U	Unstable slabs	Observation, literature review	3	4	12	M	Medium risk for users and high for workers If the slab or toilet floor is not stable or well built
	5. Ingestion of excreta or sludge due to improper hand washing	All pathogens	Ingestion	W1, W2, M, L1, U	Hand washing without soap or detergent	Observation, literature review	4	4	16	H	High for users Faeces clog urine collection pan No provision for anal cleansing water Poor construction makes it difficult to clean
	6. contact with Flies	All pathogens	Mechanical transfer	W1, W2, M, U	Not properly covering and cleaning the facility	Literature review	4	8	32	H	High risk for users

Risk assessment for the different toilet facilities/ User interface technologies/ emptying activities

Toilet type	Hazard identification			Existing control (s)			Risk assessment L=Likelihood, S= severity, R= Risk Level				Comments justifying assessment or effectiveness of the control
	Hazardous event	Hazard	Exposure route	Exposure groups	Description of existing control	Validation of control	L	S	Score	R	
	7. Ingestion of urine	All pathogens	Ingestion	W1, W2, M, U		Literature review	3	4	12	M	Medium risk for users Standard hygiene behaviour and practices are not followed
Pour Flush Toilet	8. Ingestion of excreta or sludge due to improper hand washing	All pathogens	Ingestion	W1, W2, M, U	Facility not cleaned regularly, hand washing without soap	Observation, literature review	4	4	16	H	High risk for users and workers Poorly designed U-trap is prone to clogging Bulky cleansing materials cause clogging Used with insufficient water
	9. Contact with Flies	All pathogens	Mechanical transfer	W1, W2, M, U	Not properly covering and cleaning the facility	Observation, literature review	5	4	20	H	Bulky cleansing materials cause clogging Used with insufficient water
	10. Inhalation of aerosols	All pathogens	Ingestion	W1, W2, M, U		Literature review	2	4	8	M	
Cistern flush toilet	11. Ingestion of excreta or sludge due to improper hand washing	All microbial Pathogens	Ingestion	W1, W2, M, U	Facility not cleaned regularly, hand washing without soap	Observation, literature review	4	8	32	H	Improper plumbing and/or installation Bulky cleansing materials cause clogging
	12. Inhalation of aerosols		inhalation	W1, W2, M, U	Cover lid not closed during flushing	Observation, literature review	2	8	16	H	

Risk assessment for the different toilet facilities/ User interface technologies/ emptying activities

Toilet type	Hazard identification			Existing control (s)	Validation of control	Risk assessment			Comments justifying assessment or effectiveness of the control		
	Hazardous event	Hazard	Exposure route			Description of existing control	L	S		Score	Risk assessment L=Likelihood, S= severity, R= Risk Level
Risk assessment for selected faecal / sludge collection and storage facilities											
Storage type				Existing control (s)		Risk assessment L=Likelihood, S= severity, R= Risk Level			Comments justifying assessment or effectiveness of the control		
Hazard identification				Description of existing control		Validation of control					
Pit-latrine	Hazardous event	Hazard	Exposure route	Exposure groups	Description of existing control	Validation of control	L	S	Score	R	
	13. Ingestion of excreta or sludge due to improper hand washing	All microbial pathogens	Ingestion, dermal	W1, W2, M, U	Hand washing without soap or detergent	Observation, literature review	4	4	16	H	High for users and workers Standard hygiene behaviour and practices are not followed
	14. stepping on faeces with bare foot	All microbial Pathogens	Contact	W1, W2, M, U	Inconsistent use of Shoes, Gum boots	Observation, literature review	3	8	24	H	High for users Inconsistent use of shoes and gum boots
	15. contact with flies , mosquitoes	All pathogens	Flies insect Contact,	W1, W2, M, L1, L2 U	Nil	Observation, literature review	5	4	20	H	High for users and community members Dirty toilet, excessive flies
	16. Falling in to the pit	All pathogens, Injures	Contact, ingestion, falling in to the pit	W1, W2, M, L1, L2 U		Observation, literature review	2	8	16	H	High for workers and users Unstable and prone to collapse
	17. Surface and ground water contamination from pit latrine	All pathogens	Ingestion of contaminated water	L1, L2	Poorly lined	Observation, literature review	4	8	32	H	High for community members Built in unsuitable Area, inadequate size or capacity
Conventional and improved septic tanks	18. Ingestion of waste water	All pathogens	Contact, ingestion	W1, W2, M, L1, U, L2	Hand washing without soap or detergent	Observation, literature review	2	8	16	H	High for workers Overflowing/leaking Inadequate treatment

Risk assessment for the different toilet facilities/ User interface technologies/ emptying activities

Toilet type	Hazard identification				Existing control (s)			Risk assessment L=Likelihood, S= severity, R= Risk Level			Comments justifying assessment or effectiveness of the control
	Hazardous event	Hazard	Exposure route	Exposure groups	Description of existing control	Validation of control	L	S	Score	R	
	19. Contamination of ground / surface water from septic tank	All pathogens	Ingestion (of contaminated groundwater????)	W1, W2, M, L1, U, L2	Improper treatment	Literature review	3	4	12	M	Overflowing/ leaking
	20. Contact with overflowing and leaking content from septic tank	All pathogens	ingestion	W1, W2, M, U, L1, L2	Improper design	Literature review	4	8	32	H	High for community members Overflowing/ leaking Inadequate treatment
Open defecation	21. Ingestion of excreta due to improper hand washing	All pathogens	ingestion	W1, W2, M, U, L1, L2	illegal	Literature review, KIIs	5	8	40	VH	Standard hygiene behaviour and practices are not followed
	22. stepping on faeces with bare foot	All pathogens	contact	W1, W2, M, U, L1, L2	It is illegal and should not be practiced	Observation, literature review	5	4	20	H	High risk for community members Standard hygiene behaviour and practices are not followed Do not open defecate
	23. contact with flies	All pathogens	Mechanical transfer	W1, W2, M, U, L1, L2	nil	Observation, literature review	5	4	20	H	High risk for community members Standard hygiene behaviour and practices are not followed
	24. surface / ground water contamination	All pathogens	Ingestion of contaminated water	W1, W2, M, U, L1, L2	Protected springs, extension of piped water distribution	Observation, literature review, KIIs	4	8	32	H	High for community members Open defecation should not be practiced

Motorized and human powered emptying and transport activities											
Collection and transport using cesspool emptiers and gutters (manual and mechanical emptying)	Hazard identification				Existing control (s)			Risk assessment			Comments justifying assessment or effectiveness of the control
	Hazardous event	Hazard	Exposure route	Exposure groups	Description of existing control	Validation of control	L	S	Score	R	
	25. Exposure to sludge or raw sewage during emptying due to improper hand washing	All microbial pathogens	Ingestion	W1, W2, W3, L1, M	Hand washing without soap or detergent	Observation	4	4	16	H	High for the workers Hand washing and washing of equipment after emptying activities is not widely practiced
	26. Exposure to spillage of Faecal sludge	All microbial Pathogens	Contact, ingestion	W1, W2, W3, L1, M, U	PPE, Gumboot, Overalls	Observation, literature review	4	2	8	M	Inadequate and inconsistent use of PPE, lack of post spill clean up
	27. Exposure to bad odours causes unease	Mal odours	Inhalation	W1, W2, W3, L1, M, U	Nil	N/A	5	2	10	M	Face masks is not being used
	28. Exposure to sharp objects	Injury to the body	Penetration	W1, W2, W3, M	Gumboot, Gloves	Literature review, Field observation, FGDS and KIIs	2	8	16	H	High for the workers Inconsistent use of PPE, inadequate PPE
	29. Exposure to toxic gases	Toxic gases	Orohasal	W1, W2, W3, M, U	None	N/A	4	8	32	H	High for the workers Lack of gas masks
	30. Falling into the pit during emptying	Injury to the body, exposure to microbial pathogens	Falling in to the pit, ingestion	W1, W2, W3, L1, M, U	Nil		2	8	16	H	High for the workers Low bearing capacity of the soil surrounding an unlined pit can lead to the collapse of its sidewalls during emptying.

	31. Working under the influence of Alcohol	Exposure to pathogens, injury	Falling, ingestion, contact	W1, W2, M	Nil	Observation	3	8	24	H	High for the workers
	32. Cross contamination during emptying	All microbial pathogens, Injury to the body	Improper handling of PPE, equipment, wastes etc.	W1, W2, M	Cleaning of equipment	Observation	4	4	16	H	High for the workers Cleaning of equipment without disinfectant
	33. Exposure of the household , children and community members to solid waste from the emptied pit	All microbial pathogen	Ingestion, contact	L1, L2, M	Nil		5	8	40	VH	Very high for community members The solid waste is indiscriminately disposed off
	34. Exposure of unauthorized persons at the emptying site	All microbial pathogen,	Ingestion, contact , inhalation	L1, children	Nil		4	3	12	M	Unrestricted access
	35. Contamination of the neighbourhood during emptying and transport	All microbial pathogen	Ingestion, contact	L1, L2	Cleaning	Observation, FGDS	3	4	12	M	Cleaning spillage without any detergent or disinfectant
	36. Illegal dumping or disposal of sludge or sewage in to lakes, rivers, drains and the environment leading to contamination of water sources and the environment	All microbial pathogen Heavy metals	Ingestion, contact	L1, L2, users, children , tourists	- -weak disposal, monitoring and enforcement mechanism	Observation, FGDS	4	8	32	H	High for community members Inadequate monitoring of sludge and sewage Disposal sites Illegal empiers
	37. Lack of access for tankers and gulpers	All microbial pathogen	Ingestion, contact	W1, W2, M	Nil	Observation, FGDS	4	8	32	H	High for workers Poor physical planning
	38. Undersized toilet facilities leading to more frequent emptying	All microbial pathogens	Ingestion, contact	W1, W2, M	Nil	Observations, FGDS	4	4	16	H	High for workers Poor construction and design
	39. Lack of appropriate working tools	All microbial pathogens	Ingestion, contact	W, W1	Inappropriate tool	Observation, FGDS, literature review	4	4	16	H	Provision of appropriate working tools

Transfer station										
40. Heavy load	All pathogen, injuries, pain	Contact, mechanical	W1, W2, M, W3	Nil	Literature review	4	4	16	M	Excess load
41. Exposure to bad odours, flies causes un ease	Mal odours	Inhalation	L1, L2, M and W3	N/A	Literature review	5	2	10	M	The Parish is so congested, if not well sited, not emptied regularly, access point is not convenient or well designed, undersized facility
42. Direct exposure to sewage	All microbial Pathogens	Contact, ingestion	W3, L1	Nil	Literature review	4	4	16	H	High risk for workers If not emptied regularly, the opening or access point is not convenient or Well-designed Access point is not there
43. Spillage during dumping sludge	All microbial pathogens	Contact, ingestion	W3, L2, L1	Nil	Literature review	5	4	20	H	High risk for workers If not emptied regularly, access point is not convenient or well designed
44. Exposure of unauthorized persons (children and community members)	All microbial pathogens, injury	Ingestion, contact	Childre n, L1, L2		Literature review	4	4	16	H	High risk to children and community members If not fenced and well maintained

Step 4: Develop and implement an incremental improvement plan

4.1 Consider options to control identified risks

A meeting with all the affected exposure groups and desk review was conducted to identify appropriate control measures.

Table 10: Improvement plan options for the identified risks

Sanitation step	Exposure groups (Cesspool, gulper and transfer station workers)	Recommended Control measure Hazardous event	Priority for action or control measure (High, Medium, Low)	Responsible person	
Dry toilet	Hazardous event	1. Ingestion of excreta or sludge due to improper hand washing	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	High-immediately	Community members, VHTs KCCA
		2. stepping on faeces with bare foot	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	High- Immediately	Community members, VHTs KCCA
		3. contact with flies	install vent and keep the facility clean	High-immediately	Community members, VHTs KCCA
		4. Falling in to the pit	Lining of the pit proper siting	High-immediately	Community members, VHTs KCCA
UDDT (Urine Diverting Dry Toilet)	5. .Ingestion of excreta or sludge due to improper hand washing	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	High-	VHTs , KCCA, community members	
		6. contact with Flies	Medium	VHTs , KCCA, community members	
		Proper design (to facilitate urine and faeces separation, dedicated collection point for anal-cleansing water, coated concrete or fabricated plastic			
	7. Ingestion of urine	Proper construction	Medium- medium term	VHTs , KCCA, community members	
Pour Flush Toilet	8. .Ingestion of excreta or sludge due to improper hand washing	Standard hygiene behaviour and practices should be followed including hand	High-Immediate term implementation	VHTs , KCCA, community members	

Sanitation step		Exposure groups (Cesspool, gulper and transfer station workers)			
Toilet type	Hazard identification	Recommended Control measure	Hazardous event	Priority for action or control measure (High, Medium, Low)	Responsible person
		washing and toilet cleaning			
	9. Contact with Flies	proper design and construction Separate receptacle for dry-cleansing materials adequate water should be available		High-Immediate term implementation	VHTs , KCCA, community members
	10. Inhalation of aerosols	-proper construction		High-Immediate term implementation	VHTs , KCCA, community members
Cistern flush toilet	11. Ingestion of excreta or sludge due to improper hand washing	-Proper design and construction -Cover lid when the toilet is not in use -Proper use (dry anal cleansing material should be collected separately)		High immediately	KCCA, VHTs
	12. Inhalation of aerosols	-Proper maintenance -Cover lid when not in use		High -immediately	
selected faecal / sludge collection and storage facilities					
Storage type					
	Hazardous event				
Pit-latrine	13. Ingestion of excreta or sludge due to improper hand washing	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning		High-immediately	Community members, VHTs KCCA
	14. stepping on faeces with bare foot	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning		High- Immediately	Community members, VHTs KCCA
	15. contact with flies, mosquitoes	install vent and keep the facility clean		High-immediately	Community members, VHTs KCCA
	16. Falling in to the pit	Lining of the pit, proper siting		High-immediately	Community members, VHTs KCCA
	17. Surface and ground water contamination	Site where there is a low ground water table, low risk of		High-immediately	Community members, VHTs KCCA

Sanitation step		Exposure groups (Cesspool, gulper and transfer station workers)		
Toilet type	Hazard identification	Recommended Control measure Hazardous event	Priority for action or control measure (High, Medium, Low)	Responsible person
Conventional and improved septic tanks	18. Ingestion of waste water/ excreta	flooding Lining of the pit Appropriate technologies	High-immediately	Community members, VHT's KCCA
		Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning		
		Proper construction and design		
		Medium		
Open defecation	19. Contamination of ground / surface water	Proper construction and design	Medium	Community members, VHT's KCCA
		Empty regularly, proper design (separate collection of dry cleansing materials, install grease trap and avoid use of harsh chemicals)	medium	Community members, VHT's KCCA
Open defecation	20. Contact with overflowing and leaking content	It should not be practiced, standard hygiene behaviour should be practiced, . If practiced the area should be marked and contained	High-immediately	Community members, VHT's KCCA
		Standard hygiene behaviour should be practiced e.g. wearing shoes	High-immediately	Community members, VHT's KCCA
		Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	High immediately	Community members, VHT's KCCA
		Protection of the water sources, if practiced the area should be well sited and a way from water sources	High-immediately	Community members, VHT's KCCA
Motorized and human powered emptying and transport activities				
	Hazardous event	Adequate and proper Personal protective equipment (PPE) should be provided. Provide sensitization on work place health and safety specifically on the proper use of PPE, tools and equipment, Develop of standard operating procedures,	High-Immediate term implementation	Cesspool/ gulper entrepreneurs, GZ, KCCA, CIDL, WFP and VHT's
	25. Exposure to sludge or raw sewage during emptying due to improper hand washing			

Sanitation step		Exposure groups (Cesspool, gulper and transfer station workers)		
Toilet type	Hazard identification	Recommended Control measure Hazardous event	Priority for action or control measure (High, Medium, Low)	Responsible person
	26. Exposure to spillage of Faecal sludge	Consistent use of PPE, Cleaning of the spillage with disinfectants and soap	High- Immediate	VHTs, KCCA
	27. Exposure to bad odours causes un ease	Reduction on exposure time The facility should be kept tidy	Medium- medium term	Entrepreneurs, VHTs, KCCA
	28. Exposure to sharp objects	Provision and Sensitization on work place health and safety (e.g. on use of PPE)	High-Immediate term implementation	CIDL, WFP, VHT's and owners
	29. Exposure to toxic gases	Provision of PPE (Gas mask). Enforce use of PPE	High-Immediate term implementation	Cesspool / gulper entrepreneurs, KCCA
	30. Falling into the pit during emptying	Upgrade the containment facilities (They should be properly reinforced or lined), Sensitization on work place health and safety	High-Immediate	Community members, KCCA
	31. Working under the influence of Alcohol	Sensitization on work place health and safety Not working under the influence of Alcohol	immediate	Entrepreneurs, KCCA, VHT's
	32. Cross contamination during emptying	Proper cleaning of the spillage and contaminated area with detergents and disinfectants, Development and implementation of safety procedures manual	High-Immediate term implementation	Workers, KCCA, VHTs, Entrepreneurs
	33. Exposure of the household,	Sensitization of community	High- Immediate term	CIDL, WFP, KCCA and

Sanitation step		Exposure groups (Cesspool, gulper and transfer station workers)				
Toilet type	Hazard identification	Recommended Control measure	Hazardous event	Priority for action or control measure (High, Medium, Low)	Responsible person	
	children and community members to solid waste from the emptied pit	members and children in schools on hygiene, safe emptying procedures and maintenance, improved solid waste collection services, Discourage disposal of the solid waste in to the pits Incineration of the waste	Restricted access during emptying	Immediate	VHTs, Entrepreneurs	
						34. Exposure of unauthorized persons at the emptying site
						35. Contamination of the neighbourhood during emptying and transport
						36. Illegal dumping or disposal of sludge or sewage in to lakes, rivers, drains and the environment leading to contamination of water sources and the environment
						37. Lack of access for tankers and gulpers
						38. Undersized toilet facilities leading to more frequent emptying
Transfer station	39. Lack of appropriate working tools	Creation of sanitary lanes Use of small gulpers Construction of facilities with adequate capacity Provision of appropriate working tools	immediate	immediate	Community members, VHTs, KCCA	
						40. Heavy load
						41. Exposure to bad odours, flies causes un ease
						42. Direct exposure to sewage
	43. Spillage during dumping sludge	Workers should be appropriately protected They should be properly fenced and not in direct vicinity of homes	immediate	immediate	CIDL, WFP, KCCA and VHTs	
						44. Exposure of unauthorized persons (children and community members)
		Restricted access They should be properly fenced	immediate	immediate	KCCA, GIZ, Entrepreneurs	

Step 5. Monitor control measures and verify performance

Table 11: Operational monitoring plan

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
User interface technologies (Toilet type)						
Dry toilet						
1. Ingestion of excreta or sludge due to improper hand washing	Sensitisation on standard hygiene behaviour and practices should be followed	At least 60% of the toilets should have hand washing facilities with soap and detergents	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
2. stepping on faeces with bare foot	Standard hygiene behaviour and practices should be followed including wearing shoes, hand washing and toilet cleaning	At least 60% of the facilities should be well sited, constructed, maintained, 80% of the community members, workers and users should wear shoes or gum boots	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
3. contact with flies	install vent and keep the facility clean	At last 60 % of the facilities should have a vent pipe and well maintained	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
4. Falling in to the pit	Lining of the pit, proper siting	At least 60% of the toilets should be well sited and lined	Observation and surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
UDDT (Urine Diverting Dry Toilet)						
5. Ingestion of excreta or sludge due to improper hand washing	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	At least 60% of the toilets should have hand washing facilities with soap and detergents	Observation and surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
6. contact with Flies	Empty regularly, Proper design (to facilitate urine and faeces	At least 60% of the facilities should be emptied regularly and properly constructed	Observation, surveys	Every 6 months	KCCA, VHTs, CIDL, WFP, Workers associations	Enforcement Penalise
7. Ingestion of urine	Proper construction	60% of the facilities should be well designed	Observation, surveys	Every 6 months	KCCA, VHTs, CIDL, WFP, Workers associations	Enforcement Penalise
Pour Flush Toilet						
8. Ingestion of excreta or sludge due to improper hand washing	proper design and construction Separate receptacle for dry-cleansing materials adequate water should be available	At least 60% of the toilets should be well designed and provided with adequate water and soap	Observation, surveys	Every 6 months	KCCA, VHTs, CIDL, WFP, Workers associations	Enforcement Penalise
9. Contact with Flies	proper design and construction Separate receptacle for dry-cleansing materials adequate water should be available	At least 60% of the toilets should be well designed and maintained	Observation, surveys	Every 6 months	KCCA, VHTs, CIDL, WFP, Workers associations	Enforcement Penalise
10. Inhalation of aerosols	proper construction	At least 60% of the toilets should be well designed	Observation, surveys	Every 6 months	KCCA, VHTs, CIDL, WFP, Workers associations	Enforcement Penalise
Cistern flush toilet						
11. Ingestion of excreta or sludge due to improper hand washing	- sensitization of community members on Proper design and maintenance, Proper use , provision of hand washing facilities with soap	At least 60% of the toilets should be provided with hand washing facilities with soap	Observation, surveys	Every 6 months	KCCA, VHTs, CIDL, WFP, Workers associations	Enforcement Penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
12. Inhalation of aerosols	-Proper maintenance	At least 60% of the toilets should be well maintained	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
Storage facilities						
Pit-latrines						
13. Ingestion of excreta or sludge due to improper hand washing	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	At least 60% of the toilets should be well maintained and have hand washing facilities with soap and detergents	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
14. stepping on faeces with bare foot	Standard hygiene behaviour and practices should be followed including hand washing and toilet cleaning	At least 60% of the toilets should be well maintained and have hand washing facilities with soap and detergent	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
15. contact with flies and mosquitoes	Install pipe and keep the facility clean	At least 60% of the facilities should have vent pipe and well maintained	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
16. falling in to the pit	Lining of the pit Proper siting	At least 60% of the facilities should be well lined and sited	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
17. Exposure to sharps and solid waste	Discourage dumping of solid waste in the pits Sensitization of community members and users on proper hygiene behaviours Improve solid waste collection services	At least 70% of the pits are free s from solid waste, sorting of the waste is practiced, improved solid water collection services At least 60% of the community members are sensitised	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
18. surface and ground water contamination	Proper siting where there is a low ground water table, low risk of flooding Protection of the water sources	At least 60% of the toilets should be well sited, 80% of the water sources should be well protected.	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, Workers associations	Enforcement Penalise
Conventional and improved septic tanks						
19. ingestion of waste water / excreta	Standard hygiene behaviour should be followed	At least 60% of community members / users should follow standard hygiene practices	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP, workers associations	Enforcement penalise
20. Surface and ground water contamination	Proper construction (water chamber should be tight)	At least 70% of the tanks should be well constructed	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP	Enforcement Penalise
21. Contact with over flowing and leaking content	Empty regularly, proper design and maintained	At least 70% of the facilities should be well designed and maintained	Observation, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP	Enforcement Penalise
Open defecation						
22. ingestion of excreta due to improper hand washing	It should not be practiced, if practiced the area should be well marked and contained	At least 95% of the community member should not practice open defecation	Observations, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP	Enforcement Penalise
23. stepping in faeces with barefoot	standard hygiene behaviours should be practiced	At least 60% of the community members should practice standard hygiene behaviours	Observations, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP	Enforcement Penalise
24. contact with flies	Standard hygiene behaviours should be practiced	At least 60% of community members should practice standard hygiene behaviours	Observations, surveys	Every 6 months	KCCA, VHTs, CIDI, WFP	Enforcement Penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
25. Surface / ground water contamination	Protection of water sources, the field should be well sited away from water sources	More than 80% of the water sources should be well protected There should be no evidence of open defecation around water sources	Observations, surveys	Every 6 months	KCCA, VHTs, CIDJ, WFP	Enforcement Penalise
Hazardous event (Motorised and human powered emptying transport sanitation step)						
26. Exposure to sludge or raw sewage due to improper hand washing	-Safe and hygienic procedures, proper hand washing with soap or detergent -Access to hand washing facilities and soap -Sensitisation on safe operating procedures and hygiene	All workers	Observation, survey	Every 3 months	Entrepreneur, Cesspool truck and gulper associations	Identify why the workers are not washing hands with detergent Penalise
	Deworming and immunization	All workers	Observation, survey	Every 6 months	Entrepreneur, Cesspool truck and gulper associations, KCCA, GIZ, CIDJ, WFP	Review the strategy Identify challenges
27. Exposure to spillage of faecal sludge	-Frequency and consistent use of PPE -Sensitisation of the workers on safe procedures and use of PPE	All workers use PPE and sensitised	Observation, survey	Once a month	Entrepreneur, Cesspool truck and gulper associations, KCCA, VHTs	Identify why the workers are not using protective wear Modify and improve information, education and communication programme Warn and penalise
28. Exposure to bad odours	- Frequency and consistent use of PPE -Sensitization of the workers on safe procedures and use of PPE	All workers use PPE (face mask) and sensitised	Observation, survey	Once a month	Entrepreneur, Cesspool truck and gulper associations, KCCA, VHTs	Identify why the workers are not using protective wear Modify and improve information, education and communication programme Warn and penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
29. Exposure to sharp objects	<ul style="list-style-type: none"> - Frequency and consistent use of PPE - Sensitization of the workers on safe procedures and use of PPE - discourage disposal of solid waste in the facility through sensitising community members and users 	<ul style="list-style-type: none"> - All workers - All VHTs should be sensitised on proper use of the facilities 	Survey, record review	Every 6 months	Entrepreneur, Cesspool truck and gulper associations, KCCA	-Review of the sensitisation campaign
30. Exposure to toxic gases	<ul style="list-style-type: none"> - Frequency and consistent use of PPE - Sensitization of the workers on safe procedures and use of PPE 	All workers	Observation, survey	Once a month	Entrepreneur, Cesspool truck and gulper associations, KCCA, VHTs	<ul style="list-style-type: none"> - Identify why the workers are not using protective wear - Modify and improve information, education and communication programme - Penalise
31. Falling in to the pit during emptying	<ul style="list-style-type: none"> - The facilities should be well sited, constructed, maintained and lined - Facilities being well utilized (No dumping of solid waste) 	At least 60% of the facilities should be well maintained and constructed	Survey, observation	Every 6 months	KCCA, VHTs	<ul style="list-style-type: none"> - Awareness raising - warn and penalise
32. Working under the influence of alcohol	<ul style="list-style-type: none"> - workers should not work under the influence of alcohol 	All workers	Survey	Every 3 months	KCCA, VHTs, entrepreneur	<ul style="list-style-type: none"> - Sensitise and enforce - Penalise
33. Cross contamination during emptying	<ul style="list-style-type: none"> - Reduced and Proper cleaning of spillage 	All spillage	Survey	Every 6 months	KCCA, VHTs	<ul style="list-style-type: none"> - sensitise and enforcement - penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
34. Exposure of the household, children and community members to solid waste from the emptied pit	-Discourage disposal of the solid waste in to the pits -sensitization of community members, users and children in schools on hygiene, safe emptying procedures and maintenance -improved solid waste collection services	-At least 70% of the facilities should be well utilised (solid waste should not dumped in to the pit) -At least 50% of community members and schools sensitised	Observation, surveys	Every 3 month	KCCA, VHTs	Enforcement
35. exposure of unauthorized persons at the emptying site	--Restricted access during emptying	All sites	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP	-Enforcement -penalise
36. Contamination of the neighbourhood during emptying and transport	-cleaning of the spillage with disinfectant and soap	All spillage	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP	-Enforcement -penalise
37. Illegal dumping and disposal of sludge and sewage	-Strengthen monitoring and enforcement of safe disposal methods	All emptied sludge and sewage should be properly disposed	Observation, surveys	Every three month	KCCA, VHTs	-enforcement -penalise
38. Lack of access for gulpers and tankers	Creation of sanitary lanes Increased use of small gulpers	70% of the facilities should have access	Observation, surveys	Every three month	KCCA, VHTs	Enforcement Penalise
39. Undersized facilities leading to more frequent emptying	Proper construction of facilities with adequate capacity	60% of the facilities should be of adequate capacity	Observation, surveys	Every three months	KCCA, VHTs	Enforcement Penalise
40. lack of appropriate working tools	Provision of appropriate working tools	At least 70% of the workers should have access to appropriate tools	Observation, surveys	Every three months	Entrepreneurs, KCCA	Enforcement Penalise
Transfer stations related activities						
40. Excess or heavy load	-Appropriate load	All gulpers	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP, Workers associations	-Enforcement -penalise
41. Exposure to flies, bad odours causes unease	-Proper siting and maintenance of the transfer station	All transfer stations	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP, Workers associations	-Enforcement -penalise

Hazardous event	What is monitored (Improvement activity)	Operational Limits	How it is monitored	When it is monitored	Who monitors it	Corrective action when the operation limit is exceeded
42. Direct exposure to sewage	-The transfer stations should be kept clean, minimize spill and be designed for easy access	All transfer stations	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP, Workers associations	-Enforcement -penalise
43. Spillage during dumping sludge	-Workers should be protected -It should be properly fenced and not in direct vicinity of homes	All workers All transfer stations	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP, Workers associations	-Enforcement -Penalise
44. Exposure of unauthorized people (children and community members	-Restriction -Properly fenced	All un authorised persons All transfer stations	Observation, surveys	Once a month	KCCA, VHTs, CIDI, WFP, Workers associations	-Enforcement -Penalise

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