Annex 11 Standard Operating Procedure, Emptying & Transport Faecal Sludge in Lusaka

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Glossary of terms

FS	:	Faecal Sludge
FSTP	:	Faecal Sludge Treatment Plant
H&S	:	Hygiene and Safety
LSWC	:	Lusaka Sewage and Water Company
NAWSCO	:	National Water Supply and Sanitation Council
PL	:	Pit Latrine
PTO	:	Power take off
SOP	:	Standard Operating Procedure
ST	:	Septic Tank
T	:	Tons
WSUP	:	Water and Sanitation for the Urban Poor
ZEMA	:	Zambian Environmental Management Agency

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INTRODUCTION

Faecal sludge management (FSM) includes the collection, treatment and disposal of the contents of OSS (on-site sanitation systems) which includes the sludge, water and solid waste that accumulate in pits, septic tanks and soak pits over time. In Lusaka, 90% of household rely on OSS which must be regularly emptied. Unfortunately, the current situation is that the majority of emptying service providers in Lusaka do not practice any basic health and safety protection. Thus, there is an urgent need for framing guidelines for regulation of collection, provision for treatment and safe disposal of faecal sludge within the City.

The aim of this document is to specify Standard Operating Procedures (SOPs) for Faecal Sludge emptying services, in particular manual and motorised services based on vacuum trucks and vacuum trailers (slurry tankers). In the current absence of policies and legislation specifically for pit latrine emptying services and faecal sludge management; these guidelines serve as an interim statement of required standards that are expected to improve and evolve over time.

By adhering to these standards, businesses may provide an approved and regulated service that improves occupational health and safety and minimises public health risk throughout the emptying and disposal processes.

SECTION 1: OVERALL OPERATIONS

1.1 Licensing

To operate, a private FSM operator must attain the following licences:

- Business licences from the Patents and Companies Registration Agency (PACRA) and the Zambia Revenue Authority (ZRA);
- ZEMA Waste Transport Licence;
- Permit from LWSC to allow dumping at FSTPs.

It is the responsibility of the business owner to ensure these licenses are in place prior to the onset of service delivery.

Laminated copies of each license must be carried by any operating team undertaking work.

1.2 Employee health and vaccination

Employers must ensure that the staff they employ are fit for work. In that sense, employers are mandated to present their employees to the Occupational Health and Safety Institute for medical assessments for:

- Pre-employment (Baseline examination
- Annual examination (monitoring
- Exit examination (conducted when employee stops or departs their role)

Employees must have undertaken training on H&S and SOPs before undertaking work

Those directly employed in emptying of pit latrines or septic tanks must have vaccinations for (i) hepatitis B, (ii) cholera and (ii) typhoid.

The employer is not liable to provide the vaccines but must make sure than employees meet these requirements.

1.3 Insurances

Employer must:

- Register and contribute to the social security fund to enable compensation of workers if injured;
- Provide required liability insurance for all vehicles.

1.4 Worksite operations

1.4.1 Preparation of workspace

Workspace should be cleared of all household items before beginning work to decrease the risk of contamination of goods that will remain onsite post emptying. Typical items to remove include washing buckets and clothes. Plastic sheeting must be placed on the ground in the workspace in key areas at risk of exposure to sludge.

1.4.2 Authorised personnel in workspace

No unauthorised personnel may come within 5m of the emptying operations. Children, in particular, will be curious, and it is the site supervisor's responsibility to ensure none approach the emptying team or any faecal sludge contaminated objects.

1.4.3 Contaminated items

All items contaminated with faecal sludge must be kept within the designated worksite unless being transported to a vehicle.

1.4.4 Don't

- ✘ No entry to the pit/tank. Under no circumstances are members of staff permitted to enter the pit or tank being emptied.
- ✘ Smoke, alcohol or drug: Under no circumstances should intoxicated staff be tolerated. Intoxicated staff, or staff under the influence of drugs, must be

immediately removed from site and reprimanded as they are as a hazard to themselves and to the public. No smoking is to be tolerated on site.

- ✘ Eat on worksite: Should a snack/lunch be required, staff must remove themselves from the work site, wash their hands thoroughly with soap, and eat away from the worksite.
- ✘ Let pits/tanks uncovered: Under no circumstances should an open pit be left unattended by staff. This is an extreme hazard for curious children. Barriers must be erected, and preferably the open area should be securely covered if staff needs to vacate the site.

1.5 Personal Protective Equipment (PPE)

1.5.1 PPE List

PPE for each individual working in emptying a pit latrine or septic tanks must consist of:

- Thick neoprene gloves
- Impermeable overalls offering full coverage of clothing
- Gumboots (free from holes)
- Dust mask (minimum standard) or gas mask (optimum)

Note:

Masks are only required for staff directly emptying containment systems.

Face shields only required for workers using HP washer.

PPE must be in a good state of repair and clean for each pit latrine emptying job.

1.5.2 PPE Maintenance

To maintain appropriate PPE:

- Overalls should be washed at the end of working day;
- Boots and gloves must be washed after each emptying task
- Dust masks must be replaced at least once per month

Note: Dirty PPE is contaminated, and thus PPE washing must take place in an area that does not risk community exposure to the overalls or the washing water. This is the responsibility of the main emptying supervisor to provide such washing facility.

1.5.3 Other Safety Equipment:

In addition to PPE, following equipment will be required to manage handling of spillages and contaminated items:

- Plastic bin to store emptying equipment;
- Bucket to prepare bleach solution for cleaning;
- Plastic sheeting to cover working area;
- Chemicals (bleach) in sufficient quantities for site disinfection.

2 SECTION 2: MANUAL EMPTYING

2.1 Potential hazards

Main hazards related to manual pit emptying are summarized in the following table

Category	Hazards
Physical:	Tripping and fall hazards such as hoses running across the aisles;
	Exposure to sharp objects contained in the sludge (e.g. glass, syringes);
	Accidents on the road or within FSTP
Chemical:	Direct and indirect oral, nasal and dermal exposure to chemicals (e.g. hydrocarbons that are often introduced as odour suppressants, although this practise is not recommended);
	Confined spaces in the presence of harmful gases (e.g. methane, ammonia, sulphur dioxide), in an oxygen depleted environment (in particular during manual emptying).
Biological:	Direct and indirect oral, nasal and dermal exposure to multiple types of pathogens in FS such as bacteria, viruses, protozoa, and helminths).

2.2 Equipment

List of equipment:

Figure 0-15 Equipment to be used for manual pit emptying (Source : Practica, WSUP)

Figure 0-16 Equipment to be used for manual pit emptying (Source : Practica, WSUP)

Emptying and transport equipment will include:

- wheels, pick-up or light truck for team and barrels transportation;
- Modified garden tools:
  - Pick to open access to pit content;
  - Long handle fork for solid waste fishing;
  - Bucket on long handle to remove FS;
- Any improved exhausting equipment such as potable vacuum tanks, augers, etc.
- Sealable chemical 55 litres barrels with handles for FS transfer and transport.

2.3 Manual emptying operations

1. Meet the building owner and agree with her/him on the number of drums to remove;
2. Proceed the worksite installation referring to 1.4;
3. Make a hole in the side of the latrine to access the pit;
4. Remove sludge using modified garden tools / improved exhausting equipment until the specified number of drums has been filled;
5. All solids and liquid waste must be transferred to sealed barrels, free from leaks. Lids should be put on drums immediately after filling. The external surface of the drum should be wiped should it be contaminated by sludge spillage.
6. When the last drum has been filled patches up the hole in the side of the with blocks and cement mortar. It is the responsibility of the site supervisor to ensure that the latrine is repaired to a high standard if a repair has been agreed with the customer.
7. Clean-up the site with liberal quantities of disinfectant doused wherever sludge has been spilled. All surfaces must be clean and free from faecal sludge prior to team departure. All water used for cleaning is to be brought to the FSTP.

2.4 Transport and disposal

1. Position the vehicle making sure it'll not disrupt traffic. Set parking break.
2. Place plastic sheet on floor of vehicle to protect the surface of the vehicle and ensure that it is easier to clean in case of spillage;

3. Transfer and load drums on the vehicle. Drums must be sealed to prevent waste contaminating the environment;
4. Drive the loaded vehicle slowly and carefully, bearing in mind the hazardous nature of the goods being transported. Road regulations must be obeyed at all times;
5. In the event of an accident or moving violation (citation), cooperate with local authorities. Be prepared to show driver's license, vehicle registration, and insurance if requested. A complete report will be required, and all incidents should be investigated.
6. Once arrived at the FSTP, empty drums at the disposal point;
7. Vehicle and drums should be cleaned in a safe space that does not risk human exposure to sludge. This must take place at a designated site.

2.5 Don't

- ✗ Use your hands or gloves to pick up sludge
- ✗ Use things belonging to the household (like buckets or tools) to help you with your work
- ✗ Fill the drums too full to carry
- ✗ Transport any waste container without a lid

3 SECTION 3: VACUUM TRUCK OPERATION

Figure 0-17 Vacuum tanker during operations (Source: Practica, SIA)

Figure 0-18 Vacuum tanker during operations (Source: Practica, SIA)

3.1 Potential hazards

Main hazards related to vacuum truck operations are summarized in the following table

Category	Hazards
Physical:	Tripping and fall hazards such as hoses running across the aisles Accidents on the road or within FSTP Hair/clothing getting caught in moving machine parts Noise.
Chemical:	Direct and indirect oral, nasal and dermal exposure to chemicals (e.g. hydrocarbons that are often introduced as odour suppressants, although this practise is not recommended); Confined spaces in the presence of harmful gases (e.g. methane, ammonia, sulphur dioxide), in an oxygen depleted environment (in particular during vessel cleaning).
Biological:	Direct and indirect oral, nasal and dermal exposure to multiple types of pathogens in FS such as bacteria, viruses, protozoa, and helminths).

3.2 Equipment

Equipment will include:

- Vacuum truck properly fuelled;
- Reinforced suction hoses of 3 or 4” with rigid suction nozzle;
- PPE and safety equipment’s listed under 1.4 section;
- Lube oil;
- Tools: Shovel, digging bar, rake, lifting bar for tank lids, screwdrivers, vice grips, pliers for opening tank lids.

3.3 Pre-operational safety checks

Before using the truck:

- ✓ Test of the pressure vessel must be carried by the Ministry of labour Department of Occupational Health & Safety. A permit must be issued for each vessel in use.
- ✓ For the safe operation of the truck and vacuum tank, it is imperative that a routine maintenance schedule is developed and applied according to manufacturer instructions.
- ✓ Observe all maintenance requirements and ensure operator is competent with machine before commencing operations.
- ✓ Locate and make sure that the operator is familiar with all machine operations and controls.
- ✓ Ensure all guards are fitted, secure and functional.
- ✓ Use only implements that meet the manufacturer's recommendation.
- ✓ Before starting the truck, ensure all levers are in their neutral positions, the parking brake is engaged and the clutch and PTO are disengaged.
- ✓ Make sure the driver is trained and competent and appropriately licensed.
- ✓ Ensure all lights and warning devices are functioning and the vehicle is registered.

3.4 Operating the vacuum truck

Detailed operating procedures will depend on selected equipment. General instructions for are listed below:

3.4.1 Emptying

1. Park the truck as close to the system as possible. Note that larger distances will result in longer installation / working time and higher fuel consumption;
2. Position the truck making sure it'll not generate traffic disrupts or any trouble to the neighbourhood. Chock the wheels and set parking break;
3. Meet the building owner and agree with her/him on the service to be performed;
4. Proceed the worksite installation referring to 1.4;
5. Lay out and connect the hoses from the truck to the tank or pit to be emptied**;**
6. Open the tank or pit by removing the access ports or covers over the storage system**;**
7. Engage the vacuum equipment and **i**ncrease the vacuum to the proper level with the valve closed by watching the vacuum gauge, then lowering the end of the hose into the storage system and open the valve sufficiently such that the FS is drawn out of the tank or pit. Closing the valve periodically re-builds the vacuum to enable the removal of further FS. Continue this process until the job is complete;
8. Break up FS that has agglomerated into a solid mass, either by making use of a long handle shovel and adding water when necessary to reduce the viscosity of the FS; or by reversing the direction of the flow and forcing the contents of the vacuum truck tank back through the hose and into the sanitation system in order to use the high pressure stream to break up the sludge. The direction of the flow is then returned to normal and the contents removed. It is essential to ensure that the hose is in sound condition, and that the hose connections are locked into place prior to using this method;
9. Operators should remove 90% of the contents. It is recommended that this is verified by management through periodic spot checks.

10. Ensure that the tank lids are properly attached when the pumping is complete and that they are properly secured;
11. Prepare a written report indicating information about customer and emptied OSS
12. Secure the tank lid and pack away the hoses making sure sludge within hose is properly pumped in to the vacuum tank. To do so small volume of clean water (20 litres) can be pumped before disassembling hoses;
13. Clean up any spillage using proper sorbent materials;
14. Inform the client that the work is complete.

3.4.2 Transport and disposal

Vacuum truck drivers are responsible for all rules of the road;

On the road:

1. Remove the wheel chocks and drive the truck to the next site or to the FSTP;
2. Take the most expedient rout to the disposal site considering traffic flows;
3. Drive the loaded vehicle slowly and carefully, bearing in mind the hazardous nature of the goods being transported. Road regulations must be obeyed at all times;
4. In the event of an accident or moving violation (citation), cooperate with local authorities. Be prepared to show driver's license, vehicle registration, and insurance if requested. A complete report will be required and all incidents should be investigated.

At the FSTP:

5. Position the truck so that the FS may be directed to the inlet chamber with only one length of hose;
6. Chock wheels and place parking break;
7. Open the valve and allow the septage to flow via gravity into the inlet tank. If required, set the vacuum pump in pressure setting to push sludge out of the tank;
8. When the tank is empty, disconnect hose, clean with water (directing stream into inlet tank), and replace in tool box
9. Truck should be cleaned in a safe space that does not risk human exposure to sludge. This must take place at a designated site.
10. Regularly, the vacuum vessel should be desilted in order to remove heavy debris and solids accumulated in the tank. Following precautions must be observed then:
    a. Before undoing any hatch, ensure the tank is depressurised completely.
    b. Before entering the tank, make sure it has been properly ventilated, the pump is running and that the person entering has a rope attached, which should be held by two people. Never close the entry hatch with someone inside;
    c. As some gases released sludge may be flammable, never smoke or hold up naked lights in the vicinity of the tanker.

3.5 Don't

- ✘ Do not operate truck on excessively steep terrain.
- ✘ Do not allow any person other than the driver to drive the truck and operate the PTO / auxiliary engine;

- ✗ Do not operate if guards are missing or faulty;
- ✗ Do not use faulty equipment. Report suspect machinery immediately;
- ✗ Do not operate engine in a non-ventilated area.
- ✗ Do not operate near ditches, holes or embankments, which may collapse under the truck's weight.

4 SECTION 4: SLURRY TANKER OPERATION

Figure 0-19 HP washer and slurry tanker (Source: WES Management, SIA)

4.1 Potential hazards

Main hazards related to tractor and slurry tankers operations are summarized below:

Category	Hazards
Physical:	Tripping and fall hazards such as hoses running across the aisles Accidents on the road or within FSTP Hair/clothing getting caught in moving machine parts Noise.
Chemical:	Direct and indirect oral, nasal and dermal exposure to chemicals (e.g. hydrocarbons that are often introduced as odour suppressants, although this practise is not recommended); Confined spaces in the presence of harmful gases (e.g. methane, ammonia, sulphur dioxide), in an oxygen depleted environment (in particular during vessel cleaning).
Biological:	Direct and indirect oral, nasal and dermal exposure to multiple types of pathogens in FS such as bacteria, viruses, protozoa, and helminths).

4.2 Equipment

Equipment will include:

- Tractor properly fuelled (75 HP, 2 WD);
- Single axle slurry tanker (2 to 5 m^3);

- 100 bar Diesel HP washer, and a 150 l plastic drum to fluidize sludge;
- Two Sealable chemical 55 litres barrels for solids removal;
- Reinforced suction hoses of 3 or 4" with rigid suction nozzle;
- PPE and safety equipment's listed under 1.4 section;
- Lube oil;
- Tools: Shovel, digging bar, rake, lifting bar for tank lids, screwdrivers, vice grips, pliers for opening tank lids.

4.3 Pre-operational safety checks

4.3.1 Before using the tractor:

- ✓ For the safe operation of the tractor, it is imperative that a routine maintenance schedule is developed and applied according to manufacturer instructions.
- ✓ Make sure that the operator is competent with machine before commencing operations.
- ✓ Ensure all guards are fitted, secure and functional.
- ✓ Ensure the 3-point linkage, pneumatic and hydraulic systems are functioning.
- ✓ Use only implements that meet the manufacturer's recommendations.
- ✓ Before starting the tractor, ensure all levers are in their neutral positions, the parking brake is engaged and the clutch and PTO are disengaged.
- ✓ Make sure the driver is trained and competent and appropriately licensed.
- ✓ Ensure all lights and warning devices are functioning and the vehicle is registered.

4.3.2 Before using the slurry tanker:

- ✓ Test of the pressure vessel must be carried by the Ministry of labour Department of Occupational Health & Safety. A permit must be issued for each vessel in use.
- ✓ For the safe operation of the tractor, it is imperative that a routine maintenance schedule is developed and applied according to manufacturer instructions.
- ✓ Exercise extreme caution when turning on sloping ground. Especially with a partially filled tanker as the inertia will cause the weight of the contents of the tank to be thrown to one side of the tank. Never operate on ground where there is a risk of the tractor becoming unstable
- ✓ The emergency breakaway handbrake should be connected to the tractor every time the slurry tanker is used. The connection should be via a rope attached to a solid part of the tractor such as the top link and not to a panel. The rope should be tight enough for the handbrake to be operated if the tanker becomes detached from the tractor but loose enough so that the handbrake is not applied during normal operation.
- ✓ Before using the vacuum pump ensure that the PTO shaft is turning freely and the direction of rotation is the same as indicated by the arrow on the pump. Never turn the vacuum pump shaft in the opposite direction to that indicated as this could damage internal components of the pump.
- ✓ Ensure that the safety pressure relief valve is set and working correctly by lifting the top round part, the pressure gauge should read no more than one bar – adjustment is required if the pressure is higher than this.
- ✓ Always apply the parking brake when the tanker is to be left unhitched from the tractor.

4.4 Operating the slurry tanker

Detailed operating procedures will depend on selected equipment. General instructions for using a slurry tanker are listed below:

4.4.1 Emptying

1. Hitch the slurry tanker to the tractor. Always use a recognised hitch pin with a safety clip to hook trailed implements on behind the tractor.
2. Connect PTO shaft to the Vacuum Pump
3. Park the tractor and slurry tanker as close to the system as possible. Note that larger distances will result in longer working time and higher fuel consumption;
4. Position the vehicle making sure it'll not generate traffic disrupts or any trouble to the neighbourhood. Chock the wheels and set parking break;
5. Meet the building owner and agree with her/him on the service to be performed;
6. Proceed the worksite installation referring to 1.4;
7. Lay out and connect the hoses from the truck to the tank or pit to be emptied;
8. Make a hole in the side of the latrine to access the pit;
9. Fluidize sludge by jetting water in the pit using the HP washer in combination with the fishing tool used to mix the sludge and remove floating solids. All solids and liquid waste must be transferred to sealed barrels, free from leaks. Lids should be put on drums immediately after filling. The external surface of the drum should be wiped should it be contaminated by sludge spillage;

Note:

Face shield or googles must be used during fluidizing operations.

Repetitive and sustained use of the high pressure cleaner could pose a manual handling hazard.

Ensure appropriate manual handling techniques are applied when handling the high pressure cleaner.

10. Engage the PTO at low rpm and set at the speed recommended by manufacturer to increase the vacuum to the proper level with the valve closed by watching the vacuum gauge, then lowering the end of the hose into the storage system and open the valve sufficiently such that the FS is drawn out of the tank or pit. Closing the valve periodically re-builds the vacuum to enable the removal of further FS. Continue this process until the job is complete;
11. Break up FS that has agglomerated into a solid mass, either by making use of a long handle shovel and adding water when necessary to reduce the viscosity of the FS; or by reversing the direction of the flow and forcing the contents of the vacuum truck tank back through the hose and into the sanitation system in order to use the high pressure stream to break up the sludge. The direction of the flow is then returned to normal and the contents removed. It is essential to ensure that the hose is in sound condition, and that the hose connections are locked into place prior to using this method;
12. Operators should remove 90% of the contents. It is recommended that this is verified by management through periodic spot checks.

13. Watch sight tubing for filling and turn off tap immediately when sludge reaches top of tube;
14. Ensure that the tank lids are properly attached when the pumping is complete and that they are properly secured;
15. Prepare a written report indicating information about customer and emptied OSS
16. Secure the tank lid and pack away the hoses making sure sludge within hose is properly pumped in to the vacuum tank. To do so small volume of clean water (20 litres) can be pumped before disassembling hoses;
17. Clean up any spillage using proper sorbent materials;
18. Load the drums with equipment and solids removed from the latrine on the slurry tanker. Drums must be sealed to prevent waste contaminating the environment;
19. Inform the client that the work is complete.

4.4.2 Transport and disposal

Tractor drivers are responsible for all rules of the road;

On the road:

1. Remove the wheel chocks and drive the tractor to the next site or to the FSTP;
2. Take the most expedient rout to the disposal site considering traffic flows;
3. Drive the loaded vehicle slowly and carefully, bearing in mind the hazardous nature of the goods being transported. Road regulations must be obeyed at all times;
4. In the event of an accident or moving violation (citation), cooperate with local authorities. Be prepared to show driver's license, vehicle registration, and insurance if requested. A complete report will be required and all incidents should be investigated;

At the FSTP:

5. Position the truck so that the FS may be directed to the inlet system with only one length of hose;
6. Chock wheels and place parking break;
7. Open the gate valve to the discharge unit at the rear of the tanker. If required, set the vacuum pump in pressure setting to push sludge out of the tank;
    - Engage PTO and set at the speed recommended by manufacturer;
    - Check tank pressure;
    - Engage tractor in forward gear;
    - Operate hydraulic unloading valve to discharge while driving at appropriate speed to spread.
8. When the tanker is empty, disconnect hose, clean with water (directing stream into inlet tank), and replace in tool box;
9. Truck should be cleaned in a safe space that does not risk human exposure to sludge. This must take place at a designated site;
10. Regularly, the vacuum vessel should be desilted in order to remove heavy debris and solids accumulated in the tank. Following precautions must be observed then:
    - Before undoing any hatch, ensure the tank is depressurised completely.

- Before entering the tank, make sure it has been properly ventilated, the pump is running and that the person entering has a rope attached, which should be held by two people. Never close the entry hatch with someone inside;
- As some gases released sludge may be flammable, never smoke or hold up naked lights in the vicinity of the tanker.

4.5 Don't

- ✗ Do not operate tractor and slurry tanker on excessively steep terrain.
- ✗ Do not allow any person other than the driver to drive the tractor and operate the PTO / auxiliary engine;
- ✗ Do not operate if guards are missing or faulty;
- ✗ Do not use faulty equipment. Report suspect machinery immediately;
- ✗ Never operate on ground where there is a risk of the tractor becoming unstable
- ✗ Never park the tractor and Slurry Tanker on a slope
- ✗ Always apply the parking brake when the tanker is to be left unhitched from the tractor;
- ✗ Operating pressure should be kept within the range indicated by the manufacturer to avoid overheating the pump or breaking the vanes
- ✗ Do not operate engine in a non-ventilated area.
- ✗ Do not operate near ditches, holes or embankments, which may collapse under the tractor and slurry tanker's weight.