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**Online postgraduate Diploma in WASH**

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1. **Paul, a resident in the outskirts of your town, consults you about building a latrine in the compound of his house. He is an open-minded man who is keen to improve life for his family. He has a wife and three young children, and his elderly mother also lives with them. He doesn’t have a tap in his house and gets water from a nearby well. The area has heavy soil and the rock below is impermeable.**

1. **Which types of latrine are possible choices for him?**

A latrine is a safe and private place to be used for defecation. A wide range of latrines are used in households, schools, houses of worship, and other agencies. However the type of latrine that would be his possible choice is **dry pit latrine** that has the following characteristic;

Before even considering whether they are a good technical choice or not, **latrines must be well suited to the** desires, habits, behaviours and financial possibilities of their users. If not, they are likely to be quickly abandoned or misused. Their implementation must thus be preceded by information and hygiene and health awareness raising campaign are essentially differentiated by their operating mode (with or without water), their construction type (1 or 2 pits, below or above the ground), their superstructure (temporary or permanent), their ventilation system (with or without), whether they use by-products or not (ecological latrines or otherwise), their durability and their cost.

**The main components common to all dry latrines** are as follows, which all have the following characteristics with the minor exceptions specified in the fact sheets specific to each type:

**a) Pit**

Can be circular, square or rectangular. The shallowest pits are generally square or rectangular whereas pits more than 2 metres deep (which are found in the highest numbers and which are the preferred solution, preferably being dug to a depth of at least 3 m) are generally circular. Their diameter (or width) is usually between 1 m and 1.50 m to facilitate terracing. A waterproof lining should be provided if the ground is unstable or permeable and likely to contaminate ground water within 30 m. **Size**

**b) Slab**

Is **fairly simple to make** (concrete, reinforced moulded plastic, sturdy planks or logs, or if not, other materials such as bamboo covered with gravel, old frames, etc.) and **to install**.  
It should preferably be located between 10 and 15 cm above ground level so that surface water does not run into the pit (if not, a drainage channel for water runoff should be dug around the latrine)  
**Make sure that the edges of the slab overlap the soil surface slightly** (for example, by about ten cm for a pit one metre in diameter) to ensure proper support.

**c) Superstructure - stall**

It is important because it is what makes the toilet more discreet, comfortable and pleasant to use. The choice and cost of the model and its materials (bricks, concrete blocks, planks, poles and fabrics, bamboo etc.) will depend on the desires, habits region and income of users.  
The door can be made of wood, corrugated iron or even strips of bamboo or local plants that can be attached to old wooden boards or frames, or even with simple curtains.  
The door must open outwards for safety reasons and to provide more room.  
The roof must be sealed. Is often made of fibre cement, metal sheet (although often at a high price and with a risk of heat) or local materials, which often also look better (stubble, leaves, reeds, bamboos, etc.) provided they are covered with a waterproof material or a plastic sheet.

The interior layout can be improved by providing a seat above the hole in the slab, a wooden support bar, or a seat which may be removable for disabled or elderly people, and a small bucket of sawdust, leaves or water for anal cleaning. If the pit is not very deep and is not planned to be used for long and is movable, it is better to build a fairly simple stall

**d) Ventilation**

To allow air to enter the latrine and avoid excessive odours, **openings should be made** above the door and at the bottom of a wall. The flow of air will be more effective if the door is facing the prevailing wind. The most effective system to prevent odours is, however, the so-called **VIP (Ventilated Improved Pit) latrine:**

**(b)Which types of latrine would you recommend, and why?**

I can recommend to him to build a Concrete-lined pit;

Three or more concrete rings up to required depth. Holes in rings for fluid soak way. The reasons for recommending the above type of latrine are as follows;

* Can easily be built with local skills,
* Prevents pit from collapsing;
* Can be used for many years;
* Suitable for fragile soils;
* Can be used in areas with high groundwater table;

This type of latrine can be used for areas with high groundwater table, "flooding areas and tidal areas

**( C) What other advice would you give him about the location, design and construction of the latrine?**

Several factors have to be considered when choosing the most appropriate latrine technology. A person who is about to dig the latrine should first do following steps

**Location**

For any type of pit latrine, the location of the pit relative to water sources is of prime importance.

**Distance from houses and the users also need to be considered**.

The availability of water will determine whether or not a water-flushed system is possible. If an adequate water supply is available, pour-flush or cistern-flush toilets can be considered as an option. Otherwise, pit latrines have to be the system of choice. The space requirements (especially in urban areas) may limit the choice of systems that can be installed.

**Construction materials**

The type of construction materials and their availability will often dictate the type of latrine that is possible in a given area. To keep costs down, and for the latrines to be sustainable (i.e. to be able to be used for a long time), materials that are readily available locally should be used for construction. Added to this, a system that is easy to build and maintain using locally available skills is preferable.

**Cost**

Latrine systems have to be affordable to the users. The cost is made up of two components: construction cost and operating cost. The operating cost will include the cost of pit-emptying (in the case of pit latrines) and the cost of water (for water-flushed systems). The total cost should be kept low so that most people find it affordable.

**Safety and accessibility**

The latrines should be safe for both children and adults to use. For instance, the size of the squat hole should not pose a danger to children using the facility.

Accessibility for elderly people and people with disabilities is another important consideration. The chosen system should be easily accessible to them without causing discomfort or inconvenience. As examples of modifications, handrails may need to be installed to help the infirm and those who are blind, and the door of the latrine should be wide enough for wheelchair access

**2. Nancy is a laboratory technician. She is analysing a sample of wastewater collected from a pipe that discharges effluent into a river. Name two tests Worknesh could perform to assess the physical characteristics of the effluent.**

This can be determined by a measure called the biochemical oxygen demand (BOD). BOD tests are carried out in a laboratory and involve measuring the amount of oxygen used, usually over a period of five days, as the organic matter in the wastewater breaks down. The result is the amount of oxygen used in degrading the organic matter in the wastewater, which is expressed in milligrams per litre (mg l-1). There is also a chemical method of determining the quantity of organic matter called the chemical oxygen demand (COD) test.

This test is much quicker than the BOD test, taking only about two hours to carry out. It depends on chemical oxidation of the organic matter rather than biological degradation. It involves boiling a sample of wastewater with a mixture of concentrated acids and a measured quantity of oxidising agent to oxidise the organic matter. The amount of oxidising agent remaining at the end of the test is measured. The amount that has been used up is equivalent to the amount of organic matter in the sample. The result is again expressed in mg l-1.

COD tends to give higher results than BOD because the chemical process can oxidise more material than the biological process. Inorganic material Wastewater also contains inorganic chemicals. This means any substance that has not come from animals or plants, so it includes a wide range of different chemicals as well as inert solids like sand and silt. Many inorganic chemicals are dissolved in the water and although some are harmless, others are pollutants that can damage aquatic life such as fish and other organisms that live in water. One example is ammonia (NH3) which is present in human and animal excreta. Like organic matter, ammonia is broken down in the environment by natural processes.

If ammonia is released into a river it is converted by the action of bacteria to nitrate (NO3), which is less harmful. This natural conversion of ammonia to nitrate requires oxygen and is limited if there are excessive quantities of ammonia. Other examples of inorganic chemicals in wastewaters are chloride (from salt), phosphates (from chemical fertilisers and from human and animal wastes), and metal compounds (from mining operations or metal-plating plants).

Biological characteristics of liquid wastes Liquid wastes contain many different types of bacteria and other micro-organisms originating from human wastes and other sources. Many of these bacteria are beneficial and are responsible for the biodegradation of organic components of the wastes; others may be pathogenic. The presence of bacteria in wastewater is normal and expected, but it becomes a problem if the waste is not kept separate from people or if it contaminates clean water or food

**(b)As part of the analysis she also does a BOD test on the sample and gets an unusually high result. What does the high BOD tell her about the wastewater? What effect could it have on the river?**

The safe management and disposal of any waste containing human excreta is the most critical aspect of sanitation and hygiene and is essential to prevent the spread of infectious disease. Industrial wastewaters in Ethiopia The composition of industrial wastewater will vary depending on the type of industry, the raw materials used, and the processes undertaken. Three of the most important producers of industrial wastewater in Ethiopia are the food industry, the textile industry and tanneries.

The food industry Food production is a priority in Ethiopia and plays a major part in the economy, with factories producing bread, beverages, sugar and several other products. Many of the production processes require large volumes of water and so most of the factories are located near rivers or boreholes. Canneries The volume of clean water required differs between canneries and the products they are preparing, but ensuring cleanliness is obviously essential. For tomato paste, a popular food product in Ethiopia, it takes about 220 litres of water to produce 10 kilograms of tomato paste. Canning factories that produce tomato paste, such as the Merti Processing Factory in Oromia, generate both solid and liquid waste.

The quantity of solid tomato waste may be as much as 15-30% of the total quantity of product (Faris et al., 2002). The wastewater from a cannery will contain organic solids, primarily from washing raw materials such as tomatoes, cleaning equipment, spillage and from floor-washing. Meat packaging Wastewaters are generated at animal yards, slaughterhouses and packing houses. The main sources are animal faeces, urine, blood and water that has been used for washing floors and surfaces.

The pollutants in the wastewaters are organic and can decompose rapidly, generating unpleasant odours. If discharged to a water body, they will cause severe environmental pollution. The meat industry utilises thousands of litres of water per day depending on the size of the facility and the number of animals processed. What will be the effect of the organic waste from meat packaging if it is discharged into a river? The organic waste will exert an oxygen demand as it is broken down by bacteria.

This could deplete the oxygen available for other living organisms in the water such as fish. Dairy industry Wastewaters from dairies may come from receiving stations (where milk is delivered from individual farms), bottling plants, creameries, ice cream plants, cheese production units and dried milk production plants. The wastewater from spillage, cleaning and washing usually contains milk which has a very high polluting potential. The polluting potential is the potential of the wastewaters to cause pollution, i.e. damage to the condition, health, safety, or welfare of animals, humans, plants or property. Textile industry The raw materials for the textile industry are wool, cotton and synthetic fibres.

**3. What is the purpose of the report of a rapid assessment and who should receive copies of the report? Explain the contents of Rapid Assessment Report**

Rapid assessment of urban sanitation and waste management is the process of collecting information from households and institutions to get a quick overview of the situation in an urban community. The results can then be used to identify the areas that need to be improved and suggestions of possible solutions. The assessment involves observations of the community and discussions and meetings with target households and other community members. Some examples of the type of question that could be asked are:

How many households and schools have sanitary facilities (including handwashing provision) and how are these facilities being used?

How convenient are the facilities?

Do they provide the necessary access and privacy and preserve dignity?

What is the current level of sanitation and waste management knowledge among the community?

Why do an assessment?

There are a number of reasons why a WASH team may need to carry out an assessment. Usually this relates to the need to get information on the state of sanitation and waste management in a particular town or part of a city and have the ‘facts on hand’ to inform others (particularly political leaders and community members) as they make action plans for improvements. The assessment can also be used as a monitoring exercise to provide a quick overview of how an urban community has been using its sanitation facilities and waste management system. This could be used to identify the individuals or groups of people who are at the greatest risk of harm from poor WASH practices. Assessments are also used to help plan WASH facilities in an emergency situation: after a mass movement of people to a refugee camp, for example, or while recovering from a natural disaster. Note that the assessments discussed are classed as ‘rapid’. This is because they are intended to provide a quick view of the situation and to identify the key areas for immediate action. In the longer term, it is important to assess the effectiveness of any WASH programme. An initial assessment might be done before the start of the programme to find out the baseline position (the situation before any improvement programmes are implemented).

This would be followed by further assessments during and at the end of the programme to determine its progress. Finally, an assessment carried out sometime after the end of the active phase of the programme would help to determine any long-term benefits achieved. This type of longer-term assessment is part of the more rigorous process of ‘monitoring and evaluation’,

**The assessment team;**

These assessments are most effectively carried out by a mixed team of people, rather than an individual, to make sure that all the necessary skills and experiences are present (Visscher et al., 2014). This could be the Woreda WASH Team and may also involve environmental health workers, Health Extension Workers, urban health supervisors and others. In any event, at least some of the team members should have basic public health training, experience of rapid assessment surveys and familiarity with best practices in sanitation and waste management.

Teams should include both men and women because people may not want to discuss sensitive subjects such as latrine use with a member of the opposite sex. Why is it better to use a team of people rather than one individual? A team could undertake an assessment of a larger area and/or complete the task more quickly than someone alone. Also, a single person will have less experience than an entire team and may not have the knowledge and skills required. A team including both men and women who have a variety of experiences and backgrounds will be better able to cover all aspects of the assessment.

The assessment process the first part of any assessment is to agree on why the assessment is being carried out and to identify any specific aspects of WASH that need to be looked at. An assessment that is carried out as part of a project to determine the need for latrines, for example, would need very different information than one looking at the possibility of setting up a waste composting scheme. This first part will normally be done by the team leaders working with the organization that requested the survey or provided the funding for the work. It is important that representatives of the community being assessed should be part of this process so that they can influence the decisions and remain informed.

The output from this initial stage of the process will be an overall aim, together with a series of objectives (you can think of objectives as the aims for each smaller piece of the work). All assessments should end with the production of a report, and it is important at the start to consider who this report is for. This will determine what data needs to be collected and what sort of data analysis is done. This in turn will determine some of the skills required of the project team and may identify where specialized computer data processing software is required. Based on the aim and objectives, the team should prepare a checklist of the information that needs to be collected. The advantages of using a checklist are that it:

* provides a standardized approach to what is reviewed during assessment
* helps supervisors to cover all issues without forgetting anything
* provides a means of documenting assessment findings in a simple manner that can be referred to in the future
* provides a record for tracking performance changes over time
* provides a basis for identifying needs for follow-up actions.

The information gathered during the assessment will come from both primary and secondary sources. Primary sources are the information obtained by the survey team through observations, questionnaires and other methods, which are discussed in the next section. Secondary sources consist of the results of work that has already been done, such as previous surveys in the same area or in other locations that are similar to the survey area. Reviewing existing documents and reports can also provide valuable background information for the planned assessment. For example, demographic data such as the total population of the study area, the number of people of different age groups and the proportion of men and women will be useful. Having prepared the plan and agreed the process with community representatives, at the start of the survey the team should arrive at the community or kebele as scheduled and on time.

The visit should start with introductions to the community (usually done through a small group of community representatives), including descriptions of each person’s position and responsibility in the project. The team leader should explain the objective of the assessment and agree with the community representatives how the assessment will proceed. The time required for interviews, reviews, discussion and action planning should be set at this stage. It is important to make sure that the community is aware that it is not being ‘judged’ in any way, but that the work is to find the best way of improving WASH in the community.

At this point, the community should be reassured that all discussions with individuals and questionnaire responses will be treated in the strictest confidence. An assessment method assessing the key sanitation and hygiene aspects of a community requires the use of a number of investigation methods. The main methods (Asefa and Tessema, 2000; Feleke et al., 2003 )are listed below:

1. Interviews are conversations between the investigator and members of the community, usually on a one-to-one basis. Depending on the information required, different types of interviews and questions can be used; the interviewer takes notes of the interview or uses a voice recorder. When conducting interviews it is important to gain the interviewee’s consent before starting and to make it clear how the information will be used. Generally, interviewee’s comments should not be used in reports in a way that allows the person to be identified.
2. Observation is often combined with interviews. Observation simply means recording what you see or are aware of. For example, while visiting households, interviewers observe the availability and quality of the sanitation and waste facilities, such as the household latrine, solid waste storage and disposal, and hand washing provision. In addition, the interviewer will try and gain a picture of the use of these facilities through observation and discussions. At the same time, the general condition of the housing, water management and food handling can also be observed. There is a risk that the observer will assess the position against their own personal views (a subjective view), so it is important to have a set of standards to be used by all observers to make the assessment as objective (based on things that can be measured or counted and not influenced by personal opinion) as possible. General observations can be made simply by walking around the area and noting the condition of the town.
3. Discussions with the community can provide valuable information about the concerns and health situation of community members that can help to confirm the findings of the interviews and observation. For example, one would expect a high incidence of diarrhea to be reported if an absence of latrines and hand washing facilities had been identified

Reporting the findings of the investigation and analysis need to be summarized and incorporated into a report. The report should always refer explicitly to the aims of the assessment that were agreed at the beginning and say how well these have been achieved. Depending on what the aims were, the report may identify the areas where action is necessary and make recommendations for a programme to implement the action plan. The report will often make suggestions about any additional survey work that may be needed. It is also useful to produce a brief factsheet that summaries the findings of the survey and to hold a meeting with the kebele administration at the end of the project and share the report’s findings with them. The report will be distributed to the organization that commissioned the work. They may ask that the report is also sent to other interested organizations. In any event, the report should only be sent to other organizations with the specific permission of the funding organization.

4**. Explain five ways in which urbanisation creates challenges for effective sanitation and solid waste management.**

Challenges emerging from rural-urban interaction

Urban centres are usually surrounded by rural communities and the two areas depend on each other to supply many of their needs. Urban areas depend on the rural areas to provide food, fuel and construction materials. In return, the rural community depends on urban areas to supply employment, commercial products, advanced healthcare provision, education and equipment, machinery, and other industrial outputs. Having said this, problems may arise when there is a large temporary influx of people from the rural to the urban areas. Examples include:

* the increased demand for sanitation facilities in the area around a city market
* the manure generated by animals that are brought for sale or used for transport
* the congestion caused by the number of people and animals using the roads.

**Challenges emerging from the urban situation**

Even without the influxes from rural areas, urban centres are congested and crowded. They have often grown without any planning, so the problems arising from the lack of sanitation, waste management and the other infrastructure mentioned above are present. Urban growth also means that there is an increase in the area of land covered with concrete and other hard surfaces.

* Why would an increase in the area of land covered with concrete or other hard surface be a problem?

Urban development reduces the ability of the ground to absorb rainwater. In urban areas a high proportion of the ground is paved, which prevents the absorption of rainwater. Also, unplanned developments usually lack the drainage ditches or channels necessary to carry away surface waters. These two factors combine to create an increased risk of flooding and the outbreak of waterborne disease that can follow floods.

**Challenges from industrial discharges**

Most industries in developing countries discharge untreated or partially treated liquid wastes to sewers, where these are available, or to rivers, streams or ditches. Industries also release waste gases that may contain harmful substances and produce solid wastes that may contain **hazardous** materials (such as poisons, strong acids, infectious material, etc. that can cause harm to humans because of their properties). As a result, unregulated industries can harm human health and the environment in many ways.

**Challenges from transport**

We have already mentioned problems from traffic congestion, but the use of a large number of often badly maintained petrol- and diesel-fuelled cars, lorries and buses cause additional health problems. The exhaust gases from these vehicles contain fine particles, partly burned fuel and acidic substances that make breathing difficult and cause irritation of the lungs. While this is a problem for all people, it is much worse for the old, the very young and the ill, especially those with heart problems or who suffers from asthma.

**Challenges to society**

Increasing urbanisation puts pressures on society as a whole as well as on the environment. People who migrate to cities may become unemployed and then need to be provided for. This puts pressure on welfare provision and on the charities that provide assistance to the hungry and the homeless. Even people who have jobs find it difficult to find somewhere to live and may develop illegal unplanned settlements that affect the planning and service provision of the government sectors. These settlements also add to the city’s sanitation and waste problems.

The urban population requires daily supplies of food, fuel and other goods which can put pressure on the infrastructure needed to deliver and sell these goods. Once goods reach the end of their lives they become waste, increasing the pressure on the waste collection and treatment systems.

**Challenges to administration**

A growth in population creates more work for the city’s administration. If funds are not available to increase staff numbers to deal with this demand, problems will occur. In the case of sanitation and waste management, as well as services not being provided to the whole of the city, the additional workload can reduce the effectiveness of the governance of these programmes, which can result in lower standards and a poorer service for the entire city.

To deal with the problems of population growth, various organisations need to work together; for example, water, sanitation and health service providers, and non-governmental organisations (NGOs). When growth is rapid, these organisations can be overwhelmed and so coordination can break down. This may mean that in some cases, efforts are duplicated, and sometimes there will be gaps in addressing some aspects of the programme.

If public administration and regulation is already weak, the entire system can fail. In the absence of good regulation, standards of sanitation and waste provision can fall, increasing pressures in other areas such as health services.

**5. How do good sanitation and waste management practices bring a positive effect to urban inhabitants? Give examples for effects on:**

1. **health**

Diseases linked to poor sanitation and hygiene has a significant impact on children’s health and education. 38% of Ethiopian school children are infected with parasitic worms (Mahmud et al. 2015). These infections contribute to malnutrition because the parasites prevent the child’s body from absorbing nutrients from the food that they eat. Long-term malnutrition retards children's physical and intellectual development. The Young Lives survey (2014) reported that around 30% of Ethiopian children are stunted, which is a sign of long-term malnutrition. (Stunted means that a child’s height is less than expected for their age), Children are frequently ill as a result of parasites and other infections, which leads to poor school attendance and performance.

1. **education**

Furthermore, if the school attended by an infected child does not have good sanitation and handwashing facilities the infections are likely to spread to healthy children. There are also social impacts of poor sanitation provision in schools. An absence of latrines with separate facilities for girls and boys means that post-pubescent girls are more likely to stop attending schools, especially when menstruating .When healthy children attend a school with well segregated sanitation facilities; they are present more regularly and are better learners. This, in turn, makes them better able to find jobs that demand higher-level skills on finishing school; an advantage to them, their families and the community as a whole. This contributes to wider economic benefits.

1. **economic conditions**

A healthy community has many economic advantages over an unhealthy one. If people are healthy they will spend less money on health care and the loss of work days due to diarrhoea and other related infections is reduced. Illness can affect both the sick person and their family, for example when women have to take time off work to care for sick children. Improving solid waste management has economic advantages in addition to the health advantages discussed above. Consider the following example. It is said that a firm that throws something away pays towards it three times over. Imagine a firm that uses raw materials and puts them through a manufacturing process to make a final product. First, the firm has to pay its suppliers for the raw materials.

Secondly, it pays its staff to transform the raw materials into products, and pays for the water and energy that it uses. Finally, the firm has to pay for disposal of what it throws away. So a firm that reduces the amount of waste it produces makes savings in all three areas. A firm that uses basic materials such as glass or metal faces large energy bills for the processes required in converting these materials into products. But if they follow the principles of the 3 Rs (reduce, reuse and recycle) and substitute some of their input raw material with scrap glass or metal, they can reduce their energy bills and buy less raw materials. These materials are often imported, so using recycled scrap reduces Ethiopia’s expenditure abroad, which benefits the national economy as well as individual firms.

There are further benefits from recycling. The initial stages in the recycling process (collecting material from households and businesses) is labour-intensive and provides employment for the poorest people in society. Giving them an income improves their health, which, in turn, reduces the country’s healthcare expenditure. A householder in an urban area goes shopping for food. How can they apply the 3 Rs when it comes to packaging materials? They can reduce packaging waste by buying loose fruit and vegetables rather than prepackaged goods. The can reuse carrier bags to take the shopping home rather than picking up new bags each time they shop. They can recycle by taking any glass or metal food containers to collection points or by giving them to people who earn their living by collecting recyclable wastes

1. **the environment**

What do we mean by ‘the environment’? You may think of it as your immediate surroundings in the town or kebele where you live or work. However, it can also mean the wider natural world on a much larger, even global, scale. Poor sanitation and waste management have direct impacts on the local environment, but human practices can also have broader consequences.

There are obvious local environmental benefits from improved sanitation. This means that defecation only takes place in properly constructed latrines, areas of land are not contaminated with faeces and watercourses no longer act as sewers. This in turn allows plant life, fish and other aquatic organisms to flourish. Improving waste management improves the local environment and also benefits the national and even the global environment. Good waste management means less litter in the streets and in the neighborhood of waste disposal sites. It also reduces the smell in the streets from decomposing wastes. Carelessly discarding plastic bags and other solid wastes has a negative visual impact and is hazardous to grazing animals.

Applying the 3 Rs saves energy because the energy used to recycle metals, paper, glass, etc. is far less than the energy used in producing these materials from raw materials. Energy production is a major source of greenhouse gases. Greenhouse gases, such as carbon dioxide and methane, contribute to human-induced climate change that is causing the overall warming of the Earth and changing weather and rainfall patterns. Recycling (and reduction and reuse) reduce the emissions of these gases. Improving the standards of landfills also reduces greenhouse gas emissions and lowers the risk of polluting local watercourses and the surrounding land.

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