NATIONAL OPEN UNIVERSITY OF NIGERIA

FACULTY OF HEALTH SCIENCES

COURSE CODE: EHS518

COURSE TITLE: CONCEPT OF COMMUNITY SANITATION AND DISEASE PREVALENCE

COURSE GUIDE

EHS 518
CONCEPT OF COMMUNITY SANITATION AND DISEASE PREVALENCE

Course Team: Dr. A. A. Madara (Course Developer/Writer)- University of Abuja
Prof. Abubakar Mustapha Jamda (Course Editor)- University of Abuja.
Professor Grace C. Okoli-Nnabuenyi (Course Coordinator & Programme Coordinator)-NOUN

NATIONAL OPEN UNIVERSITY OF NIGERIA

National Open University of Nigeria
Headquarters
University Village
Plot 91, Cadastral Zone
Nnamdi Azikiwe Expressway
Jabi, Abuja

Lagos Office
14/16 Ahmadu Bello Way
Victoria Island, Lagos

e-mail: centralinfo@nou.edu.ng
URL: www.nou.edu.ng

Printed2018, 2019

ISBN:

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INTRODUCTION

EHS 518 titled "Community Sanitation" is a one (1) Unit course with four (4) Modules and twelve (12) Units.

Community Sanitation is concerned with issues related to adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development. That is why, in 2008, the Prime Minister of India quoted Mahatma Gandhi who said in 1923, "sanitation is more important than independence" Improvements in one or more of these three components of good health can substantially reduce the rates of morbidity and the severity of various diseases and improve the quality of life of huge numbers of people, particularly children, in developing countries.

Although linked, and often mutually supporting, these three components have different public health characteristics. This course focuses on sanitation. It seeks to present the latest evidence on the provision of adequate sanitation, to analyze why more progress has not been made, and to suggest strategies to improve the impact of sanitation, highlighting the role of the health sector. It also seeks to show that sanitation work to improve health, once considered the exclusive domain of engineers, now requires the involvement of social scientists, behaviour change experts, health professionals, and, vitally, individual people.

Throughout this paper, we define sanitation as the safe disposal of human excreta. The phrase "safe disposal" implies not only that people must excrete hygienically but also that their excreta must be contained or treated to avoid adversely affecting their health or that of other people.

WHAT YOU WILL LEARN IN THIS COURSE

In this course, you have the course units and a course guide. The course guide will tell you what the course is all about. It is general overview of the course materials you will be using and how to use those materials. It also helps you to allocate the appropriate time to each unit so that you can successfully complete the course within the stipulated time limit.

The course guide also helps you to know how to go about your Tutor-Marked Assignment which will form part of your overall assessment at the end of the course. Also, there will be regular tutorial classes that are related to this course, where you can interact with your facilitator and other students. Please, I encourage you to attend these tutorial classes.

COURSE AIMS

The course aims to give you an understanding on the concept of Emergency Medical Care.

COURSE OBJECTIVE

To achieve the aim set above, there are objectives. Each unit has a set of objectives presented at the beginning of the unit. These objectives will guide you on what to concentrate / focus on while studying the unit. Please read the objective before studying the unit and during your study to check your progress. The Comprehensive Objectives of the Course are given below.

By the end of the course/after going through this course, you should be able to:

- Define the term concept of Community sanitation.

WORKING THROUGH THIS COURSE

To successfully complete this course, you are required to read each study unit, read the textbooks materials provided by the National Open University.

Reading the referenced materials can also be of great assistance.
Each unit has self-assessment exercises which you are advised to do and at certain periods during the course you will be required to submit your assignment for the purpose of assessment.

There will be a final examination at the end of the course. The course should take you about 17 weeks to complete.

This course guide will provide you with all the components of the course how to go about studying and hour you should allocate your time to each unit so as to finish on time and successfully.

THE COURSE MATERIALS

The main components of the course are:

- The Study Guide
- Study Units
- Reference / Further Reading
- Assignments
- Presentation Schedule

STUDY UNIT

The study units in this course are given below:

Module 1

Unit 1 Concept of Community Sanitation
Unit 2 Disease Prevalence
Unit 3 Measures of Improving Sanitation

Module 2

Unit 1 Sanitary Inspection of Premises/Institution
Unit 2 Sanitation in Market and Temporary Settlement
Unit 3 Disposal of the Dead (DOD)

Module 3

Unit 1 Methods of Cremation
Unit 2 Exhumation and Embalmment
Unit 3 Removal of Corpse

Module 4

Unit 1 Home Burial and Modern Techniques in Achieving Sanitation-Ecological Sanitation
Unit 2 Community Lead Total Sanitation (CLTS)

There are activities related to the lecture in each unit which will help your progress and comprehension of the unit. You are required to work on these exercises which together with the TMAs will enable you to achieve the objectives of each unit.

PRESENTATION SCHEDULE

There is a time-table prepared for the early and timely completion and submissions of your TMAs as well as attending the tutorial classes. You are required to submit all your assignments by the stipulated time and date. Avoid falling behind the schedule time.

ASSESSMENT

There are three aspects to the assessment of this course.
The first one is the self-assessment exercises. The second is the tutor marked assignments and the third is the written examination or the examination to be taken at the end of the course.

Do the exercises or activities in the unit by applying the information and knowledge you acquired during the course. The tutor-marked assignments must be submitted to your facilitator for formal assessment in accordance with the deadlines stated in the presentation schedule and the assignment file.

The work submitted to your tutor for assessment will count for 30% of your total course work.

At the end of this course, you have to sit for a final or end of course examination of about a three hour duration which will count for 70% of your total course mark.

TUTOR-MARKED ASSIGNMENT

This is the continuous assessment component of this course and it accounts for 30% of the total score. You will be given four (3) TMAs by your facilitator to answer. Three of which must be answered before you are allowed to sit for the end of course examination.

These answered assignments are to be returned to your facilitator.
You're expected to complete the assignments by using the information and material in your readings references and study units.

Reading and researching into you references will give you a wider via point and give you a deeper understanding of the subject.

1. Make sure that each assignment reaches your facilitator on or before the deadline given in the presentation schedule and assignment file. If for any reason you are not able to complete your assignment, make sure you contact your facilitator before the assignment is due to discuss the possibility of an extension. Request for extension will not be granted after the due date unless there in exceptional circumstances.

2. Make sure you revise the whole course content before sitting or the examination. The self-assessment activities and TMAs will be useful for this purposes and if you have any comment please do before the examination. The end of course examination covers information from all parts of the course.

COURSE MARKING SCHEME

Assignment	Marks
Assignments 1 – 3	best three marks of the each–30% of course
End of course examination	70% of overall course marks
Total	100% of course materials.

FACILITATORS/TUTORS AND TUTORIALS

Sixteen (16) hours are provided for tutorials for this course. You will be notified of the dates, times and location for these tutorial classes.

As soon as you are allocated a tutorial group, the name and phone number of your facilitator will be given to you.

These are the duties of your facilitator: He or she will mark and comment on your assignment. He will monitor your progress and provide any necessary assistance you need. He or she will mark your TMAs and return to you as soon as possible.

(You are expected to mail your tutored assignment to your facilitator at least two days before the schedule date).

Do not delay to contact your facilitator by telephone or e-mail for necessary assistance if you do not understand any part of the study in the course material. You have difficulty with the self assessment activities. You have a problem or question with an assignment or with the grading of the assignment.

It is important and necessary you acted the tutorial classes because this is the only chance to have face to face content with your facilitator and to ask questions which will be answered instantly. It is also period where you can say any problem encountered in the course of your study.

SUMMARY

Sanitation can be defined as the safe disposal of human excreta. The phrase “safe disposal” implies not only that people must excrete hygienically but also that their excreta must be contained or treated to avoid adversely affecting their health or that of other people.

Finally, you are expected to apply the knowledge you have acquired during this course to your practical life. I wish you success in this course.

MAIN COURSE

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MODULE 1

UNIT 1 CONCEPT OF COMMUNITY SANITATION

CONTENTS

1.0 INTRODUCTION

Adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development. That is why, in 2008, the Prime Minister of India quoted Mahatma Gandhi who said in 1923, “sanitation is more important than independence” Improvements in one or more of these three components of good health can substantially reduce the rates of morbidity and the severity of various diseases and improve the quality of life of huge numbers of people, particularly children, in developing countries. Although linked, and often mutually supporting, these three components have different public health characteristics. This course focuses on sanitation. It seeks to present the latest evidence on the provision of adequate sanitation, to analyse why more progress has not been made, and to suggest strategies to improve the impact of sanitation, highlighting the role of the health sector. It also seeks to show that sanitation work to improve health, once considered the exclusive domain of engineers, now requires the involvement of social scientists, behavior change experts, health professionals, and, vitally, individual people.

Throughout this paper, we define sanitation as the safe disposal of human excreta. The phrase “safe disposal” implies not only that people must excrete hygienically but also that their excreta must be contained or treated to avoid adversely affecting their health or that of other people.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- discuss the concept of community sanitation.

3.0 MAIN CONTENT

3.1 Health Impacts of Sanitation

Lack of sanitation leads to disease, as was first noted scientifically in 1842 in Chadwick's seminal “Report on an inquiry into the sanitary condition of the laboring population of Great Britain.” A less scientifically rigorous but nonetheless professionally significant indicator of the impact on health of poor sanitation was provided in 2007, when readers of the BMJ (British Medical Journal) voted sanitation the most important *medical* milestone since 1840.

The diseases associated with poor sanitation are particularly correlated with poverty and infancy and alone account for about 10% of the global burden of disease. At any given time close to half of the urban populations of Africa, Asia, and Latin America have a disease associated with poor sanitation, hygiene, and water. Of human excreta, faeces are the most dangerous to health. One gram of fresh faeces from an infected person can contain around 10^6 viral pathogens, 10^6–10^8 bacterial pathogens, 10^4 protozoan cysts or oocysts, and 10–10^4 helminth eggs. The major faeco-oral disease transmission pathways are demonstrated in the “F Diagram”, which illustrates the importance of particular interventions, notably the safe disposal of faeces, in preventing disease transmission.

3.2 Wider Benefits of Sanitation

In addition to its impact on health, improved sanitation generates both social and economic benefits. Householders understand these wider benefits but scientists have only recently begun to study individuals' motivations for improving sanitation and changing sanitation behavior.
While the main goal of agencies' sanitation programming is to improve health, householders rarely adopt and use toilets for health-related reasons. Instead, the main motivations for sanitation adoption and use include the desire for privacy and to avoid embarrassment, wanting to be modern, the desire for convenience and to avoid the discomforts or

dangers of the bush (e.g., snakes, pests, rain), and wanting social acceptance or status. Furthermore, for women, the provision of household sanitation reduces the risk of rape and/or attack experienced when going to public latrines or the bush to defecate, and for girls, the provision of school sanitation facilities means that they are less likely to miss school by staying at home during menstruation.

The economic benefits of improved sanitation include lower health system costs, fewer days lost at work or at school through illness or through caring for an ill relative, and convenience time savings (time not spent queuing at shared sanitation facilities or walking for open defecation)

3.3 Approaches to Sanitation

Recently, there has been a shift away from centrally planned provision of infrastructure towards demand-led approaches that create and serve people's motivation to improve their own sanitation. Although sound technological judgment about appropriate solutions remains essential, appropriate programming approaches are now more important and contribute most to the success of sanitation work. Some of the most promising approaches that apply to both rural and urban sanitation are described below. Regarding the costs of these demand-led approaches, there are few published comparative studies, but sector professionals estimate that they cost less than traditional infrastructure provision. For example, the Water Supply and Sanitation Collaborative Council's Global Sanitation Fund allows average costs of $15 per person for demand-led approaches, whereas governmental provision of infrastructure typically costs tens to hundreds of dollars per person.

3.4 Sanitation Marketing

Sanitation marketing uses a range of interventions to raise householders' demand for improved sanitation. The approach involves understanding householders' motivations and constraints to sanitation adoption and use. These are then used to develop both demand- and supply-side interventions to ensure that appropriate sanitation products and services are available to match the demand.

3.5 Community Health Clubs

Community Health Clubs aim to change sanitation and hygiene attitudes and behaviour through communal activities. The approach has proved effective and cost-effective in the Makoni and Tsholotsho Districts of Zimbabwe where villagers were invited to weekly sessions where one health topic was debated and then action plans formulated. In one year in Makoni District, for example, 1,244 health sessions were held by 14

trainers, costing an average of beneficiary and involving 11,450 club members. Club members' hygiene in both districts was significantly different from that of a control group, and the study's authors concluded that if a strong community structure is developed and the norms of a community are altered, sanitation and hygiene behaviour are likely to improve.

3.6 Sanitation as a Business

Traditionally, sanitation has been regarded as a centrally provided service with little role for the creativity or energy of business. However, the increased demand created by sanitation marketing, CLTS, and Community Health Clubs can be met by the development of a vibrant local private sector for producing, marketing, and maintaining low-cost toilets. For example, in Lesotho the national government organised and planned workshops for people to review toilet designs and building methods in its “local latrine builders” programme. The local private sector can also be encouraged to become involved in pit-emptying, sale of safely composted human excreta as fertilizer, generation of methane from biogas toilets, and the operation of public toilets.

4.0 CONCLUSION

Adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development. That is why, in 2008, the Prime Minister of India quoted Mahatma Gandhi who said in 1923, “sanitation is more important than independence” Improvements in one or more of these three components of good health can substantially reduce the rates of morbidity and the severity of various diseases and improve the quality of life of huge numbers of people, particularly children, in developing countries.

5.0 SUMMARY

Throughout this course, we define sanitation as the safe disposal of human excreta. The phrase “safe disposal” implies not only that people must excrete hygienically but also that their excreta must be contained or treated to avoid adversely affecting their health or that of other people.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define the term sanitation.
2. Write on sanitation marketing.

7.0 REFERENCES/FURTHER READING

"Sanitation. Definition of Sanitation in English by Oxford Dictionaries". *Oxford Dictionaries English*. Retrieved 2017-11-17.

SuSan, A. (2008). *Towards more Sustainable Sanitation Solutions*. Sustainable Sanitation Alliance (SuSanA).

UNIT 2 APPROACHES SPECIFIC TO URBAN SANITATION

CONTENTS

1.0 INTRODUCTION

For on-site urban sanitation systems, pit-emptying services are common in middle-income countries where householders can afford the cost, but less common in poorer countries. However, in Maputo, Mozambique, a small community-based association has developed a pit emptying/septic tank desludging service using self-propelled machines to provide service in unplanned areas of the city. For off-site or centralised systems, simplified or "condominial" sewerage systems, in which sewers are placed inside housing blocks and then discharged into conventional sewers if there are any nearby or led to a simple local wastewater treatment plant, can provide the same level of service as conventional sewerage but at around one-third to one-half of the cost.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain the approaches specific to urban sanitation.

3.0 MAIN CONTENT

3.1 Approaches Specific to Urban Sanitation

Most successful demand-led approaches have been developed in rural contexts. Urban sanitation is much more complex, mainly because of higher population densities, less-coherent community structures, and the absence of opportunities for open defecation. Urban sanitation must extend beyond the household acquisition of a toilet to a systems-based approach that covers the removal, transport, and safe treatment or disposal of excreta.

For on-site urban sanitation systems, pit-emptying services are common in middle-income countries where householders can afford the cost, but less common in poorer countries. However, in Maputo, Mozambique, a small community-based association has developed a pit emptying/septic tank dislodging service using self-propelled machines to provide service in unplanned areas of the city. For off-site or centralised systems, simplified or "condominial" sewerage systems, in which sewers are placed inside housing blocks and then discharged into conventional sewers if there are any nearby or led to a simple local wastewater treatment plant, can provide the same level of service as conventional sewerage but at around one-third to one-half of the cost.

In densely populated low-income urban areas, community-managed sanitation blocks, used only by community members who pay a monthly fee for operation and maintenance, are an option. Public sanitation blocks that can be used by anyone, normally for a small fee per use, can be an acceptable alternative provided that they are well operated and maintained and have 24-hour access. Finally, in less densely populated low-income urban areas, on-site sanitation for rural areas are often applicable.

3.2 The Role of the Health Sector in Improving Sanitation

Sanitation promotion is one of the most important roles the health sector can have in environmental health planning, because behaviors must be changed to increase householders' demand for and sustained use of sanitation, especially in rural areas where the pressure for change is lower. Thus, two of the most promising large-scale sanitation programmes in Africa are centred around demand creation and are both led and delivered by the Ministry of Health and its associated structures. Sanitation can be promoted by the health sector through a stand-alone programme such as sanitation marketing or CLTS or included in disease-specific control programmes such as the 'SAFE' approach to trachoma. Alternatively, it can be incorporated into a wider integrated community health package such as Ethiopia's HEP (Health Extension Programme), which was developed in 2004 to prevent the five most prevalent diseases in the country; safe sanitation and hygiene became a major focus within HEP because of the recognition that these diseases are all linked with poor environmental health.

Promotion alone by the health sector may be insufficient, however, to ensure sanitation adoption and maintenance. A "carrot and stick" approach may be needed in which sanitation coverage is increased through a combination of community-based promotion and enforcement of national or local legislation that every house must have a toilet. In many countries, Environmental Health Officers are responsible for ensuring the sanitary condition and hygienic emptying of toilets, and

have the power to sanction dissenting households with fines and court action. This enforcement role of the health sector is particularly important in urban areas where high-density living increases the risks of faecal contamination of the environment and where one person's lack of sanitation can affect the health of many other people.

The health sector also has an important role to play in advocacy and leadership. Politicians and the general public listen to doctors. That puts an onus on the medical profession to speak out on all important health issues, including sanitation. Historically, this has not happened. Thus, in 2008, *The Lancet* wrote, "the shamefully weak presence of the health sector in advocating for improved access to water and sanitation is incomprehensible and completely short-sighted".

Given the huge potential health-cost savings achieved through improved sanitation, the health sector should be advocating for stronger institutional leadership, stronger national planning, and the establishment of clear responsibilities and budget lines for sanitation. Unfortunately, although the international health community puts large human and financial resources into many low- to medium-cost health interventions such as immunisation and bed net distribution, it has been slow to act on the evidence showing that sanitation promotion and hygiene promotion are among the most cost-effective public health interventions available to developing countries.

Finally, the well-honed epidemiology and surveillance skills of health professionals must also now be applied to sanitation to establish clear links between national health information systems and sanitation planning and financing, which has historically been separate from health in most countries.

3.3 Constraints to Success in Sanitation

The lack of national policies is a major constraint to success in sanitation for additional information on this and other constraints). Governments in general and health ministries in particular cannot play their key roles as facilitators and regulators of sanitation without policies that support the transformation of national institutions into lead institutions for sanitation, that increase focus on household behaviours and community action, that promote demand creation, and that enable health systems to incorporate sanitation and hygiene. Other constraints to success in sanitation are population growth and increasingly high population densities in urban and peri-urban areas of developing countries. Furthermore, most of the people who lack improved sanitation live on less than $2 per day, which makes high-cost, high-technology sanitation solutions inappropriate.

Finally, although macroeconomic analysis shows that sanitation generates economic benefit, the benefit does not necessarily accrue to the person who invests in the improved sanitation. So the economics at the household level remain a constraint to success in sanitation—many people are simply unable or unwilling to invest, given all the other competing demands on their money. This under-researched topic is currently under investigation by the WASH Cost Project, which is studying the life-cycle costs of water, sanitation, and hygiene services in rural and periurban areas in four countries.

4.0 CONCLUSION

Most successful demand-led approaches have been developed in rural contexts. Urban sanitation is much more complex, mainly because of higher population densities, less-coherent community structures, and the absence of opportunities for open defecation.

5.0 SUMMARY

Urban sanitation must extend beyond the household acquisition of a toilet to a systems-based approach that covers the removal, transport, and safe treatment or disposal of excreta.

6.0 TUTOR-MARKED ASSIGNMENT

1. Why is urban sanitation more complex?
2. What are the constraints to success in sanitation?

7.0 REFERENCES/FURTHER READING

Human Rights Council Resolution 15/9. Human Rights and Access to Safe Drinking Water and Sanitation, (2010).

General Assembly Resolution 7/169(2015). The Human Rights to Safe Drinking Water and Sanitation, (2015).

UNIT 3 MEASURES OF IMPROVING SANITATION

CONTENTS

1.0 INTRODUCTION

The first priority is to provide a sufficient quantity of water, even if its safety cannot be guaranteed, and to protect water sources from contamination. A minimum of 15 litres per person day should be provided as soon as possible. During emergencies, people may use untreated water for laundry or bathing. Water-quality improvements should be made over succeeding days or weeks as a matter of urgency.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain the control of sanitation related diseases.

3.0 MAIN CONTENT

3.1 Control of Sanitation Related Diseases

Inadequate disposal of human excreta is a major health risk in emergency situations. Safe drinking water, basic sanitation facilities and safe disposal of infectious wastes will prevent the spread of disease and improve health conditions. In all cases, good hygiene practices are key to preventing disease transmission.

The three top priorities concerning drinking water and sanitation during an emergency situation are:

- ensuring the provision of enough safe water for drinking and for personal hygiene to the people affected by the crisis;
- ensuring that all people affected by the crisis have access to hygienic sanitation facilities;
- promoting good hygiene behaviours.

Following damage to existing sanitation systems or increased pressure due to large numbers of displaced or homeless people, effective and

well-coordinated action by all those involved in the emergency response is critical.

The first priority is to provide a sufficient quantity of water, even if its safety cannot be guaranteed, and to protect water sources from contamination. A minimum of 15 litres per person per day should be provided as soon as possible. During emergencies, people may use untreated water for laundry or bathing. Water-quality improvements should be made over succeeding days or weeks as a matter of urgency.

Inadequate disposal of human excreta is a major health risk in emergency situations. It is essential to organise sanitation facilities immediately, such as designated defecation fields or collective trench latrines. Emergency facilities need to be progressively improved or replaced with simple pit latrines, ventilated improved pit latrines, or poor-flush latrines as the situation develops. All types of latrines need to be properly cleaned, disinfected and maintained.

The provision of drinking water and sanitation services in health facilities is a top priority. Safe drinking water, basic sanitation facilities and safe disposal of infectious wastes will prevent the spread of disease and improve health conditions.

In all cases, good hygiene practices are key to preventing disease transmission. Water should be provided in sufficient quantities to enable proper hygiene. Hands should be washed immediately after defecation, after handling babies' faeces, before preparing food and before eating.

4.0 CONCLUSION

Inadequate disposal of human excreta is a major health risk in emergency situations. It is essential to organise sanitation facilities immediately, such as designated defecation fields or collective trench latrines. Emergency facilities need to be progressively improved or replaced with simple pit latrines, ventilated improved pit latrines, or poor-flush latrines as the situation develops. All types of latrines need to be properly cleaned, disinfected and maintained.

5.0 SUMMARY

In all cases, good hygiene practices are key to preventing disease transmission. Water should be provided in sufficient quantities to enable proper hygiene. Hands should be washed immediately after defecation, after handling babies' faeces, before preparing food and before eating.

6.0 TUTOR-MARKED ASSIGNMENT

List three top priorities concerning drinking water and sanitation during an emergency situation.

7.0 REFERENCE/FURTHER READING

Tilley, E., Ulrich, L., Lüthi, C., Reymond, Ph. & Zurbrügg, C. (2014). Compendium of Sanitation Systems and Technologies. (2nd Revised Edition). Swiss Federal Institute of Aquatic Science and Technology (Eawag). Duebendorf, Switzerland.

UNIT 4 CONTROL OF SANITATION RELATED DISEASES

CONTENTS

1.0 INTRODUCTION

The first priority is to provide a sufficient quantity of water, even if its safety cannot be guaranteed, and to protect water sources from contamination. A minimum of 15 litres per person per day should be provided as soon as possible. During emergencies, people may use untreated water for laundry or bathing. Water-quality improvements should be made over succeeding days or weeks as a matter of urgency.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain know the control of sanitation related diseases.

3.0 MAIN CONTENT

3.1 Control of Sanitation Related Diseases

Inadequate disposal of human excreta is a major health risk in emergency situations. Safe drinking water, basic sanitation facilities and safe disposal of infectious wastes will prevent the spread of disease and improve health conditions. In all cases, good hygiene practices are key to preventing disease transmission.

The three top priorities concerning drinking water and sanitation during an emergency situation are:

- ensuring the provision of enough safe water for drinking and for personal hygiene to the people affected by the crisis;
- ensuring that all people affected by the crisis have access to hygienic sanitation facilities;
- promoting good hygiene behaviours.

Following damage to existing sanitation systems or increased pressure due to large numbers of displaced or homeless people, effective and well-coordinated action by all those involved in the emergency response is critical.

The first priority is to provide a sufficient quantity of water, even if its safety cannot be guaranteed, and to protect water sources from contamination. A minimum of 15 litres per person per day should be provided as soon as possible. During emergencies, people may use untreated water for laundry or bathing. Water-quality improvements should be made over succeeding days or weeks as a matter of urgency.
Inadequate disposal of human excreta is a major health risk in emergency situations. It is essential to organise sanitation facilities immediately, such as designated defecation fields or collective trench latrines. Emergency facilities need to be progressively improved or replaced with simple pit latrines, ventilated improved pit latrines, or poor-flush latrines as the situation develops. All types of latrines need to be properly cleaned, disinfected and maintained.

The provision of drinking water and sanitation services in health facilities is a top priority. Safe drinking water, basic sanitation facilities and safe disposal of infectious wastes will prevent the spread of disease and improve health conditions. In all cases, good hygiene practices are key to preventing disease transmission. Water should be provided in sufficient quantities to enable proper hygiene. Hands should be washed immediately after defecation, after handling babies' faeces, before preparing food and before eating.

4.0 CONCLUSION

Inadequate disposal of human excreta is a major health risk in emergency situations. It is essential to organise sanitation facilities immediately, such as designated defecation fields or collective trench latrines. Emergency facilities need to be progressively improved or replaced with simple pit latrines, ventilated improved pit latrines, or poor-flush latrines as the situation develops. All types of latrines need to be properly cleaned, disinfected and maintained.

5.0 SUMMARY

In all cases, good hygiene practices are key to preventing disease transmission. Water should be provided in sufficient quantities to enable proper hygiene. Hands should be washed immediately after defecation, after handling babies' faeces, before preparing food and before eating.

6.0 TUTOR-MARKED ASSIGNMENT

List three top priorities concerning drinking water and sanitation during an emergency situation.

7.0 REFERENCES/FURTHER READING

Right to Water and Sanitation Derive from the Right to an Adequate Standard of Living. http://www. ohchr.org/ EN/News Events/ Pages/ DisplayNews.aspx?Ne wsID=10403&LangID=E

Tilley, E., Ulrich, L., Lüthi, C., Reymond, Ph. & Zurbrügg, C. (2014). Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag), Duebendorf, Switzerland.

MODULE 2

UNIT 1 CONTROL OF SANITATION RELATED DISEASES

CONTENTS

1.0 INTRODUCTION

The characteristics of life in these slums/squatter areas make the provision of sanitary services particularly difficult. In many cases, the poor live in neighbourhoods without legal tenure of land or in areas that authorities have deemed unfit for habitation. These peri-urban neighbourhoods often remain officially invisible. Their illegal status means that they are often not taken into account in municipal programmes to improve or extend services such as water supply, basic sanitation, garbage collection, flood protection, health care, etc.

This scenario results in poor housing sanitation characterised by overcrowding, poor ventilation and indoor air pollution, thereby increasing the disease burden within the population. This also affects productivity, thus perpetuating the cycle of poverty. Children under the age of five living in poorly ventilated houses have been shown to suffer more from upper respiratory problems than those from well ventilated houses.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- discuss what is meant by sanitary inspection of premises/institution.

3.0 MAIN CONTENT

3.1 Sanitary Inspection of Premises/Institutions

The environmental sanitation problems are made more acute by rapid urbanisation and uncontrolled population growth, without commensurate expansion in sanitary facilities. Consequently, slums/shanties have emerged in city fringes where the water and sanitation problems are more pressing. These slums with poor housing are prominent features in our environment, particularly in cities and large towns due to poor implementation of town planning laws, poor land use control, rapid spatial expansion of settlements and inadequate provision of infrastructure and services. For example, our inability to adhere to the Federal Capital Territory (FCT) development plan has created the upsurge of slums and shantytowns in the immediate environs of the city.

Spontaneous squatter settlement continues to provide shelter for immigrants in an environment of great overcrowding and appalling squalor. The characteristics of life in these slums/squatter areas make the provision of sanitary services particularly difficult. In many cases, the poor live in neighbourhoods without legal tenure of land or in areas that authorities have deemed unfit for habitation. These peri-urban neighbourhoods often remain officially invisible. Their illegal status means that they are often not taken into account in municipal programmes to improve or extend services such as water supply, basic sanitation, garbage collection, flood protection, health care, etc.

This scenario results in poor housing sanitation characterised by overcrowding, poor ventilation and indoor air pollution, thereby increasing the disease burden within the population. This also affects productivity, thus perpetuating the cycle of poverty. Children under the age of five living in poorly ventilated houses have been shown to suffer more from upper respiratory problems than those from well ventilated houses. These children are also more likely to underachieve in school when compared with those from improved areas and this often limits their ability and character in life.

3.2 Management of the Urban Drainage System

The poor surface drainage in urban areas leads to stagnant pools where mosquitoes and other disease carrying vectors breed. The high prevalence of diseases such as malaria in many towns and cities partly results from the poor drainage maintenance system. Often in towns and cities, public drains are used as substitutes for toilets and waste disposal facilities. This causes blockage of the drains and is usually responsible

for environmental problems such as flooding, erosion and landslide, which destroy homes built on marginal land, and causes major damage to public infrastructure and private property.

3.3 School Sanitation

The standard of school sanitation is very poor. Most schools are overcrowded with dirty environment. Majority of public schools lack toilet facilities. Toilets when available in schools are not functional due to lack of water to flush and this often leads to defecation in classroom corners by pupils. In other instances, where sanitary facilities are provided, pupils sometimes vandalise them.
Oftentimes, the poor design and material used for building schools sometimes renders the environment un-conducive for learning especially during extreme weather conditions. These factors have serious health implications with attendant social and economic consequences including school absenteeism.

3.4 Adequate Potable Water Supply

Water is an essential ingredient for the sustenance of life. Water in poor quality and inadequate quantity continues to pose a major threat to human health. Conversely, human development and population growth exert many and diverse pressures on the quality and quantity of water resources and on access to it. Nowhere are the pressures felt so strongly as at the interface of water and human health, especially with indiscriminate dumping of sewage sludge into rivers, non-treatment of effluents from industries and paving of surfaces thus preventing recharge of underground water.

The coverage of water supply facilities to the populace is still inadequate. It is a common phenomenon to see long queues of jerry cans and buckets in the cities especially during the dry season. According to the 2003 Nigeria Demographic and Health Survey (NDHS), 65% of the urban population has access to safe sources of drinking water while about 70% of the rural population depends mainly on unsafe sources such as open wells, rivers, streams, etc., for drinking. In areas, which are served by public water supply, the wholesomeness of the water is sometimes not guaranteed because of poor maintenance of pipes, which are prone to constant leakages, with sippage of contaminants. Unwholesome water plays a significant role in the aetiology of water borne diseases such as cholera, typhoid and paratyphoid fevers.
An inverse relationship has been observed to exist between hand washing and diarrhoea. Increased frequency of hand washing after using the toilet and before handling food, substantially decreases the occurrence of diarrhoea especially in young children. The proximity of water also plays an important role in maintaining good personal hygiene

and reducing the incidence of diarrhoea and skin diseases. In the words of Kofi Annan, United Nations Secretary-General, "Access to safe water is a fundamental human need and, therefore, a basic human right. Contaminated water jeopardizes both the physical and social health of all people. It is an affront to human dignity".

3.5 Control of Reared and Stray Animals

Animals are part of man's biological environment. A variety of animals are raised in agricultural, domestic, commercial and other settings with little or no Government regulation. In most urban centres, occupants in multi-flat apartments rear all sorts of animals in violation of Public Health Laws. In most rural areas, animals are common-place, where they stroll in and out of dwelling homes, resulting in an immense interaction between man and animals.

Most of the animals are reared in filthy, unhygienic conditions. Some of these animals are reservoir hosts to a number of zoonotic diseases and aid the transmission of anthrax, brucellosis, rabies, leptosporosis, hydatid disease, bovine tuberculosis, etc. Most animals seen around are supposedly reared however, there is no proper supervision so they roam about littering the environment with their faecal matter and causing visual blight as well as being involved in massive destruction of farm lands/produce.

4.0 CONCLUSION

The Environmental Sanitation problems are made more acute by rapid urbanisation and uncontrolled population growth, without commensurate expansion in sanitary facilities. Consequently, slums/shanties have emerged in city fringes where the water and sanitation problems are more pressing. These slums with poor housing are prominent features in our environment, particularly in cities and large towns due to poor implementation of town planning laws, poor land use control, rapid spatial expansion of settlements and inadequate provision of infrastructure and services. For example, our inability to adhere to the Federal Capital Territory (FCT) development plan has created the upsurge of slums and shantytowns in the immediate environs of the city. Spontaneous squatter settlement continues to provide shelter for immigrants in an environment of great overcrowding and appalling squalor.

4.0 SUMMARY

The characteristics of life in these slums/squatter areas make the provision of sanitary services particularly difficult. In many cases, the poor live in neighbourhoods without legal tenure of land or in areas that authorities have deemed unfit for habitation. These peri-urban

neighbourhoods often remain officially invisible. Their illegal status means that they are often not taken into account in municipal programmes to improve or extend services such as water supply, basic sanitation, garbage collection, flood protection, health care, etc.

5.0 TUTOR-MARKED ASSIGNMENT

What are the problems of environmental sanitation?

6.0 REFERENCES/FURTHER READING

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UNIT 2 SANITATION IN MARKET AND TEMPORARY SETTLEMENTS

CONTENTS

1.0 INTRODUCTION

This chapter identifies the essential considerations for the provision of sanitation technologies in the context of the coastal communities of Puerto Princesa. These considerations are the basis of the preliminary evaluation of low-cost sanitation systems. This evaluation identifies possible options for the case study and discusses the potential and limitations of these systems. Included in the evaluation are the generic classification of low-cost technologies provided in the World Bank studies on appropriate technology for sanitation. Expensive systems such as the chemical, freeze, packaging and incinerating toilets and the waterborne sewerage are not included in the comparative analysis.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain sanitation in market and temporary settlement.

3.0 MAIN CONTENT

3.1 Definition of Term

This chapter identifies the essential considerations for the provision of sanitation technologies in the context of the coastal communities of Puerto Princesa. These considerations are the basis of the preliminary evaluation of low-cost sanitation systems. This evaluation identifies possible options for the case study and discusses the potential and limitations of these systems. Included in the evaluation are the generic classification of low-cost technologies provided in the World Bank studies on appropriate technology for sanitation. Expensive systems

such as the chemical, freeze, packaging and incinerating toilets and the waterborne sewerage are not included in the comparative analysis.

Considerations in the Provision of Sanitation Systems
In the analysis of sanitation in the coastal communities, conditions were found to vary among households, depending on the location of their houses within the coastal area, whether built on dry, transition or water zones. The following discussion identifies the key considerations for the choice for sanitation systems in the three zones. These considerations, include environmental, community-specific physical, social and cultural factors.

Site Specific Environmental Factors
In this thesis, the environmental factors are the key determinants for differentiating coastal communities from other types of communities. These factors, which include the condition of surface water and soil conditions of the coastal areas, have a direct bearing on the options for sanitary means of disposing of human waste for the community.

3.2 Surface Water Condition

The condition of Puerto Princesa bay determines the acceptability of the practice of directly disposing human waste into the water without treatment. As repeatedly mentioned in this course, this practice is acceptable if the following conditions are satisfied: first, water is not consumed for drinking; 2) the feces are always deposited in water and not on land; and 3) there is sufficient current for dilution. The objective of these conditions is to ensure that the excreta are disposed of properly and to prevent the contact of waste to the community.

In the context of the Puerto Princesa Bay, the first requirement is not a problem since the water of the bay is saline and is not consumed as drinking water. The water quality of Puerto Princesa Bay, based on the water test conducted by the National Pollution Control Commission in March 11, 1988, revealed that the overall water quality of the bay is still excellent. Although this finding indicates the unpolluted condition of the whole bay, maintaining the existing ecological balance is necessary. During the survey, the observed continued practice of disposing of human waste, wastewater and garbage along the coasts of the bay indicates an alarming pollution problem. As the community grows, this traditional habit, which used to be hygienically acceptable and satisfactory, increases pollution problems. With the second and third conditions, the practice of direct disposal of human waste in the water regions is not as critical as that in the transition zones.
In houses built above the deeper waters, waste is always deposited into the water and not on the land, and there is enough current for dilution. The problems are more critical in the transition areas where solid

wastes, which are non-biodegradable, have accumulated. Compounding this problem is the extensive usage of water for domestic and personal washing which is disposed of directly into the ground and surface water. The accumulated solid wastes block the natural flow of the water thereby creating pools of stagnant waters and impeding natural flushing of other biodegradable wastes. Thus, in these areas, excreta are exposed in the environment.

3.3 Ground Condition

For parts of the community located within the elevated and transition zones, the ground condition is an important consideration in the provision of sanitation systems. The topography of the site of the coastal slums is moderately sloping or rolling. The area is very low with +3.064m. and +0.21m as the highest and lowest portions respectively above the Mean Lowest Low Water (MLLW). Thus, even on the elevated areas, internal drainage or the ability of soil to absorb water is generally low since the water table is very shallow. The clay soil is deep, poorly to very poorly drained, fine and loamy in texture. Analysis of ground conditions has to be considered to avoid groundwater contamination and pollution of the bay, because these areas have a high water table and a direct hydraulic connection to coastal waters.

The disposal of human waste into the ground presents a potential hazard to the health of the community. As discussed in the previous chapter, people consume water from the well for drinking. The location of the well is fairly close to the toilets of the nearby households. Groundwater contamination promotes disease transmission from the disposal site, through the groundwater to users of well water. Disposing human waste in the coastal areas without treatment, causes pollution of the bay. The site's proximity to the shore means that polluted runoff goes quickly to the coastal water basin with little time for natural purification through vegetation and soil. Environmental factors such as soil type and porosity, groundwater level and hydraulics, and distance to surface water influence the degree of contamination.

In the choice of sanitation technologies, ground conditions, particularly groundwater level, soil permeability and stability, are important considerations. Some sanitation technologies, except those which can be built above the ground, are feasible when the ground water level is below one meter from the surface. Other options require permeable soil for soak away of effluent and others require stable ground for construction. In this context, sanitation technologies can be classified as those without soil requirements and hence, can be contained above ground, and those with soil requirements. Systems that can be built above the ground are technically feasible in the three zones of the coastal communities. Options include the composting toilets, the vault

and cartage system, the bucket latrines, the shallow sewer system and the small bore sewer system.

On the other hand, systems that have soil requirements include pit latrines, aqua privy and septic tank. These systems require soil conditions characterised as stable, permeable and with low ground water level. These systems are technically not feasible in coastal communities, since they cannot be built on sites with adverse ground conditions. There are cases, however, when some on-site systems are modified to suit conditions of sites characterised by high groundwater level. In the case of the pit latrine, the pit can be raised above the ground level or double pits can be built to increase capacity when excavation is difficult. This prolongs the useful life of the facility and overcomes the difficulties with high water table and groundwater pollution. In the construction of the raised pit latrine, the raised portion should be lined and rendered to prevent the seepage of foul liquid out of the pit.

Community Physical Factors
Community density, circulation and access networks, and available services within the community influence the selection of sanitation technologies. The implications of these factors are discussed below.

Community Density
In selecting sanitation systems, consideration of community density is critical in settlements with high density, as in the case of Puerto Princesa. On-site systems such as pit latrines, aqua privies and septic tanks require adequate space for the infiltration of waste discharged into them. These systems are not suitable for high density settlements, since high density poses danger in terms of wells for drinking water and sanitation facilities to be close together. Water seeping out of pit latrines which are bacterially and chemically contaminated will pollute the surrounding groundwater. The effluent from the septic tank, which did not permeate well through the soil, is still laden with pathogens and contaminates the nearby supply of drinking water. Hence, these systems are suitable only in low-medium density areas. Systems suitable for high density areas include the vault and cartage system, the shallow sewer system and the small bore sewer.

3.4 Circulation and Access Network

As discussed in the analysis of present conditions in the coastal communities, the circulation network of the community consists of narrow footpaths on land and wooden walkways on water supported by stilts. In the selection of sanitation technologies for the community, some systems require methods for transporting waste from the place of defecation to another for waste treatment. In these technologies, waste is emptied manually or sludge is removed by a vacuum suction tanker or

carts and is taken away for suitable disposal. The existing access network, consisting of narrow footpaths and walkways on stilts, poses limitations to the use of technologies requiring the use of trucks or carts for transporting waste. Access for trucks within the community is impossible.

In this context, sanitation technologies are classified according to those with waste transportation requirements and those without, with the former group at a disadvantage. Systems with waste or sludge transport requirement include bucket latrines, aqua privies, the septic tanks, the vault and cartage system and the composting toilets. On the other hand, those without transport requirement include the pit latrines, the shallow sewer system and the small bore sewer system.

3.5 Proximity and Access to Services

Households located above the waters have the least proximity to the different services that are normally situated on the dry and elevated areas of the site. Unfortunately, households occupying these areas consist of a large percentage of the community. The proximity and accessibility of services such as water supply and communal toilets to the majority of the households affect choice of sanitation options.

4.0 CONCLUSION

In this context, sanitation technologies are classified according to those with waste transportation requirements and those without, with the former group at a disadvantage. Systems with waste or sludge transport requirement include bucket latrines, aqua privies, the septic tanks, the vault and cartage system and the composting toilets. On the other hand, those without transport requirement include the pit latrines, the shallow sewer system and the small bore sewer system.

5.0 SUMMARY

In the choice of sanitation technologies, ground conditions, particularly groundwater level, soil permeability and stability, are important considerations. Some sanitation technologies, except those which can be built above the ground, are feasible when the ground water level is below one meter from the surface. Other options require permeable soil for soak away of effluent and others require stable ground for construction.

TUTOR-MARKED ASSIGNMENT

1. List five waste transportation requirements.

2. What do you take into Considerations in the Provision of Sanitation systems?

6.0 REFERENCE/FURTHER READING

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UNIT 3 DISPOSAL OF THE DEAD (DOD)

CONTENTS

1.0 INTRODUCTION

To remove dead animals from property, sometimes it's simple, such as when a raccoon or opossum dies in a yard. Sometimes it's more complex, such as when a rat dies in the walls, or a squirrel dies in the attic. Every now and then, people actually call me to remove their deceased dog or cat.

2.0 OBJECTIVE

By the end of this unit, you will able to:

- explain how to dispose dead animal.

3.0 MAIN CONTENT

3.1 Disposal of the Dead (DOD)

As a wildlife removal expert, I'm often called to remove dead animals from property. Sometimes it's simple, such as when a raccoon or opossum dies in a yard. Sometimes it's more complex, such as when a rat dies in the walls, or a squirrel dies in the attic. Every now and then, people actually call me to remove their deceased dog or cat. So, how does one properly dispose of the animal carcass?

Burial: You can bury the dead body on your property. If it's a pet, you may want to put it in a box (pet coffin) for sentimental reasons. Or you can just lay the body in the ground. I recommend digging a hole at least two feet deep, to prevent scavengers from digging it up. You can also lay stones over the spot to prevent digging.

Incineration: If you have access to an incinerator, you can cremate the body. This is how the local animal shelter probably does it. Since you don't own an incinerator, you could attempt a really big bonfire, but I doubt you'll do that.

Bring it to animal services: Call your local animal services for the phone number in your county) and ask if they can accept a dead animal body for proper disposal.

Throw it out: Your local garbage service might well take a dead body, though perhaps they'll discourage it, especially if the animal is large. But a mouse, rat, or even squirrel should not be any problem.

3.2 Deceased Pet Dog or Cat

Many people don't know what to do. Your options are similar to what I've laid out above, but I wrote that about wild animals like raccoons, so I want to treat it with more care. First, one of your options still remains to bury your pet, and have a little ceremony. You can bury it on your property, of if you don't own any land, you can use a friend's property. It may not be legal in your area to use public land, but if you find a private spot, who is going to stop you, really? Bury it at least two feet down. Second, there are many pet cremation services in most cities. Do a search for pet cremation, and you'll likely find some. Third, your local department of sanitation (garbage collection) can simply take the body, if small, with the regular trash, if you're okay with that, and bring it to the landfill. I would personally be okay with that once I've said goodbye to my pet and put it in a bag inside a box. If the body is larger, maybe a dog, larger than 25 lbs, you can arrange with many city's dept. of sanitation for special pickup. They often offer deceased animal pickup.

Fourth, your local animal services might help, but they often do not take dead bodies, and you must transport it to their facility. They might cremate the animal. I do list the county animal services for most US cities and towns in the red text below the wildlife removal company listing. Most experts and health officials would definitely agree that you should not touch the bodies of animals that you found dead especially with your bare hands. You should always wear a protective glove to avoid any contamination with bacteria or other viruses that might have caused their deaths or just simply to maintain your hygiene. There are actually state regulations that you have to follow in order to bury the body of whatever animal you may found. Certain laws would tell you how best to bury them that is why you also have to seek information regarding these laws. It is also important that you stay clear of any near water sources when you bury the dead body and you have to make sure that you are not digging into some utility power lines or pipes because you might just cause a bigger problem not only for yourself but for all the people in your neighborhood.

But what if you find something bigger than a bird that has been lying around in the perimeters of your property? There are four known methods that you can make use of namely landfills, composting, burial,

and burning. If you are by chance near a landfill, you can check with your local facility to see if they would allow you to just throw the body of a dead animal into some backyard pile of landfill materials. Perhaps the most efficient and the most widely used method is burying the body. If you have a place of your own and if your local laws permit you to bury them as long as you follow their guidelines, you can go ahead and find a perfect place to lay the body and to let it rest in peace. But if the place is not yours, you can always ask the permission from the owner to do some digging to bury it. This is most recommended for those who have pets which might be the most common household dogs or cats that they feel most attached to so that they can show their proper respect for their favorite pet for the last time.

Aside from this, you can always opt for cremation. Again for those with pets, this is most ideal since you can also carry back the ashes with you if you like, to remember your beloved cats or dogs every time you see their ashes in their urn. Of course, this might cost some money but it would be worth it especially with the memento that you would have or to avoid any danger of contamination with other animals or even humans.

4.0 CONCLUSION

In conclusion, it may not be legal in your area to use public land, but if you find a private spot, who is going to stop you, really? Bury it at least two feet down. Second, there are many pet cremation services in most cities. Do a search for pet cremation, and you'll likely find some.

5.0 SUMMARY

Aside from this, you can always opt for cremation. Again for those with pets, this is most ideal since you can also carry back the ashes with you if you like, to remember your beloved cats or dogs every time you see their ashes in their urn. Of course, this might cost some money but it would be worth it especially with the memento that you would have or to avoid any danger of contamination with other animals or even humans.

6.0 TUTOR-MARKED ASSIGNMENT

List the various ways in which you can properly dispose dead animal carcass.

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MODULE 3

UNIT 1 METHODS OF CREMATION

CONTENTS

1.0 INTRODUCTION

Cremation is the burning of the human body until its soft parts are destroyed by fire. The skeletal remains and ash residue (cremains) often becomes the object of religious rites, one for the body and one for the bones. The anthropologist Robert Hertz has described this as a double burial, with a "wet" first phase coping with the corpse and its decay, and a "dry" second phase treating the skeletal remains and ash. The chief difference between cremation and burial is the speed of transformation: Corpses burn in two hours or less, but bodies take months or years to decay, depending upon methods used and local soil conditions. The method of body disposal least like cremation is mummification, which seeks to preserve the body rather than destroy it.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- discuss the methods of cremation.

3.0 MAIN CONTENT

3.1 Methods of Cremation

Alkaline hydrolysis also called aquamation, biocremation, resomation, flameless cremation, or water cremation) is a process for the disposal of human and pet remains using lye and heat. The process is being

marketed as an alternative to the traditional options of burial or cremation.

Cremation is the burning of the human body until its soft parts are destroyed by fire. The skeletal remains and ash residue (cremains) often becomes the object of religious rites, one for the body and one for the bones. The anthropologist Robert Hertz has described this as a double burial, with a "wet" first phase coping with the corpse and its decay, and a "dry" second phase treating the skeletal remains and ash. The chief difference between cremation and burial is the speed of transformation: Corpses burn in two hours or less, but bodies take months or years to decay, depending upon methods used and local soil conditions. The method of body disposal least like cremation is mummification, which seeks to preserve the body rather than destroy it.

Ancient Cremation

Archaeological evidence shows cremation rituals dating back to ancient times. In classical antiquity, cremation was a military procedure and thus was associated with battlefield honors. Both cremation and the interment of cremated remains are described in Homer's *Iliad* and *Odyssey*, both dating from the eighth century B.C.E. The seventeenth-century French painter Nicolas Poussin echoed another classical story in his masterpiece *The Ashes of Phocion*, perhaps the most famous of all cremation-linked paintings, in which a faithful wife gathers the ashes of her husband, an improperly shamed leader who was cremated without the proper rites.

The ritual cremation of Roman emperors involved the release of an eagle above the cremation pyre to symbolise his deification and the passing of the emperor-god's spirit. The reasons for shifts between cremation and burial in classical times are not always apparent; fashion or even the availability of wood may have been involved.

Cremation Cultures

It was in India and in the Indian-influenced cultures of Buddhism and Sikhism that cremation developed into a central and enduring social institution. Basic to Hinduism is the belief that the life force underlying human existence is not restricted to one life but undergoes numerous transmigrations that may involve nonhuman forms. Hence the "self" and the identity of an individual are not simply and inevitably linked to any one body. Cremation became an appropriate vehicle for expressing the ephemerality of bodily life and the eternity of spiritual life.

Hinduism. For traditional Hindus, cremation fit into an overall scheme of destiny. Symbolically, the human embryo resulted from the combination of male seed forming bones and female blood providing flesh. In this account the spirit enters the fetus through the cranial suture of the skull, with the growing embryo in a sense being "cooked" by the

heat of the womb. At the end of life, a symbolic reversal sees the heat of the funeral pyre separating flesh from bones; the rite of skull-cracking frees the spirit for its ongoing journey, which is influenced by *karma*, or merit accrued during life. The fire itself is the medium by which the body is offered to the gods as a kind of last sacrifice; cremation should take place in Banaras, the sacred city through which the sacred Ganges River flows. It is on the banks of the Ganges that cremations occur and cremated remains are placed in its holy waters. Hindus living in other parts of the world also practice cremation and either place cremated remains in local rivers or send the remains to be placed in the Ganges. While rites are also performed for set periods after cremation, there is no monument for the dead, whose ultimate destiny lies in the future and not in some past event.

Buddhism. Cremation is the preferred funeral rite for Buddhists as well and is reinforced by the fact that the Buddha was himself cremated. Tradition tells how his funeral pyre self-ignited, but only after many followers had come to pay respects to his body. When the flames ceased, no ash remained—only bones. These remains were divided into eight parts and built into eight stupas in different territories. This is a good example of how cremation makes possible a greater variety of memorialising the dead than does burial. Contemporary Buddhists practice both cremation and burial.

Evil and Emergency Cremation

Cremation is not only an established social custom but has also been used on battlefields to save the dead from the ravages of the enemy and as an emergency measure during plagues, as in the Black Death of the seventeenth century. The most inescapably negative use of cremation in human history was during the Holocaust, the Nazi regime's mass murder of millions of Jews and others, including Gypsies, homosexuals, and the mentally ill, all deemed culturally unacceptable to Hitler's Third Reich during World War II. The Nazi concentration camps came to symbolise the inhumanity of killing men, women, and children and then disposing of their bodies by cremation or mass burial. In this case, cremation was a kind of industrial process necessary to deal with the immense number of corpses that attended Hitler's "Final Solution."

Modern Cremation

With the increasing predominance of Christianity in Europe after the fifth century C.E., cremation was gradually abandoned in favor of earth burial as a symbol of the burial and resurrection of Christ. Charlemagne criminalized cremation in the Christian West in 789 C.E. There were subsequent countercurrents, including the unusual seventeenth-century treatise of Sir Thomas Browne on urn burial, and the brief French revolutionary attempt to foster cremation as a rebuke to Christianity.

It was not until the nineteenth century, however, that a widespread interest in cremation resurfaced, prompted by a variety of social, philosophical, and technological factors. The major social elements related to massive increases in the population of industrial towns and major cities, whose cemeteries were increasingly hard-pressed to cope with the volume of the dead in an era of heightened concern with public hygiene—corpses buried near the surface of the ground were seen as a potential health risk. This was also a period of considerable interest in freedom of thought and creative engagement with ideas of progress.

Traditional religious constraints were not viewed as impossible barriers to progress. Societies were established to promote cremation in many influential cities, including London and The Hague in 1874, Washington, D.C., in 1876, and New York in Italy was a major force in the renaissance of cremation; Brunetti's model cremator and display of cremated remains at the Vienna Exhibition are credited with having prompted Sir Henry Thompson's interest. There was also a congress on cremation in Milan in. These groups often existed for years before they achieved the goal of cremation as a legal and established practice.

In Holland, for example, the group did not actually open a crematorium until. Often there were objections from a variety of Christian churches, which contended that cremation would interfere with the resurrection of the body or that cremation spurned the example of the "burial" of Jesus. Sometimes the reasons were political rather than theological. Catholics in Italy, for example, found cremation unacceptable because it was favored and advocated by the anticlerical Free-masons. Indeed, it was not until the mid-1960s that the Roman Catholic Church accepted cremation as an appropriate form of funeral for its members.

The preoccupation with technological advancement in the nineteenth century also spurred the fortunes of cremation. It had become relatively easy to contemplate building ovens for the combustion of human bodies as well as architectural features to house them. Machines like the cremulator, for grinding larger bone fragments into dust, are similarly industrial in nature. The early crematoria were temporary, little more than ovens or grandly designed landmarks. In the late nineteenth and early twentieth centuries they began to resemble church buildings; in the late twentieth century there was more scope for architects to reflect upon life and death in these unique structures.

In the late twentieth century cremation became a serious topic of academic study. It was only at the turn of the twenty-first century that serious academic interest in cremation—sociological, theological, and historical—emerged. The numerous journals published by many cremation societies have also made important contributions, systematically recording cremation rates, new crematoria, and technical developments. The Archives of the Cremation Society of Great Britain,

held at the University of Durham, is one example, as is the Fabretti Institute of Turin in Italy.

Christian Traditions and Cultures

The most interesting aspect of the relationship between cremation and society within Western societies derives from the relative influence of the Orthodox, Catholic, and Protestant traditions. Greek and Russian Orthodoxy stand in firm opposition to cremation, and cremation rates are very low in strict Orthodox societies such as Greece. During the communist era in the former USSR and Eastern Europe, cremation was often pressed in an ideological fashion, which in turn spurred stronger opposition from various Christian denominations.

In Western Europe cremation rates vary with the degree of Catholic or Protestant influence in each country's tradition. In 1999, the cremation rate in Great Britain and Denmark was 71 percent and 68 percent in Sweden. In Finland, by contrast, with equally strong Protestant, Catholic, and Orthodox churches, the rate was only 25 percent. The Netherlands, roughly equally divided between Protestant and Catholic traditions, stood at 48 percent. The Catholic influence is more evident in Hungary (30%), Austria (21%), France (16%), Spain (13%), Italy (5%), and Ireland (5%).

The United States presents an interesting picture of mixed religious traditions with an overall cremation rate of approximately 25 percent. This may seem an unusually low figure, but it encompasses a wide variation in local practices. Washington, Nevada, and Oregon, have cremation rates of approximately 57 percent while Alabama, Mississippi, and West Virginia are about 5 percent.

Social Change and Cremation

In the West, the turn of the twentieth century saw the rise of strongly motivated individuals, often coalescing into small pressure groups that were ideologically committed to cremation. After World War II cremation began to be incorporated into social welfare provisions in numerous countries. Just as the urban growth of the middle and late nineteenth century had led to the establishment of many large cemeteries in European cities, so the later twentieth century was marked by the growth of crematoria. Cremation was a symptom not only of massive urbanisation and the drive for social hygiene but also an increased medicalisation of death. With more people dying in hospitals rather than at home, their bodies were collected by funeral directors and might be kept in special premises away from their home.

Indeed the very concept of the "funeral home" developed to mark a place where a body could be kept and visited by the bereaved family. Cremation thus was another example of a rising trend of commercialisation and professionalisation of various aspects of life in

the West. Cremation was but one aspect of a broader tendency toward efficiency, scientific technology, and consumer choice. It also served the psychological function of allaying the fears of those who were haunted by irrational fears of decay or of being buried alive. Cremation is also often less expensive than burial.

Although the upward trend in cremation continued unabated through the late twentieth century, there was a slight ripple of concern emanating from the environmental community, which pointed to the deleterious effect of industrial and domestic emission of gases—many communities have adopted more stringent laws for the running of cremators. On a populist front, this raised a question mark over the desirability of cremation. In Great Britain, some minority groups have raised the idea of "green" woodland burials in which individuals are buried without elaborate coffins or caskets and in full recognition that their bodies would soon return to the earth in a form of earth-friendly decay.

3.2 Cremation, Privatisation, and Secularisation

As Christianity achieved dominance in Europe in its first millennium and firmly established itself geographically in the second, it imposed a much more formal theology and ritual, not least over death. Catholic Christianity's funerary rites included preparation of the dying for their eternal journey, along with masses and prayers for their migrant souls. Cemeteries were closely aligned with churches, and death rites were under ecclesiastical control.

With the advent of cremation, there arose a new possibility disengaging death rites from ecclesiastical control. For much of the late nineteenth century and the first two-thirds of the twentieth century, the great majority of cremation rites were set within a religious ritual framework overseen by the Protestant clergy. Catholic priests were also freed to do so from the mid-1960s, but by the late twentieth century clerical involvement in cremation was on the wane. Traditional burial was conducted under the control of a Christian church, and though remains might later have been removed to a charnel house (a place for storing human bones), the transfer was often a non-ceremonial affair. Burials in some places could also be conducted without church rites, but it was with modern cremation that a secular process appeared more acceptable. Often the emphasis on what came to be called "life-centered" funerals was celebratory, with a focus on the past life of the deceased and not, as in traditional Christian rites, on the future hope of resurrection.

3.3 Cremated Remains

In contrast to the traditional practice of placing cremated remains in urns and storing them in columbaria (buildings containing niches in their walls), late-twentieth-century practices in the West have included the removal of cremated remains from crematoria by family members and their placement in locations of personal significance. This was the birth of a new tradition as individuals invented ways of placing remains in natural environments: mountains, rivers, gardens, or places of recreation and holiday where the survivors acknowledged that the deceased had spent pleasant and memorable times.

4.0 CONCLUSION

With the advent of cremation, there arose a new possibility disengaging death rites from ecclesiastical control. For much of the late nineteenth century and the first two-thirds of the twentieth century, the great majority of cremation rites were set within a religious ritual framework overseen by the Protestant clergy. Catholic priests were also freed to do so from the mid-1960s, but by the late twentieth century clerical involvement in cremation was on the wane. Traditional burial was conducted under the control of a Christian church, and though remains might later have been removed to a charnel house (a place for storing human bones), the transfer was often a non-ceremonial affair. Burials in some places could also be conducted without church rites, but it was with modern cremation that a secular process appeared more acceptable.

5.0 SUMMARY

Cremation is the burning of the human body until its soft parts are destroyed by fire. The skeletal remains and ash residue often becomes the object of religious rites, one for the body and one for the bones. The anthropologist Robert Hertz has described this as a double burial, with a "wet" first phase coping with the corpse and its decay, and a "dry" second phase treating the skeletal remains and ash.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define the term cremation.
2. List the types of cremation.

7.0 REFERENCES/FURTHER READING

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UNIT 2 EXHUMATION AND EMBALMMENT

CONTENTS

1.0 INTRODUCTION

Since the 1920s, it has been standard practice for American morticians to embalm corpses, to disinfect them so decomposition is delayed. (For a cross-cultural study of embalming techniques, click.) Even with most embalmed bodies, however, the flesh eventually dehydrates and crumbles and is devoured by bacteria. (One alleged origin of "ghost stories": Several breeds of bacteria, especially wood fungi, which feast on corpses, are luminous in the dark.) The **longevity of a cadaver's flesh and innards** depends largely on the embalming, the casket (hermetic ones preserve better), the decedent's diet (certain bacteria thrive on fat), and the warmth of the ground (a good freeze kills off bacteria).

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain what is meant by exhumation and embalmment.

3.0 MAIN CONTENT

3.1 Exhumation and Embalmment

Sometimes ago, the Pentagon ordered the opening of Arlington National Cemetery's Tomb of the Unknowns to remove the remains of a soldier killed in the Vietnam War and submit them to DNA tests to recover his identity. This is a classic example of high-profile exhumation. Celebrities exhumed in the 1990s include Czar Nicholas II, outlaw Jesse James, civil rights martyr Medgar Evers, and President Zachary Taylor. Some historians carp that conspiracy-minded publicity hounds perpetuate this fad, rudely disturbing the dead. How do exhumations work? What do religion and law have to say about them? Why do we now have so many?

Since the 1920s, it has been standard practice for American morticians to embalm corpses, to disinfect them so decomposition is delayed. (For a cross-cultural study of embalming techniques, click.) Even with most embalmed bodies, however, the flesh eventually dehydrates and crumbles and is devoured by bacteria. (One alleged origin of "ghost stories": Several breeds of bacteria, especially wood fungi, which feast on corpses, are luminous in the dark.) The **longevity of a cadaver's flesh and innards**depends largely on the embalming, the casket (hermetic ones preserve better), the decedent's diet (certain bacteria thrive on fat), and the warmth of the ground (a good freeze kills off bacteria).

Here are the most **common reasons for exhumation:** DNA extractions to settle paternity suits; criminal investigations; relocation to familial cemetery plots; and accidental discoveries–e.g., when a construction worker stumbles across an unmarked grave. Attitudes toward exhumation vary wildly. Some Native American tribes assert the body's spirit lives on and that to disturb a corpse is to disturb the spirit's life. Both Jews and Muslims take nearly **as strong positions** against disinterment. By tradition, Jews require funerals to take place within 24 hours of death, with members of the community keeping vigil over the body until it goes in the ground. Exhumation is allowed only when a body is to be reburied with family or in Israel. Christians have a more liberal exhumation policy. The Catholic and Protestant churches say bodies shouldn't be disturbed, if possible. However, upon canonization, saints have frequently been disinterred so their remains can be dismembered and turned into relics. And in the past, exhumation has been *ex post facto* punishment for heresies.

The classic example is the corpse of the corrupt Pope Formosus (816-896), which was exhumed and dragged through the streets of Rome. (Although his remains were reburied, subsequent popes had Formosus' body disinterred and further mutilated.) U.S. **laws governing exhumation remain vague and disparate,** varying from state to state. Most state regulations derive from English common law. Oddly, the common law prohibits the theft of items from a grave–shrouds, clothing, etc.–but is silent on the theft or removal of bodies themselves. This was a matter left to the church. (Only in the mid-19th century, when snatching corpses for medical experiments became endemic, did states pass laws prohibiting cadaver theft.) Generally, citizens can apply to their state's attorney general for permission to exhume family members for any reason, and requests for reburial are usually automatically granted. And the state can exhume a body when it deems a death suspicious and improperly investigated. Many questions–what if family members disagree on exhumation, and what if the dead person has no relatives?–remain to be hashed out in the courts. Pathologists say **the number of exhumations** skyrocketed in the 1980s and then increased even more in the '90s.

3.2 Scientific Advances

Forensic pathology, the use of science to solve crime, has improved dramatically, particularly with the development of new DNA tests. Until 1995, DNA tests required fresh samples from very specific body parts–e.g., strands of hair that include roots–that tend to decay quickly. Now, virtually any remaining body part–a bone, a tooth–will do. The difference: Where old DNA tests required a sample from the nucleus of a cell, the new tests work off sturdier mitochondria–the energy-producing material that surrounds a nucleus. Although the FBI considers mitochondrial DNA tests virtually infallible, many anthropologists doubt their accuracy. (In the case of the Unknown Soldier, DNA for his remains will be matched against DNA from the blood of people the military suspects are related to him.) Other new techniques include the use of computer animation to construct images of faces, based on surviving jawbones and teeth, as well as information gleaned from DNA about hair color. Previously, dental records had been the primary means of identifying unknown cadavers. (Forensic legend has Paul Revere first utilizing this technique during the Revolutionary War.)

3.3 Transitions to Democracy

With the collapse of Latin American dictatorships in the early ‘90s, human rights workers tracked down mass graves containing the regimes’ victims. In Chile, more than 900 victims of ex-dictator Augusto Pinochet’s regime have been dug up and identified. Confronted with evidence of mass graves, Pinochet remarked that they represented a “great savings of cemetery space.” Similar exhumations of mass graves in Bosnia and Rwanda are intended to obtain evidence that will convict war criminals.

4.0 CONCLUSION

Other new techniques include the use of computer animation to construct images of faces, based on surviving jawbones and teeth, as well as information gleaned from DNA about hair color. Previously, dental records had been the primary means of identifying unknown cadavers.

5.0 SUMMARY

Attitudes toward exhumation vary wildly. Some Native American tribes assert the body’s spirit lives on and that to disturb a corpse is to disturb the spirit’s life. Both Jews and Muslims take nearly **asstrong positions** against disinterment. By tradition, Jews require funerals to take place within 24 hours of death, with members of the community keeping vigil

over the body until it goes in the ground. Exhumation is allowed only when a body is to be reburied with family or in Israel. Christians have a more liberal exhumation policy. The Catholic and Protestant churches say bodies shouldn't be disturbed, if possible.

6.0 TUTOR-MARKED ASSIGNMENT

List the various reasons for exhumation.

7.0 REFERENCES/FURTHER READING

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UNIT 3 REMOVAL OF CORPSE

CONTENTS

1.0 INTRODUCTION

Most crops deplete soil nutrients during their growth cycle. Some of these nutrients leave the farm as harvested products, and the rest return to the soil as crop residues. The nutrients in residues may or may not be available to the next crop. Crop roots and residues improve soil fertility by stimulating soil microbial communities and improving soil aggregation. This improved soil physical environment facilitates water infiltration, water holding, aeration, and, ultimately, root growth and plant nutrient foraging. This section will review different ways that crop rotations affect soil fertility.

Understanding the basics of how nutrients are added to and released from soil organic matter will help the farmer in choosing crop sequences and amendments to optimise organic crop fertility. Certain fractions of soil organic matter contribute to plant nutrition more than other fractions. To effectively plan organic crop rotations to meet crop nutrient needs, several factors should be considered. Legume crops, which capture atmospheric nitrogen and “fix” it into forms available to plants, can be used strategically in rotations to meet the needs of nitrogen-demanding crops.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain the term corpse removal.

3.0 MAIN CONTENT

3.1 Removal of Corpse

Soil organic matter and clay particles hold large stores of plant nutrients. These reservoirs, however, are not all available to the crop. In an organic crop rotation, the grower manages soil organic matter and nutrient availability by incorporating different crop residues, cycling among

crops with different nutrient needs, using cover crops, and adding organic soil amendments. Most crops deplete soil nutrients during their growth cycle. Some of these nutrients leave the farm as harvested products, and the rest return to the soil as crop residues. The nutrients in residues may or may not be available to the next crop. Crop roots and residues improve soil fertility by stimulating soil microbial communities and improving soil aggregation. This improved soil physical environment facilitates water infiltration, water holding, aeration, and, ultimately, root growth and plant nutrient foraging. This section will review different ways that crop rotations affect soil fertility.

Understanding the basics of how nutrients are added to and released from soil organic matter will help the farmer in choosing crop sequences and amendments to optimise organic crop fertility. Certain fractions of soil organic matter contribute to plant nutrition more than other fractions. To effectively plan organic crop rotations to meet crop nutrient needs, several factors should be considered. Legume crops, which capture atmospheric nitrogen and "fix" it into forms available to plants, can be used strategically in rotations to meet the needs of nitrogen-demanding crops. Cover crops used after a cash crop capture surplus plant-available nutrients and conserve these for following crops. Cash crops themselves vary in their nutrient demands, considering their needs help make the most efficient use of the available soil nutrients in a rotation. Finally, other types of organic amendments, such as compost and manures or approved mineral fertilizers, can supplement nutrients at targeted times during a rotation. Each of these topics is discussed in the sections below.

Levels of soil organic matter range from about 0.4 percent to 10 percent in mineral soils in temperate regions. While organic matter is a relatively small fraction of the soil, it has large effects on soil structure and soil fertility. Soil organic matter contains an estimated 95 percent of soil nitrogen (N) and 40 percent of soil phosphorus (P), and with the right levels and conditions it may provide all of the N and P needs of a crop. Estimates of total nitrogen in a soil with 3 percent organic matter range from 2,000 to 4,000 pounds per acre; estimates of phosphorus range from 100 to 300 pounds per acre. Soil microorganisms release these nutrients when they consume organic matter and subsequently die. The rate of this nutrient release is affected by the availability of carbon sources (energy for the soil microbes), soil temperature, soil moisture, tillage, types and numbers of soil organisms, and quality of the soil organic matter.

A portion (10–20 percent) of the total soil organic matter has been termed the "active" fraction and is most easily decomposed by soil organisms. This active fraction is replenished primarily by additions of organic matter (cover crops, crop residues, manures, compost). Soil organisms, which make up another 10–20 percent of soil organic matter,

decompose this active organic matter. Upon death, these organisms release their nutrients to plants. The remaining soil organic matter is humus. The humus is more slowly digested by soil organisms and therefore is not a large source of available nutrients. Humus is very important, however, because it provides cation exchange sites, which hold nutrients in the soil and thus maintain their availability to plants.

Organic matter amendments to soil decompose at different rates, and this affects how quickly nutrients become available to crops. Several factors affect the rate of decomposition of organic amendments, including the carbon-to-nitrogen ratio of the amendment, soil type, temperature and moisture conditions, and the crop being grown. Green manures, which are part of the more active organic matter fraction, decompose readily, liberating nutrients relatively quickly. Composts have more stable, humic organic matter, and decompose more slowly. As a result, most composts release nutrients to crops more slowly than green manures.

Organic matter decomposition is enhanced in the area immediately around roots (the rhizosphere). Roots release organic compounds, such as carbohydrates, amino acids, and vitamins, into the soil, stimulating growth of microorganisms in this zone. Many of these organisms decompose organic matter, resulting in nutrient release to the crop. Very little research has been done to determine which plant varieties or species best support these nutrient-releasing microorganisms. In the future, such information may help identify crop varieties well adapted to organic systems.

When cover crops are regularly part of a rotation, their residues increase soil organic matter. The organic matter feeds the growth of microbes, which increases the release of N as they die and decompose. Thus, integrating cover crops into a crop rotation at specific points can help enhance nutrient cycling and conservation.

Legumes may be present in a rotation as a harvested crop (for example, alfalfa) or as a green manure (for example, vetch or clover). Legumes are of special interest in organic crop rotations because of their ability to add nitrogen to the system. Specialised bacteria (*Rhizobium* spp.) associated with the roots of legumes convert atmospheric nitrogen (N_2 gas) into plant-available nitrogen. The amount of N fixed by this association between bacteria and legumes varies with plant species and variety, soil type, climate, crop management, and length of time the crop is grown. When used strategically in a rotation, legumes provide N to the subsequent crop. The amount of N that a legume crop contributes to following crops depends on the amount of N fixed, the maturity of the legume when it is killed or incorporated into the soil, whether the entire plant or only the root system remains in the field, and the environmental conditions that govern the rate of decomposition. As a result, estimates

of the amount of Nitrogen contributions by legumes to subsequent crops range from 50 to over 200 pounds per acre.

Winter-hardy grains and grasses have extensive root systems that are more efficient than legumes at scavenging soil nitrates in the fall, thereby reducing late fall and winter leaching of nitrogen (75). In the northeastern US, small grains (rye and wheat) are the most common winter-hardy cover crops used by vegetable growers, since harvests of cash crops often extend into late summer and fall. Once incorporated in the following spring, these cover crops will release captured Nitrogen and other nutrients to subsequent crops, but at a slower rate than from legume cover crops because of the slower decomposition of grain residues.

In some cases, such as when heavy crop or cover crop residues with high carbon-to-nitrogen ratios (30:1 or higher) are tilled into the soil, soil Nitrogen may become unavailable to plants (immobilised) in the short run because it is taken up by soil microorganisms as they feed on the carbon-rich residues. Seeding a legume cover crop with small grains (for example, hairy vetch with cereal rye) can reduce Nitrogen immobilisation by providing additional Nitrogen to microorganisms during decomposition of residues. Alternatively, delaying the planting of a cash crop for about two weeks after incorporation of residues generally allows sufficient time for the cycling of Nitrogen through microorganisms and then back into the soil. Incorporating non-legume cover crops while they are still young and leafy also reduces problems with Nitrogen immobilisation.

4.0 CONCLUSION

Organic matter amendments to soil decompose at different rates, and this affects how quickly nutrients become available to crops. Several factors affect the rate of decomposition of organic amendments, including the carbon-to-nitrogen ratio of the amendment, soil type, temperature and moisture conditions, and the crop being grown. Green manures, which are part of the more active organic matter fraction, decompose readily, liberating nutrients relatively quickly. Composts have more stable, humic organic matter, and decompose more slowly. As a result, most composts release nutrients to crops more slowly than green manures.

5.0 SUMMARY

In some cases, such as when heavy crop or cover crop residues with high carbon-to-nitrogen ratios (30:1 or higher) are tilled into the soil, soil Nitrogen may become unavailable to plants (immobilised) in the short run because it is taken up by soil microorganisms as they feed on the carbon-rich residues. Seeding a legume cover crop with small grains (for example, hairy vetch with cereal rye) can reduce Nitrogen immobilisation by providing additional Nitrogen to microorganisms during decomposition of residues. Alternatively, delaying the planting of a cash crop for about two weeks after incorporation of residues generally allows sufficient time for the cycling of Nitrogen through microorganisms and then back into the soil. Incorporating nonlegume cover crops while they are still young and leafy also reduces problems with Nitrogen immobilisation.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is the importance of humus?
2. Explain the term levels of soil organic matter

7.0 REFERENCES/FURTHER READING

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MODULE 4

UNIT 1 HOME BURIAL AND MODERN TECHNIQUES IN ACHIEVING SANITATION-ECOLOGICAL SANITATION

CONTENTS

1.0 INTRODUCTION

Ecological sanitation can be viewed as a three-step process dealing with human excreta: (1) Containment, (2) Sanitisation, (3) Recycling. The objective is to protect human health and the environment while limiting the use of water in sanitation systems for hand (and anal) washing only and recycling nutrients to help reduce the need for artificial fertilisers in agriculture. An essential step in the process of sanitation is the containment of pathogens that can cause disease. Without containment and sanitisation, a vicious circle develops where the pathogens in excreta are released back into the environment, re-infect people through consumption of contaminated water or food, and are then excreted again, only to begin the cycle over.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- discuss home burial and modern techniques in achieving sanitation-ecological sanitation.

3.0 MAIN CONTENT

3.1 Home Burial and Modern Techniques in Achieving Sanitation Ecological Sanitation

Ecological sanitation can be viewed as a three-step process dealing with human excreta: (1) Containment, (2) Sanitisation, (3) Recycling. The objective is to protect human health and the environment while limiting the use of water in sanitation systems for hand (and anal) washing only and recycling nutrients to help reduce the need for artificial fertilisers in agriculture. An essential step in the process of sanitation is the containment of pathogens that can cause disease. Without containment and sanitisation, a vicious circle develops where the pathogens in excreta are released back into the environment, re-infect people through consumption of contaminated water or food, and are then excreted again, only to begin the cycle over. Ecological sanitation systems are designed around true containment and provide two ways to render human excreta innocuous: dehydration and decomposition. The Ecosan concept is based on following principles:

- Prevent diseases (must be capable of destroying or isolating faecal pathogens)
- Protect the environment (must prevent pollution and conserve valuable water resources)
- Return nutrients (must return plant nutrients to the soil)
- Culturally acceptable (must be aesthetically inoffensive and consistent with cultural and social values)
- Reliable (must be easy to construct and robust enough to be easily maintained in a local context)
- Convenient (must meet the needs of all household members considering gender, age and social status)
- Affordable (must be affordable and accessible)

Ecological sanitation is an alternative to the linear approaches to carry waste (excreta, soapy water, etc.) to water bodies. It is based on an ecosystem approach. The nutrients and organic matter contained in human excreta must be considered as a resource and properly treated for its contribution to food production systems. Systems typically work with urine-diverting dehydration toilets (often with soil-'flush'), flush-urine-diversion toilets and black water systems for example based on the vacuum toilets connected to a biogas plant. Different particular wastewater streams are forming the domestic wastewater. The wastewater originating from toilets is called black water and can be further divided into yellow water (urine with or without flush water) and brown water (toilet wastewater without urine). Additionally, grey water is that part of domestic wastewater which originates from kitchen, shower, wash basin and laundry. This means that they are generally

wasted instead of being used as fertilizers (except the small portion of nutrients being contained in sludge which is used sometimes as fertiliser after sanitisation).

Due to pathogens, brown water poses high health risk, but it represents a very small volume flow in domestic wastewaters (only 50 litres are excreted per person per year). In conventional systems, this small volume is mixed with other streams of domestic wastewater with higher volume flows: yellow water (tenfold volume flow compared to faeces) and grey water. Grey water volume flows depend on habits. That is why a wide range is given for grey water volume flow: 25,000 to 100,000 litres per person per year. This figure is related to Central European patterns. Of course, also extremely smaller grey water volume flows per person can be found, especially in regions with water scarcity. Additionally toilet flush water has to be taken into consideration (which might be up to 10 litres per toilet use).

It is very impressive that the large volume flow of grey water is accompanied by comparably small nutrient mass flows (about 3 % of the total nitrogen mass flow and 10 % of the total phosphorus mass flow (phosphorus concentration can still be lowered by using phosphorus free detergents) discharged with domestic wastewater). However, about one third of the potassium (which is also important for plant growth and a limited fossil fertiliser component) mass flow of domestic wastewater is contained in grey water. Because of the large volume flow of grey water (compared to yellow and brown water), its potassium concentration is quite low (commonly below 10 mg/l), however. Because of its low contribution to mass flow of the nitrogen and phosphorus in domestic wastewater and its high volume flow grey water turns out to belong to the water cycle and represents a splendid source for wastewater reuse. As grey water contains nearly half of the organic load of domestic wastewater, this is the main group of pollutants to be removed from grey water before its eventual reuse. Therefore, treatment of grey water is far cheaper than treatment of total domestic wastewater as there is no need of costly nitrification and denitrification processes mostly practiced in modern municipal wastewater treatment plants.

The scheme clearly demonstrates that greatest part of the nutrients nitrogen, phosphorus and potassium of domestic wastewater are contained in the comparably small volume flow of yellow water. Moreover, urine contains trace metals required for plant growth. Only about 10 % of the organics of domestic wastewater are urine borne. From these reasons, yellow water has to be taken into consideration as fertilizer, and is thus related to the food cycle rather than to the water cycle.

Brown water contributes greatly to the phosphorus load of domestic wastewater and can thus also be considered as fertilizer. Moreover, the

organic solids make brown water a splendid candidate as a soil conditioner after suitable treatment. Therefore, also brown water is belonging to the food cycle.

Separate collection of yellow water is possible with urine-diversion (UD) toilet, a suitable technology to separate the urine and faeces at source. Usually, the toilet has two bowls, the front one for urine and the rear one for faeces. Each bowl has its own outlet from where the respective flow is piped out. The flush for the urine bowl needs little water (0.2 l per flush) or no water at all whereas flushing water for faeces bowl can be adjusted to the required amount (about 4 to 6 l per flush) or no water in case of Urine-diverting dehydration/composting toilets.

Among the flows of wastewater, yellow water contains most of the nutrients. One person produces on average 3.92 kg of nitrogen, 0.38 kg of phosphorous and 0.97 kg of potassium per year. These nutrients, such as nitrogen in the form of urea, phosphorus as super phosphate and potassium as an ion, are in a form which is ideal for uptake by plants. Beneficially, urine contains very low levels of heavy metals and pathogens. These heavy metal concentrations are much lower than those of most chemical fertiliser. In Sweden, for instance, urine contains less than 3.2 mg cadmium per kg of phosphorus compared to 26 mg Cd/kg of phosphorus in commercial fertiliser and 55 mg Cd/kg of phosphorous in sludge.

4.0 CONCLUSION

The scheme clearly demonstrates that greatest part of the nutrients nitrogen, phosphorus and potassium of domestic wastewater are contained in the comparably small volume flow of yellow water. Moreover, urine contains trace metals required for plant growth. Only about 10 % of the organics of domestic wastewater are urine borne. From these reasons, yellow water has to be taken into consideration as fertilizer, and is thus related to the food cycle rather than to the water cycle.

5.0 SUMMARY

Brown water contributes greatly to the phosphorus load of domestic wastewater and can thus also be considered as fertilizer. Moreover, the organic solids make brown water a splendid candidate as a soil conditioner after suitable treatment. Therefore, also brown water is belonging to the food cycle. Separate collection of yellow water is possible with urine-diversion (UD) toilet, a suitable technology to separate the urine and faeces at source. Usually, the toilet has two bowls, the front one for urine and the rear one for faeces. Each bowl has its own outlet from where the respective flow is piped out.

6.0 TUTOR-MARKED ASSIGNMENT

List the Ecological sanitation principles (Ecosan principles).

7.0 REFERENCES/FURTHER READING

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UNIT 2 COMMUNITY LEAD TOTAL SANITATION (CLTS)

CONTENTS

1.0 INTRODUCTION

Community-led total sanitation (CLTS) is an approach used mainly in developing countries to improve sanitation and hygiene practices in a community. It focuses on spontaneous and long-lasting behavior change of an entire community. The goal of CLTS is to end open defecation. The term "triggering" is central to the CLTS process. It refers to ways of igniting community interest in ending open defecation, usually by building simple toilets, such as pit latrines. CLTS involves actions leading to increased self-respect and pride in one's community. It also involves shame and disgust about one's own open defecation behaviors.
The concept was developed around the year 2000 by Kamal Kar for rural areas in Bangladesh. CLTS became an established approach around 2011. Non-governmental organisations were often in the lead when CLTS was first introduced in a country. Local governments may reward communities by certifying them with "open defecation free" (ODF) status. The original concept of CLTS purposefully did not include subsidies for toilets as they might hinder the process.

2.0 OBJECTIVE

By the end of this unit, you will be able to:

- explain the term community lead total sanitation.

3.0 MAIN CONTENT

3.1 Community Lead Total Sanitation (CLTS)

Community-Led Total Sanitation (CLTS) is an approach used mainly in developing countries to improve sanitation and hygiene practices in a community. It focuses on spontaneous and long-lasting behavior change of an entire community. The goal of CLTS is to end open defecation. The term "triggering" is central to the CLTS process. It refers to ways of igniting community interest in ending open defecation, usually by building simple toilets, such as pit latrines. CLTS involves actions leading to increased self-respect and pride in one's community. It also involves shame and disgust about one's own open defecation behaviors.
The concept was developed around the year 2000 by Kamal Kar for rural areas in Bangladesh. CLTS became an established approach around 2011. Non-governmental organisations were often in the lead when CLTS was first introduced in a country. Local governments may reward communities by certifying them with "open defecation free" (ODF) status. The original concept of CLTS purposefully did not include subsidies for toilets as they might hinder the process.

CLTS is practiced in at least 53 countries. CLTS has been adapted to the urban context.[3] It has also been applied to post-emergency and fragile states settings.[4]

Challenges associated with CLTS include the risk of human rights infringements within communities, low standards for toilets, and concerns about usage rates in the long-term. CLTS is, in principle, compatible with human rights based approach to sanitation but there are bad practice examples in the name of CLTS.[5] More rigorous coaching of CLTS practitioners, government public health staff and local leaders on issues such as stigma, awareness of social norms and pre-existing inequalities are important.[5] People who are disadvantaged should benefit from CLTS programmes as effectively as those who are not disadvantaged. Community Led Total Sanitation (CLTS) is an innovative methodology for mobilising communities to completely eliminate open defecation (OD). Communities are facilitated to conduct their own appraisal and analysis of open defecation (OD) and take their own action to become ODF (open defecation free).

At the heart of CLTS lies the recognition that merely providing toilets does not guarantee their use, nor result in improved sanitation and hygiene. Earlier approaches to sanitation prescribed high initial standards and offered subsidies as an incentive. But this often led to uneven adoption, problems with long-term sustainability and only partial use. It also created a culture of dependence on subsidies. Open

defecation and the cycle of fecal–oral contamination continued to spread disease.

In contrast, CLTS focuses on the behavioural change needed to ensure real and sustainable improvements – investing in community mobilisation instead of hardware, and shifting the focus from toilet construction for individual households to the creation of open defecation-free villages. By raising awareness that as long as even a minority continues to defecate in the open everyone is at risk of disease, CLTS triggers the community's desire for collective change, propels people into action and encourages innovation, mutual support and appropriate local solutions, thus leading to greater ownership and sustainability.

History

CLTS was pioneered by Kamal Kar (a development consultant from India) together with VERC (Village Education Resource Centre), a partner of WaterAid Bangladesh, in 2000 in Mosmoil, a village in the Rajshahi district of Bangladesh, whilst evaluating a traditionally subsidised sanitation programme. Kar, who had years of experience in participatory approaches in a range of development projects, succeeded in persuading the local NGO to stop top-down toilet construction through subsidy. He advocated change in institutional attitude and the need to draw on intense local mobilisation and facilitation to enable villagers to analyse their sanitation and waste situation and bring about collective decision-making to stop open defecation.

CLTS spread fast within Bangladesh where informal institutions and NGOs are key. Both Bangladeshi and international NGOs adopted the approach. The Water and Sanitation Programme (WSP) of the World Bank played an important role in enabling spread to neighbouring India and then subsequently to Indonesia and parts of Africa. Over time, many other organisations have become important disseminators and champions of CLTS, amongst them Plan International, UNICEF, WaterAid, SNV, WSSCC, Tearfund, Care, WSP, World Vision and others. Today CLTS is in more than 60 countries in Asia, Africa, Latin America, the Pacific and the Middle East, and governments are increasingly taking the lead in scaling up CLTS. Many governments have also adopted CLTS as national policy.

After initially being conceived as an approach for rural sanitation only, there have been a variety of adaptation, for example in urban and peri-urban settings, in schools and in post emergency and fragile state contexts.

3.2 CLTS in the SDG era

The need to achieve sustainable sanitation for all is an urgent one: 2.3 billion people still lack even a basic sanitation service. 600 million people have limited access to sanitation; ie they share with other households. Globally, 892 million people still practice open defecation. (WHO/UNICEF, 2017). More research has brought to light the many wide-ranging negative effects of a lack of, or inadequacy of, sanitation facilities. There is a growing understanding that sanitation impacts on many interrelated human rights. The realisation that 'shit stunts', that OD, faecally transmitted infections (FTIs), poverty, and undernutrition reinforce each other, is gradually being acknowledged. Research is also showing that poor sanitation is related to psychological stress, and can increase women's vulnerabilities to water, sanitation, and hygiene (WASH)-related violence. A lack of suitable facilities for menstrual hygiene management can result in girls regularly missing days at school.

The growing recognition of the central role of sanitation for all aspects of human development has been mirrored in a UN General Assembly resolution which, in December 2015, 1 defined water and sanitation as two separate rights for the first time, as well as in the Sustainable Development Goals (SDGs), which include the ambitious aim of universal access to improved sanitation by 2030, with targets that include the elimination of OD. Many countries are making sanitation a political priority, and some have set ambitious targets for creating ODF nations, some with detailed roadmaps of how to get there. While the recognition of the huge potential of sanitation for improving health, wellbeing, and child development provide important fuel for the drive to sustainable sanitation for all, achieving this goal is going to need significant and rapid change within the sector, particularly in relation to reaching the poorest, where progress has been by far the slowest.

The 2017 JMP report states that 'no SDG region is on track to achieve universal basic sanitation by 2030, with the exception of Australia and New Zealand, where coverage is already nearly universal' and that '9 out of 10 countries where more than 5 per cent of the population lacked basic sanitation in 2015 are progressing too slowly to achieve universal basic sanitation by 2030.' So the question now is, how do we harness the political momentum, commitments, money, promising innovations, and new technologies that have appeared in the sanitation landscape? We also need to ask, what will it take to turn them into effective long-term solutions?

3.3 CLTS and the Changing Landscape of Rural WASH

The WASH landscape has been changing subtly but noticeably over the last few years. CLTS has proved most effective to date in tackling the sanitation challenge at scale, becoming more and more accepted, integrated into national policies, and used in a wide variety of contexts by a multitude of actors. However, the last few years have challenged the sector to look beyond the ambitions of the MDGs and examine who is not being reached by efforts to increase access to sanitation. Coinciding with or perhaps being instigated by the SDG's focus on universal coverage and reaching the poorest and most vulnerable, the complexity of the challenges facing the WASH sector and with it, CLTS, have become clear.

The WASH sector is recognising the need to become more diverse and cross-cutting in response to this complexity, with general acceptance of the need for a menu of different approaches that can either be integrated with one another or used in isolation. More and more, programmes and professionals are moving towards not being proponents of one approach over the other, but are instead arguing for the need to look closely at the context and situation to inform decisions about what approach, or cocktail of approaches and interventions, to use.

4.0 CONCLUSION

CLTS has proved most effective to date in tackling the sanitation challenge at scale, becoming more and more accepted, integrated into national policies, and used in a wide variety of contexts by a multitude of actors. However, the last few years have challenged the sector to look beyond the ambitions of the MDGs and examine who is not being reached by efforts to increase access to sanitation.

5.0 SUMMARY

The WASH sector is recognising the need to become more diverse and cross-cutting in response to this complexity, with general acceptance of the need for a menu of different approaches that can either be integrated with one another or used in isolation. More and more, programmes and professionals are moving towards not being proponents of one approach over the other, but are instead arguing for the need to look closely at the context and situation to inform decisions about what approach, or cocktail of approaches and interventions, to use.

6.0 TUTOR-MARKED ASSIGNMENT

Define the term Community Lead Total Sanitation (CLTS)

7.0 REFERENCES/FURTHER READING

Ehlers, V. (1943). Municipal and Rural Sanitation. New York: McGraw-Hill book Company, Inc.

"Call to Action on Sanitation" (PDF). *United Nations*. Retrieved 15 August, 2014.