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# SANITATION-SAFETY- PLANNING (SSP), THE NEXUS FOR CLIMATE RESILENCE, SANITION AND HEALTH IN BAYELSA STATE

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**Abstract**
In recorded human history, climate-related hazardous events have always existed; however, climate change has proved to have the potential to increase their severity and the likelihood of creating public health risks. In Bayelsa State, a sizable portion of the population has been reported to be suffering from gastrointestinal disorders particularly diarrhea and a number of children have been diagnosed of gastroenteritis and helminthes infections in the year 2021. Again, preventing exposure and contact to human waste, especially in dense urban settings requires the safe management of the entire sanitation service chain involving multiple actors and exposed groups in the collection, transport, treatment, disposal and end use of sanitation waste. To that end, a review of scientific literature, particularly the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2014), the WHO discussion Paper on Climate, Sanitation and Health (WHO, 2019) and the Bayelsa State SSP zero draft of 2021, is undertaken to ensure that climate change outcomes are considered within the Sanitation Safety Planning (SSP) risk assessment, planning and management processes. The SSP is a WHO risk based management tool for the safe use and disposal of grey water, wastewater and excreta developed in 2006 because in 2018 the WHO concluded that sanitation interventions have shown lower than expected health outcomes. Evidently therefore, the Bayelsa State SSP zero draft of 2021 reports that between March and April 2021, over 200 cases were reported from over 30 communities arising from the outbreak of acute-gastroenteritis suspected to be of cholera, and casualty figures were over 26. Hopefully, the first comprehensive Guidelines on Sanitation and Health which aim to provide evidence-based recommendations and offer guidance to ensure international, national and local sanitation policies and programmes that effectively protect public health, was launched by the WHO in 2018. It is a step-by-step risk based approach to implementing local level risks assessment and a management tool for the entire sanitation service chain covering containment, conveyance, treatment and end use of disposal. Consequently, the SSP is hereby recommended for adoption in Bayelsa State and Niger Delta Region.

**Keywords** Sanitation-safety-planning, climate change, World Health Organization.

## INTRODUCTION

Global heating driven primarily by anthropogenic greenhouse gas emissions is leading to significant changes in climates throughout the world. It is very likely that heat waves will occur more often and last longer, extreme precipitation events will become more intense and frequent in many regions and global mean sea level will continue to rise (IPCC, 2014a). In many regions, changing precipitation is already affecting the quantity and quality of water resources (IPCC, 2014b). While there is a level uncertainty associated with how climates, particularly at local levels will change, it is clear that effects of these changes pose significant health risks including through sanitation. Changes in climate variability, extreme weather events, and seasonality can directly and indirectly impact sanitation systems in numerous ways along the entire service chain. Floods that cause containment units to overflow, corrosion of wastewater treatment infrastructure from sea-level rise and rising temperatures that proliferate pathogens in waterways are only a few of many examples of how climate can affect sanitation. Although climate-related hazardous events have always existed, climate change has potential to increase their severity and the likelihood of creating public health risks. Also, disadvantaged groups are considered vulnerable and therefore more likely to disproportionally bear the burden of these increased risks [Climate, Sanitation and Health (WHO 2019)]. Furthermore, the pressures of urbanization, demand for food, water scarcity and the provision of safe affordable sanitation is becoming more complex despite the fact that access to basic sanitation at the household level

remains a critical public health intervention for preventing sanitation related disease especially for diarrhea, intestinal worms, cholera and gastrointestinal disorders which affect most people. Preventing exposure to human waste, especially in dense urban settings requires safe management of the entire sanitation service chain involving multiple actors and exposed groups in the collection, transport, treatment, disposal and end use of sanitation waste. Although evidence is limited, global burden of disease estimates for diarrhea shows that this higher level of service is effective and can achieve large health gains over and above what can be achieved with basic sanitation alone.

In Bayelsa State, a sizable proportion of the population has been reported to be suffering from gastrointestinal disorders particularly diarrhea; Also, a number of children have been diagnosed of gastroenteritis and helminthes infections. In 2021 alone, between March and April, over 200 cases were reported from over 30 communities arising from the outbreak of acute-gastroenteritis suspected to be of cholera, and casualty figures were over 26 (SSP zero draft, 2021).

The Bayelsa state SSP Zero Draft Report (2021) also categorized sanitation systems in the Bayelsa State capital city (Yenagoa) into the Pour Flush Toilet system (PFTS) and the Flush Toilet System (FTS) complete with septic tanks and effluent infiltration and offsite fecal sludge disposal systems, some of which are channeled into the Epie Creek; and that there are some households which do not have access to basic sanitary facility and therefore resort to open defecation on open spaces and rivers. According to the study, most sanitation interventions in the study area are not suitable for the flood prone State, therefore failing in the containment and prevention of the potential exposure to pathways of infections.

The Sanitation Safety Planning is therefore a WHO risk-based management tool for the safe use and disposal of grey water, wastewater and excreta developed in 2006. It is a step-by-step risk-based approach to implementing local level risks assessment and management for the entire sanitation service chain, covering containment, conveyance, treatment and end use of disposal. The 2006 WHO Guidelines were designed to assist in the development of national and international approaches and to provide a framework for national and local decision making to identify and manage health risk associated with use of waste water, excreta and grey water in agriculture and aquaculture. In 2018, after concluding that sanitation interventions have shown lower than expected health outcomes, the World Health Organization launched its first comprehensive Guidelines on Sanitation and Health which aim to provide evidence-based recommendations and offer guidance to ensure international, national and local sanitation policies and programmes that effectively protect public health. Besides its key recommendations and good practice actions for enabling safe sanitation service delivery, the guidelines offer implementation guidance on technical, strengthening of the enabling environment and behavior change interventions as well as technical resources. This engagement is therefore undertaken to publicize the WHO Guidelines on Sanitation and Health because it seeks to articulate and support the role of health and other actors in sanitation policy and programming to help ensure that health risks are identified and managed effectively.

### 1.1 Sanitation Safety Planning and Justification

Sanitation Safety Planning (SSP) is a risk-based management tool for sanitation systems. It assists users to:

• Systematically identify and manage health risk along the entire sanitation chain, which includes toilet, containment- storage/treatment,

conveyance, treatment and end use/disposal steps;

• guide investment based on actual risks, to promote health benefits and minimize adverse health impacts;

• provide assurance to authorities and the public on the safety of sanitation-related products and services.

SSP provides the platform that brings together actors from different sectors to identify health risks in the sanitation system and enables to agree on improvements and regular monitoring. The approach ensures that over time, control measures target the greatest health risks and emphasizes incremental improvement.

### 1.2 SSP Scope

It is applicable in high and low resource settings. It can be used both at the planning stage for new schemes, and to improve the performance of existing systems. It can and should take into consideration current and future risks, including those posed by climate variability and climate change.

### 1.3 SSP Target audience, use and nonuse approaches

SSP emphasizes the leadership role of the health sector to bring about safe sanitation along the entire service chain and to help bring a human health perspective to traditional non-health sectors like housing, sanitation, engineering and the agricultural sector. Once developed, SSP provides a step-by-step guidance to assist in the implementation of the 2006 WHO Guidelines for Safe Use of Wastewater, Excreta and Greywater and the 2018 WHO Guidelines on Sanitation and Health. In particular, this updated SSP toolbox offers practical advises to the implementation of the 2018 WHO recommendations (see recommendation).

The methodology and tools of SSP can be applied to all sanitary systems to ensure the system is managed to meet health objectives. The SSP procedure is targeted at a variety of users who are responsible for the safety of sanitation systems and services at different levels. For example, it could be used at the level of: local authorities, sanitation service providers, farmers, Community based organizations, farmers associations and NGOs.

In addition to its site specific use in relation to a particular SSP process, SSP is also useful for those working at a national level, including: Health authorities and regulators, those regulating the development of policies and programmes.

SSP is not intended to be used for planning and designing of new and large sanitation schemes.

## THE CONCEPT OF BASIC SANITATION AND SANITATION SAFETY

The concept of basic sanitation may describe the hygienic promotion of health through the prevention of human contact with the hazards of wastes, treatment, and proper disposal of human sewage wastewater; the provision of facilities and services for the safe disposal of human urine and excreta; and the maintenance of hygienic conditions through services like garbage collection and wastewater disposal. Also, sanitation safety could be contextualized as the cleanliness or worthiness of equipment and facility. For example, food safety may describe how food is handled to prevent food-borne illness. It could also mean how excreta could equally be handled to prevent faecal-oral exposures and diseases.

Therefore, the non-observance of proper basic sanitation and sanitation safety could lead to very poor sanitation standards, which potentially compromises the human health.

### 4.1 Structural Frame

The structure adopted as frame for determination,

presentation and discussion of findings consists of the following:

4.1.1 The pre-disposing factors to poor sanitation

4.1.2 The effects of poor sanitation and

4.1.3 The management and control of sanitation planning modules.

**METHODOLOGY**

Although climate-related hazardous events have always existed, climate change has been reported to have the potential to increase their severity and the likelihood of creating public health risks particularly from contact with human excreta. Consequent upon this observation, it has become pertinent to note that preventing exposure to human waste, especially in dense urban settings requires safe management of the entire sanitation service chain involving multiple actors and exposed groups in the collection, transport, treatment, disposal and end use of sanitation waste. To achieve this, a review of scientific literature, particularly the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2014), the WHO discussion Paper on Climate, Sanitation and Health (2018) and the Bayelsa State SSP Zero Draft Report (2021) amongst others was undertaken to determine the predisposing factors to poor sanitation, their effects, management and control; and to basically ensure that climate change outcomes are considered within the Sanitation Safety Planning (SSP) risk assessment, planning and management processes.

**3.1 The SSP Procedure**

In line with the observations made above, once developed, SSP provides a step-by-step guidance to assist in the implementation of the 2006 WHO Guidelines for Safe Use of Wastewater, Excreta and Greywater and the 2018 WHO Guidelines on Sanitation and Health. The steps are presented in modules as follows:

Module 1: Preparing for SSP

Module 2: Describing the Sanitation System

Module3: Identify hazardous events; assess existing control measures and exposure risks

Module 4: Develop and Implement an Incremental Improvement Plan

Module 5: Monitor Control Measures and Verify Performance

Module 6: Develop supporting programmes and review plans.

**RESULTS AND DISCUSSIONS**

The extensive review of empirical literature revealed that the underlying aim of sanitation planning is primarily to protect public health. Therefore, Sanitation Safety Planning (SSP) presents itself as a WHO risk-based management tool designed as far back as 2006, for the safe use and disposal of greywater, wastewater and excreta (sanitation systems). It is indeed a step-by-step risk-based approach to implementing local level risk assessment and management for the sanitation service chain, from containment, conveyance, treatment and the end use to which disposal is put to. Consequently, an adequate understanding of the actual risks presented by the sanitation systems and how those risks may best be managed is an important guide to the management, investments and improvements of sanitation systems.

**4.1 Pre-Disposing Factors to Poor Sanitation Standards**

The pre-disposing factors to poor sanitation standards may not be restricted to, but are inclusive of open defecation, unsafe drinking water, high density living, lack of awareness or proper education, increased health issues, decreased schooling and standards of education, poverty etc. These factors and more have been observed to be symptomatic of poverty and

triggers of public health risks particularly from contact with human excreta. This observation has been corroborated by WHO (2006), which reported that although climate-related hazardous events have always existed, climate change has the potential to increase their severity and the likelihood of creating public health risks; and also, that disadvantaged groups are more likely to disproportionally bear the burden of the increased risks.

### 4.2 The Effects of Poor Sanitation

Expectedly, the effects of poor sanitation would be felt more in the following areas:

i. Villages and peri-urban centers where proper sanitation may not be available. This observation very aptly describes the study area (Bayelsa State) which is largely made up of villages and peri-urban centers and therefore potentially vulnerable to the increased risk burden from poor sanitation.

ii. Again, the effects would be felt in climes disposed to water and soil pollution arising from open defecation on rivers, river beds, rail tracks and fields. This observation aptly describe the situation in the study area and corroborated already in the report of the Bayelsa State SSP Zero Draft (2021) where it was indicated that there are some households which do not have access to basic sanitary facility and therefore resort to open defecation on open spaces and rivers, and

iii. Finally, on contaminated soils, ground and surface waters which may result in cholera, typhoid, polio, meningitis etc. As indicated earlier, in Bayelsa State, a sizable portion of the population has been reported to be suffering from gastrointestinal disorders particularly diarrhea; Also, a number of children have been diagnosed of gastroenteritis and helminthes infections. In 2021 alone, between March and April, over 200 cases were reported from over 30 communities arising from the outbreak of acute-gastroenteritis suspected to be of cholera, and casualty figures were over 26 (SSP zero draft, 2021).

### 4.3 Management and Control of Sanitation Systems

The effective management and control of sanitation systems is contained in the WHO guidelines for Safe Use of Wastewater, Excreta and Greywater (2006). It provides a comprehensive framework for managing associated health risks arising from the handling and use of human wastes in agriculture and aquaculture. This finds explicit illustrations in the WHO SSP Modules and the Typical Sanitation Service Chain.

#### 4.3.1 The Sanitation Safety Planning Modules

The SSP process requires proponents to set out specific public health objectives and prioritize areas which must be clarified as major components that may need to be included in the sanitation service chain to meet the objectives set. The various steps of the sanitation system are illustrated in Fig 1.

Fig. 1. Sanitation safety planning modules

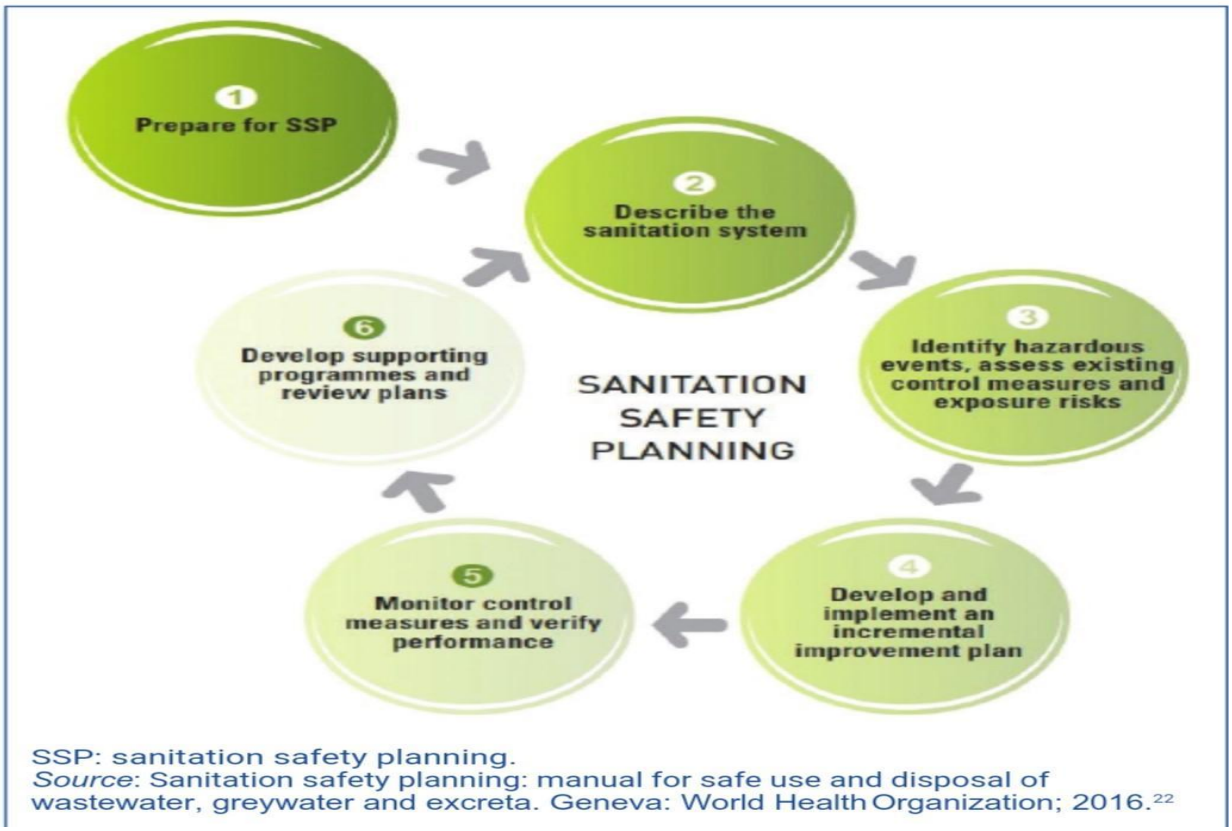


**Fig. 1: Sanitation Safety Planning Modules**
**Source: WHO SSP Manual (2020).**

### 4.3.2 Module 1: Preparing for SSP

Preparations for SSP require proponents to establish the priority sanitation challenges and address areas or activities that pose the greatest risks in response to the agreed public health objectives for the system; and to also ensure that the scope is understood by all stakeholders and is manageable. Again, owing to the interrelated natures of the above, an iterative process may need to be adhered to until they are fully harmonized upon completing the actions. It is particularly important in sanitation systems to ensure broad stakeholders' commitment to the design and implementation of the entire SSP process. However, it's advised that this module should be developed to suit local circumstances and contexts. This module is critical in the later assessment of exposure groups at risk because it aids the understanding of the source and path of waste(s) through the system.

### 4.3.3 Module 2: Describing the Sanitation System

The main objective of Module 2 is to generate a complete description

of the sanitation system within the boundary identified in Module 1.

A thorough understanding of all parts of the sanitation system and its

performance requirements supports the subsequent risk assessment

process and finds expression in the typical sanitation service chain. The second module covers the microbiological, physical and chemical constituents from all sources including every other factor that may affect the performance (strength) and vulnerability (weakness) of the system.

**SANITATION SERVICE CHAIN**

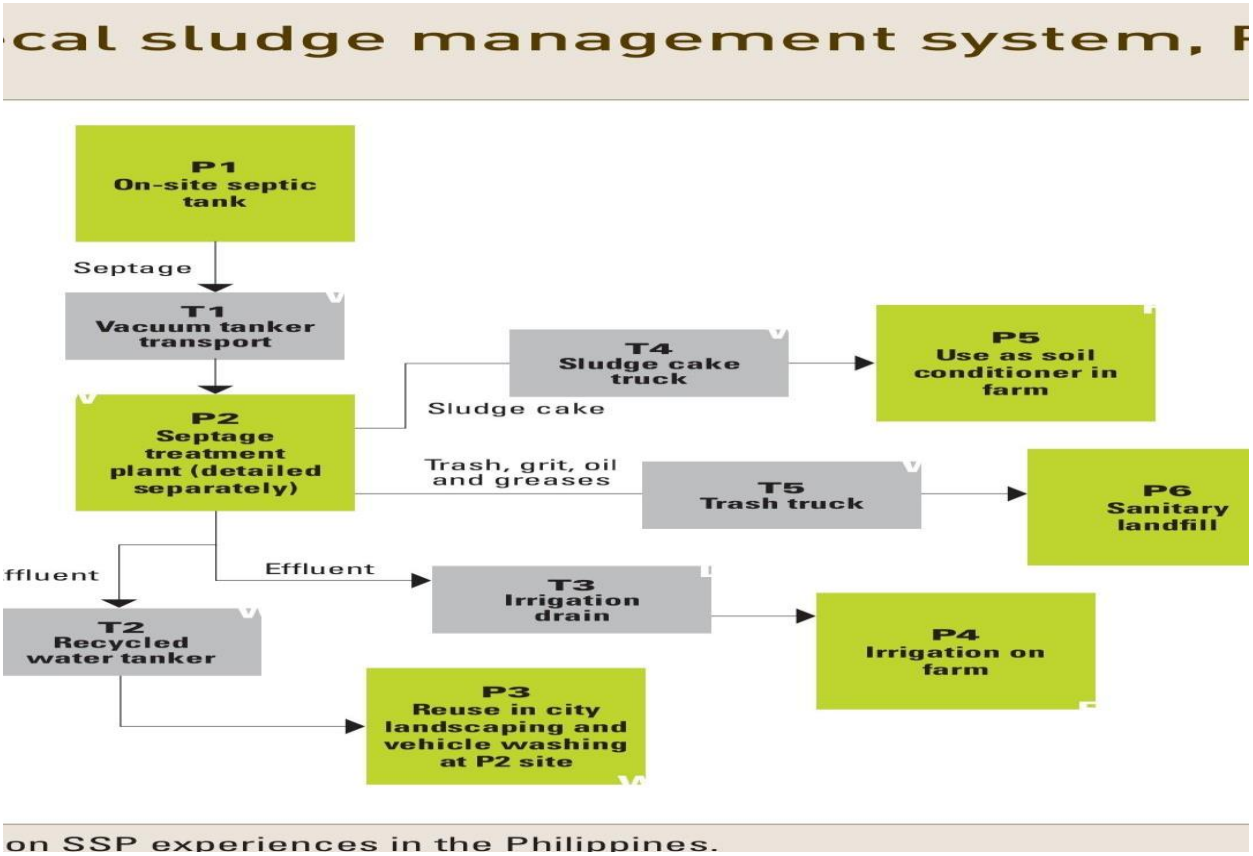


**FIG 2: A typical Sanitation Service Chain curled from the Philippines experience where P represents Process Stages and T, Transport Stages.**
**Source: WHO Guideline, (2006).**

Preventing exposure to human waste, especially in dense urban settings requires safe management of the entire sanitation service chain involving multiple actors and exposed groups in the collection, transport, treatment, disposal and end use of sanitation waste as very aptly represented on the Typical Sanitation Service Chain above (Fig 2.). There are two stages to it consisting of the process and transportation stages represented by P1 to P6 and T1 to T5 respectively, necessary for the prevention of exposure to human excreta.

**4.3.4 Module 3: Identify hazardous events; assess existing control measures and exposure risks**

The main objective of module 3 is to ensure that subsequent efforts and investments in system monitoring and improvements respond to the risks that are ranked highest first, by identifying in detail, which is likely to be at risk and how the risk occurs during use, operation and maintenance of the sanitation system, or through the use or disposal of its products. Thereafter, it determines how well the existing sanitation system protects those at risk and thus provides a structure to identify and prioritize the highest risks for attention going forward. On completion of Module

3, the SSP team will have identified the hazardous events with the highest risks. This module is recorded in relation to the mapping made in Module 1, and it ensures that an initial classification of exposed groups are identified and related to where and how exposure may occur within the system.

### 4.3.5 Module 4: Develop and Implement an Incremental Improvement Plan

This module allows flexibility in the selection of new control measures or other improvements designed to address these risks at the most effective places in the system and helps to ensure that funding and effort targets the highest risks with greatest urgency. It encourages SSP teams to consider different options to control risks including short and long term plans, treatment, non-treatment and behavioral change options, and a range of locations along the typical sanitation service chain. Also, it strengthens the options into a more visible plan of action and implements the improvement plan with action taken by the line agency responsible for the respective improvements. The 4th module includes the collection and documentation of the context in which the system exists; this may include legal and regulatory requirements, historical monitoring and compliance data and information on climate, land use, cultural practice, demographics, the likely concentrations of pollutants and pathogens, and the efficiency of system and system components to reduce the risks. If any discrepancies are identified between existing requirements and potential health hazards, these should be brought to the attention of the Steering Committee for the initiation of associated policy dialogue.

### 4.3.6 Module 5: Monitor Control Measures and Verify Performance

Sanitation systems are considered very dynamic. Therefore, even the most well designed systems can under-perform resulting to unacceptable public health risk and loss of confidence in the system. To that end, Module 5 is designed to develop a monitoring plan that regularly ensures that the system is functioning as intended and defines what should be done. Furthermore, operational and verification monitoring convey assurances to the operators, the public and the authorities that the system is performing adequately. Audit and certification are key SSP regulatory functions that are most relevant in countries where such requirements may be specified whereas monitoring is an important environmental health activity designed to track progress and shape administrative decisions. Again Environmental Health Authorities play an important role in this SSP module, as they are responsible for oversight, monitoring and enforcement of sanitation safety standards in the private, public and business premises, in the environment, and in the provision of sanitation services. It is instructive to note that the improvement plan developed and implemented in Module 4 and the monitoring and verification plans developed and implemented under Module 5 are the core outputs of the SSP process. Furthermore, the module ensures that the system description is complete and accurate. Data requirements and potential institutional gaps (e.g. policy gaps) are identified at this stage. The outputs of Module 2 should provide sufficient information to allow the SSP team to identify the system's vulnerability to hazards and hazardous events, and to validate the effectiveness of any existing control measures (identified in Module 3) and the system's performance. Much of the information within this Module may have already been gathered if the system has undergone scientific investigations such as health or environmental impact assessment. If so, findings from these studies can inform all aspects of this and subsequent Modules.

### 4.3.7 Module 6: Develop supporting programmes and review plans.

Adopting a systematic and inclusive approach to sanitation in a locality creates the need for services within the sanitation service chain that may not currently exist or that exist only on a small scale to be provided. Therefore, Module 6 is introduced to support the development of people's skills, knowledge and the institutional capacity to meet SSP commitments and the development of a well-functioning sanitation market. Also, existing programmes like training may be reconsidered only in the light of the extent to which they support the SSP objectives. These may include ensuring that SSP operations are supported with programmes of research and training for staff, and generate feedbacks to key stakeholders especially in larger or complex systems. It also recognizes that SSP works within a dynamic environment, therefore as more information become available and new controls implemented, the SSP outputs ought to be periodically reviewed to analyze new or emerging hazards and hazardous events. Also, supporting programmes and regular reviews ensure that SSP remains always relevant and responds to the current or anticipated operating needs of specific localities and society in general; supports the development of people's skill sets, knowledge bases, the institutional capacity to meet SSP goals and the development of a well-functioning sanitation market. Existing programmes like training may be reconsidered in light of the extent to which they support the SSP objectives.

## SUMMARY OF FINDINGS

As already indicated preventing exposure to human waste, especially in dense urban settings requires safe management of the entire sanitation service chain involving multiple actors and exposed groups in the collection, transport, treatment, disposal and end use of sanitation waste. These are summarized as follows:

5.1 Collection Process Stage: this is done at the home front realizing that sewage is primarily generated within and transported through PVC pipes to the on-site Septic tank wherever the Flush and the Pour Flush Toilet Systems are practiced. This stage of the service chain is known as the Process Stage One (P1) which has been aptly illustrated in Fig 1.

5.2 Transportation Stage: whereas transportation actually commences at the in-built toilets within the homes, it has been captured on the SSP service chain as Transport Stage One (T1) and it involves the conveyance by a Vacuum tanker, of sewage or septage from the on-site septic tank to a separately detailed treatment plant known as the Process Stage Two (P2).

5.3 The Process Stage Two: this is indeed the second collection process stage. It is a separately detailed treatment plant for raw septage from the on-site septic tank where sewage is treated into by-products like recycled water or effluent, trash/grit/oil and greases, and sludge cake. Again, arising from the numerous by-products from the Septage treatment plant, multiple transportation stages are established; one for each waste produced (T2, T3 and T4) respectively.

5.4 The Multiple Transportation Stage: It is instructive to note that apart from the initial transportation stage (P1), every other transportation stage of the typical Sanitation Service Chain derives from the process stage two (P2) and conveys specific wastes to end-use points. These stages are as indicated in 5.3 above, and are represented by T2, T3 and T4 respectively (Fig 2.):

5.4.1 Transportation Stage Two: It has been stated above that five potential wastes are generated from the septage treatment plant. Therefore, at the second transportation stage (T2), recycled water or effluent is conveyed to end-use point in the city

(P3) for use in landscaping and vehicle washing (car wash) at the P2 site.

5.4.2 Transportation Stage Three: Again it has been reported in 5.4 above that every transportation stage conveys a specific waste type to its end-use point. Therefore, at the third transportation stage (T3), effluent is also discharged into Irrigation Drain for onward transfer to farms as irrigation water at the fourth processing stage (P4).

5.4.3 Transportation Stage Four: Furthermore and following from 5.3 above, at the fourth transportation stage (T4), by-product such Sludge Cake is transported by Sludge Cake Truck for use as soil conditioner in farms at the fifth processing stage (P5).

5.4.6 Transportation Stage Five: Finally, at the fifth transportation stage, potential wastes such as Trash, Grit, Oil and Greases are transported by Trash Trucks (T5) to Sanitary Landfills at sixth processing stage (P6).

5.5 The SSP procedure is targeted at a variety of users who are responsible for the safety of sanitation systems and services at different levels. For example, it could be used at the level of:

•Local authorities, as a tool for planning local investment in sanitation.

• Local environmental health departments, to ensure that elements of sanitation are embedded in relevant health programs.

• Sanitation service providers, who may be formal or informal private enterprises, publicly or privately owned utilities, local government departments, or (in most cases) a combination of these.

Sanitation service providers may also range from small businesses offering

page hardware supplies, toilet construction or removals of feacal sludge, to operators of sewerage or feacal sludge treatment plants and engineering companies designing and constructing treatment works who by complying with the WHO guidelines and recommendations ensure that the products and services offered do not pose any health risk.

• Farmers who use SSP modules to complement quality assurance procedures for safe use of end products to protect consumers, as well as safeguarding their health and that of their families and surrounding communities.

• Community based organizations, farmers associations and NGOs which adopt SSP to support community based water and sanitation programs.

In addition to its site specific use in relation to a particular SSP process, SSP is also useful for those working at a national level, including:

• Health authorities and regulators, as a tool to introduce risk based approaches in the sanitation sector, and verify their effectiveness;

• Those regulating the development of policies and programmes as well as investment to improve the sanitation management.

**CONCLUSION**

SSP provides a structure that brings together actors from different sectors to identify health risks in the sanitation system in order to agree on improvements and regular monitoring. Through these local risk assessments and management approaches to sanitation systems, local stakeholders can identify incremental improvements at each step of the sanitation service chain, plan for progressive implementation towards sanitation targets and allow investments to be prioritized according to the highest health risk thereby maximizing benefits. It can be both at the planning stage for new schemes, and at the point of improving the performance of existing systems. It can and should take into consideration current and future risks, including those posed by climate variability and climate change. However,

SSP is not intended to be used for planning and designing of new and large sanitation schemes. In those cases, the planning may be preceded by specialized studies such as health impact assessments (HIA). Once the scheme has been fully developed, SSP becomes an ongoing management tool for sanitation systems.

## RECOMMENDATIONS

As far back as the year 2018, the World Health Organization have concluded that sanitation interventions have shown lower than expected health outcomes and therefore launched the comprehensive Guidelines on Sanitation and Health which aim to provide evidence-based recommendations and offer guidance to ensure international, national and local sanitation policies and programmes that effectively protect public health as follows;

7.1 Ensure universal access and use of toilets that safely contain excreta.

7.2 Ensure universal access to safe systems along the entire sanitation service chain.

7.3 Sanitation should be addressed as part of locally delivered services and broader development programmes and policies, and

7.4 The health sector should fulfill core functions to ensure safe sanitation to protect human health.

In line with the peculiarity of the study, the recommendations would expectedly be drawn from those given by the WHO in respect SSP. To that end and based on the recommendations made, the SSP is hereby recommended for adoption in Bayelsa State and Niger Delta Region.

## REFERENCES

1. Amoah P et al. Low-cost options for reducing consumer health risks from farm to fork where crops are irrigated with polluted water in West Africa. Colombo, Sri Lanka, International Water Management Institute (IWMI), 2011.
2. Bayelsa State Zero Draft on SSP. (2021). A draft report by the WHO Sanitation Safety Planning Research Team in collaboration with the Ministries of Environment and Water Resources, BYS, NIG.
3. Blockley DI (2005). The new Penguin dictionary of civil engineering. Penguin books. European Centre for Health Policy Health impact assessment: main concepts and suggested approach. Gothenburg consensus paper. Copenhagen: WHO Regional Office Europe, 1999.
4. Haas C, Rose J, Gerba C Quantitative microbial risk assessment. New York, John Wiley, 1999.
5. IPCC. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K.
6. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 2014a
7. IPCC. Summary for policymakers. In: Climate Change 2014: Impacts,Adaptation, and Vulnerability.
8. Kato S, Fogarty E, Bowman DD. Effect of aerobic and anaerobic digestion on the viability of Cryptosporidium parvum oocysts and ascaris suum eggs. International Journal of Environmental Health Research, 2003, 13(2): 169-179
9. Kengne IM, Akoa A, Kone D. Recovery of biosolids from constructed wetlands used for faecal sludge dewatering in tropical regions. Environmental Science and Technology, 2009, 43 6816-6821
10. Kone D et al. Helminth eggs inactivation efficiency by faecal sludge dewatering and co-composting in tropical climates. Water Research, 2007, 41:4397-4402

**11.** Mahassen M et al. Performance evaluation of a waste stabilization pond in a rural area in Egypt. American Journal of Environmental Sciences, 2008, 4: 316-325

**12.** Mara D. Domestic wastewater treatment in developing countries. London, Earthscan, 2004 Nielsen S Helsinge sludge reedbeds systems: Reduction of pathogenic organisms. Water, Science and Technology, 2007, 56(3):175-182.

**13.** Rickert B et al. Including aspects of climate change into water safety planning: literature review of global experience and case studies from Ethiopian urban supplies. International journal of hygiene and environmental health, 2019, 222(5), 744-755.

**14.** SFD Alliance (2018) Shit Flow Diagrams. Eschborn: SFD Promotion Initiative c/o Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. URL: https://sfd.susana.org, accessed 15 October 2015 Page 77

**15.** Smeets, P, van Swol F, Postmes L. Water cycle safety plan framework. Demonstration in Eindhoven. Eindhoven, PREPARED, 2013.

**16.** Stenström TA et al. Microbial exposure and health assessments in sanitation technologies and systems. Stockholm, Stockholm Environment Institute, 2011

**17.** Thompson T, Fawell J, Kunikane S, Jackson D, Appleyard S, Callan P et al. Chemical safety of drinkingwater: assessing priorities for risk management. Geneva, World Health Organization, 2007.

**18.** (http://whqlibdoc.who.int/publications/2007/9789241546768_eng.pdf)

**19.** USEPA Sewage sludge use and disposal rule (40 CFR Part 503), Publication Number 822F92002. USA, United States Environmental Protection Agency, 1992

**20.** WHO Guidelines for the safe use of wastewater, excreta and greywater. Geneva, World Health Organization, 2006 (http://www.who.int/water_sanitation_health/wastewater/gsuww/en)

**21.** WHO Guidelines for drinking-water quality, fourth edition. Geneva, World Health Organization, 2011.

**22.** (http://www.who.int/water_sanitation_health/dwq/en/)

**23.** WHO Guidelines on Sanitation and Healtg, Geneva, World Health Organization, 2018.

**24.** WHO Sanitary inspections for sanitation systems, 2019; (https://www.who.int/water_sanitation_health/sanitation-waste/sanitation/sanitary-inspectionsfor-sanitation-systems/en/)