MODULE 4

DEVELOP AND IMPLEMENT AN INCREMENTAL IMPROVEMENT PLAN

SANITATION
SAFETY
PLANNING

SSP Manual
Pages
61 to 76

SSP Modules

What needs to be improved and how?

MODULE 4

Overview

STEPS

4.1 Consider options to control identified risks.

4.2 Develop an incremental improvement plan.

4.3 Implement the improvement plan.

OUTPUTS

- An incremental improvement plan that protects all exposure groups along the sanitation chain.
- Progressive investments the plan

STEP 4.1

Consider options to control identified risks

OBJECTIVE

This helps considers options to control highest risks along the sanitation chain, including technology upgrades, changes in management and operation, behaviour change measures, and policy and regulatory measures.

These options may include:

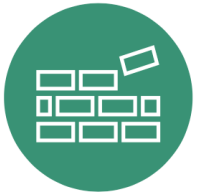
- Short- and long-term plans
- a range of locations along the sanitation chain.

STEP 4.1

Consider options to control identified risks

Improvement options

Option 1: Regulatory measures



Option 2: Technical control measures

Option 3: Management and operational control measures

Option 4: Behaviour change measures

Improvement options

Option 1: Regulatory measures

Mechanisms to regulate the sanitation service chain.

SSP measures should focus on ordinances and local by-laws passed by local authorities.

STEP 4.1

Consider options to control identified risks

SSP Manual Guidance note 4.1, page 64

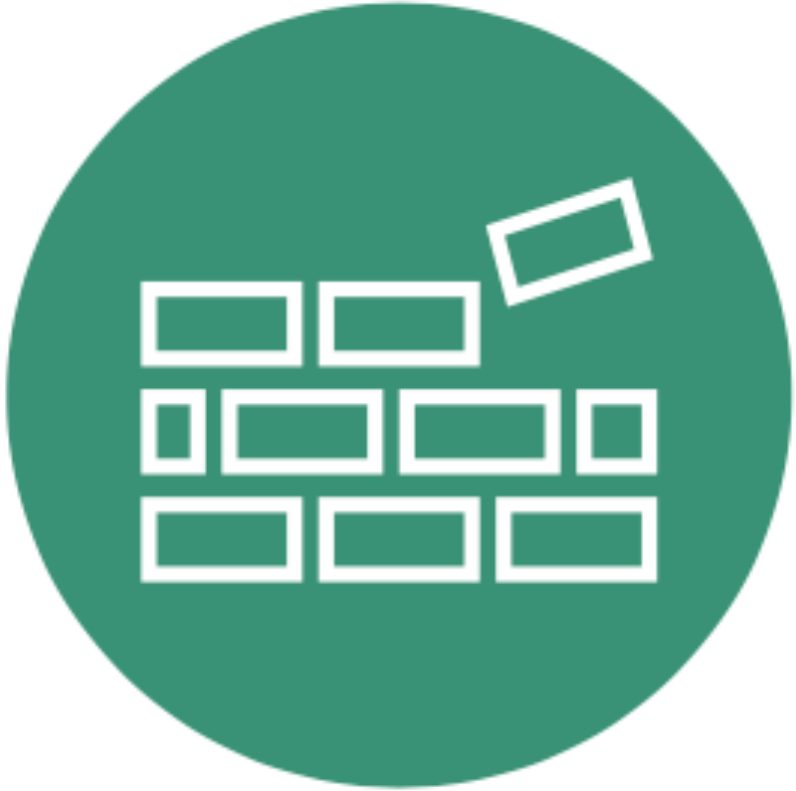
WHO Guidelines Chapter 4 Page 59

Examples of sanitation aspects covered by legislation and regulation

Toilet	Containment–storage/treatment	Conveyance	Treatment	End use/disposal
Minimum requirements for toilet room/ superstructure	Registration of onsite facilities.	Obligation for premises to be connected to sewer system if available.	Designated facilities and opening hours for faecal sludge reception	Standards for use of other products derived from faecal waste

World Health Organization

Improvement options



Option 2: Technical control measures

Also called technology upgrades, refer to the construction or refurbishment of the sanitation system.

STEP 4.1

Consider options to control identified risks

SSP Manual Guidance note 4.2, page 65

WHO Guidelines Chapter 3 Page 29

Examples of incremental technical control measures

Toilet	Containment–storage/treatment	Conveyance	Treatment	End use/disposal
Cover any wooden squatting slab with a coating of mortar.	Elevate the pits or implementing container-based sanitation.	Make motorized and/or manual pumps available to the workers.	Co-treatment of faecal sludge in existing wastewater treatment plants.	Low-contact irrigation methods.

TIP

WHO Guidelines Chapter 3 offers

- Measures to reduce risk
- Incremental control measures

For each step of the sanitation chain

World Health Organization

STEP 4.1

Consider options to control identified risks

WHO Guidelines
Chapter 3
Page 29

Improvement options

Option 3: Management and operational control measures

Methods, procedures and routines to carry out a specific activity within the sanitation service chain.

They include arrangements for how people are organized and trained to carry out their work.

TIP

WHO Guidelines Chapter 3 offers

- Measures to reduce risk
- Incremental control measures

For each step of the sanitation chain

STEP 4.1

Consider options to control identified risks

SSP Manual Guidance note 4.3, page 66

Standard operating procedures

Written instructions describing steps or actions to be taken:

- during **normal operating conditions**, and
- for **corrective actions** when operational monitoring parameters reach or breach operational limits.
- for **emergencies**.

Personnel need to be **appropriately trained** to implement the procedures and other management protocols.

STEP 4.1

Consider options to control identified risks

WHO Guidelines
Chapter 5
Page 84

Improvement options

Option 4: Behaviour change measures

Programs designed to foster behaviour change at the levels of the individual, the household, the community and key stakeholders involved in sanitation delivery.

TIP

WHO Guidelines Chapter 5 offers

- Different approaches to changing behaviours.
- Recommendations on how to design, adapt, and deliver behaviour change interventions.

STEP 4.1

Consider options to control identified risks

WHO Guidelines
Chapter 5
Page 84

Depending on the specific situation, **desired user behaviours** include:

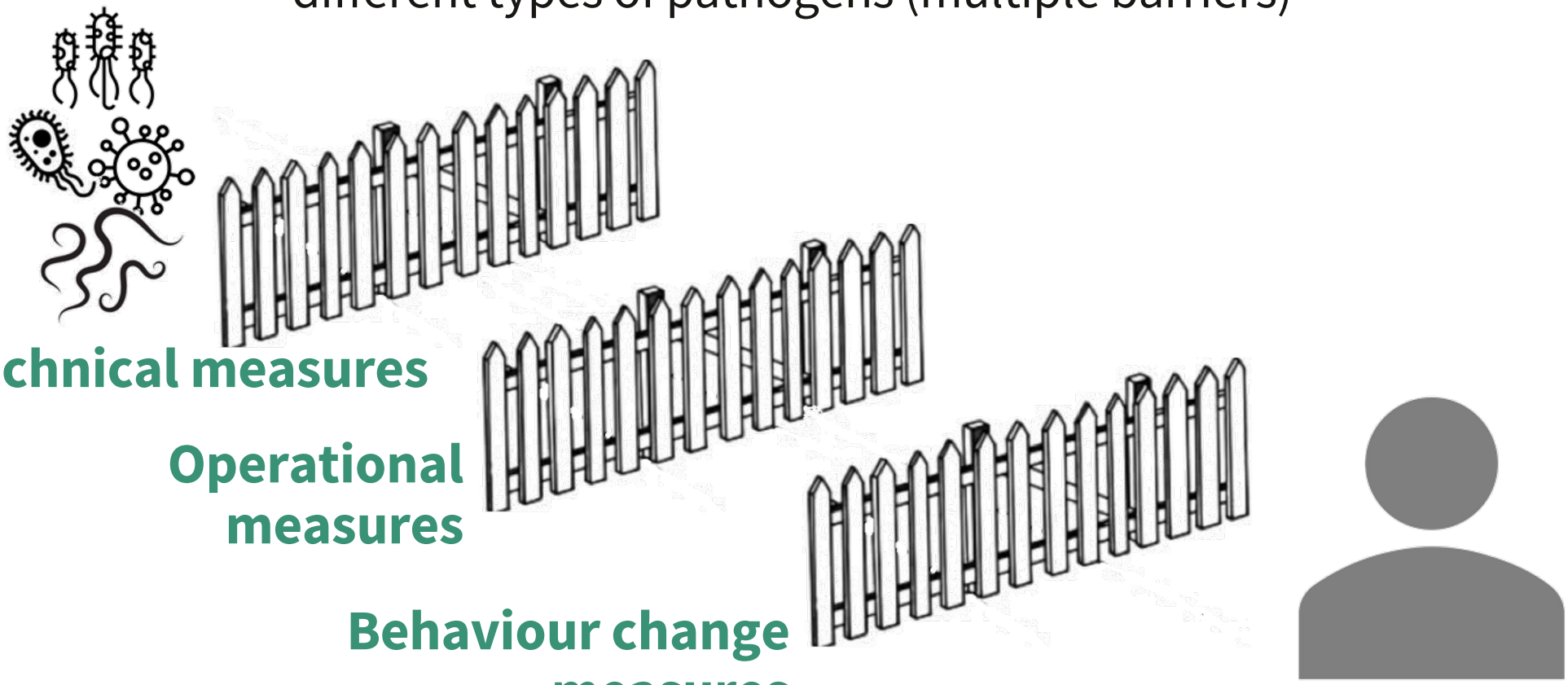
- **Abandoning open defecation** and adopting safe sanitation facilities.
- Ensuring the **regular desludging** of such facilities.
- **Connecting** to a sewerage system where available and paying the service charges.
- **Wearing** Personal Protective Equipment.

STEP 4.1

Consider options to control identified risks

Multibarrier approach

Sanitation systems should provide more than one barrier against the different types of pathogens (multiple barriers)



SSP Manual
Guidance note
4.6, page 70

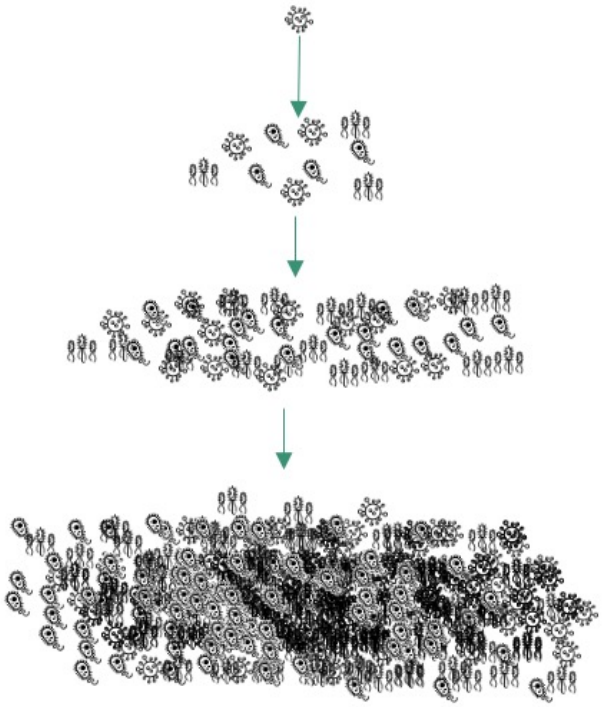
Understanding log reductions and the multibarrier approach

Raw sewage typically has about:

10^7 E. Coli per 100 ml

Remember:

Original concentration units/100 mL	
10^0=	1
10^1=	10
10^2=	100
10^3=	1000
10^4=	10,000
10^5=	100,000
10^6=	1,000,000
10^7=	10,000,000



STEP 4.1

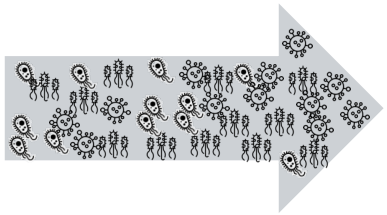
Consider options to control identified risks

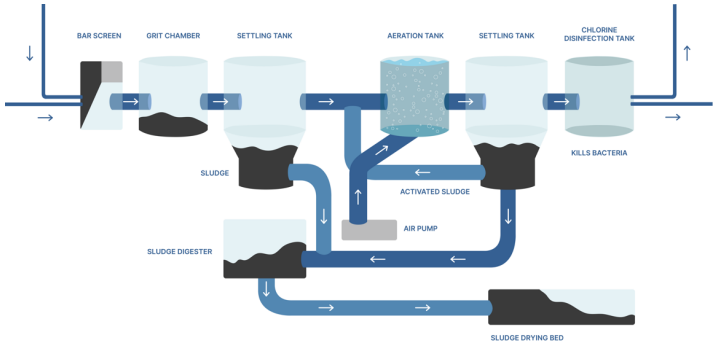
SSP Manual Guidance note 4.6, page 70

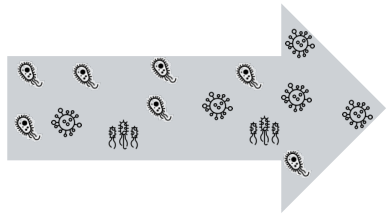
Efficiency of a sanitation system can be expressed as:

LRV: $\log^{10}$ reduction value

***Difference** between the log-transformed pathogen **concentrations** of the **influent** and the **effluent** across a particular sanitation technology*







$C_{INFLUENT} = 1.00 \times 10^7$

$C_{EFFLUENT}$ = depends on the LRV of the sanitation measure

Sedimentation tank →

LRV	% Reduction	Concentration after control measure
1	90%	1,000,000 (10^6)
2	99%	100,000 (10^5)
3	99.9%	10,000 (10^4)
4	99.99%	1000 (10^3)
5	99.999%	100 (10^2)
6	99,9999%	10 (10^1)
7	99,99999%	1 (10^0)

! Very expensive

Sedimentation + activated sludge + microfiltration →

STEP 4.1

Consider options to control identified risks

SSP Manual Guidance note 4.6, page 70

How do we achieve a safe pathogen concentrations?

- Understand the **exposure group** (*who should be protected?)*
- Understand the **exposure route** (*how pathogens get into their body?)*
- Understand the **step in the sanitation system** where the hazardous event occurs.
- Use a **combination of control measures** that together achieve the safe concentrate of pathogens.
- For effluents or end products, consider their **intended use:**
    - **Discharge in water bodies**: national regulation.
    - **Onsite infiltration**: think about the groundwater level.
    - **Reuse in agriculture**: protect farmers and consumers and plan the measures depending on the type of crops grown, irrigation practices and farming practices.
    - **Reuse for watering green areas:** protect visitors.

STEP 4.1

Consider options to control identified risks

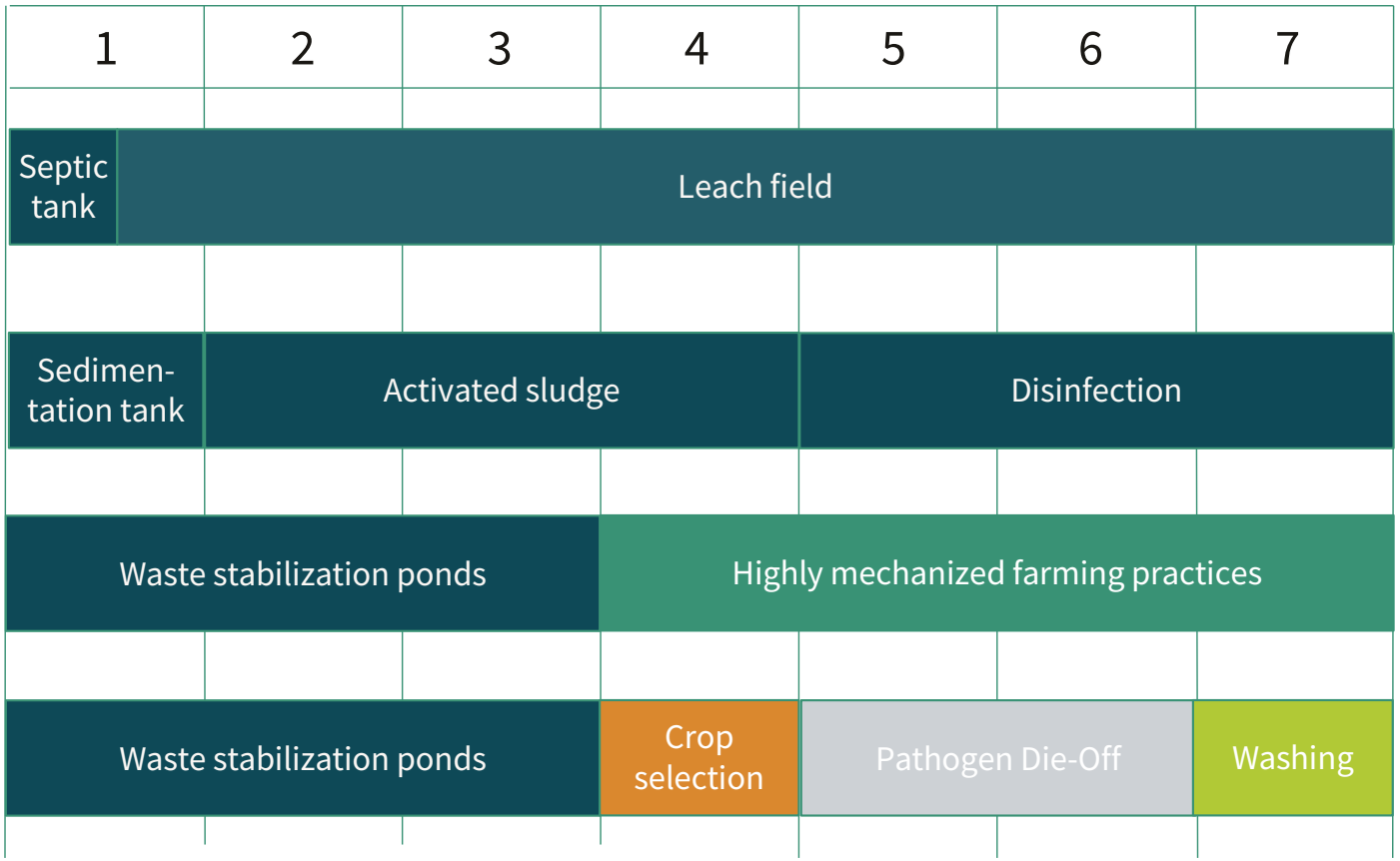
Some examples

Protecting **USERS** at their premises in areas with low groundwater levels

Protecting **WIDER COMMUNITIES** in WWTP surrounding areas

Protecting **FARMERS** during wastewater reuse.

Protecting **CONSUMERS** of crops irrigated with wastewater.



Graph based on WHO 2006 Guidelines Vol. 2 Figure 4

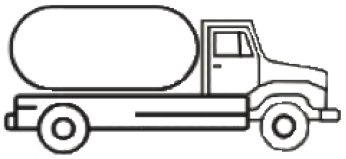
STEP 4.1

Consider options to control identified risks

SSP Manual
Example 4.1
Page 68

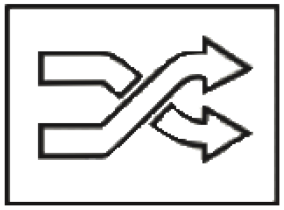
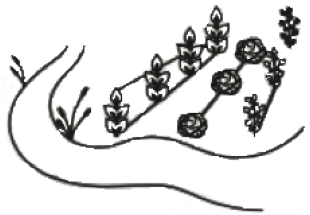
WHO Guidelines
Chapter 4
Page 59

Consider all types of improvement options in each step of the sanitation service chain

	Installation of flush toilets	Training of masons for correct installation	Program to encourage correct use and maintenance	Technical standards on material, dimensions and location
	Installation of sealed and impermeable septic tanks	Building a data base of on-site sanitation infrastructure	Program to encourage non-sealed tanks refurbishment	Guidelines on periodic inspection of onsite-systems
	Installation of faecal sludge transfer stations	Establishing a call centre for septic tank emptying	Consumer protection program	Licencing of emptying service providers

STEP 4.1

Consider options to control identified risks

	Construction of a faecal sludge treatment plant	Development of Standard Operating Procedures for operation and maintenance	Internal awareness raising program to ensure occupational health and safety	Guidelines on control of nuisances (odours, flies, noise) from treatment facility
	Additional treatment of dried sludge (e.g. co-composting)	Training farmers on crop selection (e.g. only crops not eaten raw)	Household food safety program (to encourage washing of produces)	Standards for sludge products, categorized by type of use

Analysis of improvement options

When selecting improvement options, think about:

- **Potential** for improving existing control(s).
- **Cost** effectiveness.
- Technical **effectiveness**.
- **Acceptability** to workers or exposure groups and **reliability**.
- **Responsibility** for managing new measure.
- Extent to which the control measure will provide benefits under expected **changes to the climate.**
- Potential for the control measure to **fail if the climate changes** in unexpected ways.

STEP 4.1

Consider options to control identified risks

Template to list and analyse control options

TOOL 4.1. Template to list and analyse control options

Step of the sanitation service chain: _____

Description of the hazardous event: _____

Exposure group: _____

Improvement options					
Option of new or modified control measure for this hazardous event	What is the likely effectiveness of this control measure option? (High, medium, low)	What is the level of resources required? (Including financial, human resources, political support; high, medium, low)	To what extent will this control measure be effective under the most likely climate change scenarios? (Effective, ineffective, detrimental)	Comments/discussion	Priority for improvement plan (Immediate, short term, medium term, long term)

GROUP WORK

Applying Step 4.1 to our case study

Within your groups:

- Consider different options to control the 3 prioritized hazardous events under current climate conditions.

Sanitation Safety Planning
Amman, Jordan. February 16-20, 2025

MODULE 4: DEVELOP AND IMPLEMENT AN INCREMENTAL IMPROVEMENT PLAN

STEP 4.1: Consider options to control identified risks

For each hazardous event prioritized, analyze the possible control measures using the following table:

Step of the sanitation service chain: **Description of the hazardous event:** **Exposure group:**					
Improvement options					
Option of new or modified control measures for this hazardous event	**What is the likely effectiveness of this control measure option?** (High, medium, low)	**What is the level of resources required?** (Including financial, human resources, political support: high, medium, low)	**To what extent will this control measure be effective under the most likely climate change scenarios?** (Effective, ineffective, detrimental)	**Comments/ discussion**	**Priority for improvement plan** (Immediate, short term, medium term, long term)

THANK YOU!

World Health Organization

Welcome to the Sanitation Safety Planning Training

Step-by-step risk management for safely managed sanitation systems

SANITATION
SAFETY
PLANNING

SSP Modules

What needs to be improved and how?

MODULE 4

Overview

STEPS

4.1 Consider options to control identified risks.

4.2 Develop an incremental improvement plan.

4.3 Implement the improvement plan.

OUTPUTS

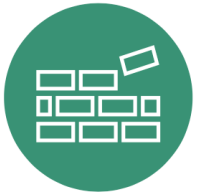
- An incremental improvement plan that protects all exposure groups along the sanitation chain.
- Progressive investments the plan

STEP 4.1

Consider options to control identified risks

Improvement options

Option 1: Regulatory measures



Option 2: Technical control measures

Option 3: Management and operational control measures

Option 4: Behaviour change measures

GROUP WORK (Continuation)

Applying Step 4.1 to our case study

Within your groups:

- Consider different options to control the 3 prioritized hazardous events under **current climate conditions**.

Sanitation Safety Planning
Amman, Jordan. February 16-20, 2025

MODULE 4: DEVELOP AND IMPLEMENT AN INCREMENTAL IMPROVEMENT PLAN

STEP 4.1: Consider options to control identified risks

For each hazardous event prioritized, analyze the possible control measures using the following table:

Step of the sanitation service chain: **Description of the hazardous event:** **Exposure group:**					
Improvement options					
Option of new or modified control measures for this hazardous event	**What is the likely effectiveness of this control measure option?** (High, medium, low)	**What is the level of resources required?** (Including financial, human resources, political support: high, medium, low)	**To what extent will this control measure be effective under the most likely climate change scenarios?** (Effective, ineffective, detrimental)	**Comments/ discussion**	**Priority for improvement plan** (Immediate, short term, medium term, long term)

Specific control measures to mitigate risks under different

climate change scenarios

STEP 4.1

Consider options to control identified risks

Control measures for climate change-related hazardous events

Septic tanks

TIPS

WHO Guidelines

Table 3.6 – climate change potential impact on septic tanks

Page 55

- **Climate change scenario:** more intense or prolonged precipitation
- **Cause of hazardous event:** Rising groundwater levels causing tank flotation
- **Hazardous event:** Ingestion of groundwater contaminated with faecal pathogens

POSSIBLE CONTROL MEASURES:

- Install sealed covers for septic tanks and non-return valves on pipes to prevent back flows
- Ensure vents on sewers are above expected flood lines
- Promote tank maintenance, hygiene and safe behaviours during/after extreme events

STEP 4.1

Consider options to control identified risks

Control measures for climate change-related hazardous events

Sewer systems

WHO Guidelines

Table 3.6 – climate change potential impact on sewers

Page 55

- **Climate change scenario:** Sea level rise
- **Cause of hazardous event:** Rising water levels in coastal sewers, causing back-flooding
- **Hazardous event:** Ingestion of pathogens in surface water contaminated with partially treated sewage due to higher pollutant concentration

POSSIBLE CONTROL MEASURES:

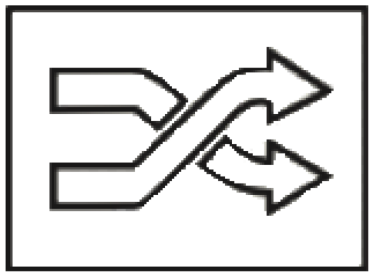
- Re-engineer to separate stormwater flows from sewage
- Provide additional storage for stormwater
- Install non-return valves on pipes to prevent back flows

STEP 4.1

Consider options to control identified risks

Control measures for climate change-related hazardous events

Treatment



TIPS

WHO Guidelines

Table 3.6 – climate change potential impact on treatment

Page 55

- **Climate change scenario:** More frequent or intense storms or cyclones
- **Cause of hazardous event:** Destruction and damage of treatment systems, causing discharge of untreated excreta flows and environmental contamination
- **Hazardous event:** Ingestion of surface water contaminated with raw sewage/faecal sludge due to nonfunctioning treatment plants

POSSIBLE CONTROL MEASURES:

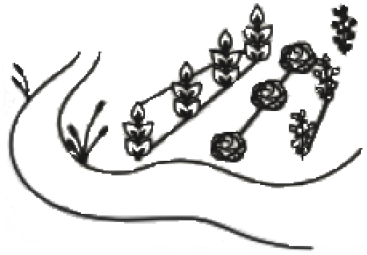
- Install flood, inundation and runoff defenses (e.g. dykes), and undertake sound catchment management.
- Invest in early-warning systems and emergency response equipment (e.g. mobile pumps stored off-site, non-electricity-based treatment systems).
- Where feasible, locate systems on sites less prone to floods.
- Provide additional storage for stormwater
- Install non-return valves on pipes to prevent back flows

STEP 4.1

Consider options to control identified risks

Control measures for climate change-related hazardous events

End use/ disposal



TIPS

WHO Guidelines

Table 3.6 – climate change potential impact on reuse

Page 56

- **Climate change scenario:** Prolonged droughts
- **Cause of hazardous event:** Increased water scarcity, leading to increased reliance on wastewater for irrigation
- **Hazardous event:** Ingestion of pathogens after contact with wastewater treatment plant effluent during irrigation or in-field farming practices

POSSIBLE CONTROL MEASURES:

- Improve enforcement/ incentives for following regulations for wastewater reuse.
- Improve crop selection, irrigation type, withholding times.
- Ensure sanitation worker vaccination and treatment.
- Promote hygiene practices and use of personal protective equipment.

STEP 4.1

Consider options to control identified risks

Emergency response plans

(ERPs) are designed to cover emergencies for which there is no specific SOP.

Overflows, flooding, uncontrolled releases

Climate-related hazards protective equipment.

What an ERP must include

- Clear emergency triggers
- Updated contact list (internal + external)
- Communication & public notification protocols
- Feasible, rapid procedures

What an ERP must include

- Annual drills & staff preparedness
- Post-event review
- Update SSP with lessons learned

GROUP WORK

Applying Step 4.1 to our case study

Within your groups:

- Consider different options to control the 3 prioritized hazardous events under the most relevant climate change scenarios.

MEASURES FOR HAZARDOUS EVENTS UNDER THE MOST PROBABLE CLIMATE CHANGE SCENARIOS

Now, for the hazardous event prioritized UNDER THE MOST PROBABLE CLIMATE CHANGE SCENARIOS (maximum 3), analyze the possible control measures using the following tables:

Climate change scenario:
Step of the sanitation service chain:
Description of the hazardous event:
Cause of hazardous event:
Exposure group:

Improvement options

Option of new or modified control measures for this hazardous event	**What is the likely effectiveness of this control measure option?** (High, medium, low)	**What is the level of resources required?** (Including financial, human resources, political support: high, medium, low)	**To what extent will this control measure be effective under the other climate change scenarios?** (Effective, ineffective, detrimental)	**Comments/ discussion**	**Priority for improvement plan** (Immediate, short term, medium term, long term)

STEP 4.2

Develop an incremental improvement plan

SSP Manual
Page 75

OBJECTIVE

To consolidate the options into a clear plan of action.

Planning sanitation systems

To formulate inclusive, equitable and practical solutions

WHO Guidelines
Section 4.3.2
Page 63

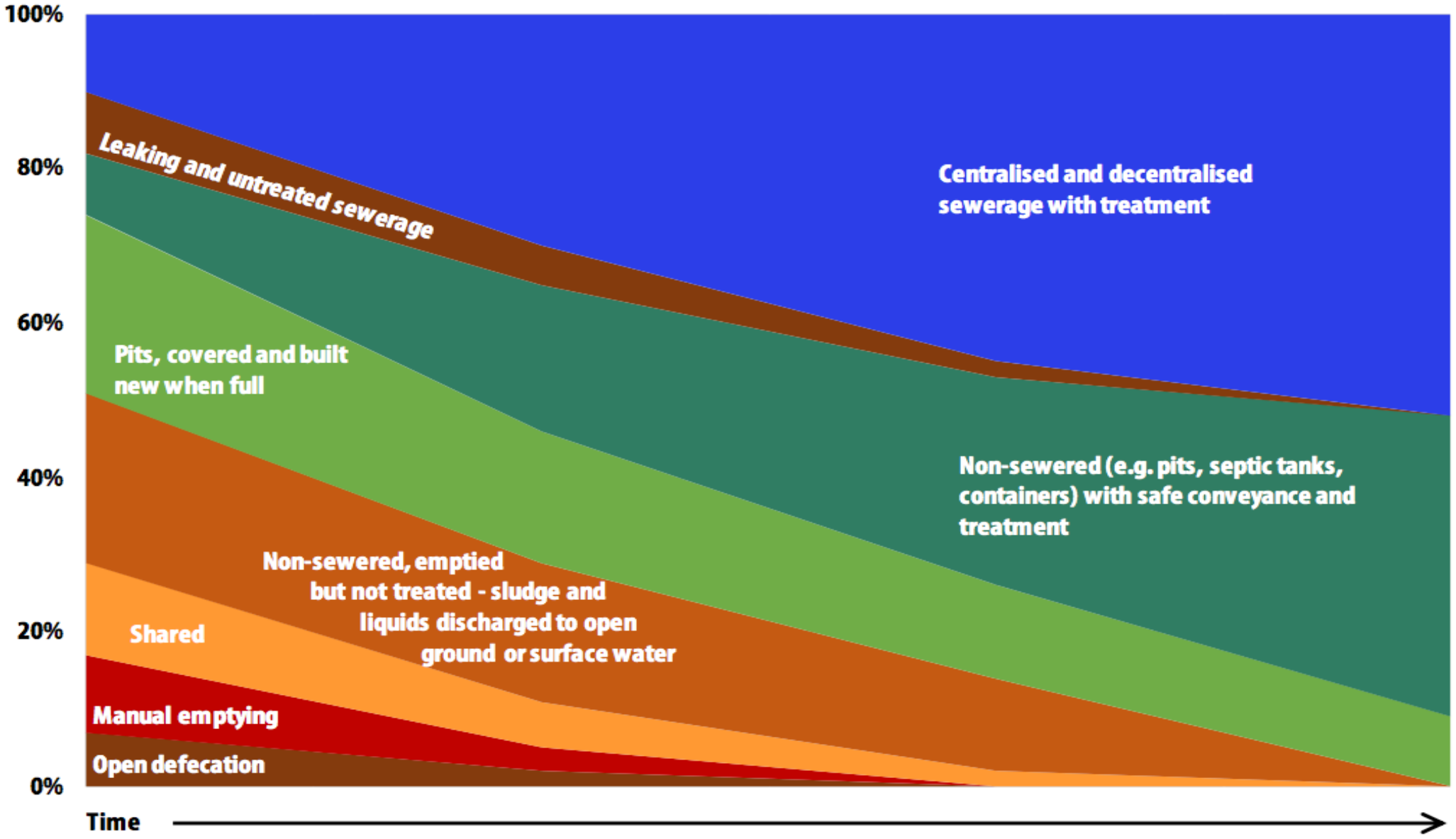
- One must understand the mix of sanitation systems in use
- Plan how that mix should change over time
- Incremental improvement of sanitation in different places at different times.
- Deliver short to medium term improvements, instead of long-term.

STEP 4.2

Develop an incremental improvement plan

WHO Guidelines Fig 4.3

Fig. 4.3: Example of phasing out unsafe sanitation over time



STEP 4.2

Develop an incremental improvement plan

While preparing the incremental improvement plan

- Prioritize plan, based on hazards with **highest risks.**
- Identify **who** (institution and individual) takes action.
- If more than one, the Steering Committee or lead SSP organization should take coordination responsibility.
- May choose **more affordable interim control** measures until sufficient funds for more expensive options are available.
- The incremental improvement plan should allow for adaptive management processes suitable to respond to emergent and unforeseen conditions, such as **climate-related hazards**.

STEP 4.2

Develop an incremental improvement plan

Template for an incremental improvement plan

TOOL 4.2. Template for an SSP incremental improvement plan

Improvement measure	Cost	Source of funds	Lead organization	Year 1												Year 2				Year 3			
				1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8

STEP 4.3

Implement the improvement plan

WHO Guidelines
Chapter 4
Page 59

OBJECTIVE

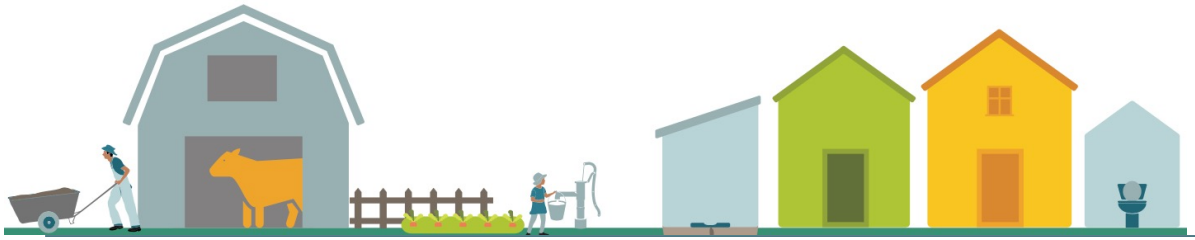
In this step, the SST team and steering committee mobilize investment and action by the responsible entities to implement the improvement plan.

A successful implementation requires:

- Enforcement and compliance
- Coordination
- Accountability and finance
- Monitoring
- Developing sanitation services and business models

Consideration about funding:

- Part of the **funds** should be **secured up-front** to ensure that immediate actions are taken.
- Technical measures will require special funding. Sources of financing could be:
    - **public national funds** (e.g., through specialized WASH [Water, Sanitation and Hygiene] budget lines and programs),
    - **provincial budgets** for municipal service delivery,
    - **taxes from citizens** and local businesses,
    - **transfers** such as international aid and loans, and
    - **tariffs** paid by users of the service.
- The **burden of fundraising** should not rely only on the SSP lead organization, and the steering committee should advocate and secure resources for implementation.



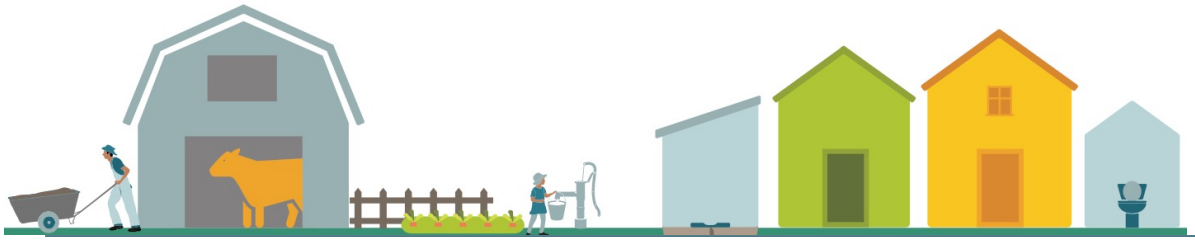
Worked example: SSP IN NEWTOWN

Step 4.1. Consider options to control identified risks

Step of the sanitation service chain: P4: Disposal of faecal sludge in open drains
Description of hazardous event: Ingestion after contact with faecal sludge discharged without treatment to open drains
Exposure group: 50 000 people (all citizens of Newtown)
Description of the hazardous event: Injury to the body, possible asphyxiation, caused by entering or falling into soak pits or septic tanks.
Exposure group: 60 people (vacuum trucks operators)

IMPROVEMENT OPTIONS

Option	Effectiveness	Level of resources	Effectiveness under climate change scenarios	Comments/discussion	Priority for improvement plan
Issuing a municipal decree/by-law for faecal sludge management	High	Low	Effective	The Municipal Council agreed to write and pass a by-law. This will only be effective with proper enforcement.	Immediate
Licensing of emptying service providers	High	Medium	Effective	There were discussions about who should take responsibility. City Service "Traffic law enforcement and licences" and Environmental Protection, DEA, decided to work together to ensure that all formal and informal emptying service providers are licensed.	Short term
Upgrading equipment and providing training on standard operating procedures among informal service providers	High	Medium	Effective	The Municipal Council agreed to support a scheme to support informal service providers through provision of safer equipment and training.	Short term
Issuing a DEA regulation to bring all faecal sludge to the WWTP	High	Low	Detrimental	There were discussions about this issue. The WWTP Operations Manager strongly opposed this option, but no other immediate solution was possible.	Immediate
Supporting an association of vacuum truck operators	Medium	Low	NA	The SSP team leader initiated discussions with vacuum truck operators relating to creation of an association.	Immediate
Training vacuum truck operators about health and safety	High	Medium	NA	The DEA and the RHD agreed to collaborate on this.	Short term
Monitoring and controlling vacuum truck operators (e.g. through GPS systems)	High	High	Effective	The DEA would like to develop this in the long term.	Long term
Strengthening enforcement authorities	High	Medium	Effective	City Service "Traffic law enforcement and licences" agreed to provide training on the traffic policy and to identify irregular practices.	Medium term
Constructing a faecal sludge treatment plant (dewatering, drying and composting)	High	High	Effective	All participants agreed that a faecal sludge treatment plant should be constructed.	Long term



Worked example: SSP IN NEWTOWN

Step 4.2. Develop an incremental improvement plan

Improvement measure	Cost	Source of funds	Lead organization	Year 1												Year 2				Year 3			
				1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
P4: Disposal of faecal sludge in open drains																							
Issuing a municipal decree/ by-law for faecal sludge management	100	MC	MC and NSD																				
Issuing a DEA regulation to bring all faecal sludge to the WWTP	100	DEA	Environmental Protection, DEA																				
Creation of an association of vacuum truck operators	1000	NSD	NSD																				
Licensing of emptying service providers	1000	DEA	City Service "Traffic law enforcement and licences" and DEA																				
Training of vacuum truck operators about health and safety	1000	RHD	DEA and RHD																				
Strengthening enforcement authorities	1000	City Service "Traffic law enforcement and licences"	City Service "Traffic law enforcement and licences"																				
Construction of a faecal sludge treatment plant (dewatering, drying and composting)	50 000	NSD	NSD																				

GROUP WORK

Applying Step 4.2 to your SSP

Use table group worksheet Module 4 for instructions.
Within your groups:

- For the selected control measures, prepare an implementation plan using the table of step 4.2.

Sanitation Safety Planning
Dehiwala-Mount Lavinia, Sri Lanka. December 8th -12th, 2025

Tool: Sanitation Safety Plan

Moratuwa Ratmalana (Sri Lanka)

developed by
participants of the SSP Training

Sanitation Safety Planning
Yogyakarta, Indonesia. June 16-20, 2025

STEP 4.2: Develop an incremental improvement plan

Use the following Gantt Chart to plan the implementation of your improvement measures. *During the training, we will conduct this exercise, if we have time.*

Improvement measure	Cost	Source of funds	Lead organization	Year 1												Year 2				Year 3			
				1	2	3	4	5	6	7	8	9	10	11	12	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Improvement measures to control prioritized hazardous event 1																							
Improvement measures to control prioritized hazardous event 2																							

MODULE 4

DEVELOP AND IMPLEMENT AN INCREMENTAL IMPROVEMENT PLAN

SANITATION
SAFETY
PLANNING

World Health Organization