Sanitation Safety Planning

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

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Today's session

- Welcome and introductions
- Background: sanitation, health, and climate impacts
- Sanitation safety planning: principles and overview of steps
- Case studies
  - Jordan
  - Oman
  - Qatar
  - Australia and California
- Short exercise and discussion
- Summary and wrap up

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Video of WASH in the EMR

Background: sanitation, health and climate impacts

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Unsafe sanitation contributes directly to 564,000 of these deaths but indirectly to many more - though contaminated water, hand contamination, vectors etc…

Direct impact (infections)*	Sequelae (conditions caused by preceding infection)	Broader well-being
Faecal-oral infections • Diarrhoeas (incl. cholera) • Dysenteries • Poliomyelitis • Typhoid **Helminth infections** • Ascariasis • Trichuriasis • Hookworm infection • Cysticercosis • Schistosomiasis • Foodborne trematodes **Insect vector diseases** (vectors breed in faeces or water contaminated with faeces) • Lymphatic filariasis • West Nile Fever • Trachoma	• **Stunting/ growth faltering** - related to repeated diarrhoea, helminth infections, environmental enteric dysfunction • **Consequences of stunting** -obstructed labour, low birthweight • **Impaired cognitive function** • **Pneumonia** - related to repeated diarrhoea in undernourished children • **Anaemia** - related to hookworm infections	**Immediate:** • Anxiety (shame and embarrassment from open defecation and shared sanitation) and related consequences • Sexual assault (and related consequences) • Adverse birth outcomes (due to underuse of healthcare facilities with inadequate sanitation) **Long-term** • School absence • Poverty • Decreased economic productivity • Anti-microbial resistance

→ Many of these adverse impacts are exacerbated by climate change

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Sanitation safety planning

SSP manual 1st edition (2015)

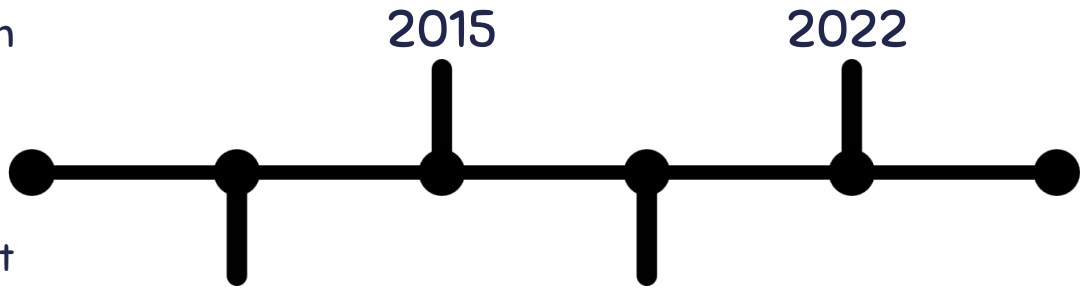
supported implementation of WHO guidelines on safe use of wastewater, excreta and greywater in agriculture and aquaculture (2006).

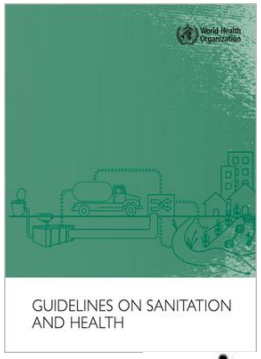
SSP manual 2nd edition (2022)

Supports recommendations in the WHO Guidelines on sanitation and health (2018) – support the whole sanitation chain, not only end-use

it also incorporates the lessons learned since the first manual in 2015

- Simplified SSP process
- Includes climate risks





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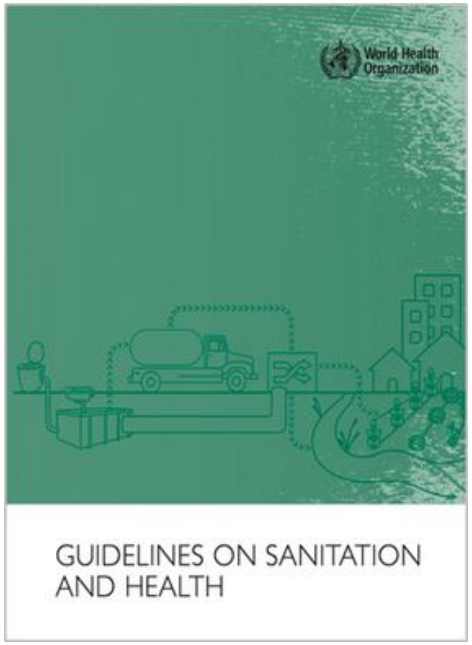
WHO guidelines on sanitation and health

WHO launched its first comprehensive guidelines on sanitation and health



·Tools
·Guidance
·Evidence/Recommendations

The guidelines were developed through a thorough review of existing evidence and by involving input from experts and end-users.

Objectives

- Ensure that sanitation systems are designed and managed safely to protect human health
- Maximize the health impacts of sanitation interventions
- Articulate the role of health sector in sanitation

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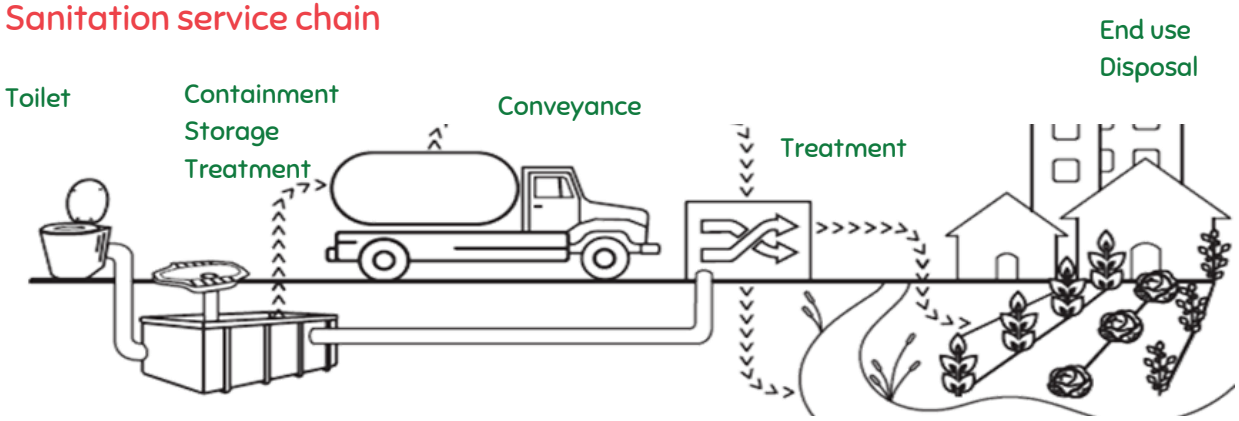
Recommendation #2

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

Safety must be ensured along the entire sanitation service chain, including toilet, containment, transport, treatment, end use/disposal.

- The selection of technologies and services should be context specific.
- Incremental improvement based on local level risk assessment (e.g. Sanitation Safety Planning)

Sanitation service chain



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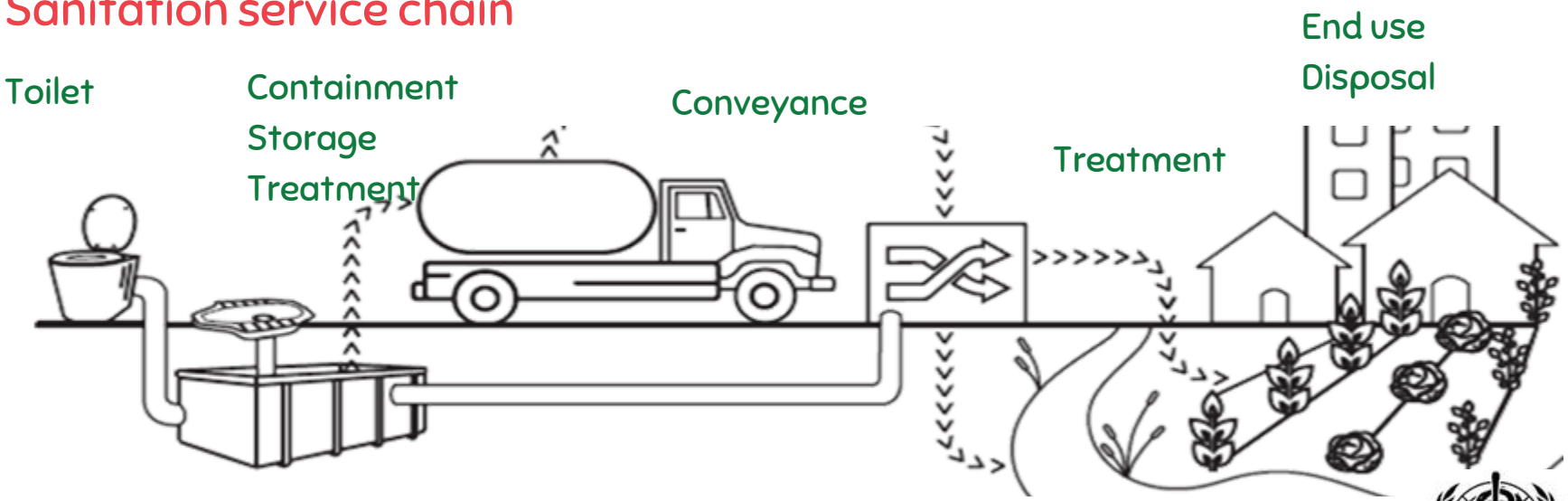
Safe sanitation systems

- Safe sanitation systems encompass an arrangement of technologies and practices designed to achieve two fundamental objectives:

1. Separates human excreta from human contact at all steps of the sanitation service chain
2. Fulfil minimum requirements:
   a. Well-designed and built
   b. Operated and maintained effectively
   c. Good hygiene practices.

Sanitation service chain



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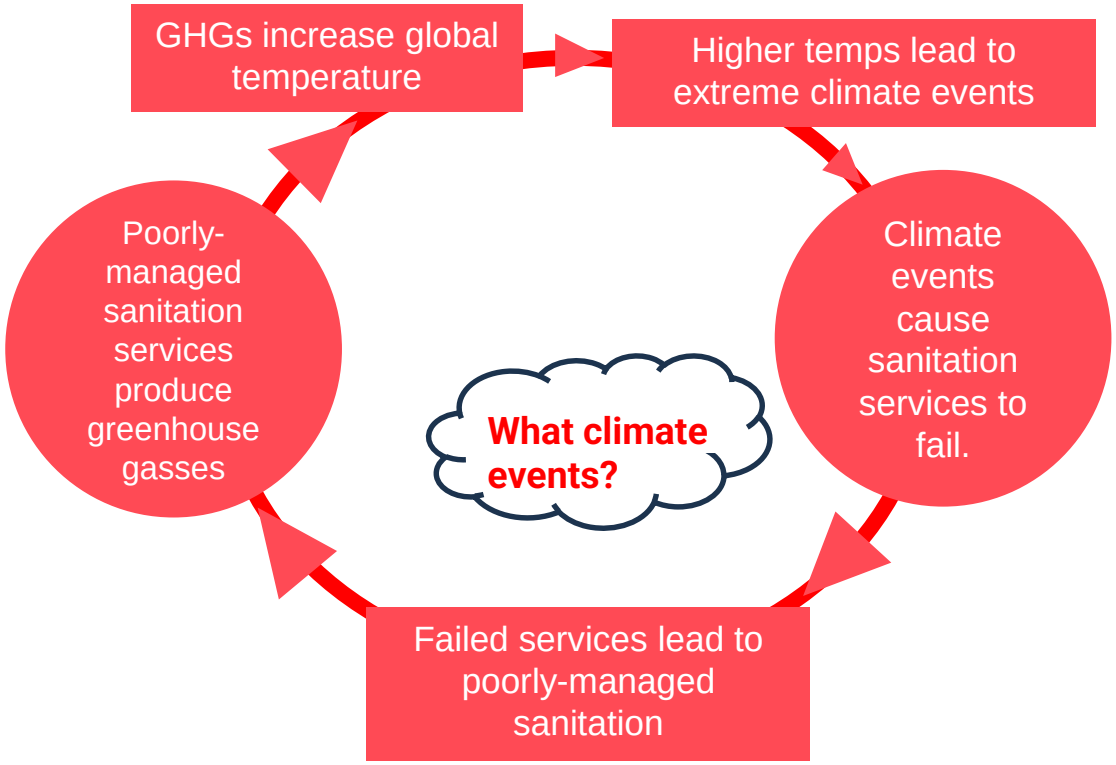
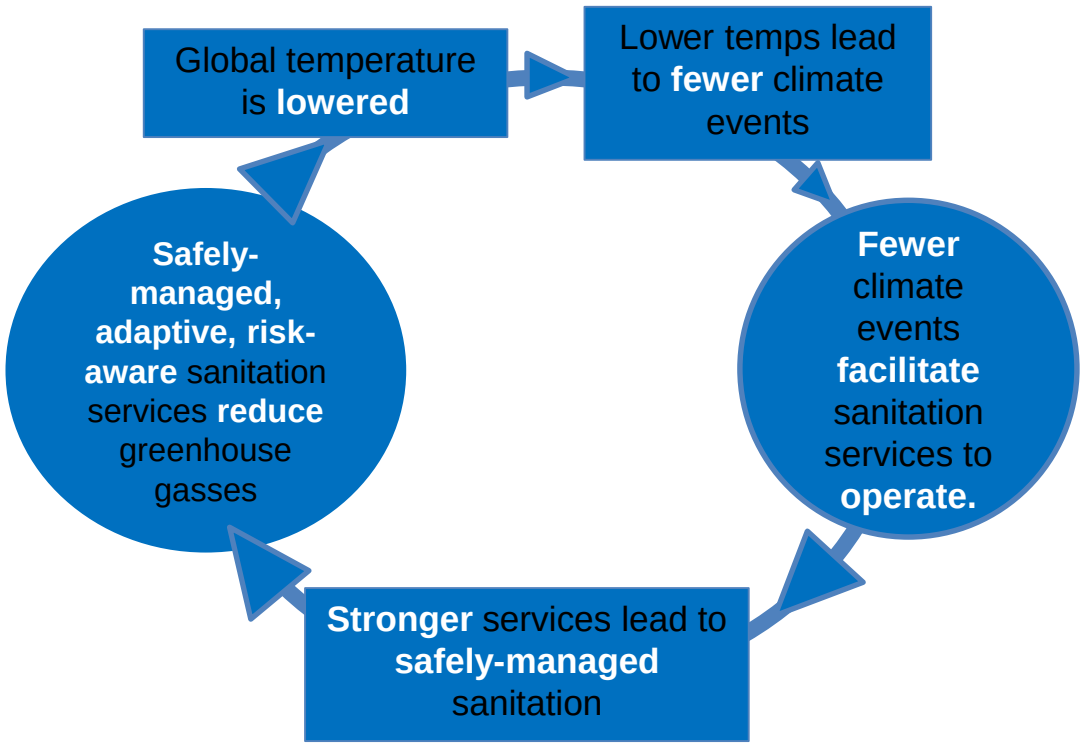
CLIMATE CHANGE AND SANITATION

CLIMATE RESILIENT SANITATION: COALITION FOR ACTION

Cycle of non-climate resilient sanitation



Cycle of climate resilient sanitation

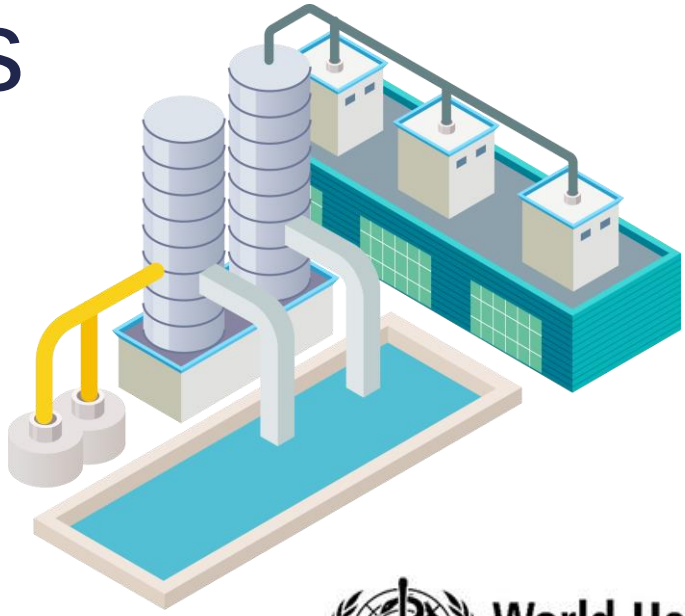


CLIMATE EFFECTS ON SANITATION

Climate Event	Result	Impact on Sanitation
Increased precipitation	Increased flooding	Damage to support infrastructure (e.g., roads, power)
		Flooding onsite systems, and return to open defecation
		Flooding treatment plants
	Erosion/Landslides	Damage to sanitation and support infrastructure
	Rising groundwater	Flooding & collapse of onsite systems, and return to open defecation
		Soil saturation leading to higher contamination from onsite sanitation
Drought	Insufficient water for flushing, cleaning	Toilets become unusable, and return to open defecation
	Insufficient water for sewerage	Sewers become unusable and unviable
Sea-level rise	Saline intrusion	Damage to wastewater treatment systems
	Rising groundwater	Flooding/inundation & collapse of onsite systems
		Damage to sanitation and support infrastructure
		Flooding treatment plants
Increased temperatures	Higher freshwater temp	Reduced efficiency of treatment plants
Stronger storms	Increased flooding	See above
	Stronger winds	Damage to sanitation and support infrastructure

CLIMATE RESILIENT SANITATION: COALITION FOR ACTION

Sanitation safety planning: principles, and objectives



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What is (SSP)?

Sanitation safety planning (SSP) is a systematic, risk-based approach to ensuring that sanitation systems are designed, operated, and maintained in a way that protects public health and the environment.

The aim to identify and manage health risks caused by unsafe practices and poor infrastructure. It protects people health and the environment.

Why Sanitation Safety Planning?

Objectives

- Maximize health benefits
- Minimize health risks
- Improve environmental protection
- Guide efforts to where it will have most impact
- Help coordinate efforts among stakeholders along the entire sanitation chain

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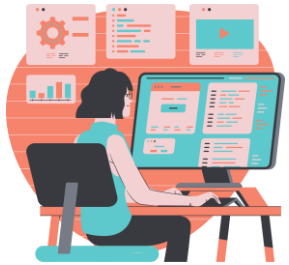
Key products:

Prioritized, incremental improvement plan



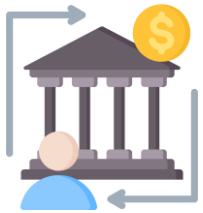
Operational monitoring plan for regular monitoring and periodic verification

Target audience

It fosters collaboration and empowers everyone to play a role in achieving safe and sustainable sanitation systems.

Sanitation service providers

Help manage service quality, and provide assurances to local authorities and regulators



local Authorities

Help coordinate, plan improvements, and monitor services in an administrative area

Public health regulators

Help identify and verify effectiveness of risk-based regulatory measures

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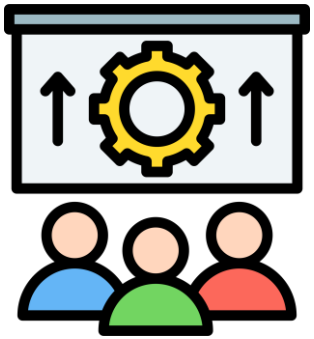
Key principles of SSP



Participatory

Engagement of stakeholders at all levels.

Flexible

Adaptation and adjustment of strategies over time.

Uniqueness

Tailoring interventions to specific local contexts.

Climate-resilience

Adaptation to changing climatic conditions.

Proactive approach

Anticipation and prevention of potential health risks

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SSP Modules

- Where should SSP be done?
- Who should be involved
- what are their roles?

- How does the sanitation service chain work?

- How should SSP be supported?
- How can we adapt to changes?

- What could go wrong?
- What existing control measures are in place and how effective are they?
- How significant are the risks?

- Is the system operating as intended?

- What needs to be improved and how?

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Module 1. Prepare for SSP

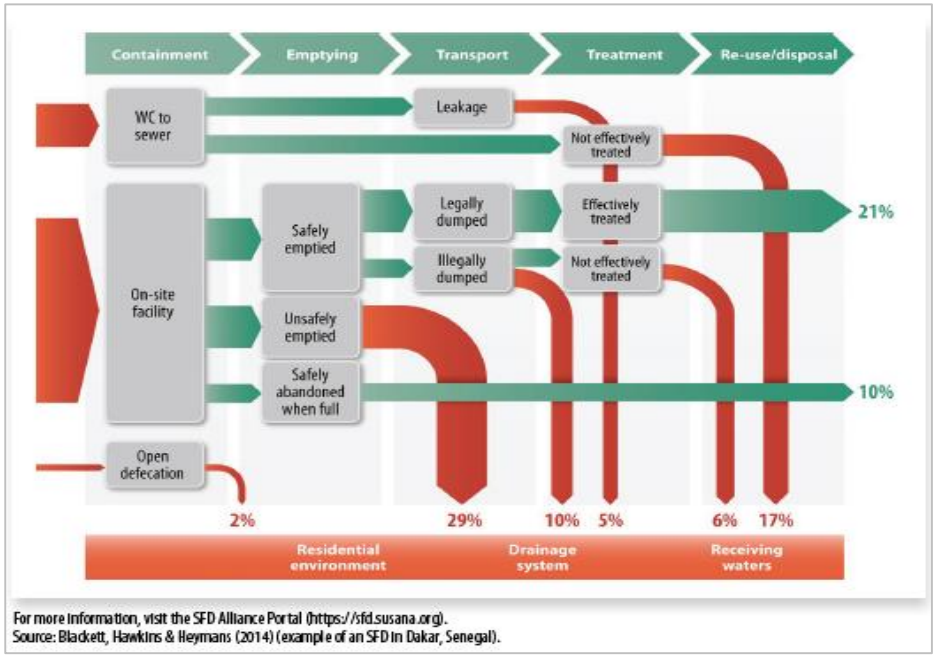
1.1 Define the SSP area and lead organization

1.2 Assemble the SSP team

1.3 Establish SSP priorities

Tools like the *Excreta Flow Diagram* can help establishing SSP priorities

Where should SSP be done?
Who should be involved and what are their roles?



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Module 2. Describe the sanitation system

2

How does the sanitation service chain work?
Who is at risk?

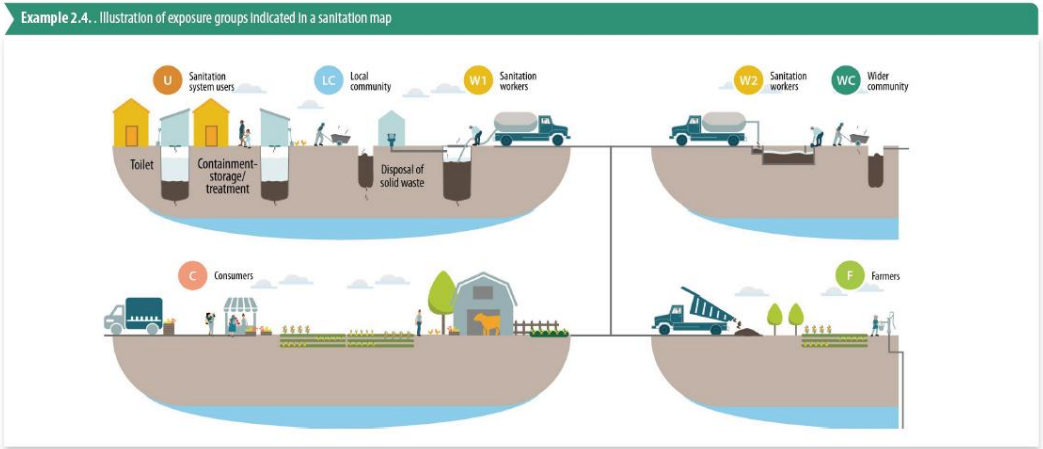
2.1 Map the system

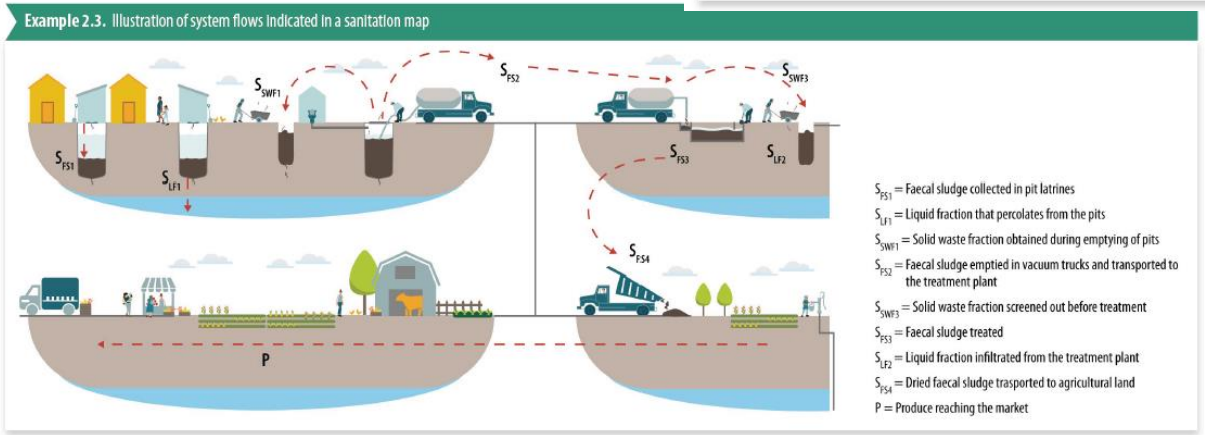
2.2 Characterize the system flows

2.3 Identify exposure groups

2.4 Gather supporting information

2.5 Confirm the system description





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Module 3. Identify hazardous events, existing control measures and exposure risks

What could go wrong?
What existing control measures are in place and h
effective are they?
How significant are the risks?

3.1. Identify hazardous events

3.2. Identify and assess existing control measures

3.3. Assess and prioritize risks

- Simple sanitary inspection
- Team-based descriptive risk assessment
- Semi-quantitative risk assessment
- Quantitative methods

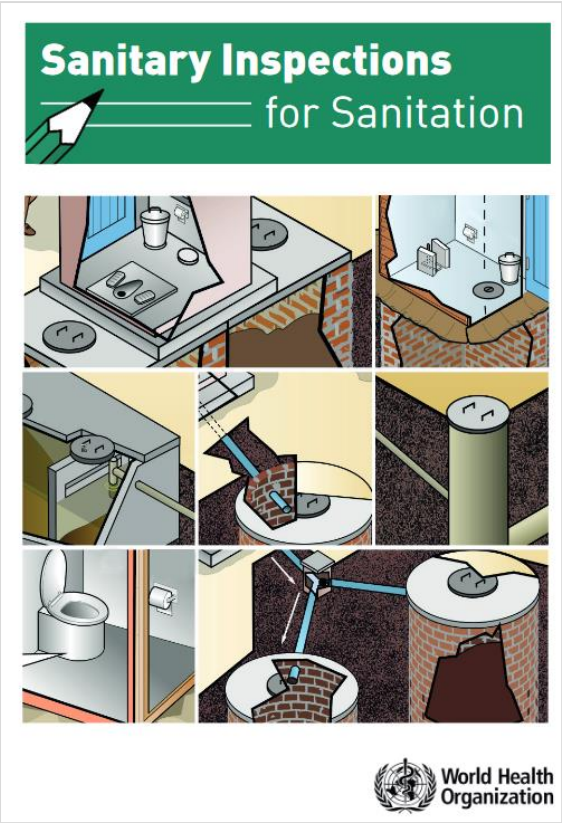
GUIDANCE NOTE 3.4.

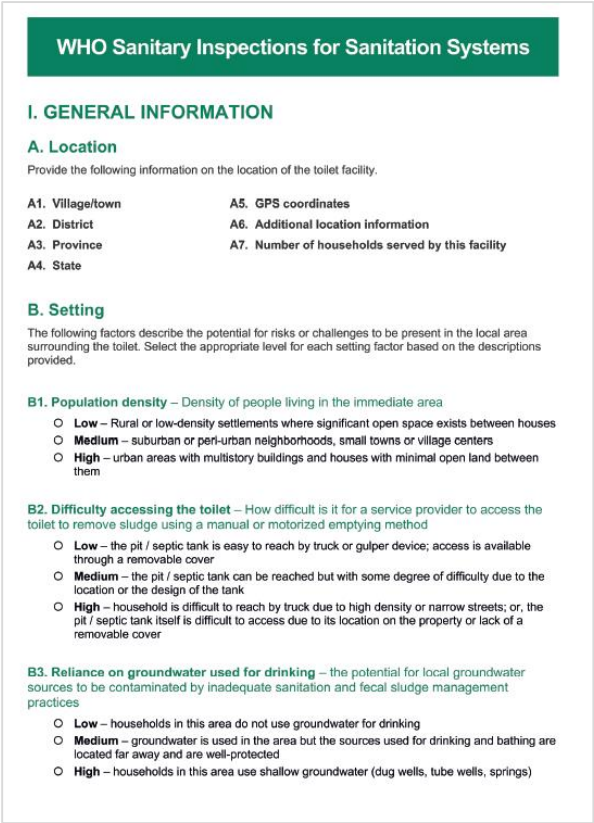
Major climate change effects and resulting hazardous events

Below are examples of climate change effects and resulting hazardous events that can be reviewed relevant to the local context and sanitation systems.

CLIMATE CHANGE EFFECT	CAUSES OF HAZARDOUS EVENTS	EFFECT ON THE SANITATION SYSTEM	EXAMPLE OF HAZARDOUS EVENT	HAZARD	EXPOSURE GROUPS
More intense or prolonged precipitation	Increased flooding	Damage to infrastructure on which sanitation systems rely (e.g. electricity networks for pumping, road networks used by FSM vehicles)	Ingestion of surface water contaminated with raw sewage due to nonfunctioning wastewater treatment plant	All pathogens	LC, WC
		Flooding of on-site systems, causing spillage and contamination	Ingestion of pathogens after contact with faecal sludge during overflowing of on-site systems	All pathogens	U, LC
			Dermal contact with faecal sludge due to overflowing of on-site systems	Hookworm	U
		Treatment plants receiving flows that exceed their design capacities, resulting in flows bypassing the treatment processes	Ingestion of contaminated water with raw sewage due to bypassing of wastewater treatment plant	All pathogens	LC
	Increased erosion and landslides	Destruction of, or damage to, sanitation infrastructure	Ingestion of water contaminated with raw sewage due to nonfunctioning wastewater treatment plant	All pathogens	LC
	Contamination of, and damage to, surface water and groundwater supplies	Treatment plants receiving flows with concentrations of pollutants that exceed their design capacities, resulting in lower treatment performance	Ingestion of water contaminated with partially treated sewage due to higher pollutant concentration	All pathogens	LC
	Changes to groundwater recharge and groundwater levels	Floating of septic systems due to groundwater levels	Ingestion of pathogens after contact with faecal sludge due to floating of septic tank	All pathogens	U, LC
		Collapse of pit latrines via groundwater	Injury to the body and possible asphyxiation, after falling into the pit due to collapsing latrine structure	Injury to the body, including drowning	U

Sanitary inspection – simplest form of SSP





WHO Sanitary Inspections for Sanitation Systems

I. GENERAL INFORMATION

A. Location

Provide the following information on the location of the toilet facility.

A1. Village/town
A2. District
A3. Province
A4. State
A5. GPS coordinates
A6. Additional location information
A7. Number of households served by this facility

B. Setting

The following factors describe the potential for risks or challenges to be present in the local area surrounding the toilet. Select the appropriate level for each setting factor based on the descriptions provided.

B1. Population density – Density of people living in the immediate area

- **Low** – Rural or low-density settlements where significant open space exists between houses
- **Medium** – suburban or peri-urban neighborhoods, small towns or village centers
- **High** – urban areas with multistory buildings and houses with minimal open land between them

B2. Difficulty accessing the toilet – How difficult is it for a service provider to access the toilet to remove sludge using a manual or motorized emptying method

- **Low** – the pit / septic tank is easy to reach by truck or gulper device; access is available through a removable cover
- **Medium** – the pit / septic tank can be reached but with some degree of difficulty due to the location or the design of the tank
- **High** – household is difficult to reach by truck due to high density or narrow streets; or, the pit / septic tank itself is difficult to access due to its location on the property or lack of a removable cover

B3. Reliance on groundwater used for drinking – the potential for local groundwater sources to be contaminated by inadequate sanitation and fecal sludge management practices

- **Low** – households in this area do not use groundwater for drinking
- **Medium** – groundwater is used in the area but the sources used for drinking and bathing are located far away and are well-protected
- **High** – households in this area use shallow groundwater (dug wells, tube wells, springs)

- Simplified risk identification for onsite sanitation facilities
- Includes version with corrective actions
- Supported by sanitation system fact sheets (applicability, design, O&M, measures to protect public health)

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Semi-quantitative risk assessment

- Appropriated for more well-defined regulatory environments.
- Teams who are familiar with the WSP methodology.

Semi-quantitative risk assessment matrix

Likelihood (L) x Severity (S) = Risk

			SEVERITY (S)				
			Insignificant	Minor	Moderate	Major	Catastrophic
			1	2	4	8	16
LIKELIHOOD (L)	Very unlikely	1	1	2	4	8	16
	Unlikely	2	2	4	8	16	32
	Possible	3	3	6	12	24	48
	Likely	4	4	8	16	32	64
	Almost certain	5	5	10	20	40	80
Risk score R = L × S			<6	6–12	13–32	>32	
Risk level			Low risk	Medium risk	High risk	Very high risk	

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Semi-quantitative risk assessment

How is the risk affected under the most likely climate change scenario?

GUIDANCE NOTE 3.8.

Risk assessment for climate change and climate variability

COMPONENT	HAZARD IDENTIFICATION				EXISTING CONTROLS		RISK ASSESSMENT						COMMENTS JUSTIFYING RISK ASSESSMENT (Under current conditions, climate change scenarios, or effectiveness of the control)
							UNDER CURRENT CONDITIONS, ALLOWING FOR THE EXISTING CONTROLS L = likelihood; S = severity; R = risk level (e.g. high)				UNDER THE MOST LIKELY CLIMATE CHANGE SCENARIOS (In the cells below, record two scenarios, e.g. drought, heavy rainfall. + means increased risk, – means decreased risk, = means the same risk)		
Sanitation step	Hazardous event	Hazard	Exposure groups	Number of people at risk	Description of existing control measure	Validation of control	L	S	Score (LxS)	R	Scenario 1 Drought	Scenario 2 More intense precipitation, floods	
Conveyance	Ingestion of contaminated groundwater due to leakage from sewers into shallow groundwater	All pathogens	Local community	50 000	Awareness-raising campaigns to encourage families to use household water treatments (HWTS) such as filters and chlorination	Not effective – household-level surveys show that families are not using HWTS	4	4	16	H	+	+	Under drought, the likelihood of collecting water for drinking from shallow sources increases. Under flooding scenarios, the quality of groundwater is affected by pollutants.

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Module 4. Develop and implement an incremental improvement plan

4.1 Consider options to control identified risks

4.2 Develop an incremental improvement plan

What needs to be improved and how?

Example 4.1. Examples of improvement options along the sanitation service chain

STEP OF THE SANITATION SERVICE CHAIN	TYPE OF IMPROVEMENT OPTION			
	REGULATORY[a]	TECHNICAL[b]	MANAGERIAL AND OPERATIONAL[b]	BEHAVIOUR CHANGE[c]
Toilet	Technical standards on material, dimensions and location	Installation of flush toilets	Training of masons for correct installation	Communication campaign to encourage correct use and maintenance of the toilet
Containment–storage/treatment	Guidelines on periodic inspection of on-site systems	Installation of sealed and impermeable septic tanks	Building a database of on-site sanitation infrastructure	Programme to encourage refurbishment of nonsealed containment tanks
Conveyance	Licensing of emptying service providers	Installation of faecal sludge transfer stations	Establishing a call centre for septic tank emptying	Consumer protection programme indicating rights and responsibilities of users of faecal sludge emptying services
Treatment	Liquid effluent standards; guidelines on control of nuisances (odours, flies, noise) from treatment facility	Construction of, or improvements to, a faecal sludge treatment plant	Developing standard operating procedures for operation and maintenance	Internal awareness-raising programme to ensure occupational health and safety
End use or disposal	Standards for sludge products, categorized by type of use	Additional treatment of dried sludge (e.g. co-composting)	Training farmers in crop selection (e.g. only crops not eaten raw)	Household food safety programme (to encourage washing of products)

on system

, 2018).

				EXAMPLE OF ADAPTATION OPTIONS
	precipitation	stability	caused by falling into the pit due to collapsing latrine structure	Line pits using local materials. Use locally adapted toilet designs: raised toilets; smaller, frequently emptied pits; vault toilets; raised pit plinths; compacting soil around pits; etc.
Septic tanks	More intense or prolonged precipitation	Rising groundwater levels, causing structural damage to tanks	Ingestion of groundwater contaminated with faecal pathogens	Install sealed covers for septic tanks and non-return valves on pipes to prevent backflows.
Conventional sewerage	Sea level rise	Rising water levels in coastal sewers, causing back-flooding	Ingestion of pathogens in surface water contaminated with partially treated sewage	Use special gratings and restricted outflow pipes. Install non-return valves on pipes to prevent backflows.

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Improvement options

Option 1: Regulatory measures

Option 2: Technical control measures

Option 3: Management and operational control measures

Option 4: Behaviour change measures

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Chapter 4
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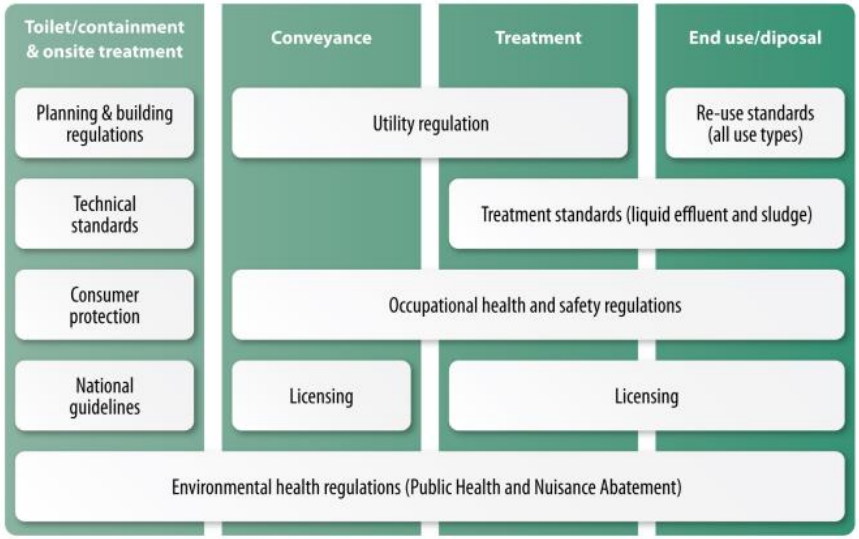
Improvement options

Option 1: Regulatory measures

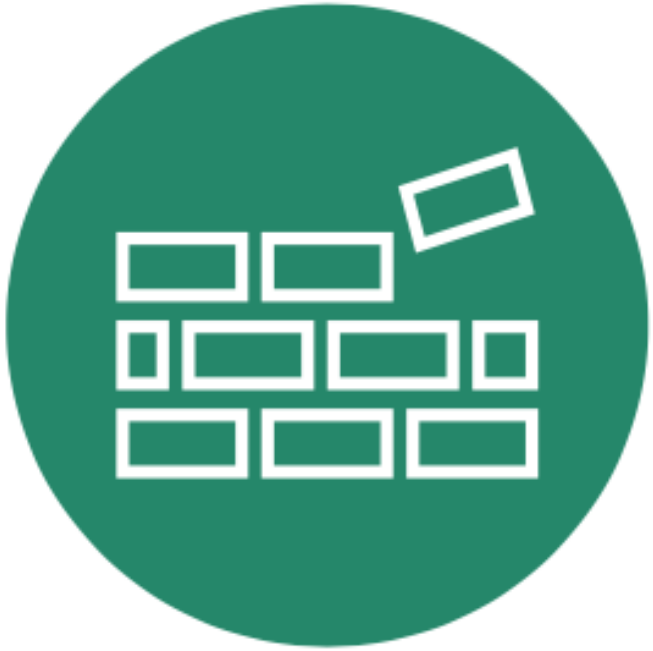
Mechanisms to regulate the sanitation service chain.

SSP measures should focus on rules and local by-laws passed by local authorities for changes in the national regulation.



Source: Figure 4.4 in WHO (2018).

Improvement options



Option 2: Technical control measures

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

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.

SSP Manual Guidance note 4.3, page 68

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.

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.

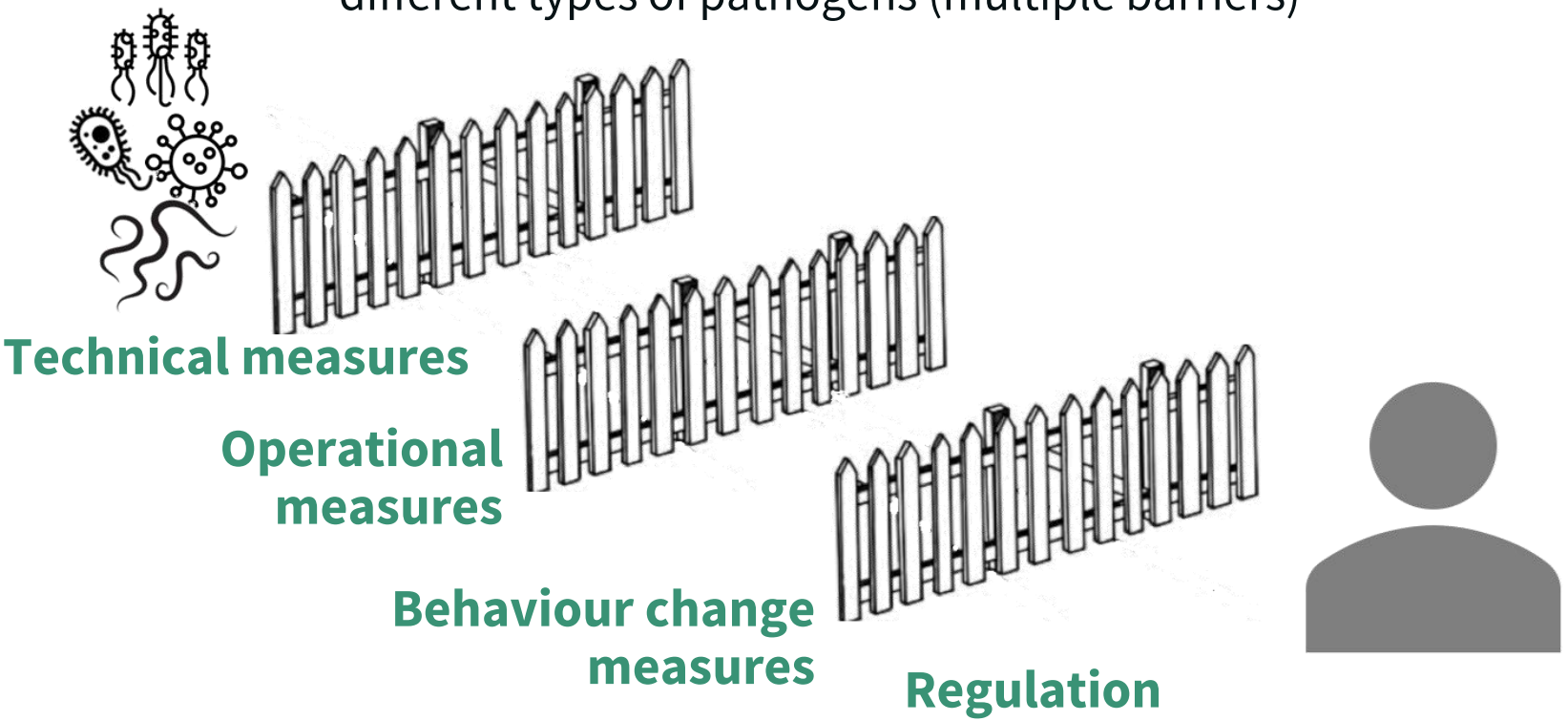
TIP

WHO Guidelines Chapter 5 offers

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

Multibarrier approach

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



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Module 5.Monitor control measures

5

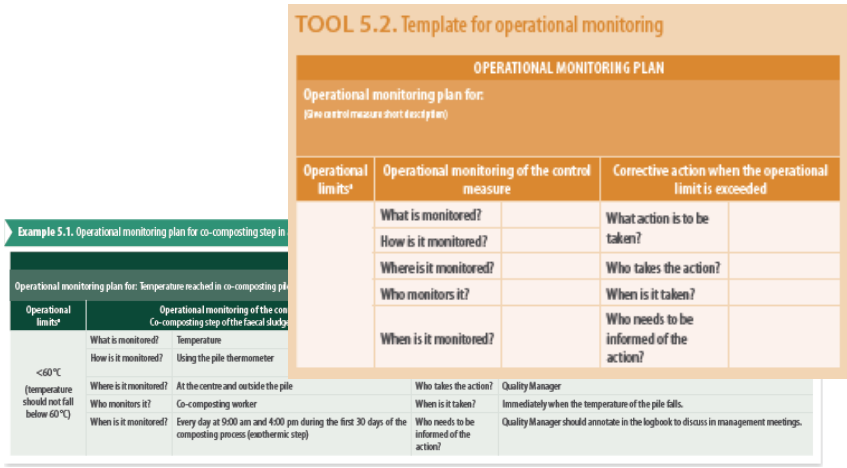
5.1 Define and implement operational monitoring

5.2 Verify system performance

5.3 Audit the system

Is the sanitation system operating as intended?
Is it effective?

Operational monitoring by service providers and verification by oversight authorities provide assurances to the public of adequate system performance and trigger corrective action when monitoring results exceed critical limits.



TOOL 5.2. Template for operational monitoring

OPERATIONAL MONITORING PLAN					
Operational monitoring plan for:					
Operational limits[a]	Operational monitoring of the control measure		Corrective action when the operational limit is exceeded		
	What is monitored?		What action is to be taken?		
	How is it monitored?		Who takes the action?		
	Where is it monitored?		When is it taken?		
	Who monitors it?		Who needs to be informed of the action?		
	When is it monitored?				

Example 5.1. Operational monitoring plan for co-composting step in

Operational monitoring plan for: Temperature reached in co-composting pi				
Operational limits[a]	Operational monitoring of the co... Co-composting step of the faecal sludg...			
<60 °C (temperature should not fall below 60 °C)	What is monitored?	Temperature		
	How is it monitored?	Using the pile thermometer		
	Where is it monitored?	At the centre and outside the pile	Who takes the action?	Quality Manager
	Who monitors it?	Co-composting worker	When is it taken?	Immediately when the temperature of the pile falls.
	When is it monitored?	Every day at 9:00 am and 4:00 pm during the first 30 days of the composting process (exothermic step)	Who needs to be informed of the action?	Quality Manager should annotate in the logbook to discuss in management meetings.

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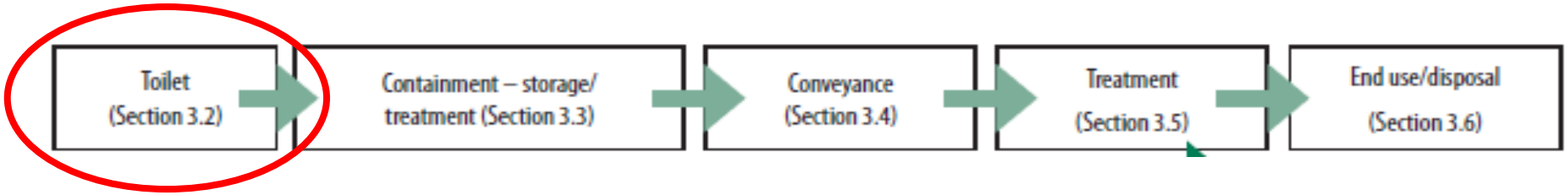


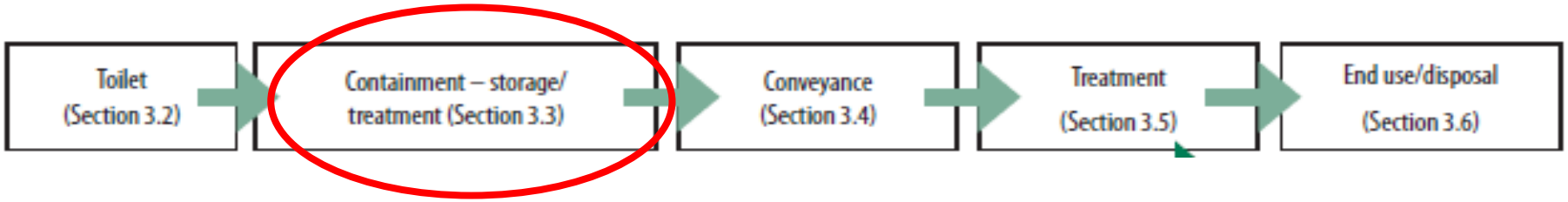
Typical risks

Example controls
(behavior, design, management, oversight/regulation)

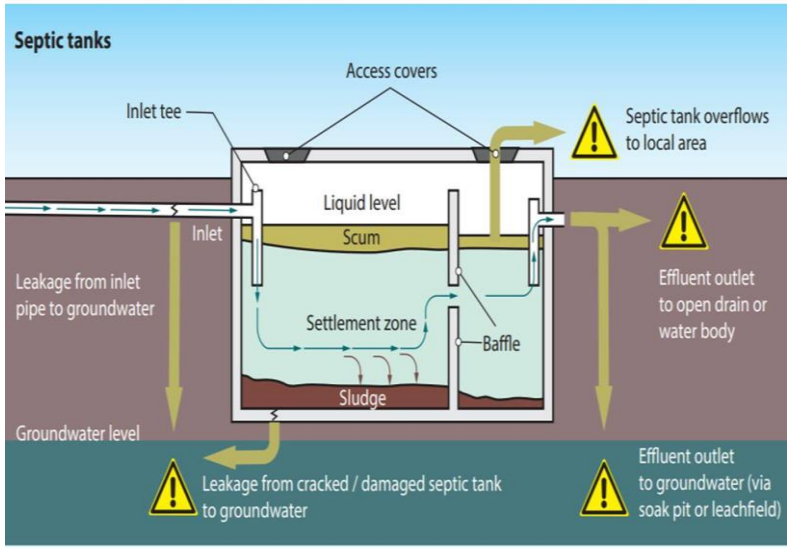
- Toilet use – behavior change rooted in local determinants
- Supply of a range of safe toilet options meeting minimum standards (and matched to culture, economy and environment)
- Routine cleaning maintenance

Monitoring
(Operation and verification)

- Periodic sanitary inspection by local govt, National surveys.
- Quality of construction.
- Cleanliness of facilities.
- Existing of handwashing facilities.



Typical risks

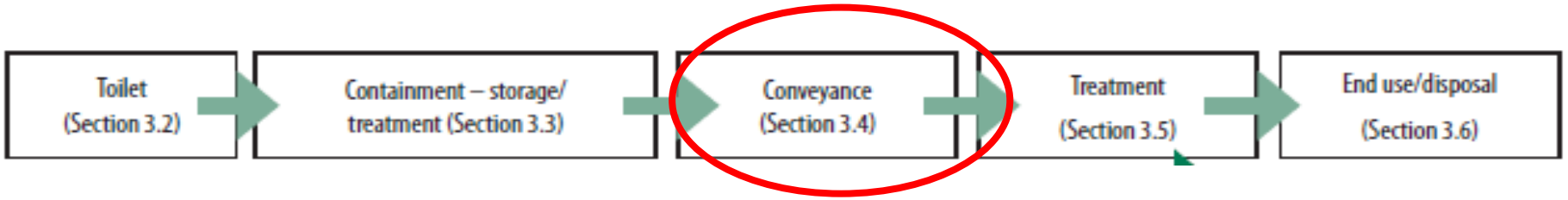


Example controls
(behavior, design, management, oversight/regulation)

- Design standards for technologies
- Training of masons to consistently meet standard
- Quality control on installation
- Period sanitary inspections

Monitoring
(Operation and verification)

- Periodic sanitary inspection by local govt, or National surveys.
- State of the facilities (Septic Tank Cover).
- Visible / reported overflows.



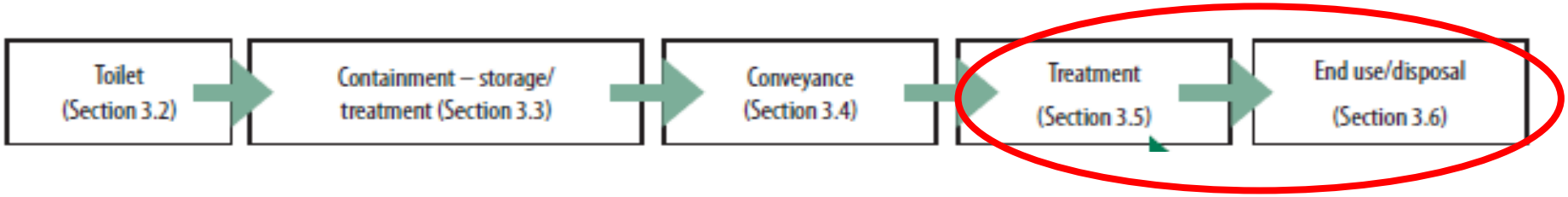
Typical risks

Example controls
(behavior, design, management, oversight/regulation)

- Protection of workers – PPE, equipment, formalization, association, Occupational health and safety regulations
- Licensing and utility regulation
- Regular sewer inspection
- Behaviour change of users on solid waste disposal
- Sewer upgrades – stormwater separation

Monitoring
(Operation and verification)

- % illegal dumping
- % workers in formalized employment
- % compliance with PPE SOPs
- Infections/deaths workers
- No. of blocks or overflows



Typical risks

Example controls
(behavior, design, management, oversight/regulation)

- Well designed WWTPs and FSTPs
- SOPs for treatment plant operation
- Monitoring of effluent and sludge
- Standards for treatment and reuse
- Protections for farmers and consumers of wastewater and sludge products (e.g. produce, compost etc.)

Monitoring
(Operation and verification)

- Retentions times/flow rates in treatment processes
- Effluent quality
- Exposure to effluent – e.g. crop irrigation, recreational use.
- Testing of BOD, COD, SS
- **Data collected and verified by occasional sampling and independent lab analysis.**
- Routine visual Inspection of farms (application / Irrigation Process, PPEs)

Module 6. Develop supporting programs and review plans

6

How should SSP be supported? How can we adapt to changes?

6.1 Identify and implement supporting programmes

SSP implementation is supported with sustainable sanitation enterprises, research programmes, and evidence-based engagement in national-level policy and planning

World Health Organization

6.2 Periodically review and update the SSP outputs

SSP Manual
Example 6.2
Page 94

OBJECTIVE

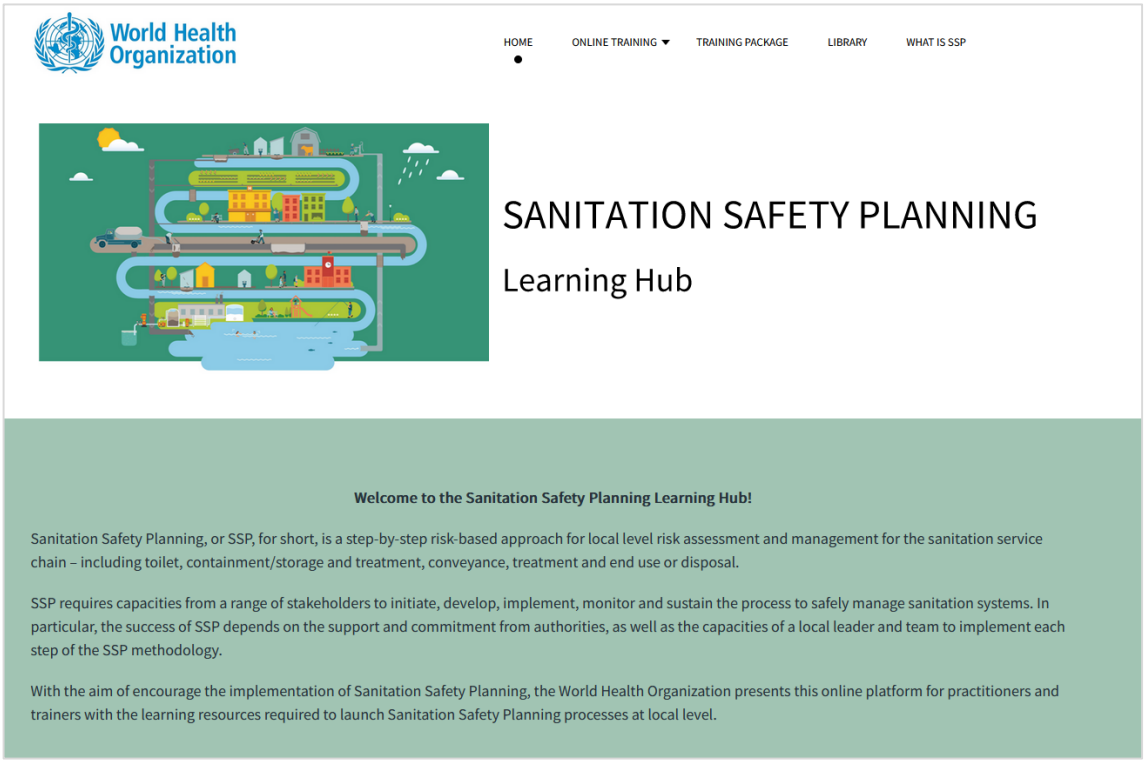
This step helps to respond to a dynamic environment, adapting SSP as new controls are implemented, or new hazards and hazardous events emerge.

Remember:

Sanitation Safety Planning is not linear!

It’s is a continuous process!

Find out more….



- SSP manual etc.
- PowerPoints
- Short videos
- SSP trainer's guide
- Worksheets
- SSP worked example

[Sanitation Safety Planning Information Hub]

World Health Organization

Case studies

World Health Organization