



Fundusze Europejskie

Risk-based drinking water surveillance

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WHO Collaborating Center for Environmental Health Risk Management



**Fundusze
Europejskie**



**Rzeczpospolita
Polska**

**Dofinansowane przez
Unię Europejską**



Content of the training

- Rationale of risk-based drinking water surveillance
- Risk-based approach in the EU drinking water directive
- Water safety planning
- Domestic distributions systems
- Water safety plan auditing
- Risk-based drinking water monitoring



Why use risk-based approach?

Drinking water



Increasing expectations

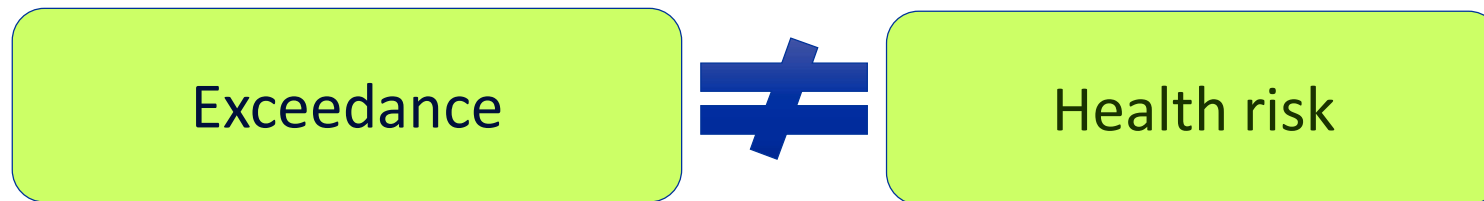
?



Safe vs acceptable?

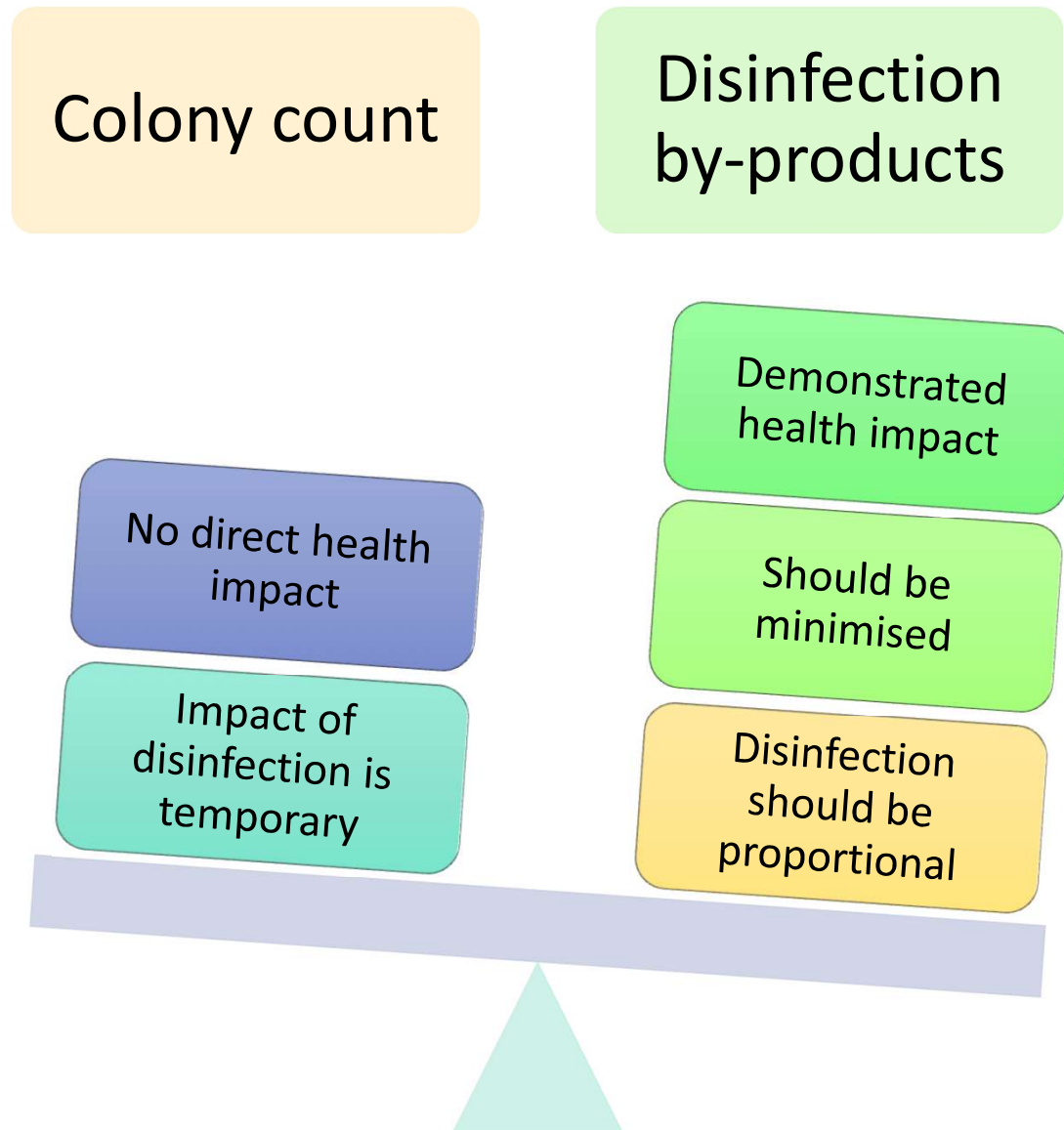


Compliant vs. wholesome

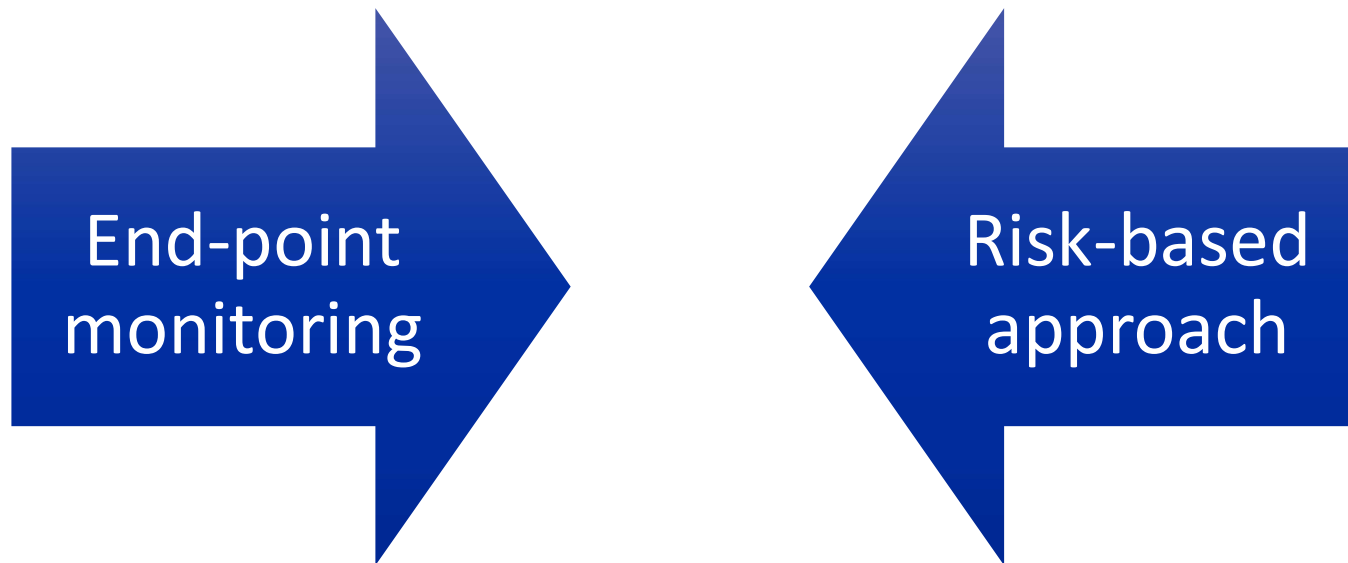


- Health risk below parametric value
 - E.g. carcinogenic compounds
- Health risk above parametric value depends on
 - Health impact of the parameter
 - Time of exceedance
 - Extent of exceedance

How to compare risk



Why use a risk-based approach?



- Reactive
- Perceived hazards only
- Fixed scheme
- Minimal health protection

- Preventive
- All potential hazards
- Continuously revised
- Real health protection

I

(Legislative acts)

DIRECTIVES

DIRECTIVE (EU) 2020/2184 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL**of 16 December 2020****on the quality of water intended for human consumption****(recast)****(Text with EEA relevance)**

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof,

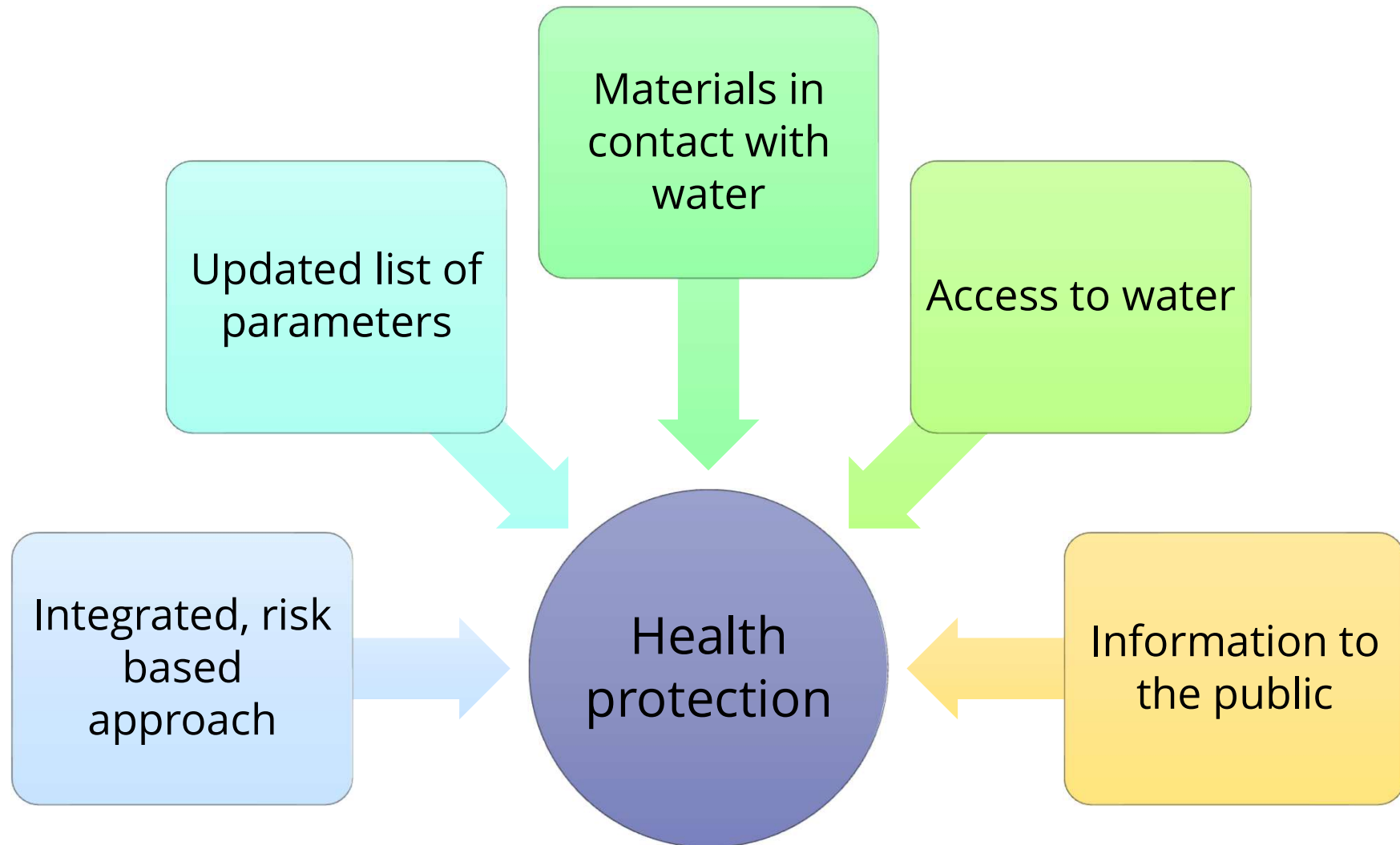
Having regard to the proposal from the European Commission,

Risk-based approach in the EU Drinking Water Directive

European Union Drinking Water Legislation

- DIRECTIVE (EU) 2020/2184 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2020 on the quality of water intended for human consumption
- Replaces Directive 98/83/EC
- (EU) 2015/1787 introduced the first elements of risk-based approach
 - Monitoring (Annex II and III)
- The recast DWD is the first legally binding supranational regulation to introduce risk-based approach in the EU

Recast of the EU regulation



Water safety planning

A roadmap to supporting resources



[Sept. 2024]

A water safety plan (WSP) is a proactive and ongoing risk assessment and risk management approach that includes all steps in the water supply chain – from catchment to consumer. WSPs are recommended by the World Health Organization (WHO) as the most effective means to consistently ensure the safety of drinking-water. The following publications by WHO and partners provide guidance on various aspects of water safety planning, including WSP development, implementation, training, advocacy and auditing. Several resources are available in multiple languages.

POLICY GUIDANCE



Guidelines for drinking-water quality
Fourth edition incorporating the first and second addenda

WHO (2022)
<https://www.who.int/publications/i/item/9789240045064>

The global reference on drinking-water safety and good practice, the guidelines position WSPs as a core element of WHO's framework for safe drinking-water and outline WSP principles and key elements for policy-makers.

Guidelines for drinking-water quality
Small water supplies

WHO (2024)

<https://www.who.int/publications/i/item/9789240088740>

Provides clear guidance for decision-makers on the progressive improvement of small water supplies, including through policies and regulations on water safety planning and sanitary inspections to proactively manage risks.



Think big start small scale up
A road map to support country-level implementation of water safety plans

WHO & IWA (2010)
<https://www.who.int/publications/m/item/think-big-start-small-scale-up>

Provides guidance to government entities on introducing and scaling up WSPs nationally, with a focus on building an enabling environment to support and sustain WSPs.

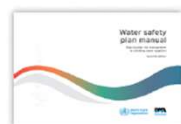
Taking policy action to improve small-scale water supply and sanitation systems
Tools and good practices from the pan-European region

WHO (2016)

<https://www.who.int/europe/publications/i/item/9789289051606>

Presents policy-makers with a range of regulatory, planning, financial and educational instruments to support effective policy and promote good practice (including WSPs) to improve small water and sanitation systems.

GUIDANCE AND TOOLS FOR WSP DEVELOPMENT AND IMPLEMENTATION



Water safety plan manual
Step-by-step risk management for drinking-water suppliers (second edition)

WHO (2023)

<https://www.who.int/publications/i/item/9789240067691>

Provides detailed guidance, templates and tools for developing and implementing a WSP, particularly for organized drinking-water supplies managed by a water utility or similar entity.

Water safety planning for small community water supplies
Step-by-step risk management guidance for drinking-water supplies in small communities

WHO (2012)

<https://www.who.int/publications/i/item/9789241548427>

Sets out the principles and steps to develop a simplified WSP for small water supplies that are managed by communities, targeting those who support these water suppliers.



A field guide to improving small drinking-water supplies
Water safety planning for rural communities (second edition)

WHO (2022)

<https://www.who.int/europe/publications/i/item/9789289058414>

A complement to *Water safety planning for small community water supplies*, this field guide provides templates and tools to assist the practical development of WSPs by local institutions supporting water supply service delivery in small communities.

Sanitary inspection packages
A supporting tool for the Guidelines for drinking-water quality: small water supplies

WHO (2024)

<https://www.who.int/publications/i/item/9789240089006>

Supports proactive risk management and drinking-water quality surveillance across a range of water delivery scenarios, and aids the practical implementation of related recommendations in the *Guidelines for drinking-water quality: small water supplies*.

GUIDANCE ON RISK MANAGEMENT AT SPECIFIC POINTS IN THE WATER SUPPLY



Protecting groundwater for health
Managing the quality of drinking-water sources

WHO (2006)

<https://www.who.int/publications/i/item/9241546689>

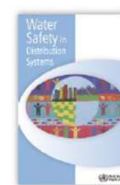
Provides guidance for health, environment and water sector professionals on risk management approaches to protect groundwater sources of drinking-water, presenting a structured approach to analysing hazards, assessing and prioritizing risk, and developing management strategies.

Protecting surface water for health
Identifying, assessing and managing drinking-water quality risks in surface-water catchments

WHO (2016)

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Water safety in distribution systems

WHO (2014)

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Provides guidance for water suppliers and regulators on applying the WSP approach to enhance risk assessment, risk management and investment planning in distribution systems.

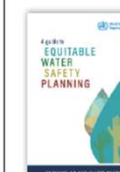
Water safety in buildings

WHO (2011)

<https://www.who.int/publications/i/item/9789241548106>

Provides guidance for those responsible for managing water supplies in buildings on applying the WSP approach to understand and address priority risks to ensure water safety is maintained within the building (e.g. hospitals, schools, child- and aged-care facilities, hotels and apartment blocks).

GUIDANCE ON ADDRESSING EQUITY AND CLIMATE RESILIENCE



A guide to equitable water safety planning
Ensuring no one is left behind

WHO (2019)

<https://www.who.int/publications/i/item/9789241515313>

Provides guidance for WSP teams and WSP coordinators to improve equity outcomes through the explicit and systematic inclusion of equity considerations through the WSP process.

Climate resilient water safety plans
Managing risks associated with climate variability and change

WHO (2017)

<https://www.who.int/publications/i/item/9789241512794>

Provides guidance to WSP teams and other stakeholders on strengthening the climate resilience of water supplies by applying the WSP approach to identify and manage risks to water quality and quantity posed by climate change.

AUDIT GUIDANCE



A practical guide to auditing water safety plans

WHO (2016)

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Provides practical guidance and tools for water suppliers and surveillance authorities on planning for, carrying out and following up on WSP audits to support the continuous improvement and sustainability of WSPs.

WHO resources

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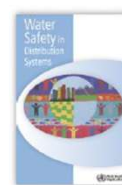
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WHO resources

TRAINING COURSES, VIDEOS AND WORKSHOP MATERIALS



Water safety planning for urban water supplies An introduction

WHO (2023)

<https://openwho.org/courses/water-safety-planning>

A self-paced course for governments, water suppliers and supporting partners, outlining the principles and steps of the WSP approach and presenting success factors that underpin effective and sustainable WSP implementation.

Water safety plans Training package

WHO & IWA (2012)*

<https://www.who.int/publications/m/item/water-safety-plans-training-package>

* Updated training package under development

A training package designed to support delivery of a 5-day WSP training event, aligned with the *Water safety plan manual* and comprising a facilitator's guide, participant workbook and slides.



WSP training video An introduction to WSP principles and steps

WHO (2020)

<https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/water-safety-and-quality/water-safety-planning/water-safety-planning-training-videos>

A virtual training session recording offering a 2-hour overview of WSP principles and steps.

Equitable water safety planning PowerPoint slides

WHO (2019)

<https://www.who.int/publications/i/item/9789241515313>

PowerPoint slides aligned with *A guide to equitable water safety planning*, detailing how and where to integrate equity messaging into WSP training events.



Establishing a WSP regulatory audit scheme Guidance package

WHO (2022)

<https://wspportal.org/resources/auditing-verification>

Material to support a 3-day workshop on key factors that underpin the development of a national regulatory WSP auditing programme, including narrated slides, facilitator's notes, country examples and participatory worksheets.



Water safety plan auditing Training package

WHO (2019)

<https://www.who.int/publications/i/item/9789241509527>

A training package on how to prepare for, carry out and follow up on a WSP audit, aligned with *A guide to auditing water safety plans* and providing everything a trainer needs to lead classroom lessons and field activities.

WSP audit training video How to carry out a WSP audit

WHO (2020)

<https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/water-safety-and-quality/water-safety-planning/water-safety-planning-training-videos>

A virtual training session recording drawing on the material in *Water safety plan auditing: training package*, presented in five segments of one hour or less.



Operational monitoring plan development A guide to strengthening operational monitoring practices in small to medium-sized water supplies

WHO (2017)

<https://www.who.int/publications/i/item/9789290225379>

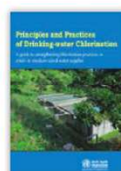
Practical guidance and training materials for small- and medium-sized water suppliers and supporting partners, focusing on strengthening operational monitoring practices - a core element of water safety planning.

Principles and practices of drinking-water chlorination A guide to strengthening chlorination practices in small- to medium-sized water supplies

WHO (2017)

<https://www.who.int/publications/i/item/9789290225362>

Practical guidance and training materials for small- and medium-sized water suppliers and supporting partners, focusing on strengthening chlorination practices - a common improvement need identified through a WSP.



WSP IMPACT AND ADVOCACY DOCUMENTS



Global status report on water safety plans

A review of proactive risk assessment
and risk management practices to
ensure the safety of drinking-water

WHO & IWA (2017)

<https://www.who.int/publications/i/item/WHO-FWC-WSH-17.03>

Presents information on the status of WSP implementation and the integration of WSPs into the policy environment, as well as WSP benefits, challenges and future priorities.

Strengthening operations and maintenance through water safety planning A collection of case studies

WHO & IWA (2018)

<https://www.who.int/publications/i/item/WHO-CED-PHE-WSH-18.69>

A collection of case studies from around the world demonstrating various operations and maintenance benefits realized through the implementation of WSPs.



Water safety plans Managing drinking-water quality for public health

WHO (2010)

<https://www.who.int/publications/m/item/water-safety-plans>

A brief note on the rationale for the WSP approach, the potential benefits for various stakeholder groups, and the value of incorporating WSPs into policies and regulations.

WSP NETWORK

Water Safety Portal

WHO & IWA (website)

<https://www.wspportal.org>

An online global forum for all WSP stakeholders to find and upload resources, share experiences and keep up-to-date on WSP news and events.



WSP LINKAGES TO OTHER INITIATIVES



WASH FIT

A practical guide for improving quality
of care through water, sanitation and
hygiene in health care facilities
(second edition)

WHO (2022)

<https://www.who.int/publications/i/item/9789240043237>

Based on the WSP approach, WASH FIT provides practical guidance and tools for health sector professionals and supporting partners in low- and middle-income countries to help improve WASH services in health care facilities.



Sanitation safety planning Manual for step-by-step management for safely managed sanitation systems (second edition)

WHO (2022)

<https://www.who.int/publications/i/item/9789240062887>

Based on WSP principles, this manual provides guidance on the assessment and management of risks to ensure the safe use and disposal of human waste. SSPs can support WSPs by managing sanitation-related risks to drinking-water supplies.



Potable reuse Guidance for producing safe drinking-water

WHO (2017)

<https://www.who.int/publications/i/item/9789241512770>

With linkages to *Sanitation safety planning*, this document provides guidance on applying the WSP approach for potable reuse, considering wastewater as the source of drinking-water with impacts on treatment, distribution and supply to consumers.

Water safety planning for urban water utilities Practical guide for ADB staff

ADB & WHO (2017)

<https://www.adb.org/documents/urban-water-safety-planning-guide>

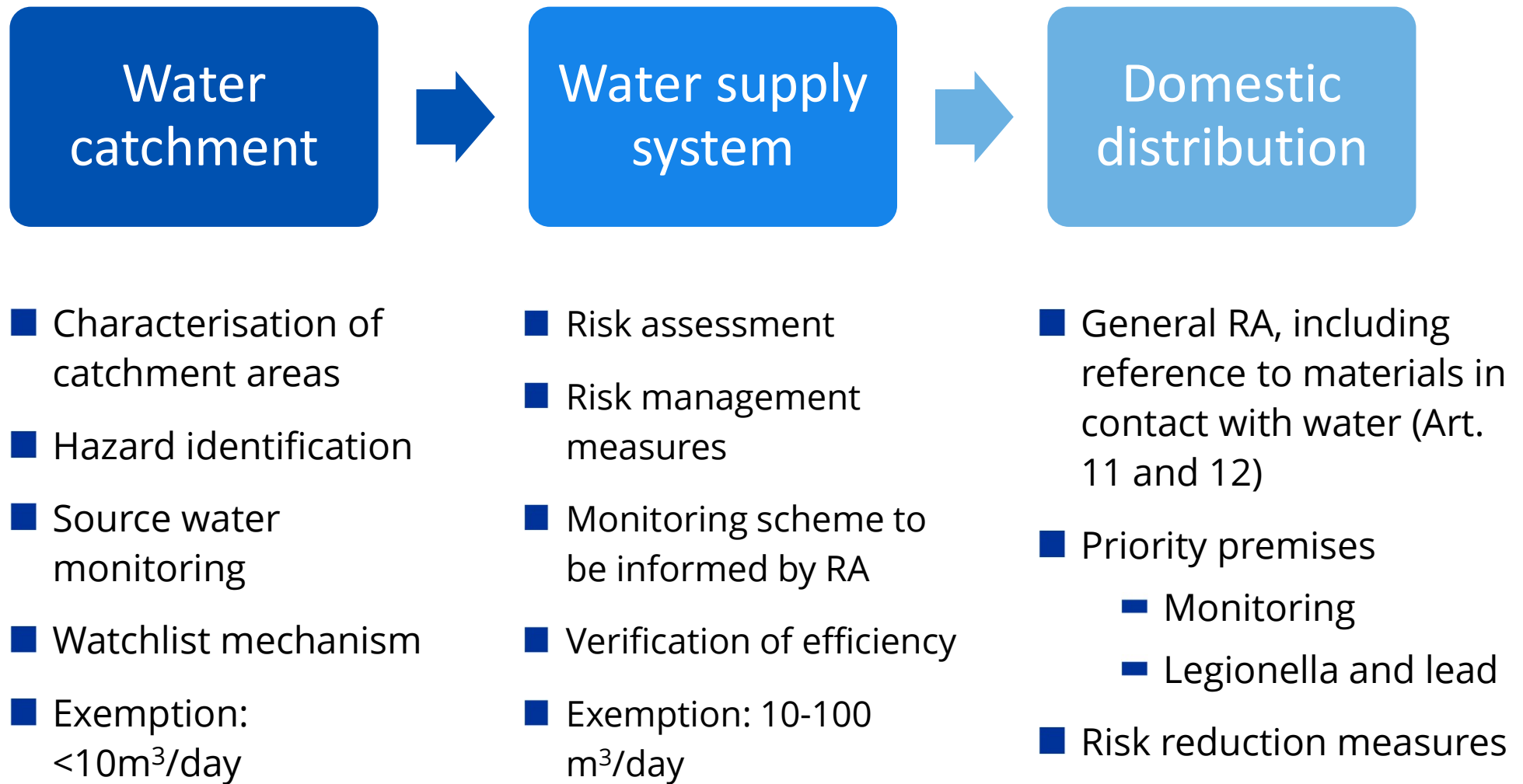
Practical guidance for ADB project officers on systematically integrating WSP development and implementation into the project cycle for projects supporting drinking-water safety.



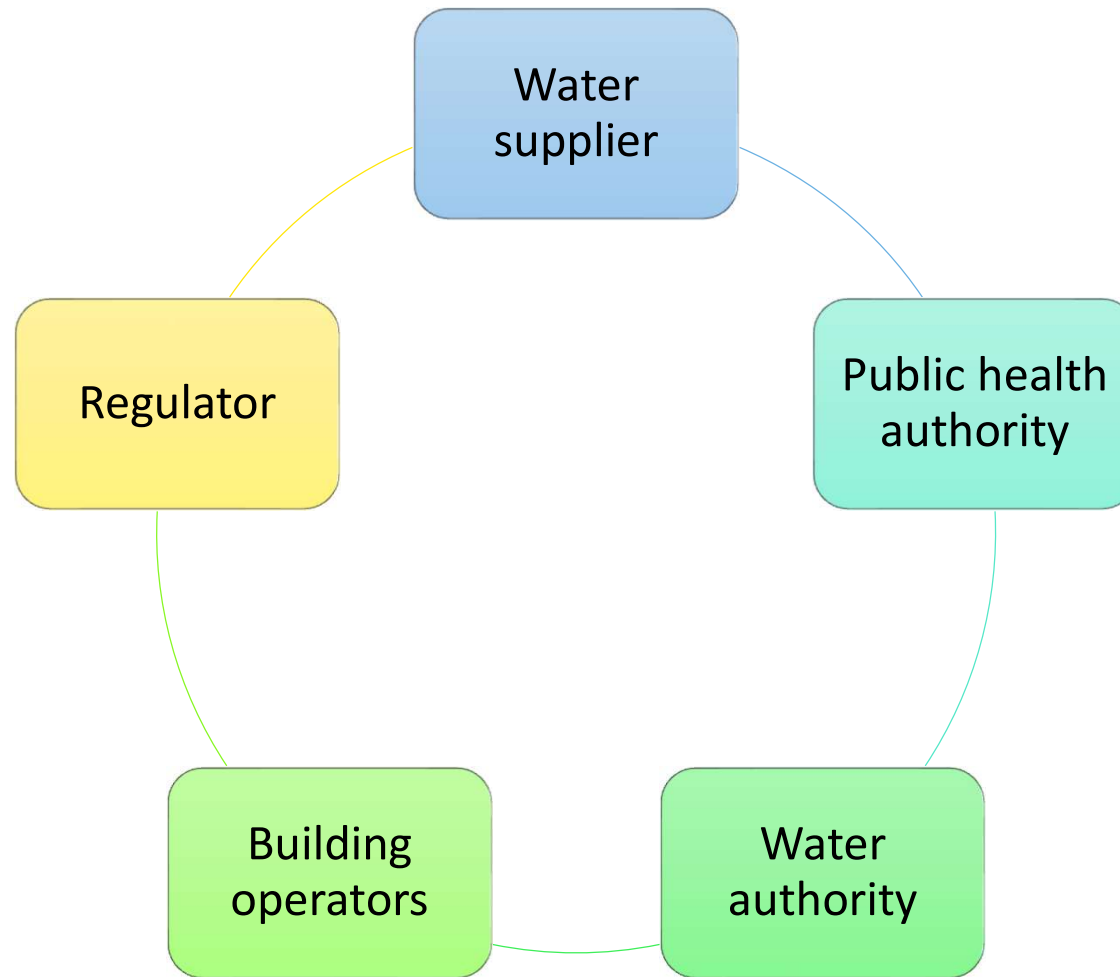
Risk-based approach in the DWD

- Two sources referenced in the recitals
 - WHO Water Safety Plan approach
 - EN 15975-2 Security of drinking water supply – Guidelines for risk and crisis management – Part 2: Risk management
- Article 2 Definitions
 - Definitions of hazard, hazardous event and risk
- Article 3 Exemptions
 - Small water supplies (<10 m³/day) and maritime vessels
- Article 7 Risk-based approach to water safety
- Article 8 Risk assessment and risk management of catchment areas for abstraction points of water intended for human consumption
- Article 9 Risk assessment and risk management of the supply system
- Article 10 Risk assessment of domestic distribution systems (Article 11, 12)
- Article 13 Monitoring
 - Annex I, II – risk assessment implications for monitoring

Risk assessment requirements under the DWD



Roles and responsibilities





Water Safety Planning

Water safety plan (WSP)

Aims to ensure the safety and acceptability of a drinking water supply

Based on hazard analysis and risk assessment at all stages of the water supply chain from source to tap

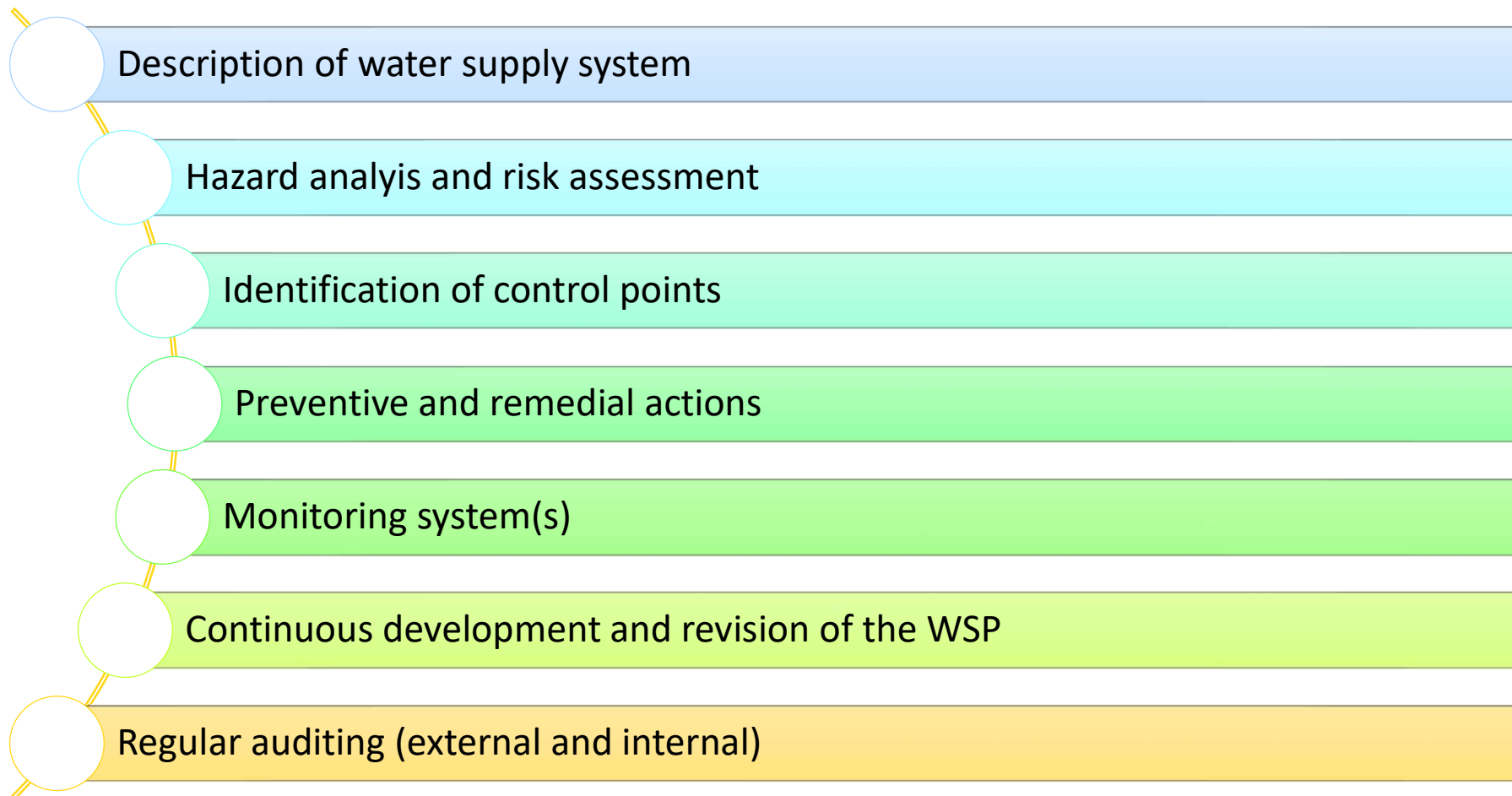
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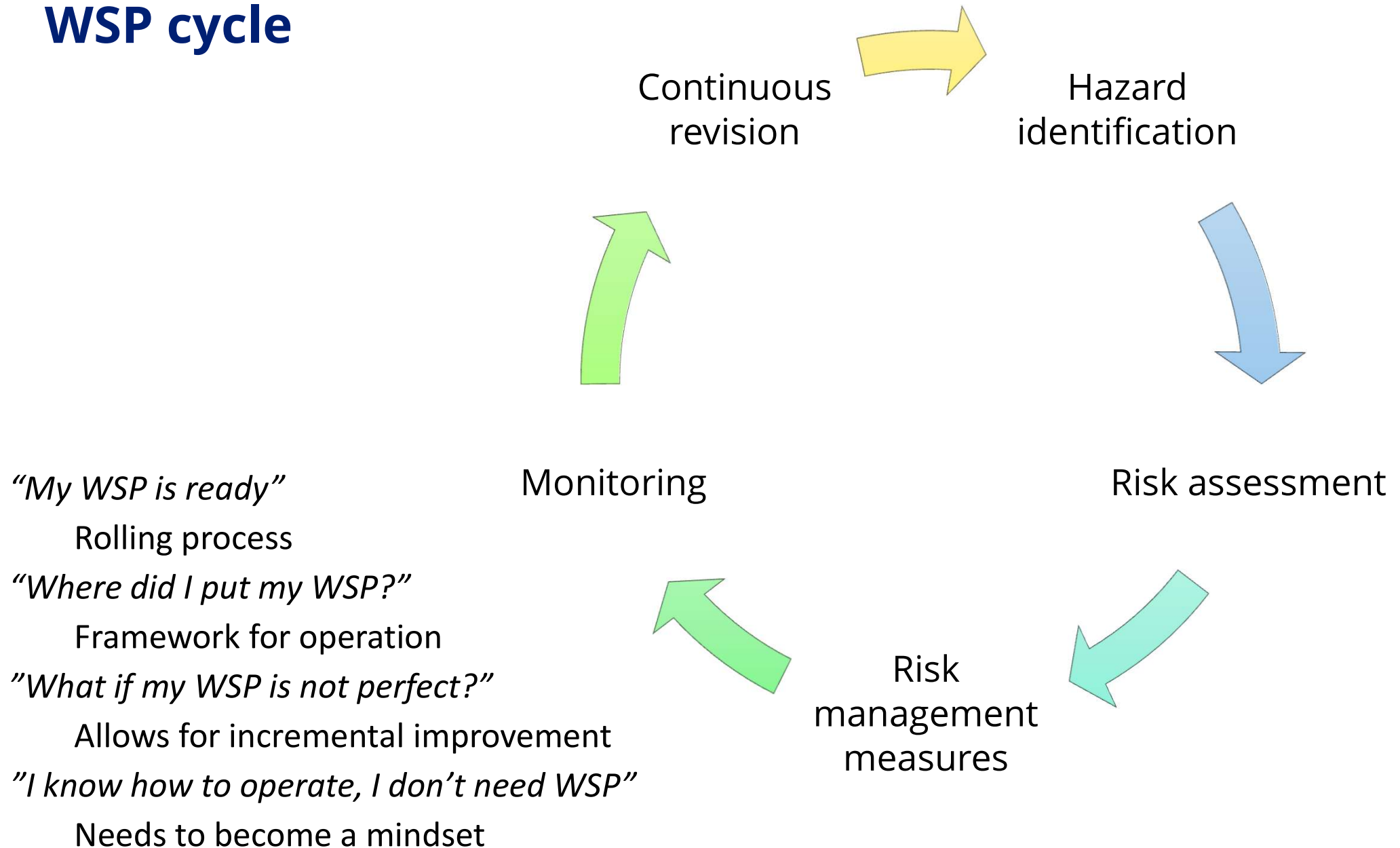
Based on hazard analysis and risk assessment at all stages of the water supply chain from source to tap

WSP is not a document but a way of operation

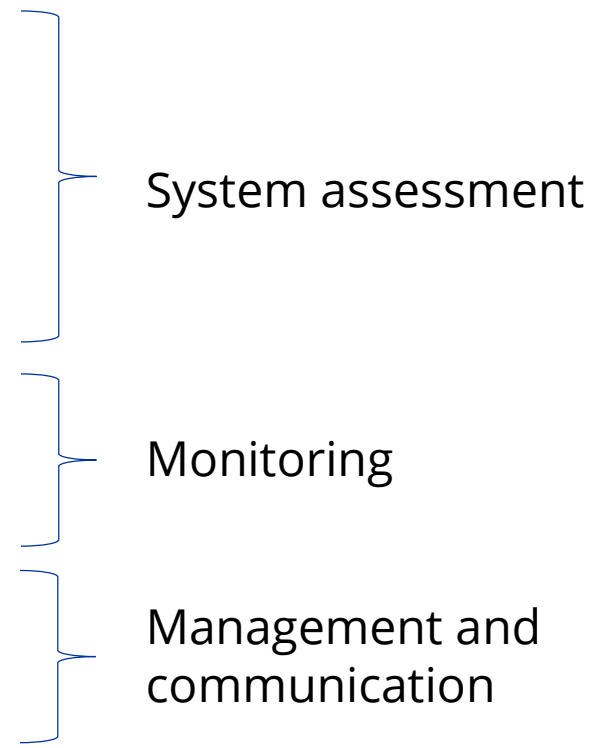
Basic elements of water safety planning



WSP cycle



WSP development steps

1. Assemble the WSP team
 2. Describing the system
 3. Identifying hazards and hazardous events
 4. Validating existing control measures and assessing risks
 5. Planning for improvement
 6. Monitoring control measures
 7. Verifying the effectiveness of water safety planning
 8. Strengthening management procedures
 9. Strengthening WSP supporting programmes
 10. Reviewing and updating the WSP
- 
- The diagram illustrates the grouping of the 10 WSP development steps into three main categories, indicated by blue curly braces on the right side of the list:
- System assessment**: This category includes steps 2, 3, 4, and 5, which are grouped by a single large brace.
 - Monitoring**: This category includes steps 6 and 7, which are grouped by a single large brace.
 - Management and communication**: This category includes steps 8, 9, and 10, which are grouped by a single large brace.

1. Assembling the WSP Team

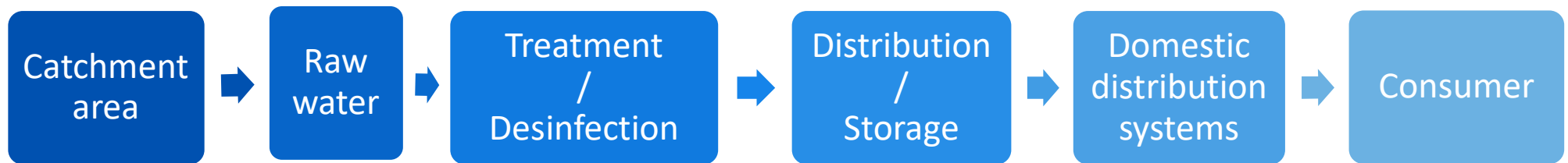
- Multidisciplinary team
 - Senior management
 - Engineers
 - Hygiene specialists,
 - Laboratory
 - Day-to-day operators
 - etc.
- External expert, as needed
 - Hydrogeologist
 - (Risk assessment expert)
 - etc.

1. Assembling the WSP Team

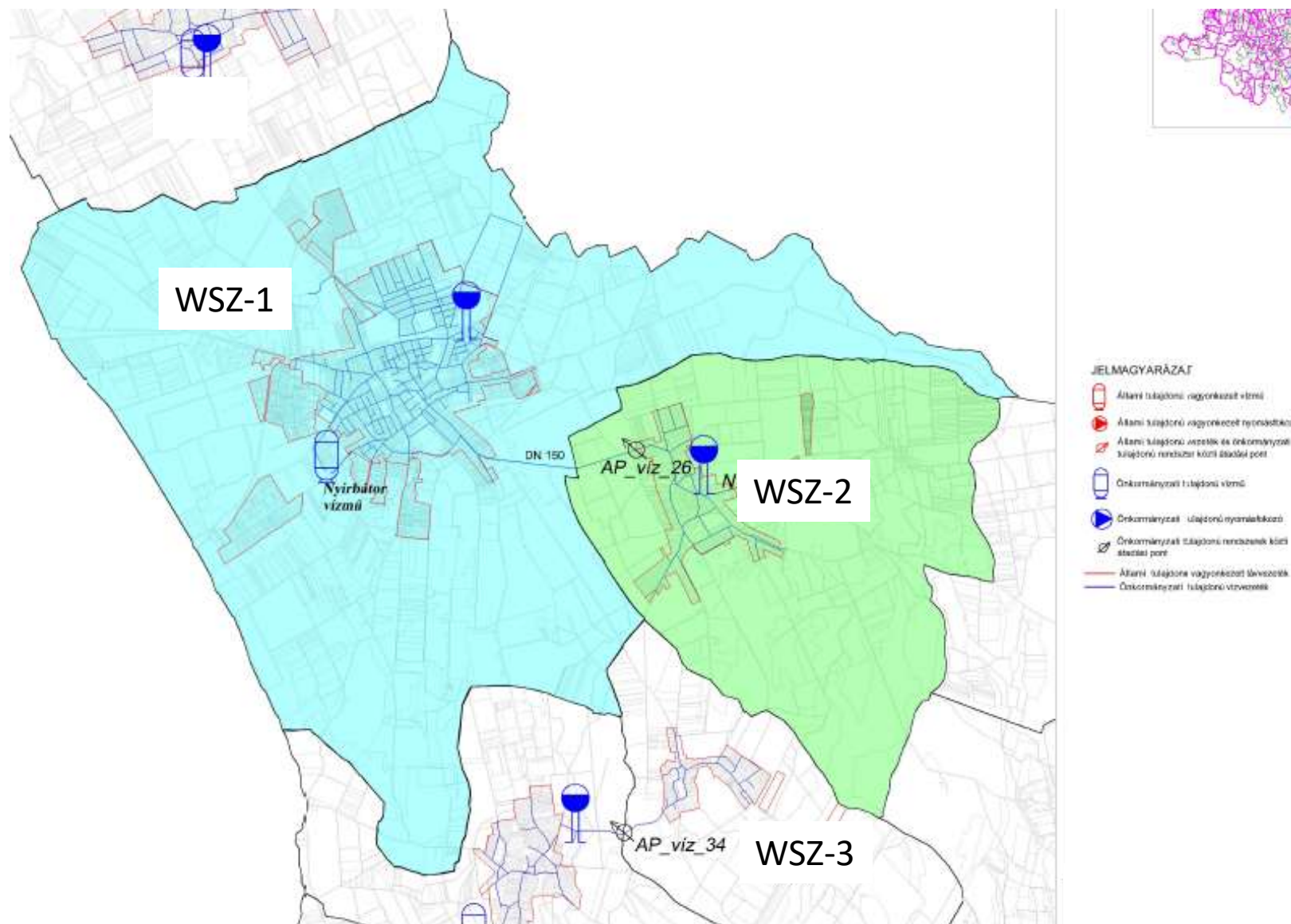
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Water safety planning cannot
be outsourced

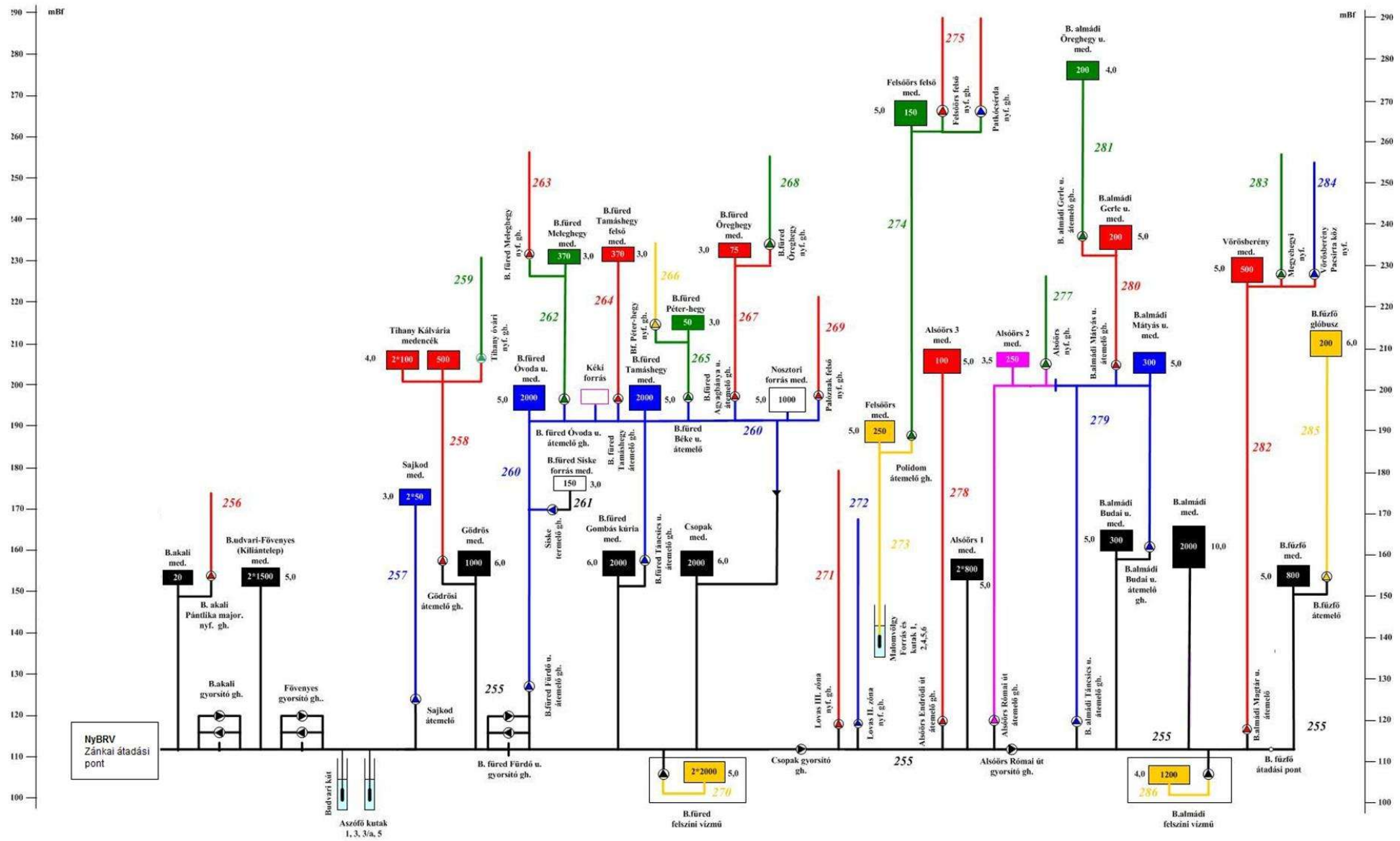
2. Describing the system



System layout



Process description



Hazard analysis and risk assessment

Hazard: a chemical, physical or microbiological agent that can cause harm to public health (eg. arsenic)

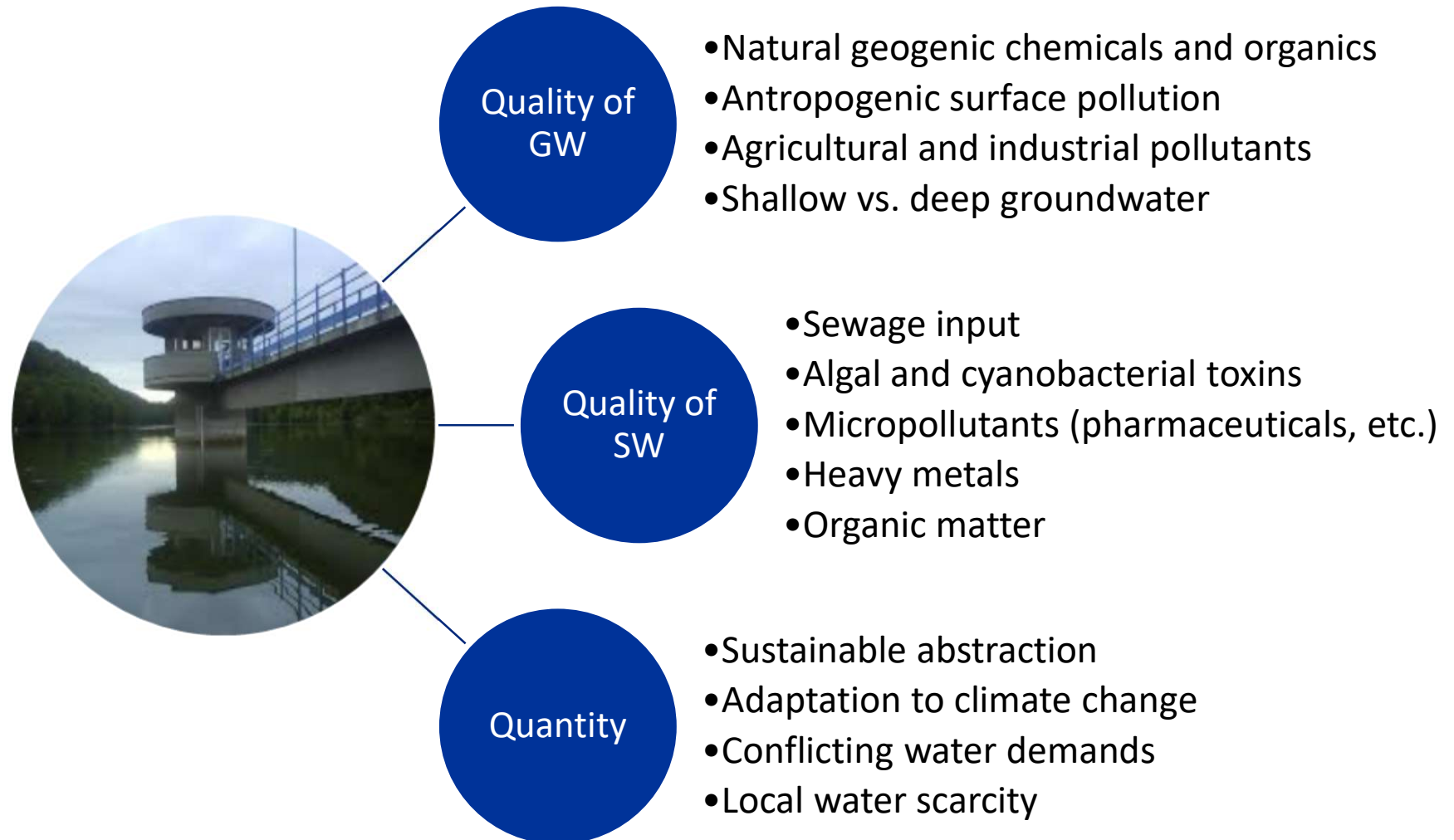
Hazardous event: an event or situation that introduces hazards to, or fails to remove them from, the water supply. (eg. technological failure)

Risk: the likelihood that a hazardous event will occur combined with the severity of its consequences

3. Identification of hazard and hazardous events

- Identify all hazards (from catchment to tap)
- The hazard description must be precise (incorrect: "unhealthy water")
- Type of hazard: biological, radiological, chemical or microbiological
- Hazards of different type and different severity need different assessment, preventive and control measure and intervention
- Frequently overlooked elements: intentional damage, radiological hazards, climate related hazards, equity dimension

Problems related to source waters



Catchment area – in general

- Description of the catchment area (location, name, etc.)
- Climate (floods, inland water, amount of precipitation)
- Activities (livestock, factories, transport, landfill, etc.)
- Regulation (protection zones, etc.)
- Source water monitoring data (WFD)
- Other water uses (irrigation, etc.)



Catchment area – surface water

- Type of water (reservoir, river, lake, etc.)
- Point sources of pollution (sewage discharge, etc.)
- Seasonal variations (quantity/quality)
- Recreational activity (beach, etc.)
- Description of water source protection activities



Catchment area – groundwater

- Water type (bank filtered water, groundwater, karst)
- Sensitivity to land use, surface discharges
- Protection of the aquifer
- Description of water source protection activities
- Seasonal variation (quantity/quality)



Water abstraction

- Number of wells
- Type of well (deep well, spring head, etc.)
- Well characteristics (depth, material, year of construction/renovation, etc.)
- Technical condition (in need of renovation, adequate, etc.)
- Operating practice (continuous, alternating, what rate, under what conditions, etc.)
- Quality and temperature of the extracted raw water
- Protected area designation



Typical hazards - catchment area and abstraction

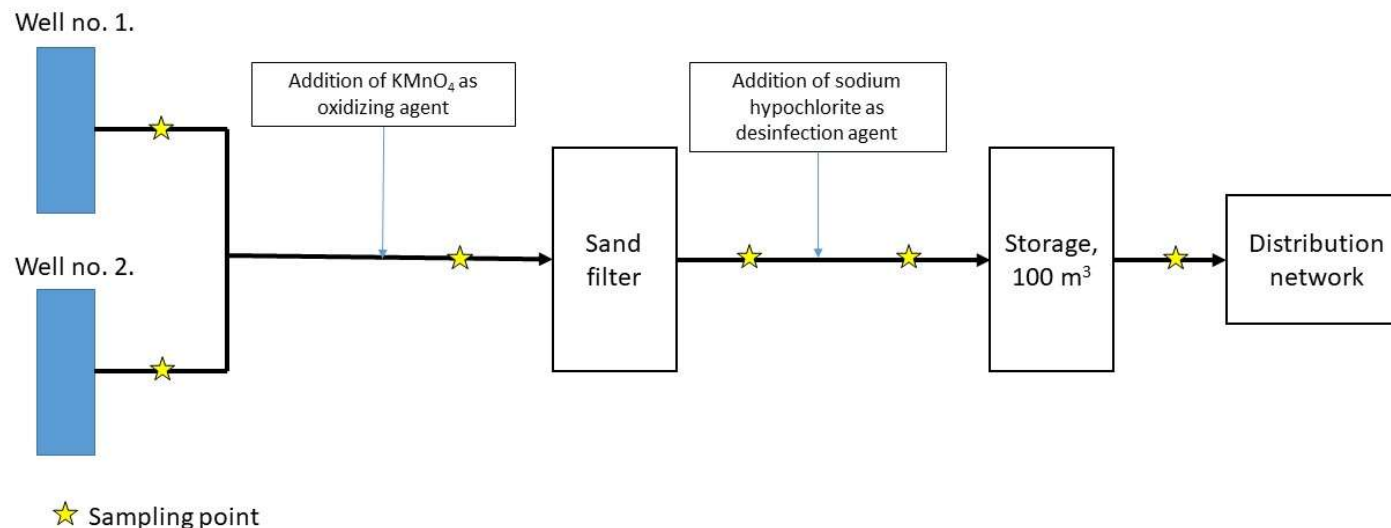
- Water quality degradation due to extreme weather conditions, well contamination (e.g. flooding, precipitation entering wells)
- Water shortage due to extreme weather (drought) or failure of a water intake
- Accidental pollution (e.g. agricultural activity, road traffic, shipping accident in the case of a surface water aquifer)
- Groundwater pollution (e.g. agricultural, industrial activity)
- Risks due to water composition and temperature (e.g. high arsenic or nitrate concentration, $>20\text{ }^{\circ}\text{C}$)
- Intentional pollution

Water treatment



Water treatment

- Water treatment aims to reduce source water related risks
- May introduce new hazards (e.g. disinfection by-products)
- Highly dependent on source water quality
- Detailed step-by-step description (flowchart)
- Disinfection (chemicals, concentrations)
- Intermittent or periodic water treatment (e.g. summer only)

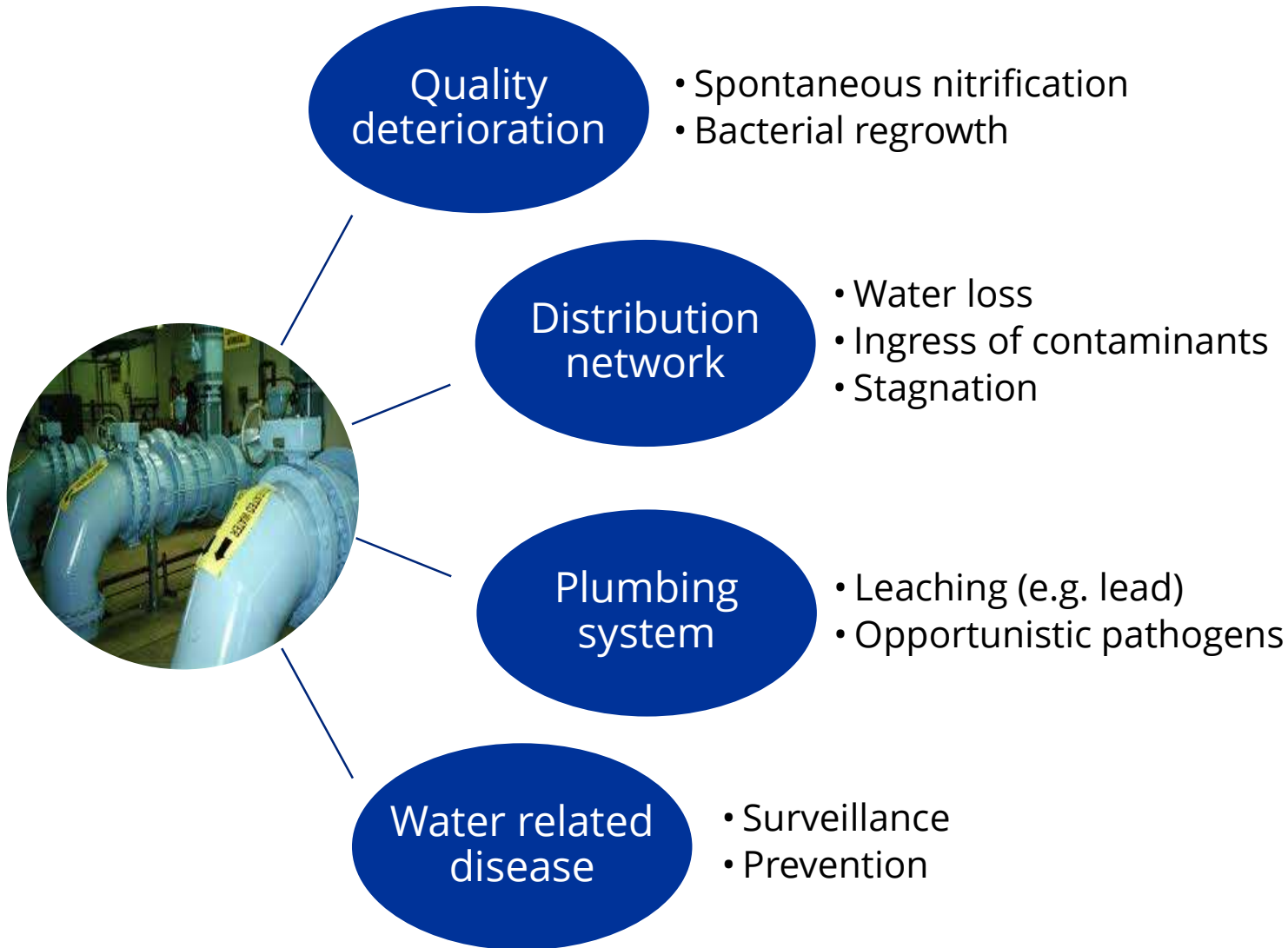


Typical hazards - treatment

- Suboptimal removal efficiency
- Equipment failure (over- or under-dosing of chemicals)
- Underdosing of disinfectant
- Disinfection by-products (e.g. THM, AOX, haloacetic acids)
- Natural disasters, energy failures (e.g. well failure)
- Intentional damage
-



Distribution and storage



Storage

- Before, during and after treatment at the water treatment plant
- In distribution
- Characterisation of reservoirs (size, capacity, construction, location, construction material, residence time, management techniques, etc.)
- Protection against human or animal interference (fence, netting, protection against precipitation, etc.)

Distribution

- Description of the water network (material, length, type, technical condition, etc.)
- Pressure and flow conditions, residence time
- General characteristics of the water distribution system (frequency of pipe bursts, fouling, microbiological growth)
- Mixing of different waters (e.g. water of different quality from different water sources and/or produced in different water treatment plants)
- Network installations

Typical hazards - storage

- Structural failure (e.g. microbiological problems/insect larvae due to holes in mosquito net/wall)
- Leaching from structural materials
- Deposits, biofilm formation (e.g.: due to inadequate cleaning technology or operation)
- Deterioration due to prolonged stagnation (e.g. nitrification, microbiological problems)
- Pressure and water quantity problems due to power failure (e.g.: failure to refill a high reservoir)
- Intentional damage



Typical hazards - distribution



- Damage or failure of the network (e.g. burst pipe)
- Network repair (e.g.: contaminated water, soil ingress)
- Leaching from structural materials
- Deposition, microbiological growth, biofilm formation (e.g.: corrosion, due to inadequate cleaning technology or operation)
- Nitrification in the distribution network
- Stagnant or rarely used sections
- Illegal connections (backflow of contaminated water from the consumer to the network)

Consumers

- Usually limited information available to the suppliers
- Number of consumers
- Sensitive consumers (eg. hospital)
- Material and condition of connection pipes
- Internal network (if/as far as known)

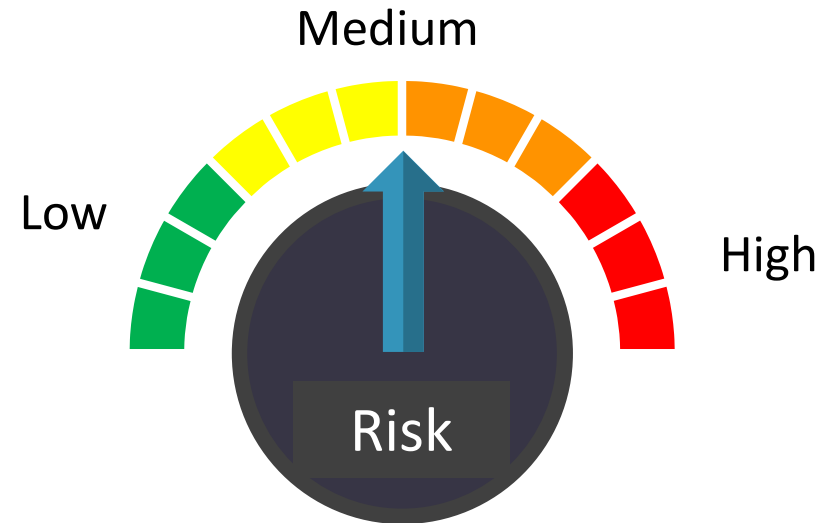
Typical hazards

- Ingress of contaminated water
 - illegal connection of a private well to a public water network)
- Leaching
 - from pipes, fittings, taps, home water treatment devices
- Water quality deterioration in domestic systems
 - microbiological and chemical water quality deterioration in stagnant water and/or in home water treatment devices)

(We will come to this later)

4. Risk assessment

- Quantitation of the risk
- Typical questions:
 - What is the highest risk?
 - Are the current barriers sufficient?
 - What additional measures are needed
- Various methodologies
- Semi-quantitative
- Methodology should be described in the WSP



$\text{Risk} = \text{severity} \times \text{frequency of hazards}$

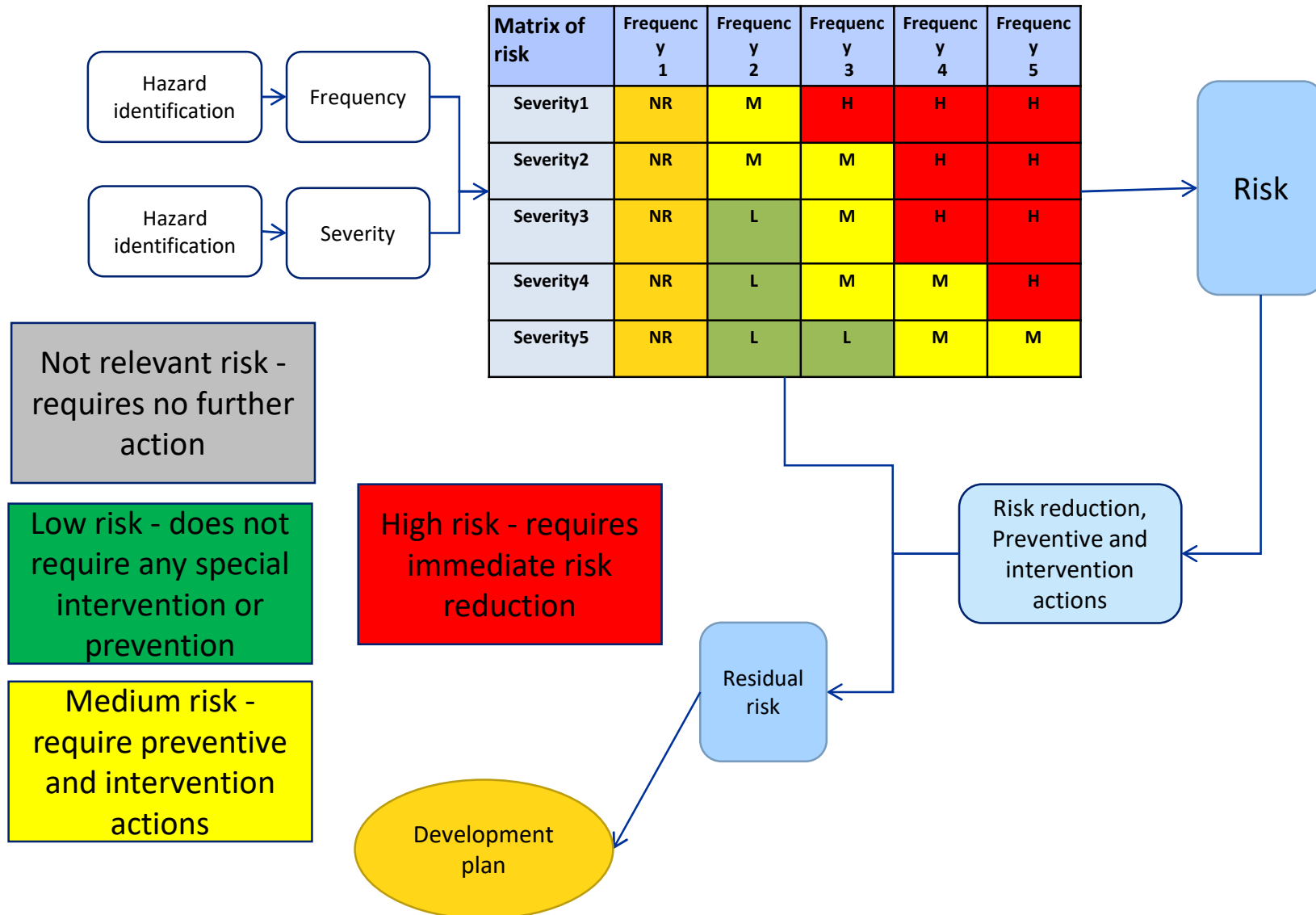
Risk assessment – risk matrix

Severity 1: may cause death
Severity 2: can cause serious damage to health
Severity 3: may cause temporary damage to health
Severity 4: harmless to health
Severity 5: insignificant

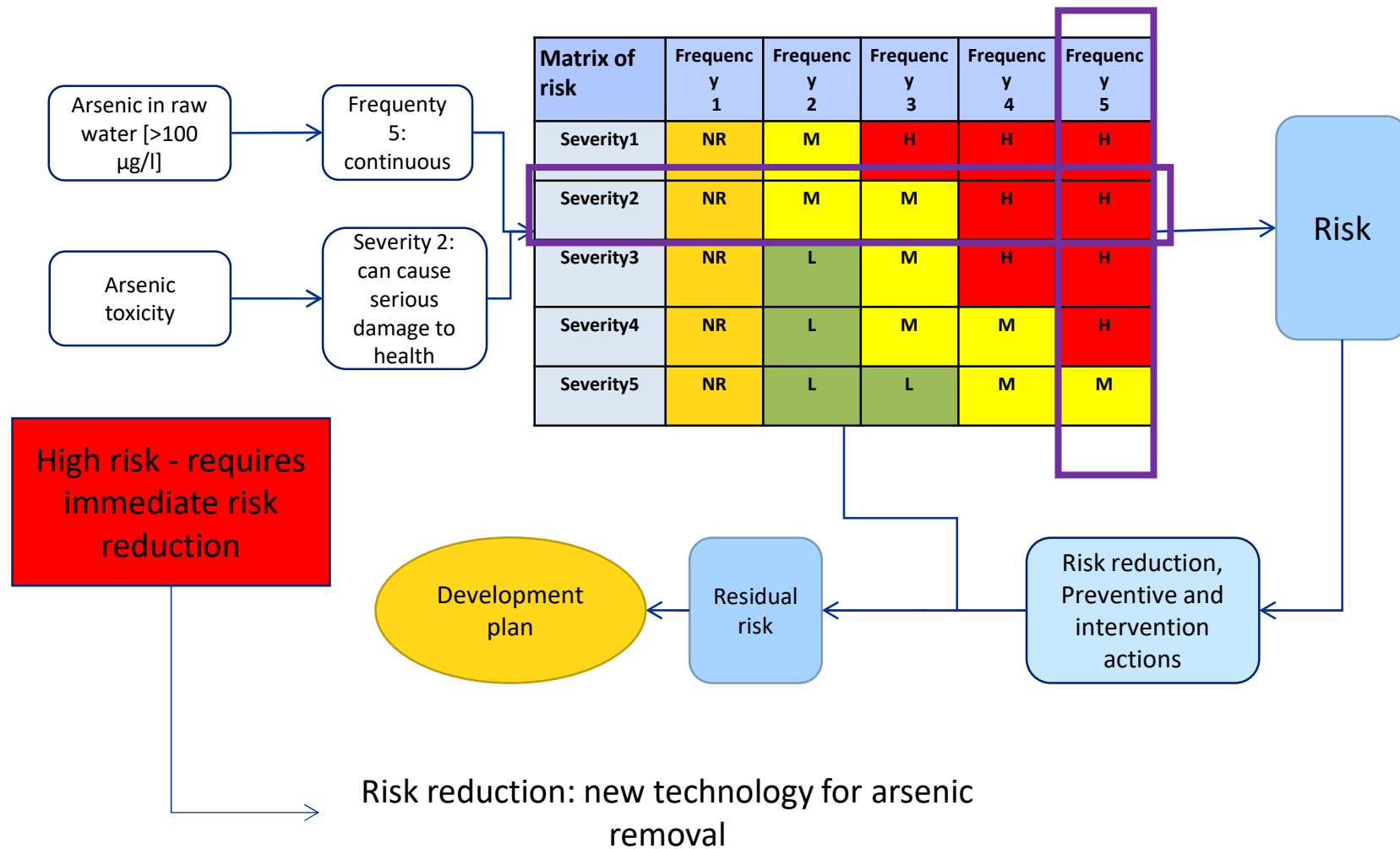
Frequency 1: not relevant
Frequency 2: in every 5 years
Frequency 3: in every year
Frequency 4: in every month
Frequency 5: continuous

	S1	S2	S3	S4	S5
F1					
F2					
F3					
F4					
F5					

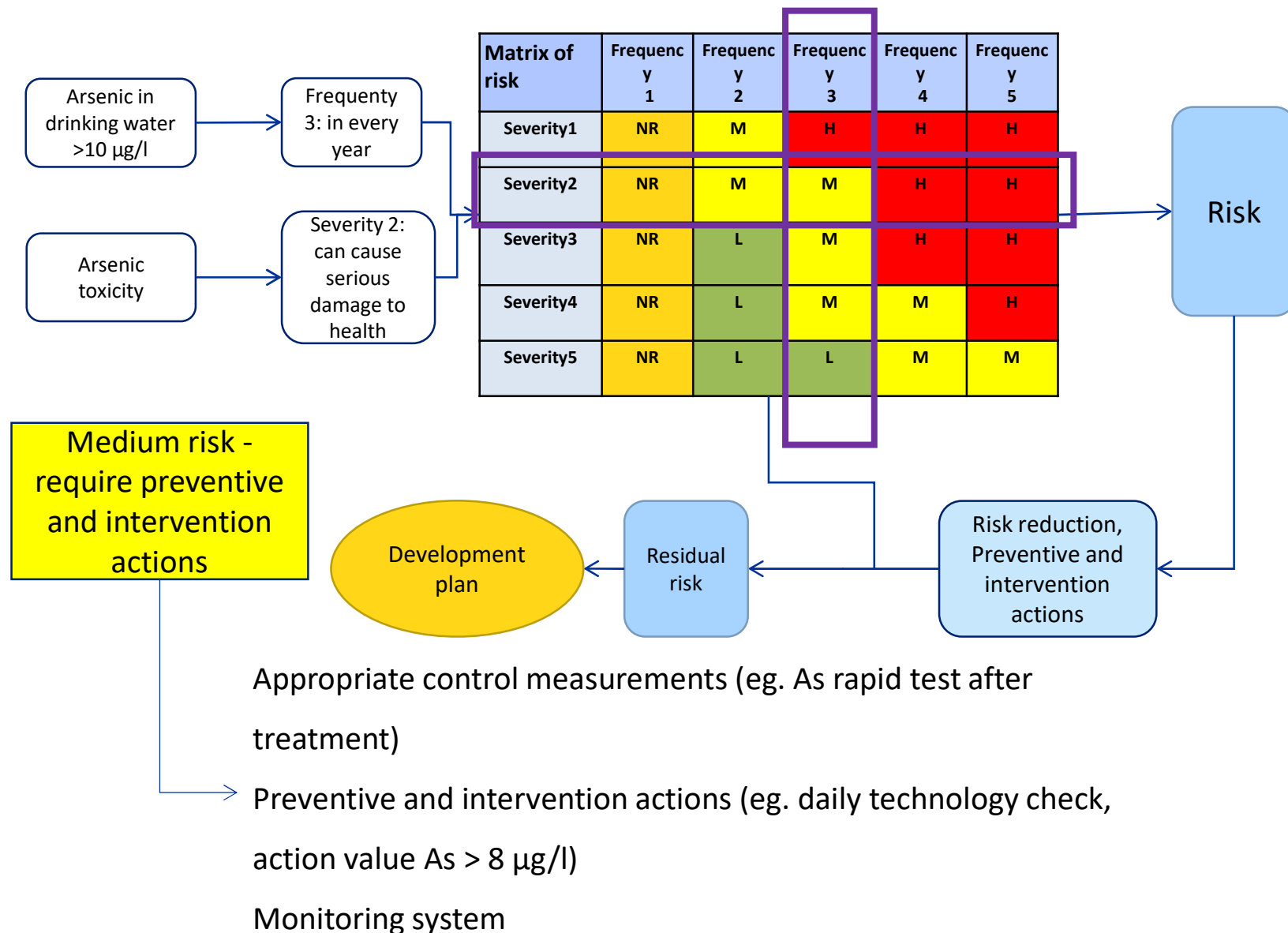
Risk assessment



Risk assessment - example



Risk assessment - example



5. Planning improvements

- Ideally, highest risk first
- ...but also “low hangingfruit”
- Immediate, medium and long-term interventions
- Includes preventive and mitigation measures

Catchment – preventive and mitigation measures

- Preventing contamination of the source water
- Delineation of protection zones
- Regulation, restrictions (land use, access, discharge, etc.)
- Monitoring and assessment of point sources of pollution (e.g. monitoring wells)
- Intervention values (based on raw water quality)

Treatment – preventive and mitigation measures

- Installation of new technology
- Optimisation of existing processes
- Use of approved chemicals and materials
- Checking the quality of chemicals
- Operation of an appropriate failure notification system
- Action values

Distribution and storage – preventive and mitigation measures

- Continuous control and maintenance of the integrity of structures (pipes, reservoirs)
- Physical protection (e.g.: fencing, mosquito nets)
- Use of approved materials in contact with water
- Minimize time of stagnation
- Measurement of water volume/pressure
- Avoiding sudden changes in the operation of the network (e.g.: gradual increase in water pressure)
- Develop SOPs for repairs and maintenance
- Establishment of network disinfection procedures
- Disinfectant residue measurement

Consumers

- Optimisation of water treatment to minimise leaching
- Control of consumer systems, backflow prevention devices (non-return valves, etc.)
- Continuous monitoring of parameters affecting leaching (e.g. temperature, pH, conductivity, phosphate content, TOC)
- Research and survey of consumer habits
- Awareness campaign, information (high priority)

Example: catchment derived hazard

- **Identified risk:** intentional pollution, introduction of foreign chemical substance into the source water
- **Preventive action:** protection of the wells and the well area
- **Control:** visual inspection of wells daily, camera and security system
- **Responsible:** operator
- **Place of documentation:** logbook
- **Action value:** signs of unauthorised access
- **Intervention:** emergency sampling / well closure
- **Remediation:** well closure until the removal of the contamination

Example: treatment related hazard

- **Identified hazard:** High arsenic concentration in Well1
- **Preventive action:** Operation of arsenic removal technology
- **Control:** Check arsenic in water after filter by rapid test daily (operational monitoring)
- **Responsible:** technologist
- **Place of documentation:** data logbook
- **Action value:** As > 8 µg/l
- **Intervention:** immediate intervention - operation of Well2
- **Remediation:** check chemical dosing, wash/replace filter

Example – storage related hazard

- **Identified risk:** nitrification in the main storage tank due to an ammonium content of 0.2 mg/l in the finished water
- **Preventive action:** minimize stagnation time
- **Monitoring:** measurement of nitrite concentration by rapid test every week
- **Responsible:** technologist
- **Place of documentation:** data logbook
- **Action value:** nitrite > 0.40 mg/l
- **Intervention:** reduce storage time

Monitoring

6. Monitoring control measures

7. Verifying the effectiveness of water safety planning

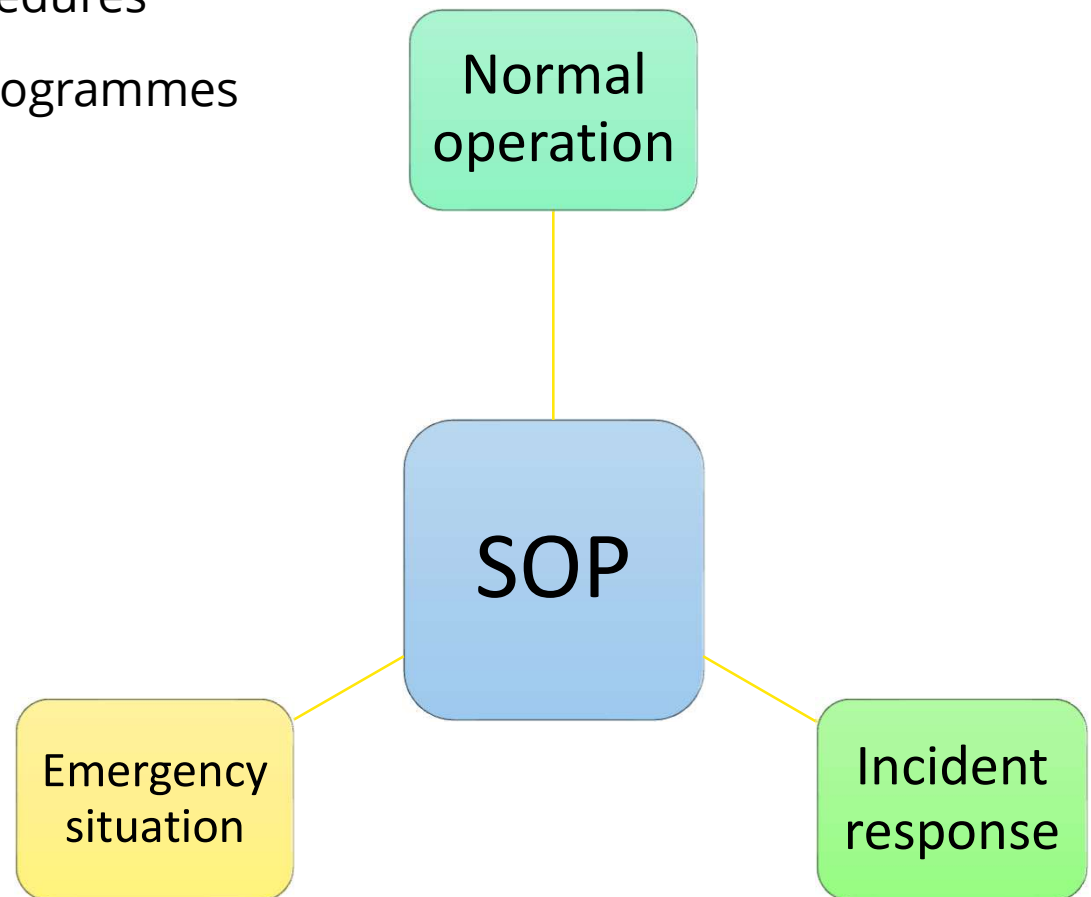
- What, where, when
- Compliance monitoring, trend analysis
- On-site or on-line measurement, laboratory measurement, visual inspection
- Control points, parameters, inspection frequency
- Action values
 - Precautionary principle
 - Can vary with the monitored process
- Verification also includes
 - Consumer satisfaction
 - Auditing (internal/external)



Management and communication

1. Strengthening management procedures
2. Strengthening WSP supporting programmes

- Standard operational procedures
- Roles and responsibilities
- Documentation
- Communication channels
- Practicable and available

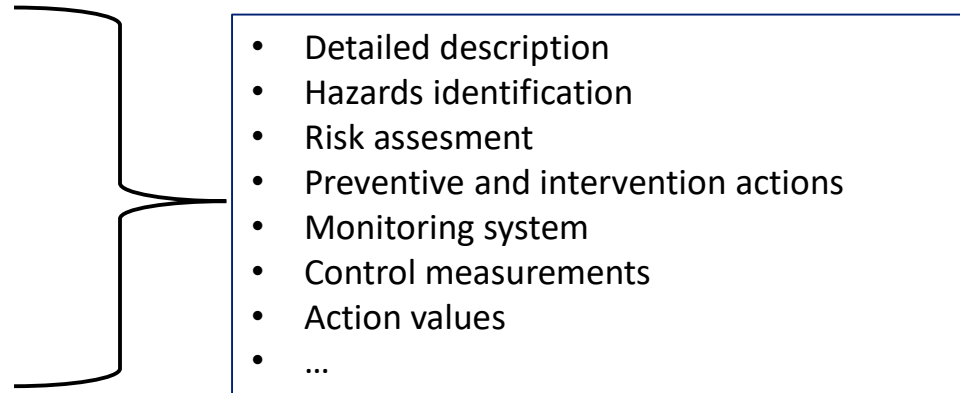


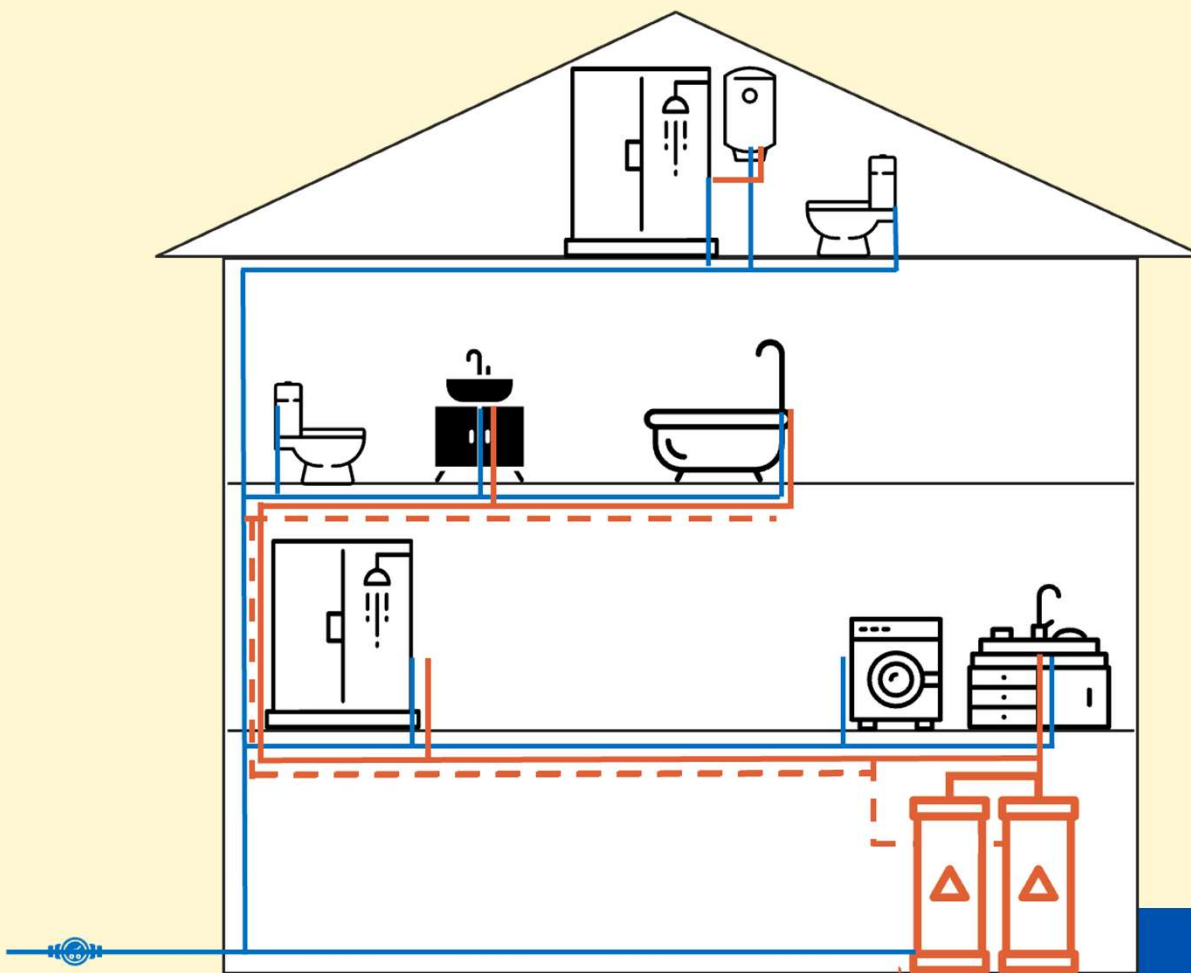
10. Reviewing and updating the WSP

- Integral part of WSP
- Can be informed by:
 - Outcomes of the internal/external audit
 - Incidents or „near-misses“
 - Consumer complaints
 - Analysis of monitoring data
 -
- Revision is necessary even if there is no perceived change
 - E.g. once a year
- Immediate revision in case of severe incidents

Summary – WSP contents

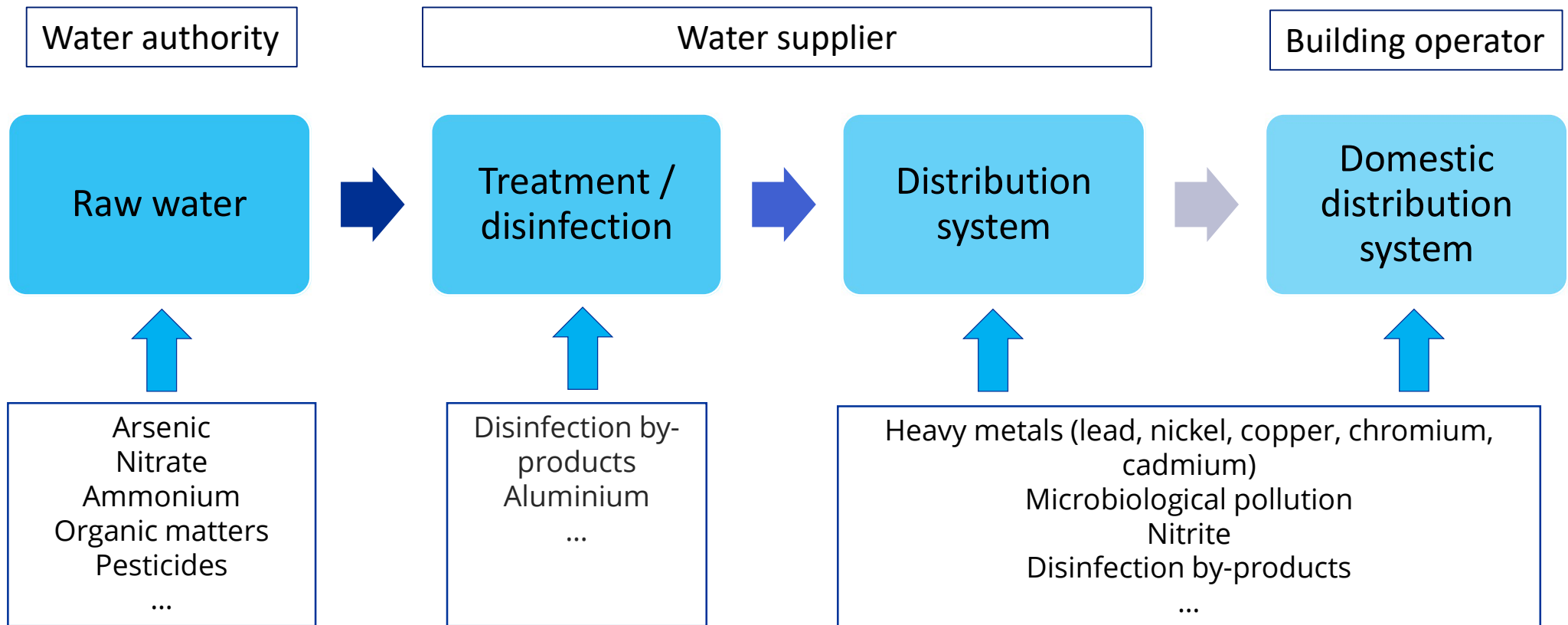
- WSP Team
- Catchment area
- Raw water
- Treatment/desinfection
- Distribution and storage
- Domestic distribution system and consumers
- Flowchart of operation
- Development and upgrade plans
- Metodology of risk assesment



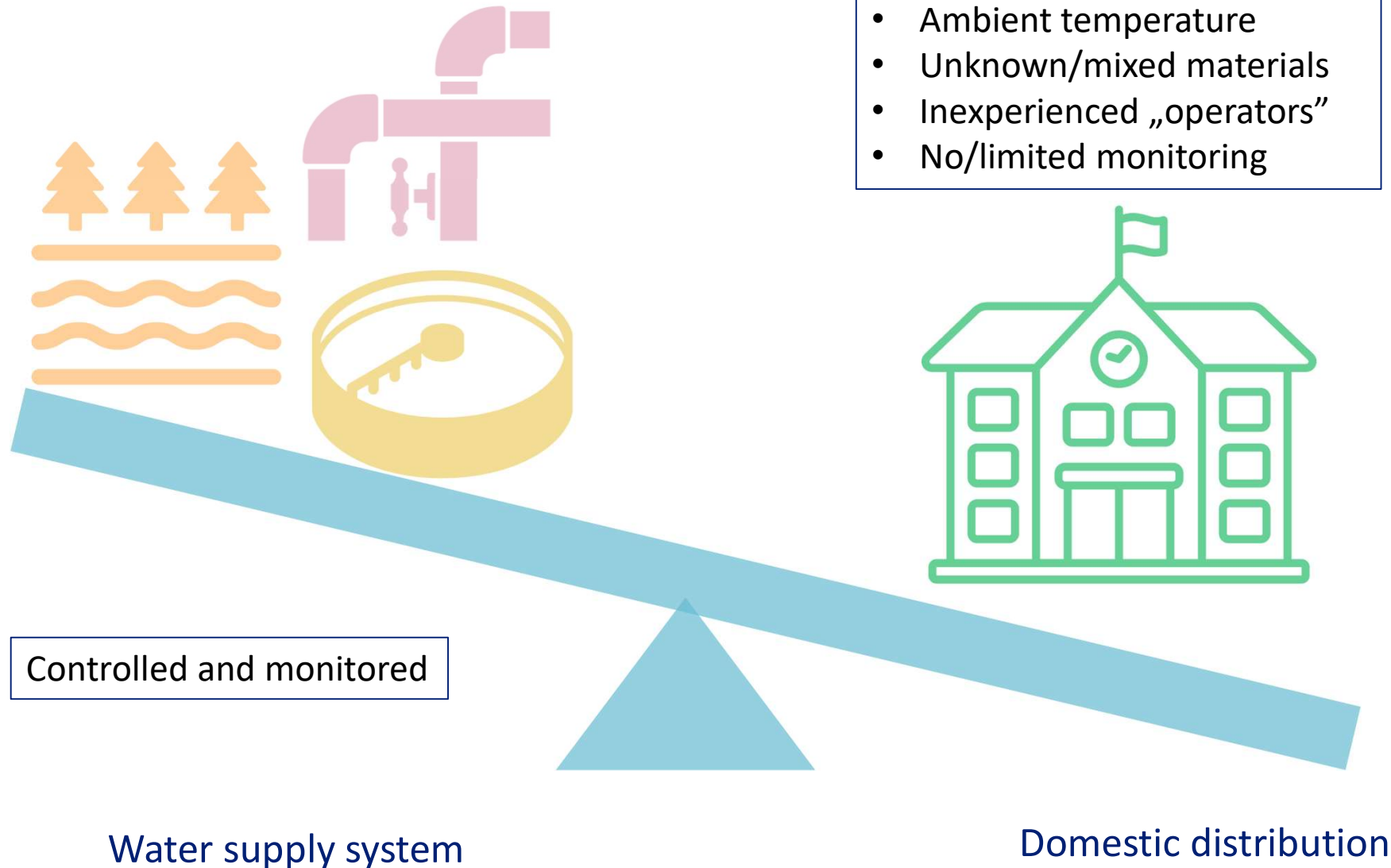


Domestic distribution systems

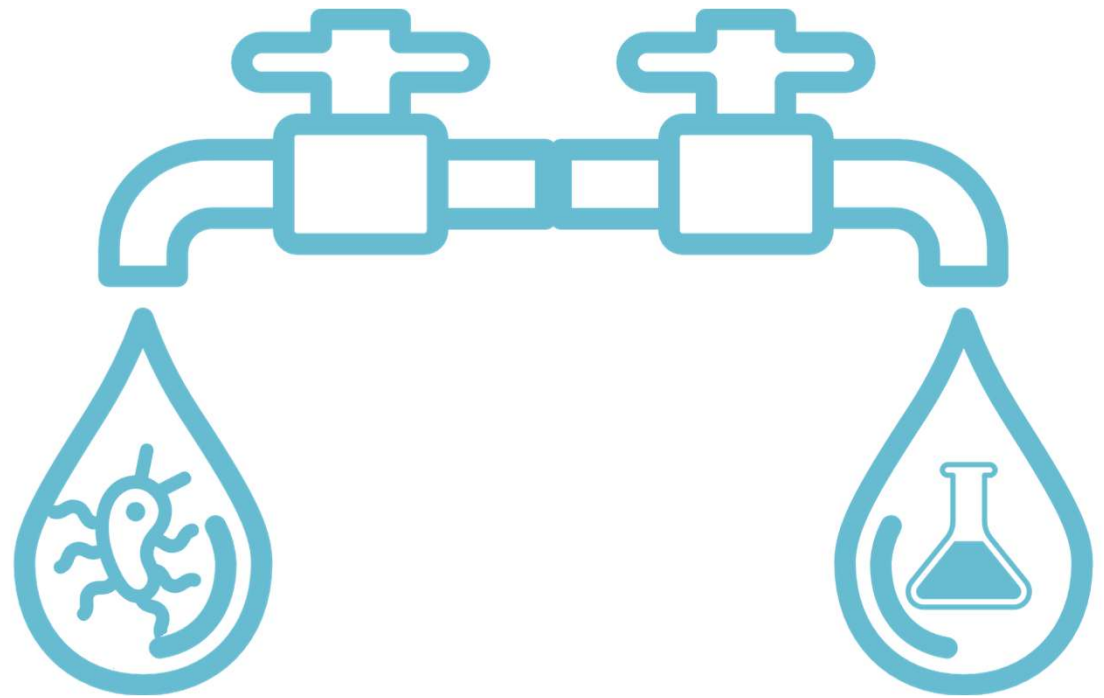
Sources of pollution



Domestic distribution systems



Risks in domestic distribution systems



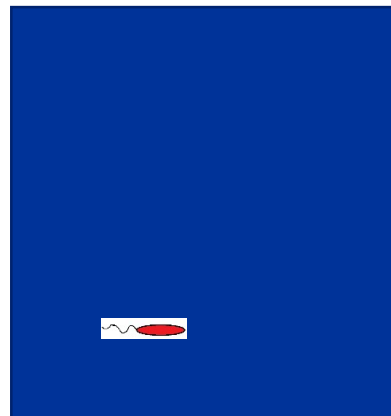
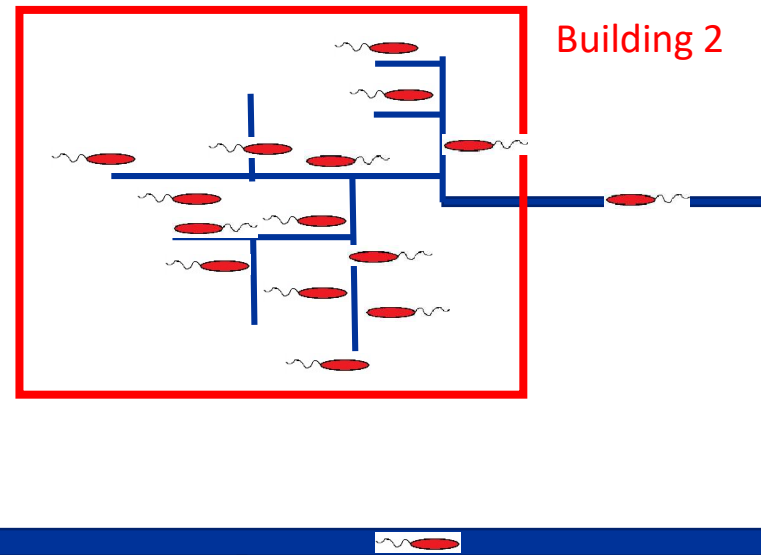
Microbial hazards

Chemical hazards

Microbial regrowth in the water network

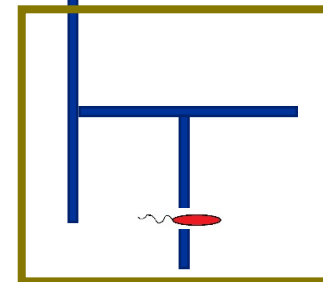
Poorly operated water systems

- Inadequate temperature
- Unused network segments
- Not certified materials
- Bacterial growth starts immediately



Water quality in the mains distribution system

- Low total bacterial count
- Pathogenic bacteria not detectable

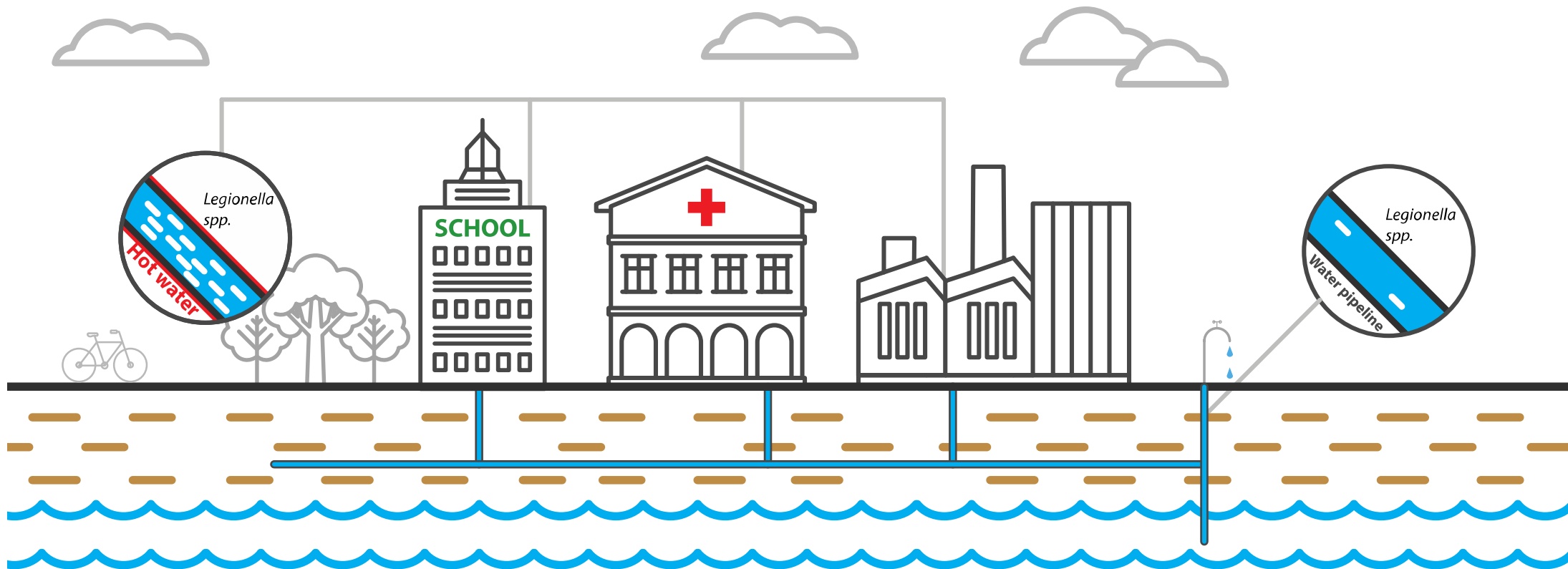


Well-operated water system:

- Microbial counts below risk levels

Legionella as an indicator of microbial regrowth

- Legislation focuses on priority buildings
 - In the context of *Legionella*, primarily healthcare facilities and accommodation sites
- Parametric value 1000 CFU/L
- Monitored at the highest risk point (**not** in the supplied water)



Chemical hazards in domestic distribution systems



Heavy metals	Nitrite	Organic pollutants	Disinfectant residues
Lead		Benz(a)pyrene (PAHs)	Chlorine
Nickel		Styrene	Disinfection by-products
Copper		Vinyl-chloride	
Cadmium			

Primary concern: lead

- Highest burden of disease
- Prevalence of lead pipes in old buildings
- No safe concentration
- Reduction of exposure requires coordinated action



DWD regulatory requirements for lead

12 January 2023

PV in product
approval:
5 µg/l

Target value:
5 µg/l

12 January 2029

Risk assessment for
lead in DW in
priority buildings

12 January 2036

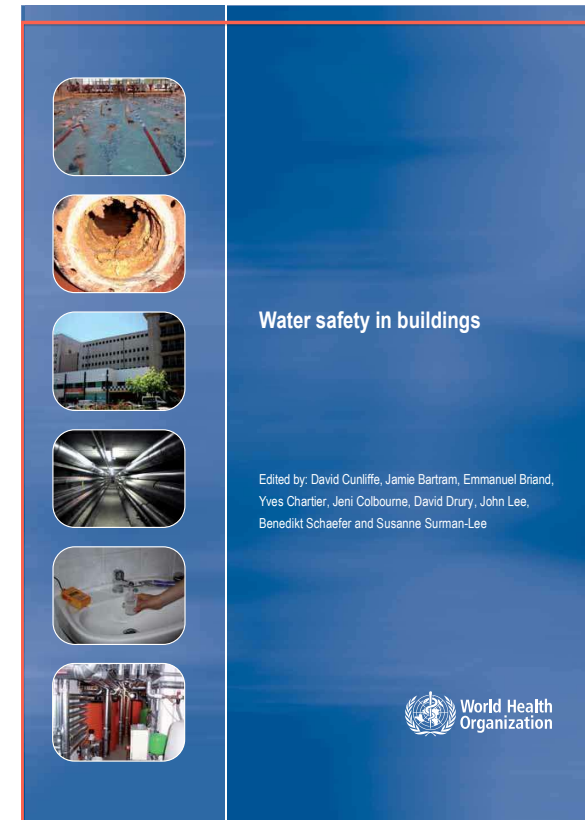
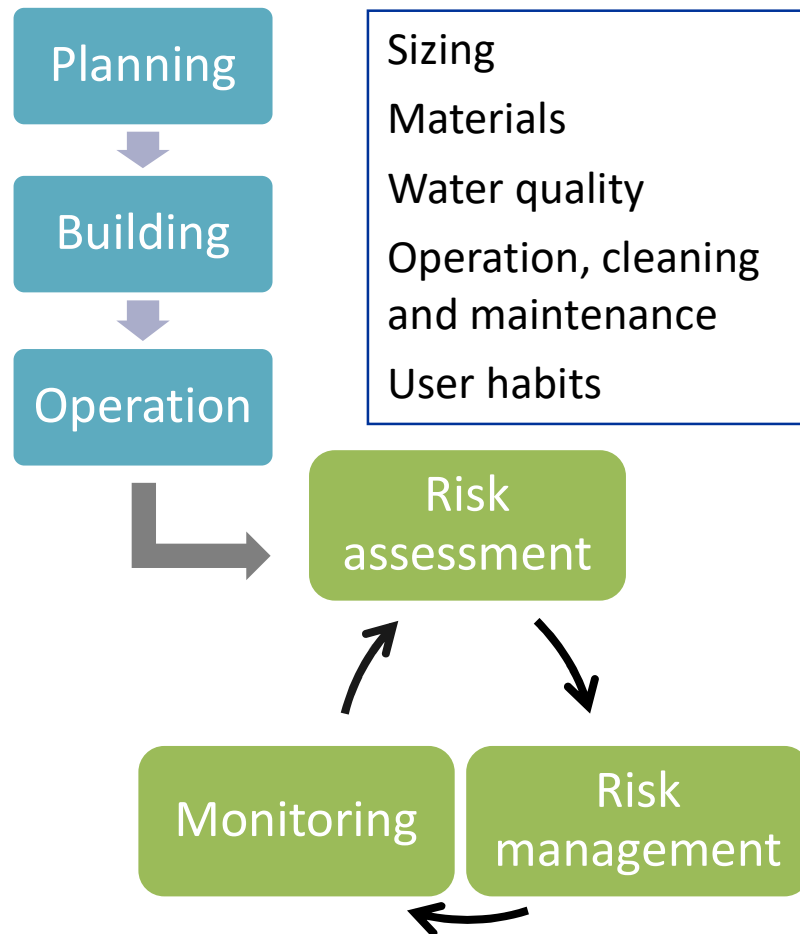
PV in DW entering the
building: 5 µg/l

PV in DW in priority
buildings: 5 µg/l

PV in new or
reconstructed
buildings: 5 µg/l

Priority buildings in the context of lead: schools, kindergardens and other childcare facilities

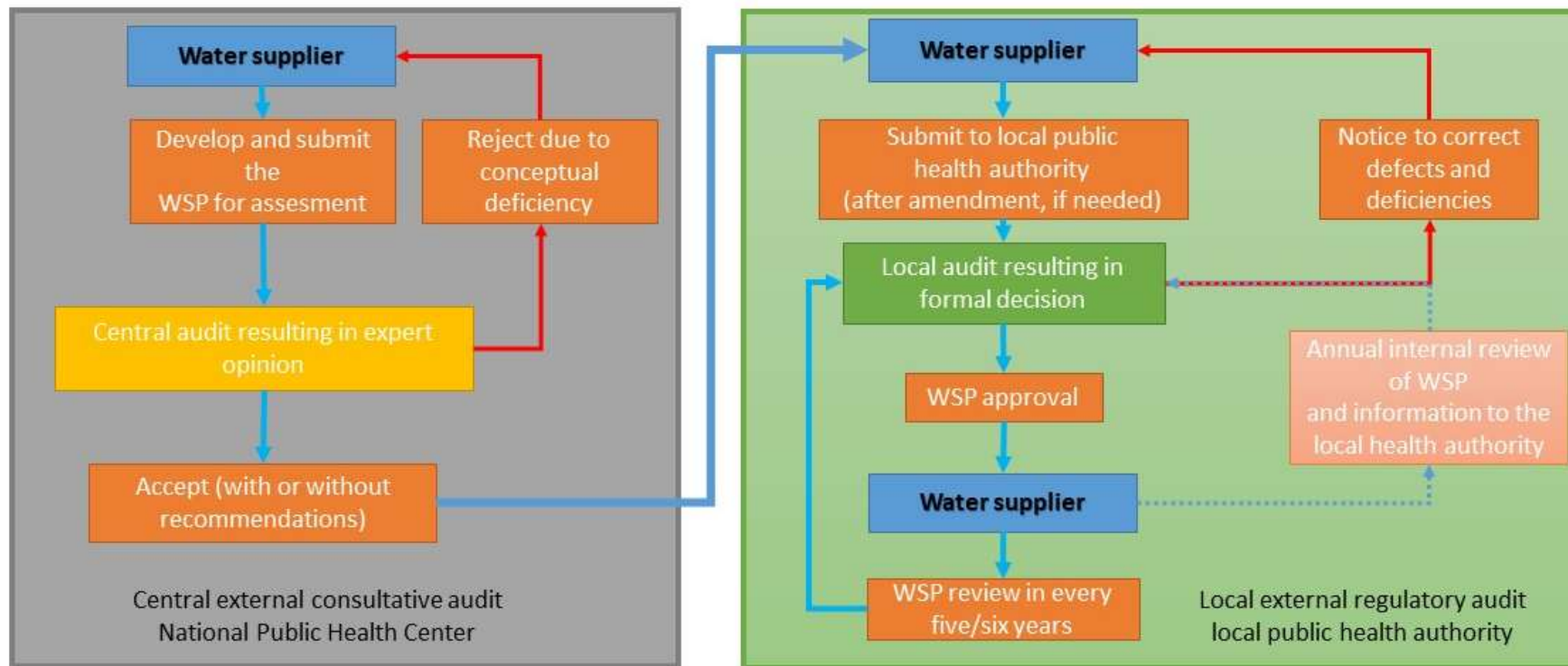
Risk prevention and mitigation in domestic distribution systems



Risk mitigation in domestic distribution systems is a complex task

Public health	Water supplier	Architects, builders and plumbers	Building operators	Users
<ul style="list-style-type: none">• General risk assessment• Guidelines for building risk assessment and safe operation• Trainings	<ul style="list-style-type: none">• Water quality to prevent deterioration• Non-aggressive• Biologically stable	<ul style="list-style-type: none">• Well-designed systems• Certified materials• Easy-to-clean design• Trainings	<ul style="list-style-type: none">• Best practices of operation• Cleaning and maintenance• Monitoring (priority buildings)	<ul style="list-style-type: none">• Awareness of risks• Good user practices• Avoiding cross-connection• POU/POE devices

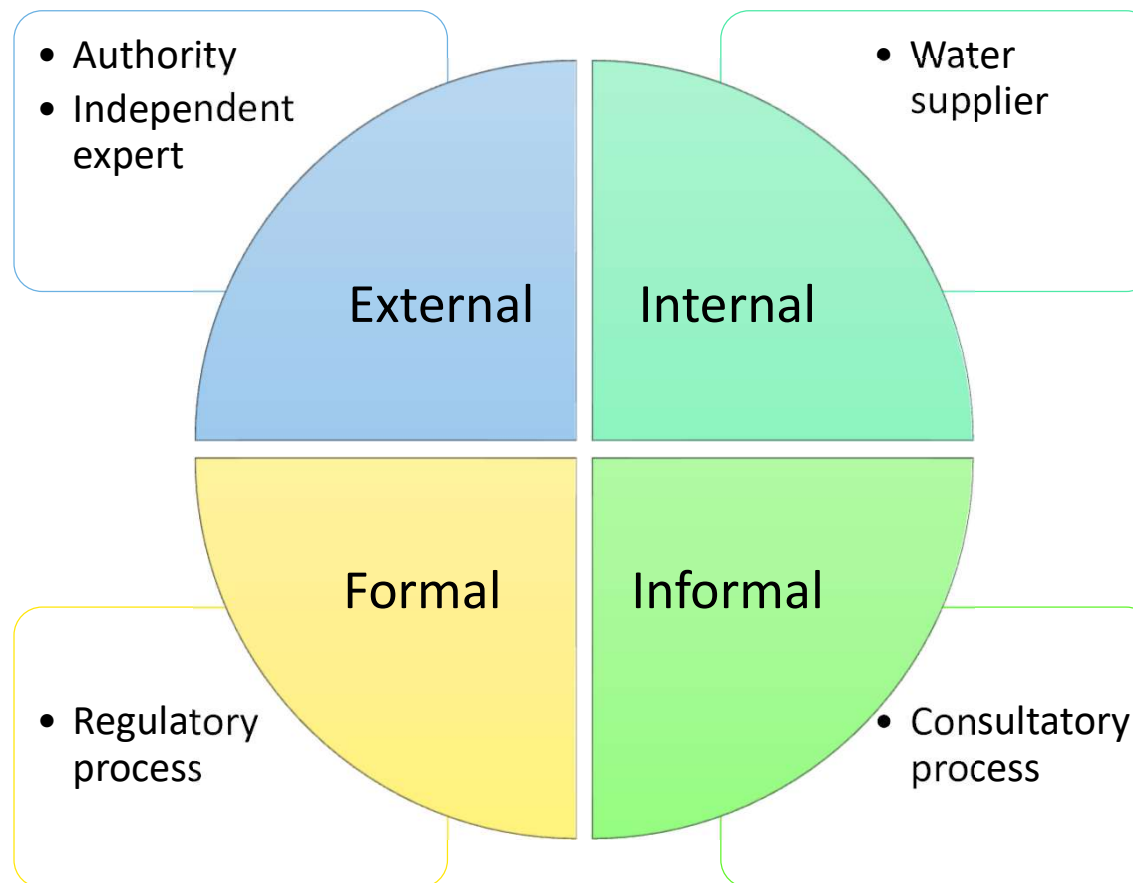
Engagement and awareness-raising of the public is critical



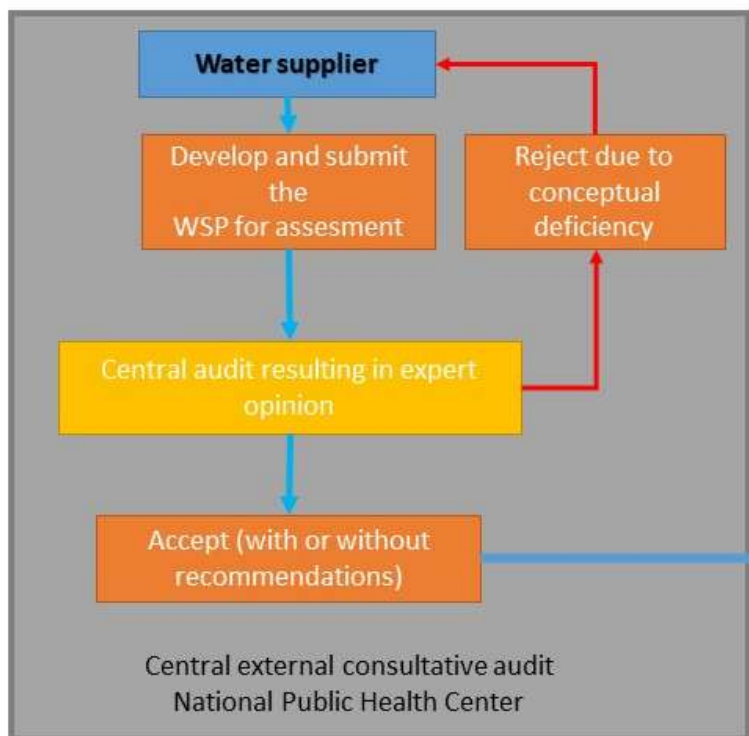
Water safety plan auditing

Water safety plan auditing

- Verification of the WSP
- Quality assurance framework
- Independent from the WSP development team

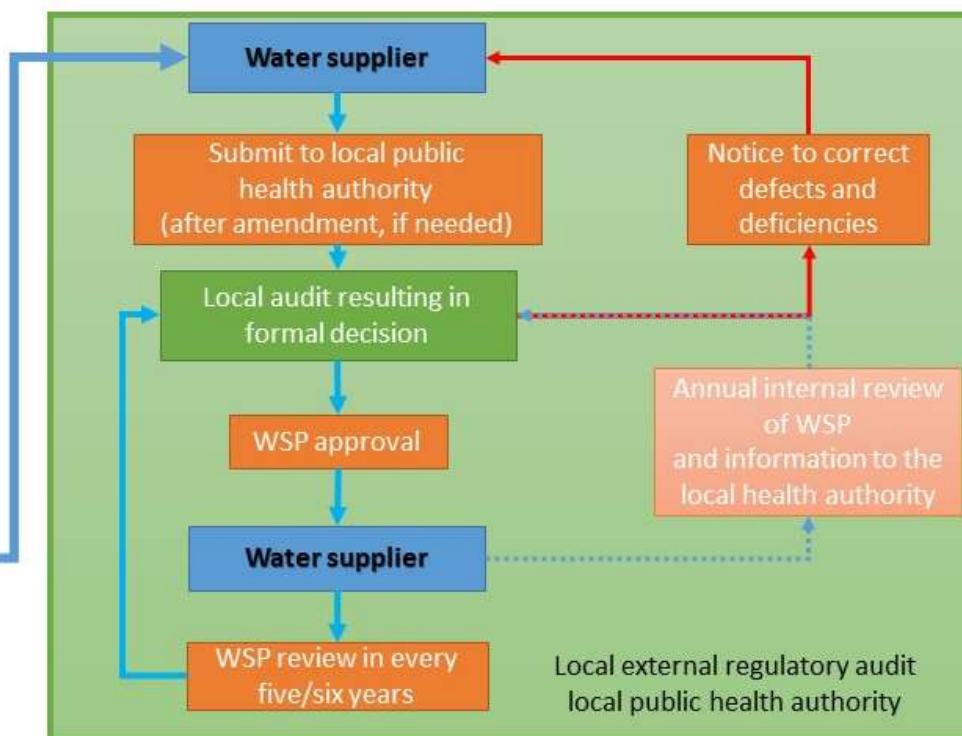


Process of WSP approval – Example of Hungary



Initial external audit – central

- More technical expertise (technology, risk assessment, etc.)
- Less information on local aspects
- More flexible – consultative process



Initial external audit – local (approval)

- Varying level of technical, WSP methodology expertise
- Knowledge of the water supply, personal contact
- Site visit
- More formal process (legal deadlines, communication etc.)

Internal revision

- every year
- report the changes to local authorities

Local external audit

- every 6 years
- public health authority

Elements of audit - external and internal

- Review of WSP documentation, annexes and related documents
- On-site inspection – comparison of the WSP and on-site practice
- Verification of the effectiveness of the WSP through other information and analysis
 - drinking water quality data
 - customer complaints and comments collected
 - staff interviews
- Evaluate the audit and report on the adequacy of the WSP
- Requires complex expertise
 - Risk assessment
 - Technical knowledge of water supply
 - Hygiene aspects
 - Legal framework
 - ...



Risk-based drinking water quality monitoring

**Proactive
surveillance**

**Reactive
surveillance**

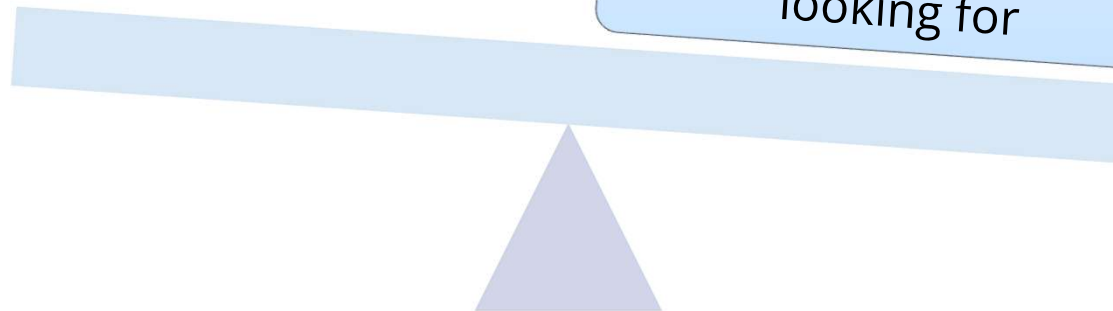
**Why do we need risk-
based monitoring?**

Many unnecessary
measurement

Insufficient frequency to
spot contamination

Not measured at the
right point

We only find what we are
looking for

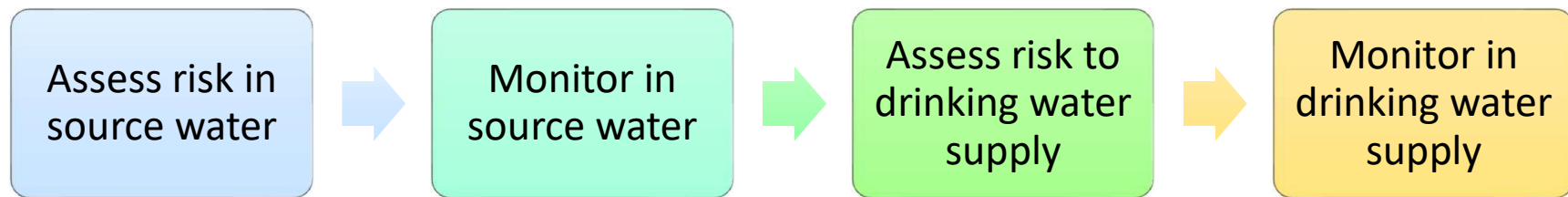


Risk-based monitoring



Elements of risk based surveillance in DWD

■ Watchlist mechanism



■ Verification of virus removal efficiency using somatic coliphages

- Part of monitoring of control measures

■ Operational monitoring of turbidity

- Part of monitoring of control measures

■ Site inspection and on-site/on-line measurements

■ Flexibility in compliance monitoring

- Option to reduce/increase monitoring frequency
- Option to remove parameter from the list of monitored parameters

Monitoring schemes

Operational monitoring

- At control points of the water supply system
- Informs intervention (preventive or remedial)
- Includes inspection, online/onsite/offsite measurements
- Compliance against action values
- High frequency

Compliance monitoring

- At the legal point of compliance
- Accredited laboratory measurements
- Compliance against regulatory values
- Might inform remedial action
- Legally defined frequency

Verification

- One-off or infrequent
- Monitoring of the effectiveness of established barriers
- In-depth analysis
- Laboratory or data analysis

Dziękuję!

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