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**Small-scale water supplies and sanitation**

**INFORMAL DOCUMENT**

# Small-scale water supply and sanitation systems in the WHO European Region: good practices for policy-makers

- Draft for comment by the Working Group on Water and Health -

The programme of work for 2014-16 stipulates the finalization of a policy guidance document on small-scale water supply and sanitation. A draft for comment has been prepared by the lead Parties and organization in cooperation with the members of the expert group on small-scale water supply and sanitation, as well as the secretariat.

The Working Group on Water and Health is requested to review the draft document and submit comments and/or suggestions for amendment to Ms Bettina Rickert (bettina.rickert@uba.de) by **9 January 2015**.

The draft document is for use by the Working Group for Water and Health only and not for wider distribution.

# Small-scale water supply and sanitation systems in the WHO European Region

Good practices for policy-makers

DRAFT NOT FOR DISTRIBUTION

27 October 2014

# Contents

# Abbreviations

| | |
|---|---|
| ATOs | minimum catchment areas (*ambiti territoriali ottimali*) |
| BDZ | Demonstration Centre for Decentralized Wastewater Treatment (Bildungs- und Demonstrationszentrum für dezentrale Abwasserbehandlung) |
| CLUES | community-led urban environmental sanitation |
| DIBt | German Institute for Structural Engineering (Deutsches Institut für Bautechnik) |
| DVGW | German Technical and Scientific Association for Gas and Water (Deutscher Verein des Gas- und Wasserfaches) |
| DWA | German Association for Water, Wastewater and Waste (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall) |
| EPA | Environmental Protection Agency |
| EU | European Union |
| GLAAS | UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water |
| JMP | WHO/UNICEF Joint Monitoring Programme (for Water Supply and Sanitation) |
| NGO | nongovernmental organization |
| OECD | Organisation for Economic Co-operation and Development |
| OOWV | Oldenburg and East Friesland Water Association (Oldenburgisch-Ostfriesischer Wasserverband) |
| SPANC | public services for onsite sanitation (*service public d'assainissement non collectif*) |
| SSP | sanitation safety plan |
| SuSanA | Sustainable Sanitation Alliance |
| SVGW | Swiss Gas and Water Industry Association (Schweizerischer Verein des Gas- und Wasserfaches) |
| TajWSS | Tajikistan Water Supply and Sanitation (Network) |
| UNECE | United Nations Economic Commission for Europe |
| UNICEF | United Nations Children's Fund |
| WECF | Women in Europe for a Common Future |
| WSP | water safety plan |
| WSSP | water and sanitation safety plan |
| ZWAV | Vogtland Association for Water and Wastewater Management (Zweckverband Wasser und Abwasser Vogtland) |

# 1. About this document

## 1.1. Background

The challenges faced by small-scale drinking-water supply and sanitation systems are a recognized concern across the entire WHO European Region. Such systems are typically prevalent in rural areas, small towns and periurban areas, where they are often the most suitable option for economic, technical or hygiene reasons. 266 million people (29% of the population of the WHO European Region) live in rural areas *(1)*. Across the Region, approximately 196 million people (22% of the population) are served by water supplies serving fewer than 5000 people; a further 62 million people (7% of the population) are served by very small non-piped water supplies (i.e. individual wells and similar) *(2)*. Most of these people are also served by sanitation systems of a similar scale or do not have access to adequate sanitation. In central and eastern Europe, for example, 40% of the population is not connected to wastewater collection and treatment systems *(3)*.

Small-scale systems often face a variety of managerial, operational, technical, staffing and resourcing challenges. These may hinder the provision of safe and sustainable drinking-water and sanitation services, and may result in adverse health outcomes and environmental damage. Increasing access to safe drinking-water and sanitation will improve community health and subsequently enhance sustainable livelihoods, poverty reduction and economic development.

Strong links exist between the provision of safe drinking-water and safe sanitation practices, particularly in rural areas, where facilities are typically located very close to each other. Poorly regulated, designed and managed onsite sanitation (such as pit latrines or leaking septic tanks contaminating groundwater resources) can have a severe impact on drinking-water and thereby on public health. It is thus important to take a holistic approach, addressing drinking-water, sanitation and hygiene aspects together. Fostering close communication and collaboration among relevant stakeholders – particularly those responsible for water and those responsible for sanitation – is also critical.

Recognition of the need for more national and international policy attention to address the challenges related to small-scale systems is growing. The 1999 Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes *(4)* addresses this subject as one of the priority programme areas in its 2014–2016 programme of work. In 2011, the publication *Small-scale water supplies in the pan-European region (5)* was released under the Protocol as a first step to support better understanding of the current state of small-scale water supplies and the challenges they face. Based on that analysis, this document describes how the situation can be improved and an enabling environment created for small-scale drinking-water supply and sanitation systems. It addresses both individual systems and small public systems for water supply and sanitation.

As part of the Protocol's programme of work for 2011–2013 a survey was conducted to improve the evidence base on small-scale water supplies in the WHO European Region *(2)*. It requested, among other items, information on regulations, numbers and types of small-scale water supply, water sources used, individuals and organizations operating such supplies and drinking-water quality. This document was informed by the information received from the survey.

## 1.2. Aim and scope

This publication responds to the need expressed by the Parties to the Protocol to address the challenges related to small-scale water supply and sanitation systems in the WHO European Region. It primarily aims to support effective policy action and promote good practices for improving the situation of small-scale systems.

Policy-makers can choose from a wide range of regulatory, planning, financial and educational instruments to improve the situation of small-scale water supply and sanitation systems. This document illustrates a range of such instruments applicable at both the national and subnational levels. This overview is supported by details of a number of good practices, case studies from across the WHO European Region and information from the survey on small-scale water supplies conducted under the Protocol *(2)*. The aim is that these examples will inspire decision-makers and practitioners to consider improvement actions that they might adapt for their own circumstances.

## 1.3. Target audience

The primary target audience of this document is policy-makers who develop water supply and sanitation policies at the national or subnational – for example, regional or state – levels. The document aims to reach out to different sectors, such as health, water management, environment, agriculture, rural development and finance. This includes those responsible for one or more of the following:

- establishing and reviewing the effectiveness of policies, legislation, regulations, norms and standards for drinking-water, sanitation and hygiene;
- mainstreaming health aspects into the policies of different sectors;
- allocation of financial resources to enable the implementation of policies and programmes;
- providing guidance and capacity-building to local entities (such as local governments).

Other stakeholders such as aid and funding agencies, local governments and nongovernmental organizations (NGOs) may also find the information relevant for their programmes and projects.

## 1.4. Structure

Sections 2 and 3 of this document help the reader to understand the problem from a broader perspective: they highlight the concerns surrounding small-scale systems and the benefits that result from addressing them.

Sections 4 and 5 form the core of this publication. Section 4 outlines a range of policy instruments that may address the different good practices described in Section 5; these represent a “toolbox” of options from which policy-makers may choose.

# 2. Concerns related to small-scale water supply and sanitation systems

## 2.1. Definitions of “small-scale” systems

Small-scale water supply system types comprise private or individual facilities (those typically supplying one or a small number of premises, private wells and similar), community-managed supplies and publicly managed supplies. These may be piped or non-piped, and may or may not

include centralized treatment, storage and distribution. A similar situation exists for small-scale sanitation[1] systems: the technologies range from simple onsite systems such as pit latrines to centralized sewerage and wastewater treatment systems. These systems can be operated by organized utilities; however, many are operated by individuals with little or no technical knowledge or experience.

There is no universal definition of a "small-scale" system: descriptions differ between countries within the WHO European Region. Legislation typically defines small-scale water supplies based on criteria such as the number of people served, the quantity of water provided and whether the supply is piped or non-piped, rural or urban. Similarly, small-scale sanitation systems may be classified by the quantity of wastewater treated, the number of service connections or the type of technology used. In many cases rural areas do not have the same level of access to safe water and sanitation services as urban areas *(6)* (see Box 1). The problem, however, is not the size itself – it is the characteristics and challenges of their use that set small-scale systems apart.

**Box 1. Rural–urban disparities in access to "improved" sanitation and drinking-water sources in the WHO European Region**

The WHO/United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP) for Water Supply and Sanitation *(1)* defines access to "improved" sanitation as access to a facility that hygienically separates human excreta from human contact. The definition of an "improved" drinking-water source is one that, by the nature of its construction, is adequately protected from outside contamination – particularly faecal matter. The categories "improved sanitation" and "improved source of drinking-water" describe specific system technologies that are generally fit to deliver safe services. It should be noted, however, that the JMP does not collect data on whether these systems do indeed deliver safe services (such as information on their condition or the quality of drinking-water they supply) but only on whether they are in place.

The JMP data for 2012 illustrate significant rural–urban disparities for the population of the WHO European Region.

- While 94% of the urban population had access to improved sanitation facilities, this only applied to 89% of the rural population.
- Although 99% of the urban population had access to improved drinking-water sources, this was only the case for 94% of the rural population. In addition, while 97% of the urban population had access to piped drinking-water on their premises, only 71% of rural dwellers enjoyed piped household water connections located inside their dwelling, plot or yard.
- Although access to improved drinking-water sources and sanitation facilities has increased in the past 10 years, this progress masks significant disparities between countries and subregions. In the Caucasus and central Asia, for example, 71% of the rural population lives in homes without access to piped water on the premises, whereas only 14% of town and city residents are similarly disadvantaged.

These figures demonstrate not only that rural–urban disparities exist in access to improved services but also that access to improved sanitation in the Region is less common than access to improved drinking-water sources.

## 2.2. Challenges facing small-scale systems

Small-scale water supply and sanitation systems have a number of similar characteristics and face a range of comparable challenges. It should be noted, however, that not every characteristic

[1] In accordance with the definition provided in Article 2 of the Protocol, "sanitation" means the collection, transport, treatment and disposal or reuse of human excreta or domestic wastewater, whether through collective systems or by installations serving a single household or undertaking.

described in this section is necessarily relevant to all small-scale systems; nor are the challenges limited to small-scale water supply and sanitation systems alone. The most important aspects influencing small-scale systems include the following.

- Lack of awareness of the importance of safe drinking-water supplies and sanitation for public health protection may lead to a lack of a sense of responsibility among the relevant decision-makers. As a result, small-scale systems often receive limited policy attention and institutional support, resulting in under-resourcing and little action on improvement.
- The sanitation sector frequently lags behind the drinking-water sector. For example, less political attention is often given to sanitation, and only limited or poor services may be present even when improved drinking-water supplies are in place.
- Small-scale systems are often unregulated. In settings where regulation is in place, drinking-water and sanitation are frequently regulated and operated separately. This hinders the uptake of holistic approaches, which would be particularly beneficial for small-scale systems in rural areas.
- Small-scale systems are often located in rural areas where drinking-water sources and sanitation facilities, as well as local animal husbandry practices, are located in close proximity. Inadequate sanitation and farming practices may be a source of faecal contamination of drinking-water sources and thereby pose a risk to public health.
- Limited inter-institutional collaboration between public authorities at different levels of government (local, subnational and national) may prevent the particularities of small-scale systems – which are typically best known at the local level – from being taken into account sufficiently at the national and subnational levels (for example, in regulations).
- A lack of ongoing independent surveillance is frequently in evidence. In around 11% of the countries in the WHO European Region only regular self-checking of water quality is required and no independent surveillance is undertaken; in another 4% neither independent surveillance nor self-checking is required *(2)*.
- Appropriate use of treatment technologies is generally limited; where it is in place it does not necessarily reflect local conditions and needs. There is often a lack of knowledge of alternative cost-efficient sanitation and wastewater treatment systems; and on occasion, the regulatory framework may hinder the implementation, operation and maintenance of such facilities.
- Requirements or standards for good operation and maintenance practices are frequently not readily available. Maintenance and repair of infrastructure are often compromised due to limited knowledge or sustainable financial resourcing.
- Small-scale systems are often operated by untrained or undertrained individuals who lack specialized knowledge and have limited awareness of the health aspects related to water and sanitation services. Of the respondents to the Protocol survey, 49% stated that no minimum qualification requirements for operators of small-scale public water supplies are in place in their country or territory *(2)*.
- Operators typically take care of water and sanitation systems only as one aspect of their many duties. In some settings no person or institution is formally responsible for system operation. This, in combination with irregular financial support, may compromise their sustainable operation (see Box 2).
- Owing to the broad geographical spread and sometimes the remoteness and isolation of small-scale systems, operators frequently lack access to professional networking, information, expert assistance and technical support, and may not know about the existing assistance and support mechanisms available in the region.
- Small-scale systems typically have relatively larger per-unit costs for technical installations, materials and construction because of the smaller number of people served *(7)*. In addition, the

ability to pay for the services is frequently lower among the rural population than in urban areas. As a result, small-scale systems often face a lack of financial resources to maintain or upgrade the systems.

Sections 4 and 5 aim to show what can be done to improve the situation for small-scale systems and to meet the challenges they face.

**Box 2. Sustainability of sanitation and drinking-water services**

A particular challenge for small-scale water supply and sanitation systems is their sustainability. Abrams et al. describe sustainability as "whether or not something continues to work over time" *(8)*. Applied to water supplies, this definition becomes whether water continues to flow over time and whether that water meets the agreed standards or level of service. For sanitation, it refers to whether the benefits of access to sanitation (such as adequate separation of human waste and contact, and including convenience and privacy) are maintained over time. What is crucial here is that the definition refers to the sustainability of the service, not of the system. A system may eventually come to the end of its expected life, but the service should continue – it will need to be replaced or extended.

Two broad approaches to sustainability exist. The first recognizes the large number of factors that affect sustainability; these are typically grouped into social, technical, economic, financial, institutional and environmental categories. This approach is especially predominant around sanitation. For example, the Sustainable Sanitation Alliance (SuSanA) includes requirements for protection of the wider environment: "in order to be sustainable a sanitation system has to be not only economically viable, socially acceptable, and technically and institutionally appropriate, it should also protect the environment and the natural resources" *(9)*.

The second approach considers the quantity, quality, accessibility and reliability of the supply as indicators of sustainability. The level of service, in turn, depends on the performance of service delivery tasks at different institutional levels, typically covering:

- performance of the service provider (the entity responsible for operation, maintenance and administration);
- performance of the service authority (the entity responsible for planning, coordination, support and oversight roles – typically local government);
- performance of national entities (those responsible for creating an enabling environment through policy setting, monitoring, finance and regulation).

This second approach thus describes the current performance of a service as a basis for extrapolating the likely future situation. Another example for sanitation sustainability is a generic sanitation ladder, based on service levels, to include accessibility, status of infrastructure (in terms of cleanliness and maintenance), convenience and privacy and environmental protection *(10)*. Unlike in the case of water, this second approach has not been further elaborated for sanitation regarding the performance of service providers or the enabling environment.

## 2.3. Consequences

Insufficient or inappropriate sanitation and excreta management may lead to the presence of faecal pathogens – and in some circumstances harmful chemicals – in the environment, including contamination of local drinking-water sources, as well as direct contact of humans with excreta. These issues are enhanced in cases where knowledge of the relationship between drinking-water, sanitation and hygiene is limited, and where hygiene behaviour is inappropriate or compromised (for example, due to lack of soap and/or facilities for washing hands after use of sanitation facilities). As a result of the challenges outlined in Section 2.2, small-scale systems are more vulnerable to breakdown and poor management. They may also be dysfunctional, which may in turn lead to a lack of sufficient quantities of safe drinking-water and sanitation services (see Box 3).

Higher exposures to faecal pathogens of human and animal origin, insufficient amounts of drinking-water, unsafe drinking-water and inadequate hygiene behaviours increase the risk of water-, sanitation- and hygiene-related diseases – primarily diarrhoeal illness and soil-transmitted helminth infections – and thereby pose a threat to public health.

In many countries regular water-quality surveillance and reporting of data on small-scale water supplies is inadequate or nonexistent. Similarly, many countries do not have readily available data on the prevalence and conditions of sanitation facilities, particularly in rural areas. Scientific evidence on the real situation surrounding prevailing sanitary risks related to water, sanitation and hygiene is therefore sparse.

Nevertheless, the information currently available indicates a clear relationship between the size of the supply and drinking-water quality: in smaller supplies the risk of noncompliance with limit values is higher. This is illustrated by the results of a survey organized by the European Commission. For the period 2008–2010, European Union (EU) countries reported that compliance with microbiological water-quality parameters laid down in Council Directive 98/83/EC on the quality of water intended for human consumption *(11)* (known as the "Drinking-water Directive") was significantly lower for small-scale supplies (serving 50–5000 people) than large systems *(12)*.

**Box 3. Examples of drinking-water quality data for small-scale water supplies**

A rapid assessment of drinking-water quality and prevailing sanitary risk in two pilot districts of rural Georgia (Dusheti and Marneuli) in 2011 indicated significant microbiological contamination of drinking-water. Noncompliance with the national standards for faecal indicator bacteria, such as *Escherichia coli* (*E. coli*), was evident in more than 60% of the samples. Overall noncompliance for one or more microbiological and physicochemical parameters investigated during the assessment was even higher, occurring in more than 75% of the samples *(13)*.

Regulatory data from Scotland for 2011 indicate a clear gradient in noncompliance with microbiological standards from large to small supplies: supplies serving fewer than 50 people showed comparatively high average noncompliance rates at 42% for coliform bacteria and 22% for *E. coli*. In contrast, for supplies serving between 501 and 5000 inhabitants, the noncompliance rates for these two parameters were just 2% and 1% respectively *(2)*.

Systematic evidence on the degree of water-related disease attributable to small-scale water supply and sanitation systems is not yet readily available. Anecdotal evidence, however, suggests that the incidence of water-related disease in rural communities is largely underreported. In low- and middle-income countries in the WHO European Region, an estimated 3564 deaths per year are attributable to inadequate water, sanitation and hand hygiene *(14)*.

A clear example of health risk relating to unsafe sanitation is the infection caused by soil-transmitted helminths (commonly called "intestinal worms"). They continue to be a significant health burden because of poor human excreta disposal practices. WHO estimates that in the European Region more than 4 million children are in need of deworming *(15)*.

The effects of unsafe and unreliable water and sanitation services also go beyond direct health impacts, affecting social, economic and environmental factors and exacerbating existing discriminatory patterns. Poor sanitation facilities in schools may especially prevent girls from attending school and lead to unequal learning opportunities. Extensive collection times for fetching small amounts of drinking-water from distant sources may reduce the time available for learning or generating family income. Limited availability of water may hinder market gardening and animal husbandry, and thus income generation. The health care costs incurred for treating children suffering from water-related diseases may put undue demands on family earnings.

# 3. Benefits of improving small-scale water supply and sanitation systems

## 3.1. Building healthy and resilient communities

Whether people are healthy or not is determined by their physical environment and circumstances, among other factors. The provision of adequate sanitation and safe drinking-water in sufficient quantities for good personal and domestic hygiene is a key determinant of public health. Good individual, family and community health enhances opportunities for sustainable livelihoods, reduction of poverty and economic development. Safe sanitation, adequate wastewater treatment and safe disposal or reuse of excreta and wastewater contribute to a clean and healthy environment.

## 3.2. Increasing gender equality

Women and girls are particularly vulnerable in cases of inadequate sanitation and hygiene conditions *(16)*. They benefit from improvements and more convenient access to sanitation facilities through lower risks of physical attack, urinary tract infection and gastrointestinal disease, as well as better capacity for menstrual hygiene management *(17; 18)*. Adequate sanitation facilities at workplaces, schools and public places can lead to increased attendance at school and work and further opportunities for income generation and social activities *(19; 20; 21; 22)*. Involving women and children in planning and decision-making regarding water and sanitation facilities will ensure that their needs are better reflected in design and construction and help to overcome inequalities *(23)*.

## 3.3. Achieving economic benefits

There is clear evidence that the financial benefits outweigh the investments in improvements to small-scale systems. It has been estimated for the WHO European Region that an investment of US$ 1 results in a mean return ranging from US$ 2 in higher-income countries to US$ 21 in lower-income countries, where “investment” encompasses cost-of-improvement interventions in small-scale water supplies aimed at reducing acute diarrhoeal illness and “return” includes the value of preventable disease measured by direct and indirect costs of illness prevented by these interventions *(24)*. For the Caucasus and central Asia, for example, every dollar spent on improving sanitation brings an average economic return of US$ 4.8, in the form of lower health costs, time savings and improved productivity *(25)*. Furthermore, it has been estimated that that the benefit–cost ratio of interventions to attain universal access to improved drinking-water sources and sanitation in the Caucasus and central Asia region is 2.6 *(25)*.

## 3.4. Improving the human rights situation

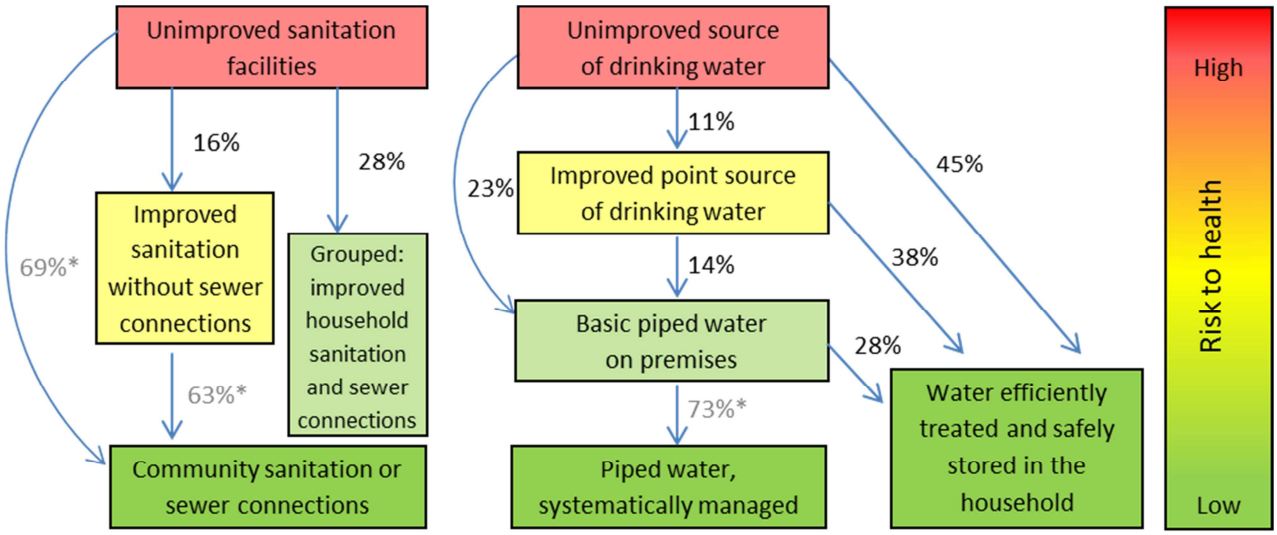
Safe drinking-water and sanitation are recognized as human rights by United Nations General Assembly Resolution 64/292 *(26)* and Human Rights Council Resolution 18/1, as well as previous Human Rights Council Resolutions 7/22, 12/8, 15/9 and 16/2 *(27)*. The progressive realization of these rights requires that all should have equitable access to affordable services, including isolated rural populations as well as poor, vulnerable and marginalized community members. Improving small-scale water supply and sanitation systems contributes to a reduction in rural–urban

disparities and gender and other inequities, thereby fostering implementation of the human rights to water and sanitation.

## 3.5. Reducing the burden of disease

Diarrhoeal disease can effectively be prevented through safe management of drinking-water and sanitation services. For example, a study from Iceland showed that the population receiving drinking-water from supplies applying the WHO-recommended water safety plan (WSP) approach – a proactive risk assessment and risk management method (see Section 5.2 on water, sanitation and hygiene safety planning and respective case studies) – was 14% less likely to develop clinical cases of diarrhoea *(28)*. WHO researchers estimated in a global assessment that a transition from improved sanitation facilities without sewer connections to community sanitation or sewer connections could account for a significant reduction in diarrhoeal disease risk in low- and middle-income countries *(29)*. Large reductions in the risk of diarrhoeal disease are possible when water supply systems are improved – for example, by a transition from access to basic piped water on premises to services systematically managed by WSP-type approaches (see Fig. 1).

**Fig. 1. Diarrhoeal disease risk reductions associated with transitions in sanitation and drinking-water**




* Estimates of risk reductions associated with transitions to higher levels of service are based on limited evidence and should therefore be considered preliminary.
*Source*: WHO *(28).*

# 4. Policy processes to create an enabling environment

It is the responsibility of national and subnational decision-makers to set the stage for and implement long-term strategies to improve the situation of small-scale water supply and sanitation systems. Establishing a firm rationale for improvement and defining an explicit policy with clear goals and short-, mid- and long-term targets is essential to secure the commitment of stakeholders at all levels and to mobilize and allocate necessary resources. In order to develop effective policies on small-scale water supply and sanitation systems, the following actions are paramount for policy-makers:

- to have a clear vision of the situation and the political will to improve it;

- to ensure resources for change, as otherwise improvement may be difficult to achieve;
- to address water supply and sanitation in one integrated and coherent management framework;
- to consult with relevant authorities at all levels to understand the perspectives of those who will be affected by the policies or who can contribute to the policy-making process;
- to embed local and subnational initiatives in the overall policy-making process;
- to follow a step-by-step improvement approach that reflects prevailing conditions, priorities and available resources – this allows immediate small improvements as well as larger solutions in the future, and thereby facilitates the establishment of both short-term and long-term targets.

The provisions of the Protocol on Water and Health *(4)* provide a strong framework for improving the situation of small-scale water supply and sanitation systems to cater to countries' needs, priorities and available resources. Networking – under the Protocol and in other international networks – fosters exchange of experiences and good practices to improve the situation of small-scale systems (see Case study 1 for an example of international networking on the topic of small-scale water supplies).

**Case study 1. WHO networking – the International Small Community Water Supply Network**

The International Small Community Water Supply Network, which is hosted by WHO, was established in 2005 *(30)*. In order to assist Member States in the operation and management of small-scale supplies, particularly in rural or remote areas, the Network provides a platform to identify common management and technical issues regarding small community water supplies. It also aims to develop workable solutions in a geographical, socioeconomic and cultural context.

The Network fosters exchange among various stakeholders. Membership is open to governments, NGOs, academic institutions and members of civil society at large, on the condition that they subscribe to the Network's purpose and its shared objectives:

- building an evidence base to support decision-making and the development of guidance and tools;
- advocating and collaborating with stakeholders in mainstreaming small community water supplies into the policy environment and obtaining commitments from senior decision-makers to improve their management;
- developing and facilitating access to guidance and tools to assist stakeholders at all levels in improving the management of small community water supplies for which they are responsible.

The Network promotes mutual understanding and explores ways forward in collaboration. It has grown to include around 125 members from approximately 35 countries. International meetings of the Network are held regularly, giving participants the opportunity to share information on subnational, national and international approaches, good practices and challenges. Between meetings, a virtual forum gives all Network members the chance to raise issues for discussion and to participate in ongoing activities, regardless of their ability to attend Network meetings.

Several processes are available to policy-makers to reach the goals set. The following sections focus on how these can be tailored to the particularities of small-scale systems, adapting the information provided to prevailing national conditions. These processes may address elements such as the examples of good practice described in detail in Section 5.

## 4.1. Baseline analysis and target-setting

- Baseline analysis is a precondition of prioritizing action based on a solid information basis and setting targets for improvement.
- Consideration of incremental improvement in target-setting is particularly relevant for small-scale systems: it helps with monitoring the achievements and progress made.

- The target-setting process is a valuable instrument to encourage the stakeholders involved in water supply and sanitation to work together.

As a first step in ascertaining the need to adopt or amend existing policies to improve the situation for small-scale water supply and sanitation systems it is important to determine the status quo. Such baseline analysis will provide information on which areas are particularly in need of policy attention and support arguments for resource allocation.

The Protocol *(4)* is an effective instrument to address improvements for small-scale water supply and sanitation systems at the policy level. Article 6 of the Protocol requires Parties to establish and publish targets for achieving a high level of protection of human health and sustainable management of water resources. The main steps required are:

- identification of key stakeholders and setting up of a coordination mechanism;
- baseline analysis;
- identification and prioritization of problems;
- agreement on draft targets, programme of measures and indicators to assess progress towards achieving the targets;
- broad consultation on the proposed targets with all stakeholders, including public participation (see Box 4);
- final agreement on targets, their publication and communication to all stakeholders;
- implementation of the monitoring programme of the targets;
- review and assessment of progress and reporting.

**Box 4. Public participation**

It is highly recommended that the general public should be involved in target-setting through a public participation process. A key principle, according to Article 5(i) of the Protocol on Water and Health *(4)*, is access to information and public participation in decision-making concerning water and health.

A wide range of tools exists to enable the public to participate in decision-making. Popular tools are referendums, hearings and workshops, in which the key to success is to take the concerns and considerations of the public seriously. Actions to address water, sanitation and hygiene aspects with the involvement of all stakeholders – from different social, cultural and economic levels – can benefit the whole community. Working together on safer water and sanitation systems increases ownership and understanding of the needs and challenges of the services delivered. The *Guide to public participation under the Protocol (31)* gives further guidance on how to manage the process.

Detailed information on this process is given in *Guidelines on the setting of targets, evaluation of progress and reporting (32)*. Although the approach was developed under the Protocol, countries that are not Parties may take a similar approach, applying these principles in a step-by-step manner. The Protocol acknowledges that targets may be set to improve the situation of small-scale water supply and sanitation systems. It supports countries in development of their own nationally adapted and relevant targets, according to their priorities and needs. The paragraphs within Article 6 of the Protocol *(4)* set out a number of thematic areas for target-setting for prevention, control and reduction of water-related disease. Possible areas of relevance for target-setting for small-scale systems include:

- improving access to drinking-water and sanitation services in rural areas (paragraphs 2(c) and 2(d));

- improving the performance level of drinking-water and sanitation systems and service providers (paragraph 2(e));
- increasing the application of recognized good practices (paragraph 2(k) and 2(m));
- reducing the occurrence of discharges of untreated wastewater (paragraphs 2(g) and 2(h));
- improving protection of resources for drinking-water supplies (paragraphs 2(f) and 2(m));
- reducing the scale of water-related diseases in rural areas (paragraph 2(b)).

The Protocol sets out drinking-water and sanitation as separate areas for target-setting; however, wherever possible, they should be considered in an integrated way. Targets for different areas may influence and complement each other, or may be set as joint targets.

### *4.1.1. Getting started: forming a steering group and stakeholder mapping*

Setting national targets creates a platform for discussion and promotes partner alignment between sectors, bringing together different stakeholders. Similarly, an existing multistakeholder group on water and sanitation can be tasked with guiding the target-setting process at national level (see Case study 2). Countries that have already set targets under the Protocol have reported positive results when a steering committee has provided clear leadership in the target-setting process. Stakeholder groups to be considered for consultation throughout the baseline analysis and target-setting process include but are not limited to:

- regulators with the authority to develop regulations and legislation;
- authorities at different levels (local, subnational and national), including those responsible for implementation, surveillance and enforcement of policy instruments;
- authorities from different sectors, including public health, water resource management, environment, water supply, sanitation, rural development, finance, agriculture and construction;
- water suppliers and wastewater operators;
- professional associations and consumer associations;
- standard-setting bodies;
- scientists to substantiate the policy measures;
- enterprises providing small-scale water supply and sanitation system technologies (consulting and construction companies);
- NGOs involved in the water and sanitation sector, including those representing sections of the population such as girls and women and marginalized groups;
- schools and universities for education measures.

The target-setting process calls for close cooperation among many authorities at the policy and management levels and among several different sectors. It is important to engage all main stakeholders early on in the process to ensure their long-term commitment. Roles and responsibilities of the stakeholders involved should be defined.

Particularly for small-scale systems, the impetus for improvement does not always have to come from the national level; it can also originate in local or subnational initiatives that can be scaled up. Generally, those directly affected by measures (whether through advantages or restrictions) need to be involved in the process, as well as all those who can “make a difference”.

**Case study 2. The Tajikistan Water Supply and Sanitation (TajWSS) Network**

The TajWSS Network was established in 2009 and is intended as a national multistakeholder network of actors from government; international institutions and donors; science institutions and academia; and public, private and other not-for-profit organizations in the water and sanitation subsector in Tajikistan, who gather on a quarterly basis to advance the national drinking-water and sanitation agenda *(33)*. The Network was launched within the framework of the TajWSS project, which is funded by the Swiss Agency for Development and Cooperation and implemented by Oxfam, in cooperation with the United Nations Development Programme and the Ministry of Energy and Water Resources of Tajikistan. Local-level networks are also in place; these coordinate subsector activities and act as a link between the local and national actors.

Since its establishment the Network has become a platform for many interested organizations to discuss gaps hindering water and sanitation policies; share practices, tools and methodologies across institutions and partners; and take stock of both what exists and works well and lessons learnt from failures: how water and sanitation policy "solutions" can work. For example, in 2010 the Network contributed to the passing of a national law on drinking-water *(34)* and played a crucial role in stakeholder consultations to develop draft national targets under the Protocol in 2013. Further major contributions made to national policy, regulations and bylaws (for example the development of a national methodology to calculate water tariffs) concerned tariffs, the taxation system, ownership of water supply systems and construction permits.

TajWSS has supported the establishment of local water user associations to manage small-scale systems in its pilot villages and conducted training sessions on their management, accounting, operation and maintenance, as well as on gender equality, water treatment and sanitation.

### *4.1.2. Baseline analysis: determining and understanding the status quo*

A multidisciplinary team should carry out a baseline analysis for potential target areas, including a review of the current legal basis, regulations, strategies and other information provided by the various key stakeholders of small-scale water supply and sanitation systems. This includes agreeing on a definition of the systems to which the target-setting process should apply. Data to be gathered include but are not limited to:

- regulations, standards, guidelines and other policy tools in place, including information on how far they address small-scale systems and how they are enforced (see Sections 4.2 on legislation and regulations and 4.3 on design and management standards);
- requirements for self-checking and independent surveillance of small-scale systems (see Section 4.4 on surveillance);
- numbers and prevailing technologies of small-scale systems, their distribution and performance, the populations served and their share of the whole water supply/sanitation sector;
- responsibilities for management, operation, maintenance, financing and surveillance of small-scale systems;
- linkages between water and sanitation in practice, such as collaborative approaches applied (see Section 5.1 on collaborative arrangements and networking);
- accessibility, continuity, affordability and sustainability of services, drinking-water quality, quality of wastewater discharges, sanitary status of water supply and sanitation systems, the main related challenges and variations over time;
- epidemiological data and health indicators related to small-scale water supplies, sanitation and hygiene;
- information on the management of excreta, wastewater and sludge from pit latrines and septic tanks, the reuse of wastewater, the quality of reused wastewater, reuse practices and similar;
- qualifications of staff operating small-scale water supply and sanitation systems;

- programmes and initiatives already in place to address small-scale systems;
- awareness-raising, training and education programmes and their adequacy (see Sections 4.7 on advocacy and awareness-raising and 4.6 on education, qualifications and training programmes);
- future challenges expected – for example, concerning climate change, population development projections, population distribution, land use and human activities.

It is not unusual that information on small-scale systems is limited at the outset: the survey on small-scale water supplies conducted under the Protocol *(2)* revealed, for example, that only 21% of national authorities had information readily available at the national level on drinking-water quality for individual or non-piped supplies. In many cases, data will not be available for the entire country but will rather result from projects and studies targeted at a limited area or a limited number of system categories. Although restricted in scope, however, such data are a valuable information source.

Data collection on small-scale systems may become a first target on which further development can be based. This may include:

- liaison with local water and/or health agencies to gain further information that may not be available at the national level;
- building an inventory of small-scale systems (see volume 3 of the WHO guidelines for drinking-water quality *(35)* for more details);
- undertaking a rapid assessment of the situation to gain a statistically representative snapshot of the water quality and sanitary conditions of water supplies (see the WHO publication *Rapid assessment of drinking-water quality (36)* for more details and Case study 3 for an example of a baseline analysis of small-scale water supplies that served as the basis for recommendations for further action).

If no specific data on small-scale systems exist, more general information from rural areas may serve as an indicator, since the systems are often prevalent in such areas. Information gathered under existing national and international monitoring mechanisms on water, sanitation and hygiene (such as the United Nations Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) *(37)* and the WHO/UNICEF JMP *(1)*) may be used to establish the baseline situation and define priority targets under the Protocol.

**Case study 3. Assessing small-scale water supply systems in Georgia**

In Georgia 48% of the population lives in rural areas, where small-scale water supply systems are frequently in use. Anecdotal evidence shows that the situation concerning water-related diseases is usually worse in rural areas; in recent years, however, surveillance and thus available data have been limited. The rural population in mountainous regions faces difficulties in accessing drinking-water, is exposed to a high risk of waterborne diseases and has a low level of health and hygiene awareness. The management of small-scale water supply systems was identified as an issue of national importance. Georgian authorities initiated a project to assess the drinking-water quality and sanitary risks in such supplies in two pilot districts to improve the evidence base regarding the current situation *(13)*.

The assessment project team visited the drinking-water supplies and took water samples, which were analysed for microbial and chemical parameters at water sources, storage and distribution locations and households. The team also conducted sanitary inspections of the supplies and their surroundings and interviewed supply operators. These activities were supported by outreach programmes for the local population, training of local authorities and translation and dissemination of training and awareness-raising material in Georgian; this was prepared in advance (including leaflets on how to avoid waterborne diseases and hand-washing procedures). The core project team comprised members from the health, water, environment and agriculture sectors.

On average, 70% of the analysed samples showed microbial contamination. Sanitary inspections revealed

a significant number of risk factors compromising the provision of safe drinking-water. These included nonexistent sanitary protection zones, pit latrines built too close to wells – in violation of the sanitary rules – and compromised integrity of the abstraction facilities (such as nonexistent covering of wells and faulty spring masonry). Water abstraction and water storage practices in households were found to be inadequate and water disinfection was mostly either not in place or not operational.

Based on the main issues identified, recommendations for further action were developed in order to improve drinking-water safety in small-scale water supply systems in Georgia. The baseline analysis also informed the national process of target-setting under the Protocol. Recommendations included further development of the regulatory framework and mechanisms to increase protection of supplies, implementation of WSPs, strengthening of the surveillance system, adherence to sanitary rules for construction of decentralized sanitation facilities, recommendations for technical improvements and increased awareness-raising activities for the population.

### *4.1.3. Assessment and prioritization*

Once sufficient data are acquired to understand the situation it is possible to draw conclusions about improvement needs and to prioritize action. It is advisable to consider water, sanitation and hygiene in a holistic manner in order to prioritize the areas in which action is needed most urgently. Questions to be considered in this process include the following.

- What health risks, environmental impacts, economic inefficiencies and other consequences are related to the current situation of small-scale water supply and sanitation systems?
- What key gaps are currently or potentially causing health and equity problems?
- What are the underlying causes of these risks and gaps?
- What approaches or instruments have proved successful (e.g. in other districts or countries that faced a similar situation)?

Prioritization of areas for improvement involves identifying some of the root causes of these problems, as addressing them will allow the gaps to be filled and risks to be reduced.

### *4.1.4. Setting targets for improvement of small-scale water supply and sanitation systems*

Targets for improving small-scale systems may be identified and chosen to address the range of policy tools and good practices presented in this document (see Sections 4 and 5). For example, they may focus on:

- updating legislation, regulations and norms to reflect the particularities of small-scale systems;
- establishing water protection zones in rural areas;
- promoting approaches for safe management of small-scale systems;
- increasing access to improved drinking-water supply and sanitation systems in rural areas;
- conducting awareness-raising and education campaigns for communities and local decision-makers;
- adapting surveillance programmes to include remote areas;
- introducing grant schemes to support improvement of private (onsite) sanitation and drinking-water supplies.

Policies and approaches applied in other countries can inspire policy development. To this end, intercountry collaboration under the Protocol, the WHO International Small Community Water Supply Network *(30)* (see Case study 1) or the WHO International Network of Drinking-water Regulators *(38)*, among others, may serve as a tool for information exchange.

Prioritizing action also needs to take into account availability of resources to align what ideally should be done with what realistically can be done. A step-by-step approach to improve the situation can be defined, based on the institutional, human and financial resources available to support small-scale water supply and sanitation systems. This may include a review of the likelihood of and prerequisites for acquiring external funding (for example, from donors, aid agencies, infrastructure investment banks, and so on; see also Section 4.5 on costing and financing).

In setting targets it is important to strive for incremental improvement rather than to risk discouragement by starting the process with unrealistically high and barely achievable targets. Timelines agreed in the target-setting process should include regular reviews of achievements and effectiveness of measures, as well as adaptation of the targets, if required. Part of an agreement on targets is also the identification of reliable quantitative (such as proportion of access to improved sanitation in rural areas) and/or qualitative (such as publication and distribution of a booklet to support local operators of small-scale systems) indicators to measure progress.

Table 1 outlines options for targets and indicators to address areas for improvement identified by baseline analysis.

**Table 1. Examples of target-setting for small-scale systems**

| Areas for improvement | Possible targets | Possible indicators |
|---|---|---|
| Legal and institutional issues:<br>• regulation gaps (e.g. legislation does not sufficiently address small-scale systems)<br>• unenforced laws (lack of human resources to enforce at the local level) | Revising the legal system:<br>• development/amendment of law to take into account particularities of small-scale systems<br>• increased flexibility of inspection scheme for remote areas (risk-based schemes)<br>• provision of incentives for compliance | For targets on legal and institutional issues:<br>• existence and enforcement of legal acts, including specifications for small-scale systems<br>• existence of inspection system, including for rural/remote areas; availability of corresponding inspection reports |
| Management issues:<br>• poor normative system and managerial procedures, not addressing small-scale systems sufficiently and/or in appropriate language<br>• insufficient human (untrained staff) and technical resources<br>• poor-quality management (poor planning management practices) | Creating an effective managerial system:<br>• creation of technical standards, technological cards or guidelines addressing small-scale systems<br>• capacity-building for staff and certification of operators<br>• performance control of management<br>• creation of collaborative arrangements among operators<br>• introduction/scaling-up of risk management approaches<br>• improvement of quality of services provided | For targets on management issues:<br>• existence of good practices, managerial guidelines, technical specifications and feedback on their implementation<br>• availability of sufficient (quality and quantity) human resources in rural areas<br>• proportion of water authorities with performance control<br>• proportion of small-scale systems with risk management approaches in place |
| Monitoring issues:<br>• insufficient data available on small-scale systems at the | Improving availability of reliable data:<br>• improvement of evidence base through targeted investigations/ | For targets on monitoring issues:<br>• existence of quality |

| Areas for improvement | Possible targets | Possible indicators |
|---|---|---|
| national level<br>• poor monitoring procedure guidelines that do not or insufficiently include small-scale systems<br>• insufficient human and technical resources at local surveillance authorities<br>• poor monitoring verification<br>• poor-quality services provided by small-scale systems | rapid assessments<br>• improvement/introduction of regular reporting schemes<br>• increased flexibility of surveillance schemes for remote areas, to include small-scale systems (risk-based schemes)<br>• training of staff in local authorities<br>• local authorities equipped to perform field-based water-quality analyses<br>• introduction of data quality control system | standards and monitoring procedures (national indicators)<br>• coverage of surveillance of small-scale systems<br>• existence of reporting system which covers small-scale systems<br>• quality control procedures are in place and applied in small-scale systems<br>• increased level of compliance with established standards |

### *4.1.5. Defining an action plan*

The next step, based on the information and considerations described in Sections 4.1.1–4.1.4, is to establish a concrete action plan for improving small-scale water supply and sanitation systems. This should include timelines, resources (both required and available) and responsibilities for implementation.

Timelines should take into account the geographical spread and number of locations for which improvement is sought, and thus include a step-by-step approach for incremental improvement. For example, training initiatives to increase the qualification level of operators will not typically take place at the same time across the country but will be rolled out over time.

Assigning responsibilities may include review and encouragement of possible partnerships in implementation – for example, by making use of the network of associations, NGOs and aid agencies (see Section 4.1.1 on stakeholder mapping). It is also important that the roll-out of targets at the local level involves local stakeholders.

### *4.1.6. Examples of target-setting under the Protocol*

A number of countries (Belarus, the Czech Republic, Finland, Germany, Hungary, Kyrgyzstan, Norway, the Republic of Moldova and Ukraine) have set and implemented targets related to small-scale water supply and sanitation systems *(39)*. A selection of specific examples is set out below.

**Czech Republic**

In the Czech Republic national targets were first adopted in 2008 and revised in 2013. Several of the 2013 targets specifically address small-scale systems. Target 1 on the quality of supplied drinking-water states that for water mains serving fewer than 5000 inhabitants the number of instances of noncompliance should be reduced to 1% for indicators with high health relevance. Target 2 deals with reissuing or updating awareness materials about wells. Target 6 concerns ensuring that inhabitants of outlying areas and small municipalities can connect to the public mains; it also expands on financial assistance for this target. Target 8 focuses on applying Council Directive 91/271/EEC on urban wastewater treatment *(40)* to small agglomerations with population equivalents of less than 2000 where public sewers exist to reflect one of the priority targets of ensuring high-quality and adequate wastewater treatment *(41)*.

**Hungary**

Specific targets were set in Hungary to improve drinking-water quality in public water supplies and sanitation and sewage treatment for different settlements.

- By the end of 2015 the aim is that 96% of the population should be supplied with public drinking-water that complies with the health relevant chemical limit values and significant improvements should be made in the reduction of arsenic and nitrite concentrations in drinking-water. For example, nitrite noncompliance was reduced in many supply zones as result of implementation of the Nitrite Action Programme, as well as enhanced monitoring and improved management practices. Exceeding the limit values for ammonium, manganese and iron of geological origin is still a frequent problem. The country aims to achieve compliance in the framework of the Drinking-water Quality Improvement Programme and through installation of removal technology in the affected areas.
- A further target was to ensure sanitation and advanced sewage treatment for settlements with population equivalents of more than 15 000 by the end of 2010. Extension of the collective sewerage system is one of the most dynamically developing areas in Hungary as a result of targets corresponding to EU obligations and financial resources provided for the fulfilment of these. The 2010 targets were mostly achieved. The next target is to establish 100% access to sanitation in settlements with population equivalents between 2000 and 15 000 by the end of 2015.
- In addition, a target was set that no untreated sewage should be discharged from settlements with population equivalents of more than 2000 after 2015 *(42)*.

**Kyrgyzstan**

Provision of safe drinking-water and adequate sanitation in cities, rayon centres and rural areas is a major challenge in Kyrgyzstan. A national policy dialogue on integrated water resources management began in 2008, supported by the United Nations Economic Commission for Europe (UNECE), with the initial aim of achieving the millennium development goals and then beginning the target-setting process under the Protocol. Targets were identified and adopted in 2013 by a joint order of the Minister of Health and the Minister of Agriculture and Melioration *(43)*. The targets specifically address the problematic situation of water, sanitation and hygiene in rural areas. For example, intermediate and final targets were set for rural settlements to ensure compliance of drinking-water quality with microbiological and sanitary-chemical standards (in more than 90% of annual samples by 2017 and more than 95% by 2020). This is a concrete example of target-setting in the context of the Protocol by a country that is not a Party to the Protocol, which Kyrgyzstan has not yet ratified.

**Norway**

In Norway in particular, smaller water supply systems face many challenges, including insufficient water treatment and a lack of data on water quality. A number of targets and related measures address these.

- Targets for compliance levels are defined for different sizes of supply type.
- The supervisory authority should maintain an up-to-date overview of the drinking-water quality for all water supply systems supplying more than 50 people.
- All water and sewerage works that serve 50 or more people/population equivalents should have a satisfactory internal control system, including a risk and vulnerability analysis that covers the effects of climate change.

- In accordance with the relevant regulations, drinking-water sources should be protected from pollutants so that the need for treatment of drinking-water is minimized.
- Separate sewerage systems should be adapted to recipients' capacity and should function effectively. The municipalities must survey the condition of the sewerage treatment plants, monitor the need for improvements and supervise the smaller sewerage systems.
- Systems serving population equivalents of more than 50 should be assessed for inclusion in an operational assistance scheme.
- In rural areas connection to public sewerage systems should be considered, as well as cross-subsidization of costly connections to the collective water supply.

**Republic of Moldova**

In the Republic of Moldova the greatest challenges are improving the quality of drinking-water, reducing the percentage of noncompliance in small-scale water supplies and achieving access to improved water supply and sanitation systems. Different targets are in place for urban and rural areas as set out below.

- To improve drinking-water quality, WSPs should be developed and implemented by 2015 in all cities and by 2020 in other settlements with populations of over 5000.
- The percentage of noncompliance of drinking-water with microbiological parameters (such as *E. coli* and enterococci) in annual samples should be reduced by 10% for 2015, 7% for 2020 and 5% for 2025 in rural areas and by 5% for 2015 and 3% for 2020 in urban areas.
- Access to improved water supply systems should be provided to 68% of the total population and 35% of the rural population by 2015 and to 80% of the total population and 45% of the rural population by 2020.
- Access to improved sanitation systems should be provided to 85% of the urban population and 45% of the rural population by 2015 and to 90% of the urban population and 70% of the rural population by 2020.
- The total number of settlements served by improved small-scale (individual and collective) sanitation systems should be increased to 50% by 2015 and to 100% by 2020.

**Ukraine**

Ukraine also set different targets on quality of drinking-water and access to water and sanitation for urban and rural areas, using a step-by-step approach to create the targets. The proportion of annual samples showing noncompliance of drinking-water quality with chemical parameters is targeted at 15% for 2015 and 7.5% of annual samples for 2020 in rural areas, and at 7% for 2015 and 3% for 2020 in urban areas.

### *4.1.7. Further reading*

Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes *(4).*

Guidelines on the setting of targets, evaluation of progress and reporting under the Protocol on Water and Health *(32).*

Guide to public participation under the Protocol on Water and Health *(31).*

## 4.2. Legislation and regulations

- It is important that legislation and regulations cover small-scale water supply and sanitation systems.

- The level of health protection and the principles of safe management set out in legislation and regulations apply to all sizes of system.
- Legislation should take into account the specifics of small-scale systems, including local particularities, geographical spread, their numbers and available resources.
- Several options exist to make legal provisions relevant and suitable for small-scale systems.

Legislation and regulations can be powerful instruments for translating the aims and visions of an agreed policy for small-scale drinking-water and sanitation systems into action, contributing to achieving the goals set. Legislation can provide the “regulatory push” necessary to ensure that improvements to small-scale systems happen. Such a push can stimulate change and help to mobilize resources; this is particularly relevant in resource-limited settings. Legislation and regulations are typically made at the national or subnational level. Nevertheless, the impetus to create legislation can be inspired by “bottom-up” initiatives, where experiences at the local level show or confirm the benefits of feasible approaches that justify and trigger pick-up in national legislation and regulations.

Introducing or modifying legislation can be a complex and lengthy process. Therefore, to ensure greater flexibility, further details of legislative provisions could be specified in supporting documents, which can typically be adapted more quickly and easily to allow for incorporation of technical and scientific developments. These include regulations, bylaws, sanitary norms, standards, technological cards and codes of good practice. For example, the legislative framework might specify that only those substances that are not harmful for health should be used in drinking-water treatment, while the details of the substances to include and/or avoid could be specified in detail in a more flexible document.

The human rights to water, sanitation and health demand that the level of health protection set out in legal and regulatory provisions should be the same for the entire population of the country. This means that national or subnational provisions on drinking-water quality, wastewater discharge quality and environmental protection are universal, regardless of whether supplies are large or small and whether sanitation systems are centralized or decentralized. Principles of safe management also apply across the board, regardless of a system’s size. Several options are available to achieve these outcomes by making legislation and regulations that reflect the situation and particular needs of small-scale systems.

- A step-by-step approach is preferable for implementation of newly introduced requirements – this will encourage long-term improvement and increase compliance. It is likely that it will not be possible to meet all requirements at once, particularly in resource-limited settings.
- Separate legislation and regulations for small-scale systems could be issued (see Case study 4 for an example of regulating small-scale sanitation, including onsite systems) or requirements that address both large and small systems integrated into current legislation. In the latter case, these might include specific provisions for small-scale systems.
- Authorities may formulate specific monitoring and surveillance requirements for small-scale systems that reflect the realities of financial, technical and institutional capacities. Risk-based surveillance approaches allow greater flexibility, taking into consideration local specifics (see Section 4.4 on surveillance).
- Bylaws, documents, sanitary norms, standards, technological cards and codes supporting legislation need to be flexible enough to accommodate new developments (such as newly emerging technologies that may be particularly suitable for small-scale systems).
- The regulatory authority responsible may find it beneficial to approach enforcement differently for large and small systems. The mechanisms used to regulate large systems may be

perceived as threatening by operators of smaller systems and may decrease trust in the authorities. Legislation and regulations should be flexible enough to accommodate approaches to enforcement that will be suitable for small-scale systems, such as a primarily advisory role for local authorities or incentive mechanisms.

**Case study 4. Regulation, institutional framework and financing of small-scale sanitation systems in Finland**

About 1 million people in Finland are not connected to communal sewerage systems because settlements are widely dispersed. The Environmental Protection Act *(44)* concerns all buildings with wastewater effluent in areas with no communal sewerage network connection. The legislation obliges homeowners and occupants to install or renew existing wastewater treatment systems that can fulfil the load reduction criteria under normal circumstances and to keep records about their systems. If all inhabitants at the property are over 68 years of age, however, the property is relieved of liability to install the treatment systems. Inhabitants can also apply for relief from liability for five years for socioeconomic reasons such as low income, sickness or long-term unemployment.

Homeowners and occupants have to bear the costs of changes to the system but can apply for financial aid. Tax deductions can be granted for work done at homes and holiday residences, and allowances for renovations can be granted from general government funds. The Finnish Ministry of the Environment can also, based on the Act on Support for Water Supply *(45)*, subsidize the total costs of the wastewater treatment system by up to 30% (in special cases by up to 50%).

Guiding principles for making legislation and regulations suitable for small-scale systems include the following.

- Good understanding of the reasoning behind changes to legislation will increase compliance among relevant stakeholders (including local municipalities, surveillance agencies, professional associations, operators and the public). This can be achieved by consulting and communicating with them when preparing and implementing legislation.
- Regulatory power to improve the situation for small-scale systems may not always lie within the obvious policy sectors. Those from a different policy sector (such as agriculture or construction) who might have an impact should be involved where possible.
- An ongoing communication and coordination process between relevant institutions and sectors may help to overcome inconsistencies in existing legislation from different sectors. If an interagency coordination mechanism already exists, it is advisable to build on this. The communication process should also include a feedback loop, especially since implementation of regulations for small-scale systems is usually the task of regional and local authorities; this could provide important information for future reviews of legislation and regulations (see Case study 5 for an example of including private wells in national legislation).
- It is beneficial to take into account the status and number of small-scale systems and their geographical spread, as well as institutional capacity to support implementation of legislation and regulations (see Section 5.1 on collaborative arrangements and networking).
- It may be useful to set out definitions and categories of different types and sizes of system in legislation to aid understanding and implementation.
- Policy-makers need to consider the financial impacts of new legislation or regulations and who will bear these, and make provisions to ensure that the financial impacts can be covered.

**Case study 5. Private wells in Germany**

Under the German Drinking-water Ordinance *(46)* the requirements for drinking-water quality must be met by all supplies, regardless of their size or organizational and ownership structures. The minimum requirements cited in the Ordinance therefore apply to private wells, which are also subject to surveillance by the authorities: the same limit values apply, all supplies have to be notified to the respective authority,

they are subject to regular self-checking and independent surveillance and operators have to notify the local health authority in case of noncompliance. Nevertheless, the Ordinance differentiates requirements for the following factors according to the size of the supply and whether it is only for personal consumption:

- frequency of independent surveillance
- scope of parameters and frequency of water testing and inspection
- required measures in case of noncompliance with limit values
- documenting and reporting on drinking-water treatment to consumers
- provision of information to consumers on drinking-water quality
- development of a plan describing measures in case of disruption of the water supply.

Private well owners need to analyse their drinking-water at least annually and to notify the local health authority in case of noncompliance.

Germany has a joint inter-institutional working group on private wells, comprising representatives of the 16 federal states and federal authorities, including the health and resource protection sectors. It is mandated to review current evidence on private wells and to provide advice to the local health authorities responsible for surveillance. The working group has developed an advice booklet addressing private well owners and informing them – in easy-to-understand language – of their statutory obligations, highlighting the benefits of regular self-checking and surveillance by the authorities. It provides information on common hazards in the vicinity and potential structural damage and highlights options for repair, control and monitoring. The booklet also aims to improve communication between owners of private wells and the authorities. The working group has also developed a brochure with recommendations on the surveillance of private wells for local health authorities.

Legislation will usually specify drinking-water quality standards and wastewater discharge requirements and may include other provisions relating to water and sanitation. Legislation and regulations form the backbone of all policy instruments highlighted in this section and can expand upon, amongst others, those policy elements related to good practice highlighted in Section 5. Most countries already have legislation and regulations or sanitary norms on sanitation and drinking-water quality in place, which means that revising them to include requirements to address small-scale systems is not a process that will start from scratch. Legislation from other countries can also serve as a model.

For EU countries, European legislation can serve as a starting-point for action at the national level. The Drinking-water Directive *(11)* lays down minimum requirements on water quality and obligations for remedial actions, monitoring and reporting. The Directive distinguishes requirements for monitoring frequency for different sizes of water supply, depending on the volume of water supplied and the number of people served (see Box 5).

The Directive is binding law for EU countries, but allows exemption of individual supplies providing less than 10 $m^3$ of water per day, or serving fewer than 50 people. Nevertheless, several EU countries (including Germany and Portugal) decided not to leave such supplies unregulated and applied requirements from the Directive to small-scale systems.

**Box 5. Categories used in Council Directive 98/83/EC on the quality of water intended for human consumption (Drinking-water Directive)**

The Directive stipulates monitoring frequencies according to the following sizes of drinking-water supply:

- $\leq$100 $m^3$/day
- >100 to $\leq$1000 $m^3$/day
- >1000 to $\leq$10 000 $m^3$/day
- >10 000 to $\leq$100 000 $m^3$/day

- >100 000 $m^3$/day.

The volumes represent annual averages of drinking-water supplied. Member States may use the number of inhabitants in a supply zone instead of the volume of water to determine the minimum frequency for sampling and monitoring, assuming a water consumption of 200 l/day/capita.

Council Directive 91/271/EEC on urban wastewater treatment *(40)* makes provision for agglomerations with population equivalents of 2000 and over to set up collection and treatment systems. This Directive is complemented by a guide on extensive wastewater treatment processes adapted to small and medium-sized communities with population equivalents of 500 to 5000 *(47)*. Several EU countries (including Finland and the Netherlands) have also put in place regulations to cover wastewater from small communities and settlements with remote houses (see Boxes 6 and 7 for examples of legal and regulatory requirements for small-scale systems).

WHO guidelines provide a scientific point of departure for developing national legislation and regulations defining minimum requirements for protecting public health. These include guidelines for the safe use of wastewater, excreta and greywater in agriculture *(48)* and for drinking-water quality *(49)*. Volume 3 of the latter *(35)* specifically addresses small-scale systems, acknowledging their particularities. This volume deals with planning and implementation of surveillance, undertaking surveys and sanitary inspections, water sampling and data analysis (see Section 4.4 on surveillance). Furthermore, they discuss different types of technology, hygiene education and legislative, regulatory, policy and basic management aspects.

**Box 6. Examples of legal and regulatory requirements for small-scale water supplies**

- In Denmark the requirement for water quality is universal but different requirements are in place for mandatory monitoring, depending on the size of the supply. The legal instrument regulating catchment also applies to small-scale water supplies serving fewer than 10 households.
- Regulations in England specify that the local authority must conduct a risk assessment for and monitor small-scale ("private") supplies *(50)*, whereas for large ("public") supplies responsibility lies with the utilities *(51)*.
- Some countries have issued separate legislation for regulating small-scale supplies, such as Finland's Decree for supplies serving <50 consumers or providing water <10 $m^3$/day – including private household wells – where, according to the legislation, local health authorities must ensure that owners are adequately informed about the water quality in their regions *(52)*.

**Box 7. Examples of legal and regulatory requirements for small-scale sanitation systems**

- According to Finnish law, there must be an appropriate toilet in or in the immediate proximity of each dwelling *(53)*. The article goes on to state that "a toilet has to be placed, constructed and kept in order in such a way that it does not harm the health of those visiting it or staying in its vicinity" (see Case study 4).
- In the Netherlands Article 10.33 of the Environmental Management Act of the Ministry of Infrastructure and the Environment *(54)* stipulates that even though municipalities are responsible for the collection and transportation of municipal wastewater, separate sanitation systems are not prohibited, as long as they do not damage the environment.

Where enforcement capacity is limited and technological innovation or the use of locally appropriate solutions to achieve a particular policy goal are encouraged, incentive-based regulation or market-based instruments can be considered. Incentive-based regulation – including establishing a system of tradable permits for polluting activities that expire after a certain time,

taxes for polluting activities, subsidies for activities preventing pollution and combined approaches – has a long tradition in environmental policy-making *(55, 56)*.

In the context of small-scale systems, for instance, it is conceivable to lower taxes for wastewater treatment plants according to the level of effluent quality achieved. Other incentive-based mechanisms may be relevant in the context of resource protection (see Section 5.3). In a similar vein, donor agencies have been exploring results-based financing mechanisms, including for solutions for small-scale sanitation systems. The publication *Identifying the potential for results-based financing for sanitation (57)* provides examples of these efforts.

### *4.2.1. Further reading*

Guidelines for drinking-water quality – fourth edition *(49).*

Guidelines for drinking-water quality – second edition. Volume 3: surveillance and control of community supplies *(35).*

Guidelines for the safe use of wastewater, excreta and greywater. Volume 2: wastewater use in agriculture *(48).*

Identifying the potential for results-based financing for sanitation *(57).*

## 4.3. Design and management standards

- Policy-makers responsible for small-scale water supply and sanitation systems or other stakeholders can either develop specific standards or select those that are appropriate and applicable for small-scale systems from the pool of generically valid design and management standards.
- Making standards available to operators of small-scale systems and explaining them in easy-to-understand language is beneficial for their application.
- Technical standards may have a higher legal significance, whereas guidelines can be changed more flexibly and can be developed in language that targets operators of small-scale systems.
- International standards and guidelines need to be adapted to the national context and made available in national or even local languages.

In order for small-scale systems to provide safe services that are protective of human health it is advisable that they adhere to proper technical standards and/or guidelines offering information and requirements for their design, construction, operation and management, among others (see Box 8). Using guidelines may reduce errors and can simplify the approval of systems.

**Box 8. Definitions of standards and guidelines for small-scale systems**

Standards, guidelines and similar technical and management documents can be statutory or nonstatutory. When a law or regulation does not necessitate a specific standard or guideline, a user may choose any other technical solution that provides compliance with the mandatory legal requirements. Technical standards and guidelines may specify the design of water or wastewater treatment systems and processes, distribution/collection systems, wastewater reuse, construction procedures, operation of plants (risk management), monitoring requirements, laboratory accreditation, training and qualification requirements (see Section 4.6. on education, qualifications and training programmes),environmental and cultural protection, among others.

**Technical standards**

Technical standards (also sometimes referred to as technological cards, management standards or codes of good practice) comprise a set of rules. They are different from water-quality standards. They set definitions, specifications and requirements for technology, products, processes, services and proper management. Such standards may be initiated by industry or legislators and are typically approved by national or international standardization organizations. Products, processes and services are typically

standardized on a voluntary basis; however, laws, regulations and sanitary norms may refer to them and require compliance with them.

**Guidelines**

Guidelines are sets of instructions, recommendations or technical information prepared by expert organizations or government bodies. They can be adopted as legal requirements or used only as recommendations. Guidelines can be continually updated according to changes in technology and can therefore change much faster than regulations and standards. In contrast to standards, guidelines are broader and can refer to a wider range of options and possibilities. Guidelines may, for example, refer to an integrated water resource management approach that promotes coordinated development and management of land and water as well as surface water and groundwater.

Legislation may make reference to standards that specify relevant provisions. It may also allow the use of products, technologies and management approaches that are not (yet) standardized, provided they meet the stipulated requirements aiming at health protection, operation demands and limit values. Technologies and management approaches that are not standardized may be described in guidelines. For example, compact sanitation systems are often standardized, while natural treatment systems tend to be covered by guidelines. Guidelines can be adapted more rapidly to new technologies and may be more applicable than fixed standards. Standards may also specify how to operate and manage potentially contaminating activities safely in order to protect source water. Case study 6 provides an example of legislation referring to standards and guidelines. It also shows how technical and scientific associations select those standards and guidelines most relevant to small-scale systems and make them affordable.

**Case study 6. Technical standards and guidelines for small-scale water supply and sanitation systems in Germany**

One of the main tasks of the German Technical and Scientific Association for Gas and Water (DVGW) is developing technical rules and standards that represent generally recognized codes of practice, as referred to in the Drinking-water Ordinance of 21 May 2001 *(46)*. The rules and standards support drinking-water hygiene and the safe operation of drinking-water supplies in Germany. Their development is based on a process of broad participation of experts and practitioners in their respective fields; thus, they represent the latest technical knowledge and principles applied in the field.

Fulfilling their requirements leads to legal certainty for operators and supports due diligence in the operation of drinking-water supplies. Areas covered by these standards and rules include, for example, management of source waters and drinking-water installations, as well as abstraction, treatment, distribution, organization and management of drinking-water supplies. Many operators of small-scale supplies, however, regard this set of more than 350 technical rules as too expensive and complex to implement. Application of the full set is not widespread and operators often follow only a limited number of the rules.

In response, DVGW facilitated application in small-scale supplies by selecting the 45 standards and rules most applicable to small-scale systems. The selection includes technical rules on organization and management of drinking-water supplies, planning for emergencies in public water supplies, norms of the German Institute for Standardization and relevant legislation. DVGW offers this selection at a significantly reduced price. The online version also provides links to scientific publications and circulars, as well as information on dates of relevant training courses.

Furthermore, the German standard DIN 2001 specifically addresses requirements for drinking-water, planning, construction, operation and maintenance for small-scale water supply units and nonstationary plants *(58)*. The German Federal Environment Agency published a guidance document targeting private well owners, which provides advice and guidance on legal requirements, sanitary inspection and remedial actions *(59)*.

The German Association for Water, Wastewater and Waste (DWA) plays a similar role in the field of sanitation and wastewater management. It publishes uniform technical guidelines for water management, land development, soil conservation, wastewater and waste technology. The guidance documents contain

statements on the latest developments in planning, construction, operation, maintenance and inspection of facilities, on services and products and on the sustainable use of water and soil. DWA has prepared several guidelines for small-scale wastewater treatment systems *(60–62)*.

The technical rules are prepared by specialist committees and are subject to a formal public procedure of acceptance. They are usually developed in consultation with other organizations and follow a defined standard.

Following their adoption, standards and guidelines have to be applied effectively in small-scale systems and mechanisms for proper implementation must be ensured. Nevertheless, operators of small-scale water supply and sanitation systems and local authorities advising homeowners often struggle with limited skills and knowledge. They may need support in applying good construction and operational practices according to the standards and advice on how to improve the system and its operation. Operators may be overwhelmed by the wide range of standards and guidelines available, which are not necessarily all pertinent to small-scale systems. Another potential obstacle to the use and adoption of technical standards in small-scale systems is that they often need to be purchased. Guidelines, in contrast, are often available free of charge; they may support implementation of standards in small-scale systems by offering, for example, further background information or examples of what the application may look like in practice; and they may use simpler language to facilitate implementation.

Policy-makers and other stakeholders can help to overcome these challenges for small-scale systems by, for example:

- developing specific standards and guidelines;
- selecting from the wide range of standards and guidelines those most relevant;
- making relevant documents available free of charge or at a reasonable price that operators can afford;
- raising awareness about the existence of relevant standards;
- helping operators to access standards (for example, through Internet platforms or by distributing hard copies);
- providing assistance or guidance to facilitate understanding of relevant standards, which are often written in difficult technical language.

National technical and management standards for small-scale water supply and sanitation systems should consider the systems' size and local characteristics. Technical solutions need to fit the reality of the systems. For example, slow sand filtration, ultraviolet disinfection and chlorination are effective at a large scale but can also be tailored to small-scale systems. Provisions for collective sanitation systems could cover technical and managerial aspects of wastewater collection, treatment, discharge and (if applied) reuse, including quality of discharged wastewater, location of systems and sites for discharge (especially with respect to the location of surrounding water supplies). In the same context, policy-makers could consider the possibility of encouraging source separation (collecting domestic wastewater separately from rainwater runoff) in order to decrease the amount of wastewater or to make it more suitable for treatment and reuse and to set the potential for rainwater harvesting. However, if the norms and standards are referred to in legislation, it should be ensured that this does not hinder the application of alternative innovative solutions.

The obligations for construction, operation and maintenance of onsite sanitation systems also need to be regulated. These may be the responsibility of the site owner or conferred upon a service

provider – such as a public wastewater association running collective as well as onsite systems – or a special service institution (see Section 5.1 on collaborative arrangements and networking).

Legislation can adopt a list of standards applicable in different settings, such as different treatment technologies for different sizes of system. If legislation requires compliance with a certain standard, it should clearly state whether it is applicable to all systems or just selected ones. Different standards may be required for different sizes of system and different locations. The WHO guidelines for drinking-water quality *(49)* encourage national regulatory agencies to formulate health-based targets in terms of specific technology targets for small-scale water supply systems. Legislation may thus make reference to standards addressing, for example, specific and approved treatment processes or requirements for protection of wellheads. References to standards make it easier to keep such targets up to date with prevailing scientific knowledge and technology.

Products and processes can be standardized on a national, multinational (the European Committee for Standardization, for example) or international level (the International Organization for Standardization, for example). When developing standards for small-scale systems, those from other countries or at a multinational level can be used as models, particularly if they refer to a similar setting (see examples from the European context of standards and guidelines specifically addressing small-scale systems in Boxes 9 and 10). Guidelines are also available at national, multinational and international levels. Guidelines and standards usually complement national or international water and wastewater legislation.

**Box 9. Examples of standards and guidelines for small-scale sanitation systems**

At the EU level the following standards specifically address small-scale wastewater systems:

- small wastewater treatment systems for up to 50 PT [population equivalents] – Parts 1–7 (EN 12566) *(63)*;
- mobile non-sewer-connected toilet cabins – requirements of services and products relating to the deployment of cabins and sanitary products (EN 16194) *(64)*.

Austrian guidelines address constructed wetlands soil filter application, dimensioning, construction and operation *(65)*.

Denmark has guidelines for implementation of both vertical flow *(66)* and horizontal flow *(67)* reed bed treatment plants for population equivalents of up to 30.

The German principles for design, construction and operation of reed beds for municipal wastewater for population equivalents of up to 1000 have also been published as technical guidelines (see Case study 6).

**Box 10. Examples of standards for small-scale water supplies**

Austrian guidance for implementation of a simple WSP was published in 2008 *(68)*.

Belarus's Aqua-Bel Association has produced regulations on water supplies and sanitation in cottages and on facilities and equipment of decentralized drinking-water supplies used in populated areas *(69).*

Finnish authorities and research institutes have produced several guides applicable to small-scale water supplies, covering emergency planning, crisis communication, operation and maintenance of small waterworks, back-up distribution during delivery breaks, wells, well-water analyses, materials used in drinking-water mains and good practices for sewage water treatment (see, for example, *Operation and maintenance of small waterworks (70)*).

In Ireland the Department of the Environment, Community and Local Government produced guidance documents on the preparation of rural water strategic plans and on treatment for group water schemes in 1998 *(71)*. The National Federation of Group Water Schemes also publishes information booklets and

training for the efficient operation of small water supplies *(72).*

The Regulatory Authority for Water and Waste Services in Portugal has published technical guides and recommendations on its website, including Recommendation 03/2008 on control of drinking-water quality in individual supplies *(73).*

The Republic of Moldova has produced sanitary regulations for non-piped water supply quality, protection and maintenance Nr. 06.6.3.18-96 *(74)*.

Scotland has produced a technical manual for private water supplies in the United Kingdom *(75).*

The Swiss Gas and Water Industry Association (SVGW) has produced Regulation W 1002, which offers recommendations for a simple quality assurance system for water supplies *(76)*.

### *4.3.1. Further reading*

TBC

## 4.4. Surveillance

- A comprehensive surveillance approach is advisable for small-scale water supply and sanitation systems, which are frequently located in rural areas. This would go beyond monitoring of the quality of drinking-water supplied and treated wastewater discharged to include monitoring of the safe management of systems and inspection of the physical status of the infrastructure.
- In the case of small systems, independent surveillance and self-checking by service providers constitute complementary elements.
- A cooperative approach to surveillance – focusing less on fining noncompliance and more on providing support and technical advice – supports agencies undertaking surveillance activities for small-scale systems.
- The remoteness and broad geographical spread of small-scale systems may pose challenges to securing their routine surveillance. Options are available to facilitate surveillance for small-scale systems, which benefit from being specified in regulations.

Surveillance is an investigative activity undertaken to identify and evaluate potential health risks associated with drinking-water and sanitation systems. It contributes to the protection of public health by promoting improvements to drinking-water supplies and provides an opportunity to gather data about the status of small-scale water supply and sanitation systems. Onsite surveillance activities also facilitate provision of technical advice to those who operate small-scale supplies, as well as building relationships and trust between those people and the relevant surveillance authorities. A dual approach that involves contributions from both the authorities responsible for independent oversight and operators of water supplies is effective, particularly for small-scale systems. Case study 7 provides an example of combining independent surveillance and regular self-checking by operators with the legal requirement for a WSP approach.

**Case study 7. The dual approach – water-quality surveillance by authorities and operator self-checking for WSP monitoring in France**

Compliance sampling and analysis requirements for surveillance are defined by the French water authorities according to the Drinking-water Directive *(11)*. Regional health agencies organize sampling and analysis at the local level, to be carried out by independent laboratories after a formal tendering process.

In addition to this independent sampling, operators are obliged to create a WSP that outlines suitable monitoring for routine operations. The monitoring activities must provide relevant information to ensure that hazards do not enter the system and must comprise the following, according to the French public health code *(77)*:

- regular verification that measures to protect the resource and supply are in place and effective, and that works are operating according to specifications;
- a sampling and analysis programme at critical points identified by the risk analysis, as defined by the water supplier;
- a file containing all the instructions and records (the "sanitary file").

For treatment plants and distribution systems regular verification must cover, among others, availability of chemicals, regular checking of sensors and control for intrusions. Sampling and analyses (onsite measures with quick field tests or laboratory analyses) must be proportionate to the risks identified, and sampling frequency defined according to the resources and performance of the installations.

In this dual approach to water surveillance by authorities and operators, record-keeping in the "sanitary file" is essential to ensure traceability of operations and surveillance; the approach also ensures greater frequency of monitoring or more control points on specific parameters. If the water authorities observe noncompliance in their sampling they can check the "sanitary file", and an operator discovering noncompliance during self-checking is obliged to alert the authorities. This set-up enables health services to verify that the WSP is effective.

Whereas national agencies provide a framework to enable and require operators to meet obligations and independent agencies to perform oversight, the actual surveillance takes place at the local level. Relevant agencies should be required to perform regular surveillance by auditing aspects of safety and/or verification testing. Ideally this would be supported by more regular self-checking by operators to ensure that their systems are capable of routinely delivering safe services, and by reporting of related outcomes. Case study 8 provides an example of how independent surveillance of small-scale sanitation systems by the relevant authorities can be supported by checks conducted by certified experts.

**Case study 8. Surveillance of small-scale onsite wastewater treatment plants in Bavaria, Germany**

In the Federal State of Bavaria around 84 000 small-scale onsite wastewater treatment plants for which the owners are accountable are in place for 380 000 inhabitants *(78)*. The requirements for effluent standards are set according to both the size of system (in line with the Waste Water Ordinance *(79)*) and the receiving water where the effluent is discharged to (in line with the water law of the state). Most of the plants (82%) need to meet the standard for biochemical or chemical oxygen demand removal only, 11% the standard for nitrification and 7% the standard for nitrogen removal. An additional requirement to meet hygienic standards concerns 6% of the plants and 1% regarding phosphorus removal.

Bavaria initiated an incentive programme for 2003–2014 to upgrade small-scale wastewater systems, which provides €2000 on average per small-scale wastewater treatment plant. The programme has been allocated a total of €172 million until the end of 2013. It is envisaged that by 2015 all small-scale wastewater systems in Bavaria will be upgraded.

Technical systems for onsite wastewater treatment require approval from the German Institute for Structural Engineering (DIBt). Based on this approval, maintenance routines have to be carried out two or three times annually, according to the type of technology. Regular surveillance by the regional water authorities, as for urban wastewater treatment plants, is not feasible for small rural systems, but effluent standards are expected to be met if the construction, operation and maintenance are performed according to the approved specifications. Based on the Bavarian Water Act *(80)*, the owner has to prove that the treatment plant fulfils the effluent standard every second or fourth year by assigning a certified expert to assess the system. As part of this assessment, an onsite inspection is conducted to check performance and the operational diary is reviewed to assess self-checking and maintenance, including results.

The Federal State of Bavaria created a free Internet platform for surveillance and approval data from onsite wastewater treatment plants *(81)*. Although its use is voluntary, data from more than 50 000 wastewater treatment plants have been recorded to date. Evaluation of the data shows extensive compliance with both the Waste Water Ordinance effluent standards and the DIBt approval criteria: 94% of the plants meet the required chemical oxygen demand standard, 83% the nitrification standard, 77% the nitrogen removal standard and 80% the phosphorus removal standard. If the results do not meet the legal requirements immediate action needs to be taken by the operator and, in case of significant deficiencies, a

follow-up check needs to be conducted by a certified expert within two months.

In the context of small-scale water supply and sanitation systems, independent surveillance can encompass the following activities:

- monitoring of drinking-water quality;
- onsite sanitary inspections of drinking-water supplies' infrastructure and surroundings;
- monitoring of other service level parameters, such as water quantity supplied and accessibility, coverage, affordability and continuity of sanitation and water systems;
- monitoring of treated wastewater for discharge or reuse, focusing on relevant health-related parameters;
- checking of monitoring routines and results of operators of small-scale systems;
- onsite inspections of public latrines or toilets (for example, in schools);
- data collection on safe operation and capacity (for example, an operator's qualifications);
- auditing of WSPs where these are in place.

Sanitary inspections are a crucial element of surveillance of small-scale systems. They can be performed more regularly and at lower costs than drinking-water-quality analyses. They establish information about the possible sources of immediate/ongoing contamination, identify contamination sources (possibly before they can compromise water quality), provide a longer-term perspective on causes of contamination, enable prediction of likely future changes (as an "early warning" function) and enhance knowledge of supply system conditions. Detailed information on surveillance and control of community supplies can be found in volume 3 of the WHO guidelines for drinking-water quality *(35)*, including both regulatory and practical aspects.

Where capacities and resources allow, surveillance approaches may also include additional factors, such as monitoring and annual auditing of indicators of financial management of small-scale public systems (for example, unaccounted-for water, tariff levels and financial balance sheets). These factors are usually not addressed by surveillance agencies tasked with water-quality surveillance. It may therefore be advisable to strengthen cooperation with agencies working in the area of financial surveillance. Similarly, agencies tasked with water quality surveillance may wish to cooperate with disease surveillance agencies to obtain a better picture of the presence and status of waterborne diseases.

Surveillance means that a systematic approach is taken to all these activities. It not only safeguards regular investigation of drinking-water quality but also establishes who is responsible for conducting the surveillance and how often, what activities this encompasses and which systems are subject to these activities. In addition, it ensures that information is generated from the data obtained, which can be used to identify improvement actions, inform policy-making and detect potential and actual risks to public health and/or to the sustainability of the service. While surveillance takes place at the local level, organization of surveillance systems should take place at the national or subnational agency level. National or subnational policy-makers should make provisions on surveillance in legislation and regulations, considering the guiding principles for small-scale systems explained in Section 4.2.

In the context of small-scale systems, surveillance agencies often need to take on a supporting role. Indeed, to achieve improvements it may be more important to give guidance and/or organize external support rather than threaten dire consequences of noncompliance such as fines. It is often

useful to have such statutory compliance requirements and to make sure that operators of small-scale and individual systems understand that they must eventually be implemented, but to allow time and give support (such as technical advice) to solve the problems identified. Such an atmosphere of cooperation facilitates access to information for the surveillance authority. It is therefore beneficial if regulations on surveillance accommodate such cooperative approaches for small-scale systems.

Various challenges mean that authorities tasked with undertaking surveillance activities for small-scale water supply and sanitation systems are often unable to do so. Small-scale systems are generally in rural locations, and very large numbers of them can be dispersed over wide areas. Unresolved ownership of such systems also represents an obstacle to surveillance; in these cases there is no legal entity to which the surveillance agency can prescribe remedial and corrective measures or penalties. In order to overcome this barrier it is beneficial to clarify such responsibilities through regulation (see Section 4.2 on legislation and regulations).

### *4.4.1. Facilitating surveillance for small-scale systems*

Conducting drinking-water and wastewater quality tests, onsite visits for sanitary inspections and information collection may be a resource-intensive task in terms of staffing, travel time, travel costs, sampling devices, consumables and transport, as well as laboratory capacities. In order to overcome these costly and logistical difficulties, and acknowledging that visiting (including follow-up), inspecting and testing of all systems – even at minimum frequencies – is not always feasible, several options are available to facilitate surveillance for small-scale systems. If national policy-makers choose to make use of these options, it is important that their application is supported by legislation and regulations so that local authorities are able to apply them in practice.

The first option is to support independent surveillance with activities conducted by operators of small-scale systems.

- Sanitary inspections do not have to be conducted by the surveillance agency alone; they can be carried out by operators of small-scale systems or other community members to support independent surveillance.
- Water-quality testing by surveillance authorities can be complemented by self-testing by operators of small and individual systems. This requires establishment of a mechanism for collecting and ideally reporting of these data, as well as the facility to contact the regulatory agency in case the operators or users are concerned by the results. Prerequisites for complementing surveillance activities by self-testing include trained operators and continual supply of consumables.
- Self-reporting is also a relevant and feasible option for many of the other parameters of service level, financial sustainability and operator capacity. Some of these data already need to be collected by operators. For example, an operator may need to measure quantities supplied regularly in order to establish how much water is being produced, sold and lost. The aggregate numbers can be reported to the relevant authorities, such as regulators. The same goes for financial data. It is important, however, that the authorities provide feedback on the information received and suggest measures to improve in order to achieve the spirit of cooperation outlined above.
- In order to increase commitment to support of independent surveillance and improvements, communication to enhance understanding of surveillance results and required follow-up actions – through either verbal explanations or easy-to-understand written guidance – is a helpful approach. This could be combined with awareness-raising activities (see Section 4.7 on advocacy and awareness-raising).

The second option is to use analytical and communication solutions to overcome the challenges related to system remoteness.

- Sufficiently equipped laboratories may not be available in rural areas to allow for complex analyses of a wide range of parameters, and the time taken to transport samples from remote supplies may be too long to allow timely analysis of, for example, microbial parameters. Mobile laboratories and/or field testing kits can be used by authorities conducting surveillance. By analysing water quality on site, the burden of transporting samples – as well as the administrative effort of reporting results back to the system managers – is decreased. Results can be shown and communicated directly to the operators and users, fostering their understanding of the relationship between water, sanitation and health. If use of field testing kits is an officially accredited method that is allowed by law, it is important to maintain the supply of testing chemicals and other consumables to surveillance authorities in order to ensure their sustainable use. The selection of parameters to be monitored and the type of monitoring (whether via central/regional laboratories, mobile laboratories or field kits) will depend on the financial resources that can be provided from the national level, as well as the remoteness of the systems to be monitored.
- Communication technology can help to facilitate surveillance activities for small-scale systems, such as the use of Internet-based data collection and exchange, mobile phone technology, exchange of digital photos to report on Internet risks discovered or improvements made and the option of phone consultations with surveillance authorities. Using such technologies can reduce the administrative and financial burden for authorities and support continual surveillance.

Another option is to prioritize small-scale systems for surveillance.

- Risk-based approaches such as WSPs can support prioritization of surveillance efforts, particularly in low-resource settings. If in place and made available to surveillance agencies, these can be used as a basis to decide on:
    - coverage and schedules for water-quality testing, including emphasis on those supplies that report significant risks;
    - frequency of inspection visits, decreasing with previous satisfactory surveillance results;
    - tests, which may have a limited number of parameters to begin with but may be expanded if there is an indication of risk from specific contaminants.
- If no risk-based approach is in place or if legislation does not allow for such an approach, system sizes can be used as a first indicator to help prioritize surveillance activities: sampling and inspection frequency can be staggered according to the population sizes served. This should not, however, lead to a lack of surveillance of small-scale systems in the long term, and surveillance should aim at a representative picture of the prevailing technologies and conditions.

As with legislation and regulation, surveillance activities relate to many other aspects of good practice discussed in this document. For example, if surveillance that covers small-scale water supply and sanitation systems is in place, the results may be used as indicators for documenting progress towards achieving targets (see Section 4.1 on baseline analysis and target-setting). Surveillance results may also inform water safety planning processes by identifying areas of concern that need increased attention. At the same time, information resulting from the WSP process can also feed into a surveillance system (see Section 5.2 on water, sanitation and hygiene safety planning). Surveillance that covers small-scale systems, including in remote areas, also requires financial means, which need to be mobilized (see Section 4.5).

**Case study 9. Placeholder: Notification system for waterborne outbreaks in Finland.**

**Case study 10. Kazakhstan: risk-based approach to surveillance**

**Case study 11. A risk-based surveillance approach in Scotland**

Sampling and analysis requirements for small-scale water supply and sanitation systems in Scotland are specifically set out in national legislation. Scotland is obliged to comply with the requirements of the Drinking-water Directive *(11)* for supplies that produce $10m^3$ or more a day, supply 50 or more people or supply a commercial or public activity. The Private Water Supplies (Scotland) Regulations 2006 *(84)*, meantime, set out requirements for sampling on request from owners and users of small-scale systems (those producing less than $10m^3$ a day or supplying fewer than 50 people). A risk-based approach for many parameters is allowed for in the regulations, so that a large number of parameters can be eliminated either through risk assessment or if they have not been detected over a period of time. This significantly reduces the cost to the owners and users of supplies, who are generally charged for sampling and analysis. Samples are taken by local authority environmental health teams and must by law be analysed at an accredited laboratory.

Sample results are reported by the local authority to the owners and users of supplies and the authority is under a duty to investigate failures of water quality standards and to give health-based advice on the supply. Formal notices of improvement can be issued. Analysis results are reported by local authorities to the Drinking Water Quality Regulator for Scotland under a statutory requirement; they are published in the Regulator's annual report.

### *4.4.2. Further reading*

Guidelines for drinking-water quality – fourth edition *(49)*.

Guidelines for drinking-water quality – second edition. Volume 3: surveillance and control of community supplies *(35)*.

Chemical safety of drinking-water: assessing priorities for risk management. Geneva: World Health Organization; 2004 (http://www.who.int/water_sanitation_health/dwq/cmp/en/, accessed 24 October 2014).

## 4.5. Costing and financing

- Several options are available to ensure affordability of water and sanitation services for users of small-scale systems, including arrangements to pool financial risks between systems.
- Sustainable financing requires good financial planning and assessment, including accurate estimations of costs.
- Recovering costs for small-scale systems requires a combination of different sources of financing.

Making provisions for the sustainable financing of small-scale water supply and sanitation systems is the basis for maintaining good services in the long term, ensuring affordable services for all, and thereby represents a means to create equitable outcomes. While improvements generate costs at the beginning, they will nevertheless result in savings, such as through higher willingness to pay tariffs and better cost recovery in the long run. Above all, the framework of sound tariff-setting rules and mechanisms should be established at the national or subnational level to promote more efficient use of water resources and ensure transparency and predictability.

The provision of water and sanitation services incurs different types of cost, ranging from the initial development of the infrastructure and employment of qualified staff to ongoing operation and maintenance, and even the payment of interest over capital (see Table 2). It is important that all

these costs are covered, which may require different sources of financing. For small-scale water supply and sanitation systems, this raises some important considerations about the extent to which they can be covered through tariffs and public funding in relation to the affordability of the service.

**Table 2. Cost components of rural water, sanitation and hygiene services**

| Cost category | Description |
|---|---|
| Capital or one-off costs | |
| Capital expenditure – hardware and software | Expenditure on fixed assets such as concrete structures, pumps, pipes and toilets, both for initial construction or system extension, and the accompanying "software" such as capacity-building or sanitation promotion |
| Recurring costs | |
| Operating and minor maintenance expenditure | Expenditure on labour/staff, fuel, energy and materials needed for operation and routine maintenance to keep systems running, not including major refurbishment |
| Capital maintenance expenditure | Renewal, replacement and rehabilitation costs that go beyond routine maintenance – prioritization based on water (and sanitation) safety planning is a strong basis for such investments |
| Expenditure on direct support | Costs of ongoing support to users and local stakeholders – for example, support by local government to service providers and monitoring |
| Expenditure on indirect support | Costs of higher-level support, such as government planning, policy-making and regulation |
| Cost of capital | Costs of servicing capital such as repayment of loans or payment of dividends and the cost of tying up capital |

*Source*: adapted from Fonseca et al. *(85)*.

Financing sustainable, reliable and safe services requires that approximate costs are known from the start so they can be matched with sources of financing. In reality, cost data for small systems are often lacking or incomplete, and it is crucial to carry out assessments on the size and distribution of all relevant cost categories. Reference costs may be known, particularly for the initial capital expenditure, but much less insight often exists in the other cost categories. This information can be obtained from dedicated studies, which could be commissioned by national policy-makers. To give even better groundwork data, the different costs could be tracked regularly, based, for example, on a sample of representative types of system.

### *4.5.1. Sources of financing*

As shown in Table 2, costs may occur at different levels – namely:

- at the national or subnational level for higher-level support, such as government planning, policy-making or establishing grant schemes;
- at the local authority level for ongoing technical support and advice and surveillance activities;
- at the local system level for capital expenditure, staffing and ongoing repair and maintenance costs, among others.

After the approximate costs are known, it is important to identify, in broad terms, the sources of financing. The Organisation for Economic Co-operation and Development (OECD) divides these sources into three large groups: tariffs (user fees and initial contributions), taxes (internal public finance) and transfers (external development aid) *(86)*. Other sources often mentioned – such as

micro-credit – eventually fall into one of these three groups. Credit, for example, needs to be paid back by users and would thus come under the “tariffs” heading.

A challenge in identifying which source of finance should cover which costs is that the financial gains often occur for a different group of stakeholders from the group that pays. At a higher level, the health sector may benefit from protective regulations established in the environmental sector, for example. Furthermore, there is a time aspect to this issue: financial gains may only occur in the middle or long term after investments have been made.

With the OECD’s three sources of funding in mind, the cost categories are typically funded as follows.

**Capital expenditure**

In most countries the bulk of initial investment costs come from taxes, supported by transfers where relevant, in line with the public responsibility to provide basic services like water and sanitation. It is common practice that communities contribute a part of the initial investment costs – sometimes as an upfront payment, sometimes included in the tariff later in the process. Private water supplies from individual wells or springs are by definition almost entirely self-financed. Collective aspects of sanitation like sewers or wastewater treatment plants are usually covered by public finances. For onsite sanitation, policies differ greatly: some countries provide full subsidies (essentially applying public financing); in others it is the financial responsibility of the individual household.

The main question for this cost category is often whether the current total levels of investment from taxes and transfers are sufficient either to cover the people who do not yet have access or to upgrade existing services – for example, to increase safety and reliability. This question can be answered through exercises such as estimating the investment that would be required for universal coverage. If the outcome of this exercise is not satisfactory, an argument can be made for mobilizing additional investments, including loans from banks. Given the higher per capita costs of small-scale water supply systems and the fact that most urban areas in Europe are already well covered, additional funding may also be raised through urban tariffs higher than the actual costs of the urban services. The additional funds raised may then be used for investment in rural areas to cover small-scale systems; this represents a solidarity mechanism in the country.

For example, Hungary has a subsidy system targeted towards areas that face very high costs of services, within which an inter-ministerial committee allocates the total available budget appropriation. In Spain the Aragonese autonomous community has designed the financing of the construction and operation of new wastewater treatment plants in agglomerations of more than 1000 inhabitants such that the inhabitants of the capital city of Zaragoza (home to over half of Aragon’s population) effectively cross-subsidize the costs for the rural areas. In this setting, the costs for sanitation services are the same for all users, irrespective of the actual costs of the service. Cross-subsidizing may also take place across borders: for example, French subnational authorities can use funds from their budgets and water bills to fund decentralized cooperation in the water and sanitation sector *(6)*. Such advanced types of financing via tariffs require very clear accountability frameworks so that citizens can see how their tariffs are invested.

In some cases, countries rely on external financial means to improve and/or extend the water and sanitation infrastructure and to cover financial gaps. External support is typically a one-off or temporary source that may be used to establish infrastructure in the first place. This needs, however, to be supported by, for example, taxes for sustainable financing of continuous management of the systems. Official development assistance or donor assistance was for many

years a potential source of financial support for the eastern Europe, Caucasus and central Asia region. As grant aid may reduce, loans may become more important to finance capital expenditure. This, in turn, will require having a strong economic rationale for investing in small-scale water supply and sanitation systems. Guidance on considerations for making social cost–benefit analyses of drinking-water interventions with special reference to small-scale systems can be found in the WHO publication *Valuing water, valuing livelihoods (87)*.

**Operation and minor maintenance costs**

Regulations in most countries indicate that these costs should be covered fully from tariffs – the monthly instalments users pay their service providers. In the context of small systems, however, several factors need to be considered.

- In order to set appropriate tariffs to allow for cost recovery, service providers must have good insight into their cost structures. This can be achieved by providing guidance and training for operators of small-scale systems on how to set tariffs and estimate costs at the system level. Regulators are often tasked with providing such guidance and support..
- Only service providers of sufficient size are able to recover all their operation and maintenance costs from tariffs. Those servicing very small systems are often able to cover only the minor recurrent costs (such as the salary of an operator or minor repairs), but will usually require (cross-) subsidies from larger systems or general taxes for occasional bulky costs (such as major repairs).
- To ensure that tariffs are reflective of sustainability considerations and to prevent them being lowered for political reasons, it is advisable that regulations on tariff-setting define a framework, reflecting the economic realities of small-scale systems and taking into account affordability and social criteria. This supports service providers in defining a tariff that allows them to recover operational costs and protects them against undue interference.
- Synergies should be found in tariff-setting between sewerage wastewater management and water supplies to compensate for potential differences in willingness to pay. For example, service providers usually correlate the tariff for wastewater services with drinking-water tariffs, charging for the wastewater service according to the quantity of drinking-water delivered to the household.

**Case study 12. Place holder: Protecting tariffs from undue interference through economic regulation in Portugal**

**Capital maintenance expenditure**

This category frequently appears to be underfunded in practice, particularly in small-scale water supply systems. Tariffs are often adequate to cover operation and minor maintenance, but including full capital maintenance expenditure in the tariff is often not feasible, even in well developed countries. Moreover, if these costs were included in the tariff, a small-scale system service provider would need to set aside money over a long period prior to the system replacement, which is not economically efficient use of money, as it is sitting idle in a bank account and subject to inflation. Instead, these costs are often covered through rehabilitation programmes paid for out of general taxes (not tariffs), but this frequently happens in an ad hoc manner, as in many countries no ongoing provisions are made for such work *(89)*. The following more efficient alternative options to fund renewals and repairs could be considered:

- creating larger organizational units, in which individual or small-scale system operators or communities contribute to a common fund (see Section 5.1 on collaborative arrangements and networking), possibly also replenished from public taxes;
- national or subnational governments organizing their own maintenance funds to support communities.

**Direct support costs**

These are most often incurred by local government and are thus funded through taxes. They include, for example, the costs of surveillance and providing operators of small-scale water supply systems with technical assistance and advice. It is important in national policy-making to provide indications for the parts of the budget to be spent on surveillance of and support to small-scale systems, and to take into account different needs of funding of small-scale systems in rural areas (where surveillance needs to cover remote areas) and urban systems.

**Indirect support costs**

These fall under the "taxes" heading. Public sector agencies fulfil these roles and carry the costs. In some instances they may be supported via transfers – for example, for specific pieces of work like the development of policies on small-scale systems or sector reform programmes.

**Costs of capital**

This is often neglected but can be quite substantial. It needs to be considered depending on how the capital was obtained. In the case of interests on a loan, the cost of capital will be borne by general tax payers.

### *4.5.2. Financing, affordability and subsidies*

Financing systems should take into account the affordability of these services for all consumers, including the poor, as part of achieving equitable access to drinking-water and sanitation services. If no country-specific data are available, as a rule of thumb 3–5% of the household budget spent on water and sanitation can be used as an indicator of affordability for planning purposes *(90–94)*. [Note: the original endnote contained these citations, but none appears to be listed among the references: "van Damme and White, 1984; Saunders and Warford, 1986; McPhail, 1993, Briscoe, 1998; Waughrey and Moran, 2003". Could you provide publication details for all of these (or whichever are actually required)?].

National, subnational or local solidarity financing mechanisms can help in providing access to safe water and sanitation through small-scale systems in rural areas. In Armenia, for example, the water supply is – regardless of system size – financed mainly by tax-based subsidies and only approximately 35% by tariffs *(95)*. Many countries have such mechanisms in place, either in the form of general income support or through cross-subsidies to tariffs, whereby better-off users pay a higher tariff to subsidize reduced tariffs for poorer ones. Income support is mostly based on household income and size, but may also include health, disability or age criteria. One key aspect of subsidized tariffs is that the criteria for accessing them must be clear, verifiable and easily adapted from the regular tariffs.

Block tariffs that have a first subsidized block and increase step-wise with the level of water consumption are now widely used in many OECD countries and are also applicable to small-scale systems. This requires metering of connections, however, and is therefore not always an option that can be applied without additional preliminary work.

Public subsidies from general taxation are an option to support the poorest water users, but they require financial transfer from a public authority to the water or wastewater operator or to the individual household after a demonstration of eligibility. One argument against this is the paperwork it creates, while an argument in favour is that it limits subsidies to those who actually need them, thus ensuring that the setting of water prices to cover costs is not undermined.

If embedded into a sound legal framework, cross-subsidies are another option. These can be applied within a single system, where better-off users subsidize tariffs of poorer ones, or across systems, where users in large urban systems subsidize small-scale system tariffs. For small-scale systems it is important to create a larger level of scale. This can be achieved, for instance, by establishing cooperation between several communities that share tasks of operating and maintaining the water and sanitation systems, within which the responsibilities of all stakeholders should be well defined (see Section 5.1 on collaborative arrangements and networking and respective case studies).

Alternatively, regulators can establish discrete supply zones, where large supplies are combined with small ones; this is a particularly useful option for small-scale supplies in periurban areas. At a larger scale, arrangements for cross-subsidies can more easily be included. Where aspects of regulating small-scale systems include incentive-based mechanisms, this can be a cost-efficient way to combine, for example, regular charges for polluting activities or water abstraction, with mechanisms in place to target this money for investment in improvement activities or safe practices (see Section 5.3 on resource protection and details on incentive-based regulation in Section 4.2).

**Case study 13. A private water supplies grant scheme in Scotland**

This case study provides an example of a financing scheme providing funds particularly aimed at small-scale water supply systems.

Private water supplies (small community supplies) serve around 150 000 people in Scotland and a much larger number will use them occasionally in any year, typically when on holiday. The quality of water from private water supplies is highly variable and when poor can cause significant health problems.

In November 2001 the Scottish Government published a consultation outlining a variety of options regarding strengthening regulation of private water supplies. The primary driver for legislative change was the revised Drinking-water Directive *(11)*; others included the WHO guidelines for drinking-water quality *(49)* and a report to the Scottish Government following an *E. coli* outbreak, both of which stressed the benefits of carrying out a thorough risk assessment from water source through distribution and treatment to the point of consumption.

Responses to the consultation confirmed widespread support for the strengthened regulatory regime, particularly from health professionals, but the financial implications for rural communities and businesses attracted criticism. Ensuring compliance with the Drinking-water Directive gives rise to capital costs where a private water supply requires improvement and ongoing compliance (sampling and monitoring) costs. Both will vary widely – particularly the capital costs – depending on the quality of the water supply and the risks to which it is exposed.

An independent economic assessment, commissioned in support of the strengthened legislative package, indicated that capital improvement costs were likely to be in the range of €150–2900 per household, rising in some cases to around €11 500, but that most health benefits were derived from the installation of ultraviolet treatment and appropriate pre-filters. Typical installation costs for the ultraviolet treatment were estimated to be €650–750.

The Scottish Government was sensitive to the financial implications for rural communities and businesses but equally recognized the significant public health benefits of supporting the provision of clean and

wholesome drinking-water. To that end, it introduced the Private Water Supplies Grant Scheme in July 2006, to be administered by local authorities, to assist with capital improvement costs. Specific provision for the scheme was set out in primary legislation and governed by regulations. The scheme is intended to assist those dependent on private water supplies with the financial implications of bringing them up to modern standards and to ensure that rural consumers are not disadvantaged. In order that the available funds make the maximum contribution to public health across all consumers of private supplies and are used effectively towards solutions that offer good value for money, individual grants were capped at a maximum of €900 per premises (domestic or commercial).

Preliminary research commissioned by the Scottish Government suggests that the health benefits (the avoided costs of illness) realized through the use of source-to-tap risk assessment and the grant scheme in one local authority area will result in positive health benefit savings of €1.7 million over a 15-year period. Equivalent health benefit savings are expected to be reflected across other local authority areas.

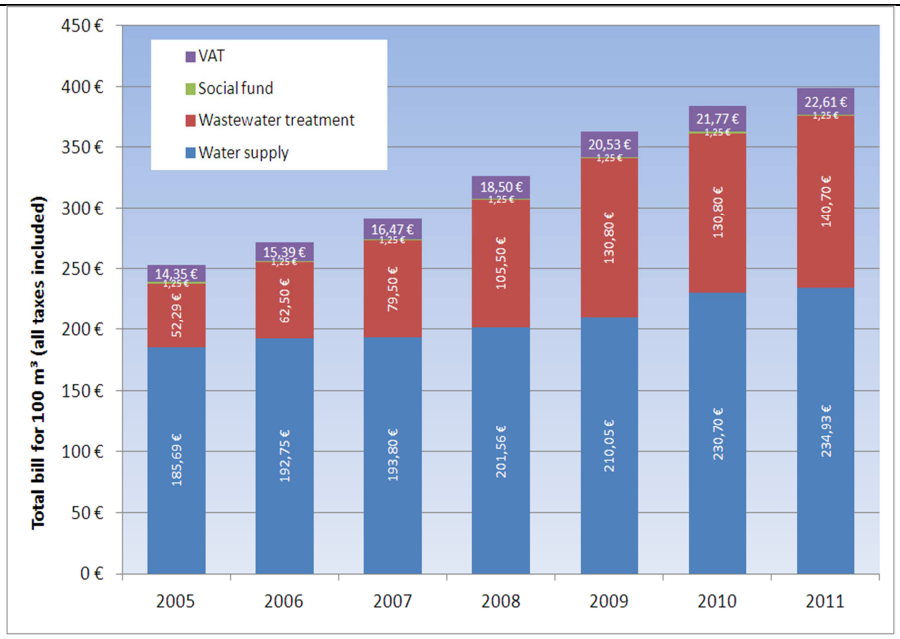
**Case study 14. Solidarity mechanisms in Belgium**

This case study provides an example of a financing water supply through tariffs, while sanitation is funded through taxes, and cross-subsidizing to reduce inequities in access.

In Belgium the three regions (Flanders, Wallonia and Brussels-Capital) are individually responsible for the application of the EU water and wastewater regulation *(96)*, so each has its own policy *(97)*. In the Flemish region the water tariff is composed of three elements: a guaranteed free minimum supply of 15 m³ water per person per year, a variable cost depending on the amount consumed beyond this minimum quantity and a basic fee covering fixed costs of connection, independent of household consumption. The variable cost depends on the quantity of water consumed and is established by the distribution company in accordance with regional authorities. While drinking-water is paid by tariff, sanitation is included in the regional tax regime, and everyone in the region has to pay sanitation tax except the poorest citizens living below the minimum subsistence level. This group includes retired people with a minimum pension, people with a low income who have the right to receive social aid and people with disabilities who are supported by public solidarity.

In the Walloon region guaranteed access to safe drinking-water and operation of water services by public entities are established by law for all citizens. The region introduced a tariff with four categories relating to consumption levels and a social fund for the 10% of poorest households, which receives 1.9% of the revenues from public water users. Up to 30 m³ per household per year (82 litres per household per day) are provided at a lower price than all other blocks, thus facilitating access to water for small users.

**Total bill for 100 m³ drinking-water in the Walloon region**




*Source*: La Société Wallone des Eaux, Bruxelles 2012, Eric van Sevenant *(98)*.

**Case study 15. The Water Trust Fund in Tajikistan**

The aims of the Water Trust Fund are to establish a mechanism to promote increased investment and financial sustainability in the drinking-water sector and improve good governance and coordination between stakeholders at the district level *(99)*. The Fund provides resources for rural water supplies; it is an effective mechanism for streamlining donor funding to the district level and for merging these resources with funds already committed by the Government of Tajikistan. Every external financial contribution leverages additional financial commitment from the government as the Ministry of Finance has encouraged different government entities to contribute 30% to the Water Trust Fund (15% from the central government budget, 10% from district budgets and 5% from operators) in line with the 70% received from donors.

The Water Trust Fund has so far been established in the districts of Muminabad Rudaki and Kuliab, and more districts and organizations are exploring options to follow suit. The fund is chaired by the district government and has a board of trustees comprising relevant stakeholders, including local government officials and representatives of civil society. It was established through a memorandum of understanding and a local decree of the Government of Tajikistan, outlining the financial and institutional structure of the fund. Communities submit funding applications to the board; these are reviewed in a transparent and accountable manner. The Fund promotes ownership by local administrative divisions, while community-based organizations act as operators. The concept of the Water Trust Fund was developed by Oxfam in the framework of the TajWSS project financed by the Swiss Government (see Case study 2).

### *4.5.3. Further reading*

Financing water supply and sanitation in EECCA countries and progress in achieving the water-related Millennium Development Goals (MDGs). OECD Papers. 2007;7(3):1–40.

Managing water for all: an OECD perspective on pricing and financing *(86)*.

Barraqué B. The development of water services in Europe: from diversity to convergence. In: Castro JE, Heller L, editors. Water and sanitation services: public policy and management. London: Earthscan; 2009.

Fonseca C, Smits S, Nyarko K, Naafs A, Franceys R. Financing capital maintenance of rural water supply systems: current practices and future options *(89)*.

Pearson M. US infrastructure finance needs for water and wastewater. Washington, DC: Rural Community Assistance Partnership; 2007 (http://www.rcap.org/node/670, accessed 22 October 2014).

Cameron J, Hunter P, Jagals P, Pond K, editors. Valuing water, valuing livelihoods: guidance on social cost–benefit analysis of drinking-water interventions, with special reference to small community water supplies *(87)*.

Reference for the dutch law: https://zoek.officielebekendmakingen.nl/dossier/30578/kst-20062007-30578-A?resultIndex=8&sorttype=1&sortorder=4

## 4.6. Education, qualifications and training programmes

- A minimum level of specific qualifications for operators of public small-scale water supply and sanitation systems is a strong basis for safe management of such systems.
- It is beneficial for operators to attend professional training on a regular basis.
- Training fees can be included in the budget for water supply and sanitation systems as part of sustainable financing (see Section 4.5 on costing and financing).
- Information on training possibilities needs to be available to operators, including those in remote areas.

Knowledgeable personnel who understand the risks related to the management, finances, operation and maintenance of their systems are an important prerequisite for the safe operation of small-scale water supply and sanitation systems. This is especially the case in remote areas, where regular surveillance may be a challenge or where the level of expertise of the local authorities (such as health, water and environmental protection offices) might be limited. While staff operating small-scale water supply and sanitation systems are often untrained or undertrained, these systems are typically less complex than larger ones and training can focus on their specific requirements. A minimum understanding of potential hazards to water quality and controls is also important for the owners and operators of individual wells and/or small-scale onsite sanitation systems. This can be supported by, for example, providing training for groups of operators of small-scale systems in a region or providing guidance in easy-to-understand language (see Section 4.7 on advocacy and awareness-raising).

Ensuring proper qualifications and ongoing training of operators has a number of benefits:

- better understanding by operators of the water or sanitation system and increased awareness of the causes and consequences of failure – this facilitates better technical, administrative and financial (and even social) management and operation of the system, potentially leading to lower numbers and/or severity of water-quality incidents, near misses or failures;
- increased operator awareness of the benefits of safe management and operators' capacity as a basis for priority-setting;
- better prioritization by operators of necessary investments for upgrading and developing small-scale water supply and sanitation systems and thus better allocation of respective funds;
- better resource protection and minimized risk of water pollution by human excreta and wastewater through safe management of decentralized sanitation systems;
- increased recognition and reputation of trained personnel, including operational staff;

- increased commitment to work;
- initiation of better collaboration and networking with other operators and institutions, leading to exchange of knowledge.

Regulations may require minimum levels of qualifications and/or competency testing of staff working on water supply and wastewater treatment systems (see Case study 16 for an example of national legal specifications of minimum competence requirements for those working in small-scale water supplies). Box 11 shows further examples of countries' legislation and activities regarding training for operators of small-scale supplies.

**Case study 16. Competence tests for waterworks employees in Finland**

In order to reduce the number of water-quality incidents and waterborne disease outbreaks, especially in small-scale drinking-water supplies, Finland introduced legislation requiring competence testing for all employees whose work might have a direct impact on water quality *(100)*. This includes all people working at abstraction sites, waterworks or distribution networks for installation, maintenance, control and adjustment of devices and handling of chemicals, including construction workers laying pipelines. All such employees of waterworks serving more than 50 people or delivering more than 10 $m^3$ of drinking-water per day must be certified by the National Supervisory Authority for Welfare and Health in technical utility operations and water hygiene skills, showing competence and experience in the field of drinking-water quality and technology. This is evaluated by a test comprising 30 multiple-choice questions covering water intake, treatment, distribution systems, water-quality legislation, operational and surveillance monitoring, water chemistry and microbiology, as well as contingency planning. A tester authorized by the Authority organizes the evaluation. As a minimum, the tester needs to be competent and experienced and hold a bachelor's degree or similar qualification. Certification will be awarded to an employee who passes the test and is valid for five years. The legislation entered into force at the beginning of 2007; by 2013 approximately 30 000 employees had passed the test.

**Box 11. Qualifications and training of operators of small-scale water supplies in the WHO European Region**

From the survey on small-scale water supplies conducted under the Protocol on Water and Health *(2)*, 23 questionnaires (51%) returned from 20 countries stated that minimum qualification or competence requirements were in place for operators of small-scale public supplies, and 53% stated that relevant qualification or training programmes were provided for the operators.

According to the Act on Water Supply and Sewerage Systems for Public Use *(101)*, operators of small-scale public supplies in the Czech Republic supplying between 50 and 5000 people must have a licence or approval from the water authority concerning their qualifications. An operator or a designated representative of the operator must comply with following minimum qualifications:

- secondary education in the field of water management or equivalent level of education, as defined in the Act;
- four years of practice in the field of water supply management.

Minimum qualifications are also required for operators of small-scale public wastewater systems.

In Hungary the 21/2002 Ministerial Decree of the Environmental Protection and Water Ministry *(102)* lays down specific qualification requirements for those working in different areas of water supplies and wastewater collection and treatment systems. The requirements range from different types of technical qualification and bachelors' degrees to various post-graduate degrees; they are specified for different categories defined by the volume of water supplied or treated respectively.

Special training was provided for Community Drinking-water User Union operators of rural piped water supplies in Kyrgyzstan under the first phase of the "Taza Suu" (clean water) programme. The Agency for Community Development and Investment is developing training modules for operators belonging to the Union.

Luxembourg is developing a training programme for operators of small public water supplies in

cooperation with the Centre national de formation professionelle continue and Association luxembourgeoise des services de l'eau.

No specific minimum qualifications or competence requirements are in place when employing operators to run small public water supplies in Scotland. Once employed, however, operators are required to obtain a national water hygiene card (for which they need to undertake training followed by an assessment) and will be enrolled on the Scottish Water Competent Operator Scheme, which is a United Kingdom-wide scheme.

The requirements for operators of all public water supplies in Slovakia are set according to the Ministry of Agriculture of SR Regulation No. 124/2003 Coll. *(103)*, stipulating details on professional capability to operate public mains and public sewage.

It may not be feasible to require the same level of qualification for smaller as for larger systems; therefore, defining minimum requirements specifically for small-scale water supply and sanitation systems and fulfilling them gradually may be a more realistic aim. Increasing the level of qualifications in small-scale systems may also be an area for target-setting under the Protocol on Water and Health *(4)* (see Section 4.1 on baseline analysis and target-setting). Sustainable financial support needs to be made available, since it is a prerequisite for continually improving and updating the knowledge of local operators.

Methods to improve the knowledge of those involved in operation of small-scale water supply and sanitation systems fall into three main areas.

- University education: inclusion of aspects of water, sanitation and hygiene in relevant degree course curricula plays an important role in qualifying students and preparing them for a potential future role in operating water supply and sanitation systems. This may be complemented by targeted awareness-raising activities (see Section 4.7 on advocacy and awareness-raising).
- Training: ongoing further vocational training is required, for both staff with a level of education in water supply and/or sanitation and those without formal qualifications. Regular training can help to inform and qualify personnel in a step-by-step way and/or keep their knowledge up to date. Single training activities may be embedded in broader training programmes for a large number of people across a wide area. This would increase operators' knowledge of health consequences that might arise from faulty operation, available treatment processes (including criteria for their selection), materials in contact with water, maintenance and repair requirements, as well as knowledge on land use planning to minimize risks.
- Networking: sharing knowledge and experience in workshops or seminars for operators of several communities is a valuable form of peer-to-peer education. Especially for small-scale water supply and sanitation systems, where only a limited number of people in each community are responsible for operations, such networking can efficiently build capacity and increase motivation.

Training and qualification programmes could address, among others, information on national administrative, management and legal aspects of small-scale water supply and sanitation systems, economic and environmental aspects, good practices for planning and safe management, operation and maintenance, including aspects of how water, sanitation and health issues are interrelated.

It is important that educational, qualification and training programmes include a link between safe drinking-water supply and safe sanitation by presenting basic sanitation principles to those working on drinking-water and vice versa. Such programmes can be stipulated or initiated at the national or subnational level. Important partners in designing and implementing educational programmes and training courses for communities and operators are water associations, professional associations,

professional training providers, NGOs, research institutions, universities and consulting agencies. Case study 17 provides an example of how water associations and subnational authorities can initiate and support vocational training for operators of small-scale systems.

**Case study 17. Training for operators of small-scale water supplies in Germany**

The German organization DVGW (see Case study 6) is the professional industry association for large and small public water supplies. Among other services, DVGW provides training programmes for technical staff of small-scale water supplies in a number of the 16 federal states of Germany (including Bavaria, Baden-Württemberg, Hesse, Rhineland-Palatinate and North Rhine-Westphalia). These are vocational programmes that include basic and follow-up modules for groups of neighbouring water supplies. Topics covered include aspects of liability, legal requirements, relevance and details of technical rules, health and safety requirements, qualification requirements and technical aspects of managing drinking-water safely, including water abstraction, treatment, storage, distribution and operational monitoring. The programmes do not result in a qualification that meets the conditions of DVGW's technical rule W 1000, which specifies general requirements for the qualification and organization of drinking-water supplies; nevertheless, they contribute to continuing professional development of water supply operators.

Public authorities also provide training. For example, the Federal State of Baden-Württemberg conducts basic annual training for operators of water supplies, initiated by the state's Ministry of the Environment, Association of Municipalities and Towns, Ministry of Rural Areas and DVGW. A coordinating team agrees the topics to be addressed (such as the latest technical developments and regulations) in the courses, which include presentations as well as practical exercises.

In the Federal State of Schleswig-Holstein several public authorities, together with regional associations, developed the training platform "Forum Trinkwasserversorgung Schleswig-Holstein" particularly to support small and medium-sized water supplies *(104)*. Funding is provided by the authorities and associations involved, as well as by the Regional Association on Water and Soil, DVGW and associations of city and municipal utilities. The training programme is based on the water supplies' requirements, which were assessed via a questionnaire. The training presentations are available online free of charge.

Involving skilled trainers and facilitators and tailoring training programmes to the prevailing conditions, technical equipment employed and personnel and financial realities have proven to be success factors. Case study 18 provides an example of how water associations can initiate and support vocational training for operators of small-scale systems, including respective requirements in their guidelines. Free access to information and educational materials in the national language and online availability may enhance the application of advice by operators of public and individual small-scale water supply and sanitation systems.

**Case study 18. Training programmes for water supply operators in Switzerland**

At the federal or cantonal level in Switzerland no specific requirements or qualifications are defined as prerequisites for employment as a water supply operator. Nevertheless, according to SVGW guidelines for the preparation of a water supply operator job description, it is highly recommended to employ someone with professional education in the field. Therefore, SVGW offers suitable training programmes.

The further education course *Wasserwart* (for which a loose translation is "skilled workers who have been trained in maintenance and supervision of water supply facilities") is specifically geared to the needs of operators of simple, small-scale water supplies. It lasts six days and conveys basic knowledge of quality assurance, operation and maintenance of a water supply. The course focuses on SVGW Regulation W 1002, which offers recommendations for a simple quality assurance system for water supplies *(76).* These guidelines have been developed to satisfy the needs of small-scale water suppliers with regard to the legally required establishment of WSPs. The course has been offered since 2004, and meanwhile four courses per year with 24 participants, respectively, are carried out.

In addition, a six-week course offers preparation for the national professional examination to become a "water supply operator with a federal certificate of higher vocational education and training". This SVGW course is aimed at water supply operators that have already gained at least three years' practical

experience in a water supply.

A further one-day SVGW course for municipal policy-makers focuses on strategic management in water supply, including responsibilities, quality assurance, financing and communication. The aim of this course is to inform participants of their tasks and responsibilities with respect to water supplies.

Training is not only necessary for operators – other stakeholders can also benefit from adapted training. To improve the level of knowledge and skill in design, operation and safe management of small-scale water supply and sanitation systems it is important to tailor qualifications and training programmes to the needs of different stakeholders. This is especially important for:

- local authorities – to increase their knowledge of surveillance, inspections, technical installations and/or good management practices relevant for small-scale systems;
- mayors or local community leaders who are commonly responsible for the provision of water and sanitation services – to increase their understanding of the required skills for adequately operating small-scale water supply and sanitation systems and of the need to have well qualified staff in place;
- private companies – to increase their knowledge of health consequences that might arise from faulty operation, standards, guidelines and legal aspects of private sector participation in this field.

In the case of small-scale water supply and sanitation systems, for which sometimes only one person is responsible, operators can learn about new developments through education and networking programmes for sharing information with other professionals. Case study 19 provides an example of how networking and peer-to-peer training can be implemented in collaborative arrangements of small-scale systems at the local level. It is important that training helps to inspire operators and convince them that their input is essential for improving the living and health conditions in the area they service. Offering operators an adequate salary and future prospects contributes to the avoidance of both high staff fluctuations and the presence of untrained and undertrained staff, which would counteract the success of the qualification and training programmes.

**Case study 19. “Wastewater treatment plant neighbourhoods” – networking and peer-to-peer training in Germany**

In 1968 the first German “wastewater treatment plant neighbourhoods” were introduced by DWA (see Case study 6) with the aim of training operational staff efficiently. Each neighbourhood covers about 15 to 20 wastewater treatment plants located close to each other; they are voluntary associations without legal status. In some federal states financial support is provided to the neighbourhoods by the Ministry of the Environment; otherwise, funding is based on annual membership fees. There are currently 320 neighbourhoods, with approximately 7400 sewage treatment plants in place.

Neighbourhoods meet about two to four times a year to receive training from an external expert and exchange experiences. These “neighbourhood days” are organized and carried out with a focus on issues of day-to-day practice in management and operation. They intensify personal contact among practitioners: this leads to mutual consultation, assistance and support, which includes not only loans of equipment but also substitution during absence in emergencies.

Through this regular training and exchange of experiences the operators’ knowledge and qualifications are continually improving, which also leads to significant cost saving through more efficient operations. The strong contacts built among members of neighbourhoods are also beneficial in the acquisition of plants and machinery. In addition, word spreads quickly within a neighbourhood about whether a company’s technical service is bad or expensive and who does good work.

The sewage treatment plant neighbourhoods do not necessarily stop at national boundaries. For example, operational staff of the treatment plants around Lake Constance meet annually within the framework of the

"international Lake Constance neighbourhood", in which Switzerland, Austria and Liechtenstein are also involved.

DWA's Neighbourhoods Committee has developed uniform framework conditions and ensures professional exchange throughout Germany and even internationally. In addition to organizing the training, DWA publishes target-oriented professional journals for the neighbourhoods, providing information on a regular basis.

Local budgets for water and wastewater services need to consider the costs of staff training to ensure sustainable financing for safe management of small-scale water supply and sanitation systems. Regular training for operational staff and responsible bodies and periodic checks of competence help to keep their knowledge up to date and in line with recent developments.

Availability of training offers and qualification requirements that match the needs of the operators need to be communicated effectively so that the information reaches the target groups at the local level.

### *4.6.1. Further reading*

Training and international cooperation [website]. Hennef: DWA (http://en.dwa.de/training-and-international-cooperation-en.html, accessed 24 September 2014).

Training [website]. Barcelona: Global Water Operators' Partnerships Alliance. (http://gwopa.org/index.php/what-gwopa-does/training, accessed 24 September 2014).

Training [website]. The Hague: IRC International Water and Sanitation Centre; 2014 (http://www.ircwash.org/training, accessed 24 October 2014).

## 4.7. Advocacy and awareness-raising

- Advocacy activities are an important means to draw attention to the particular challenges of small-scale water supply and sanitation systems.
- Raising awareness of local decision-makers and users of small-scale water supply and sanitation systems is important so that they understand their contribution to safe management of the systems.
- Especially in rural areas, the local population needs to be made aware (including farmers, for example) of the influence of their activities on water quality and public health.
- Attention needs to be paid to the communication tools and languages selected to reach target audiences in remote areas.

The main goal of raising awareness is to inform local decision-makers, other local stakeholders and the general public about drinking-water and sanitation safety as key factors for public health protection, and consequently for economic development and sustainable livelihoods. It is important that all these parties understand the importance of small systems for rural communities, the challenges they experience, the solutions available and the health and economic benefits of improving the situation. It is important to tailor the messages to appropriate target audiences, considering their priorities and needs.

Cross-sectoral approaches are critical in the context of small-scale systems, particularly to explain the link between drinking-water and sanitation. Advocacy efforts need to address those who can have an impact on small-scale systems but do not work on water and sanitation directly, and awareness-raising activities need to consider that in rural areas those receiving water from small-scale water supplies typically also use the catchment area, which could lead to pollution risks. For

example, agricultural activities may affect water resources used for drinking-water, but the farmers also require water for these activities.

Awareness-raising activities are usually conducted at the local level – for example, in community meetings, consultations or media appearances. This may happen in the context of water and sanitation in general where particular attention is drawn to small-scale systems, in efforts that are particularly tailored to small-scale systems or in the context of related topics (such as community health). Local awareness-raising activities can be organized and/or supported at the national or subnational levels. Possibilities include:

- planning of national campaigns, incorporating:
  - planning communication dissemination strategies and mobilizing resources accordingly (such as involvement of NGOs and other stakeholders);
  - considering use of mass media (radio, television, Internet) and reaching young people via schools and kindergartens (see Case study 20);
  - considering different campaign approaches – for example, combining personal communication at public meetings with individual consultations, in order to reach a broad share of the target audience;
  - defining a time horizon, targets and indicators for measuring the effects of a campaign;
- making finances available for national campaigns or local awareness-raising activities;
- developing the content, messages and basic materials of national campaigns or local awareness-raising activities, comprising:
  - allowing flexibility for adaptation at the local level;
  - tailoring details to relevant target audiences;
  - using easy-to-understand language and images;
  - organizing translations into local languages;
- conducting background research, providing data and information that can be used for awareness-raising and advocacy (see Section 4.1 on baseline analysis and target-setting);
- promoting awareness-raising activities to be integrated into other water and sanitation activities at the local level (see Case study 3);
- making arrangements so that women and marginalized groups can also benefit from awareness-raising activities.

**Case study 20. WSPs involving schools in Georgia, the Republic of Moldova and Romania**

The WSP approach can be used as a tool to raise awareness and mobilize communities. The NGO Women in Europe for a Common Future (WECF) developed a WSP approach involving schools *(105)*, in which teachers were trained to develop the WSP schedule for their local water supply systems and to carry out associated activities with their pupils.

The WSPs were developed with the involvement of pupils and local authorities, supported by local partners and WECF. During the initial stage the schools investigated their own local situations by analysing the water sources, investigating appearances of diseases associated with water, inviting contributions from the local doctor or other experts and performing rapid water-quality tests with the children. This analysis led to mapping of the results and identification and mapping of possible sources of pollution. The resultant map informed the villagers about the quality of wells and pointed out those to avoid. The results of the investigations were presented to the authorities and local citizens. Discussions with all stakeholders and planning for improvements to the local situation followed and initiated further action.

When developing the content of awareness-raising activities, the following elements are particularly suitable in the context of small-scale water supply and sanitation systems:

- the duties of and possibilities for local stakeholders to protect water sources, improve wastewater management and maintain drinking-water and sanitation facilities (see Section 5);
- the impact of changing technologies or increasing the standard of services – for example, replacing latrines with flush toilets will greatly augment the amount of wastewater generated that then needs to be managed (see Section 5.3 on resource protection);
- the interaction of water, sanitation, hygiene behaviour and health – particularly where households operate individual onsite water supply and sanitation systems, people need to be informed about adequate management of the systems and health risks related to lack of access to safe water and sanitation (see Case study 5);
- the costs and benefits of the provision of safe water and sanitation, including the costs of operation and maintenance of the systems – people need to understand that the provision of safe water and sanitation services has a price;
- the health benefits of hand-washing and features of good hygiene behaviour;
- measures that can be taken at the household level both if drinking-water quality is compromised and to prevent contamination (see Section 5.2 and respective case studies);
- aid programmes and support measures for individual systems.

In addition to information about water, sanitation and hygiene issues and their potential contribution to them, users of small-scale systems should also have access to transparent, up-to-date and relevant information, such as the water sources of their supply, existing standards and limit values or quality of drinking-water supplied. They should also be aware of the elements leading to the fees requested from them for the services provided. Whereas information on the system needs to be provided locally, this can be complemented by information at an overarching level on the general underlying principles, such as what makes up the costs of services from small-scale systems.

School education can play an important role in raising the level of knowledge about water, sanitation and hygiene issues and how these are interrelated. Schools can inform students about these issues, thereby improving their hygiene behaviour, and can also help to spread the message further when students report at home what they have learned. Particularly in rural areas, this may have a significant effect on the contribution of the community to safe water supply and sanitation.

In addition to awareness-raising activities at the local level action may also be taken at the national level. This might use, for example, occasions like the annual World Water Day (22 March), World Toilet Day (19 November) and – if the topic is applicable – World Health Day (7 April) to provide information about the challenges of small-scale water supply and sanitation systems and how they may be overcome.

Public access to information is a prerequisite for public participation in decision-making processes (see Box 4) and for transparency within and efficiency of decision-making and implementation. Informing and involving the public both helps to ensure that the services provided are aligned with people's perceived needs and contributes to transparency and acceptance of the decisions taken and measures implemented.

**Case study 21. Placeholder: Georgia**

**Case study 22. Irish protect your well application**

In 2014, the Irish Environmental Protection Agency (EPA) launched its online "Protect your well assessment application" (app) *(107)*. The app was developed to improve the sanitary status of private wells and to raise awareness among their owners of drinking-water quality issues. Its launch was accompanied by a social media campaign. A short risk assessment is introduced by a video explaining the health risks from unsafe water, the benefits of testing well water and the possible risks to drinking-water from wells. This is followed by a short set of easy questions, such as "Do you know if your well water has ever been tested?" and "Does your well water smell?" After all the questions are answered, the assessment culminates in advice and contact information for the responsible authorities in the private well owner's location. The information submitted through the app is transmitted to the Irish EPA, which can, on the basis of the data submitted, estimate the status of wells and their respective geographic distribution.

The web application has a public use licence so that other interested authorities can adapt it to their circumstances, translate it and use it in their countries, as long as its development by the Irish EPA is acknowledged. A link to a blank version of the app is available *(108)*.

(Darragh, could you kindly add here a couple of sentences on EPA's first experiences with the App and how it supports your surveillance activities and to which extent it facilitates awareness raising efforts)

The launch of the app and the associated awareness campaign generated significant public interest, including a story on the national evening news, around 20 interviews with the developers on national and local radio stations and around 40 articles in national and local newspapers and magazines. The response to the first phase of the communication campaign was positive and the message has been received. The campaign also involves direct communication with stakeholder groups such as farmers, drillers and health professionals, which is intended to continue. In the future it is planned to integrate this campaign with the Green Schools programme for schools in rural areas to raise awareness among a younger audience and encourage them to use the app on their own wells. An assessment of the effectiveness of the campaign – including examinations of target audience awareness, engagement with the material provided and the effect on behaviour – will be carried out. This will include assessing indicators of behavioural change, such as testing rates on private wells and applications for private well grants, to determine the effectiveness of the awareness of the risks.

**Case study 23. Raising awareness as a legal obligation in Serbia**

This case study gives an example of how the issue of awareness-raising can be integrated in legislative requirements.

In Serbia raising awareness about personal and collective hygiene, usage of safe drinking-water and adequate waste disposal is a legal obligation prescribed by the Regulation on protection of the population from communicable diseases and Programme on protection of the population from communicable diseases from 2002 to 2010 (extended to 2016) *(109)*. This legal document stipulates priorities, specific goals and measures in the fields of epidemiology, hygiene and health promotion. Raising the level of knowledge and forming and promoting good habits are important for the prevention and control of communicable diseases: they are thus priority goals in the field of health promotion envisaged by the Programme.

Various measures are set out to achieve the goals concerning personal and collective hygiene, usage of safe drinking-water and adequate waste disposal:

- informing the population about the importance of these factors through cooperation with the media, health forums, exhibitions and health campaigns;
- organizing teaching and learning that contribute to the formation of good habits and attitudes through health lectures; discussions (individual, planned and additional); working in small groups; organized meetings, seminars and individual counselling; and multimedia access (educational television and radio programmes, articles in newspapers and magazines and the Internet);
- changing attitudes and behaviours through formation of networks and committees, developing

educators' programmes, community mobilization, active teaching methods (creative workshops, roleplaying), environmental demonstrations and individual counselling.

The Regulation also defines participants in implementation of the Programme. These include the entire national population and society as a whole, as well as specialized health institutions at the local, subnational and national levels with specific prescribed tasks and obligations for Programme implementation.

### *4.7.1. Further reading*

Guide to public participation under the Protocol on Water and Health *(31)*.

# 5. Good practices to improve small-scale water supply and sanitation systems

The policy processes to create an enabling environment described in Section 4 may address and support different good practices that have proved suitable to improve the situation of small-scale water supplies and sanitation systems. The following sections give examples of such practices and focus on how these can be tailored to the particularities of small-scale systems and what policy-makers can do to promote them. Such activities by policy-makers may, for example, include setting targets to enhance the application of the best practices in small-scale systems, referring to them in legislation and regulations or supporting them through other processes described in Section 4.

## 5.1. Collaborative arrangements and networking

- Joining forces with neighbouring operators is a useful way to increase professional capacities and combine staff and financial resources. Multiple options for partnership arrangements exist.
- Networking is important for operators of otherwise isolated systems in order to exchange experiences and receive proper advice.
- National policy-makers can support networking activities for small-scale water supply and sanitation systems in various ways.

The responsibility for operation and maintenance of small-scale water supply and sanitation systems usually lies at the municipal or community level, although operation may be delegated to third parties in some settings. Operators in small villages or communities, however, do not always have sufficient knowledge, skills and financial means to operate the systems safely. In such cases, it is useful for small-scale systems to join forces with neighbouring municipalities and communities or bigger utilities through networking or cooperative partnership arrangements. Case study 24 shows examples of associations for organizational and infrastructural cooperation regarding water supply and sewerage.

**Case study 24. Municipal associations for water supply and sewerage in the Czech Republic and Germany**

From the 1950s in the Czech Republic 11 large state enterprises exclusively operated drinking-water supplies and sewerage systems on a regional basis and took care of the management and development of the respective infrastructure. In 1993 the government entrusted all water supply and sewerage infrastructure, as well as the responsibilities and rights to manage these services, to the relevant municipalities; this led to the creation of more than 1200 small operators. Rural municipalities in most cases owned their water supply infrastructure and in some cases also operated it.

Small villages soon realized that it would be better to join forces with neighbouring municipalities, and several municipal associations were established to manage drinking-water supply and sewerage systems.

One such example is Vodovody a kanalizace, svazek obci se sidlem v Trebici [Water Supplies and Sewerage Association of Municipalities in Trebic], which was established in 1993 by 75 municipalities, mostly small towns and villages but also including the former district capital Trebic (population 35 000). By 2012, 123 municipalities had joined. The Association has an agreement with Vodarenska a.s. (a water management company), which operates under licence all supply and sewerage systems owned by the Association; these serve about 100 000 people in total. Although local conditions and operational costs differ, there is a unified price for water in all municipalities, which has to be agreed by all members of the Association.

The main advantage for municipalities is that they need only invest a small effort to secure regular water supply and wastewater removal. The five employees of the Association manage preparation, financing and implementation of all construction activities.

In Germany the municipalities are responsible for drinking-water supply and wastewater disposal. In the administrative district of Vogtlandkreis, 39 cities and municipalities with a population of approximately 240 000 established the Vogtland Association for Water and Wastewater Management (ZWAV). Since 1993 ZWAV has been responsible for technical and economic management of drinking-water supply in all 39 and wastewater disposal in 37 of the municipalities. It has around 280 employees and operates 83 wastewater treatment plants, about 80 spring sources, 45 small waterworks and water distribution networks interconnected within around 80% of the municipalities, through which temporary local water deficiencies can be compensated.

A uniform price for drinking-water applies across the entire region, irrespective of the length of water supply pipelines required, thus removing the financial burden from remote municipalities. For bigger investments, prioritization is based on the urgency of the measure rather than the financial capabilities of the municipality affected.

ZWAV is not responsible for the operation of decentralized sanitation facilities, but it has entered contractual maintenance agreements with the operators of some of these facilities.

In cooperative arrangements, capacities and efficiency increase as a result of extended human, technical and financial resources. For example, rather than giving staff in a municipality numerous responsibilities (of which water supply and/or sanitation is just one), partnership arrangements may train staff for one specific area of expertise that can serve several municipalities, thereby ensuring that several systems benefit from the training that one person receives. Costs can be shared, with increased flexibility in applying funds if several municipalities contribute and agree jointly on priorities for their use, and overall operational costs may be reduced through sharing of facilities and equipment. Cooperative arrangements also create better conditions for management of small-scale water supply and sanitation systems, leading to higher levels of professionalism in operation and management, implementation of technical innovations and rationalization in procurement of equipment and spare parts. Case study 25 provides an example of municipalities joining forces to establish local public sanitation services.

**Case study 25. SPANCs – public services for onsite sanitation in France**

France has the highest ratio of scattered dwellings (15% of the population in 36 000 municipalities) in the EU. During the 1980s state services ensured that all new houses without connection to public sewers had efficient onsite technologies such as septic tanks (receiving both grey and black water), treatment by subsoil spreading (when permeable) or sand filter-based substitutes.

Since the local health administrations had insufficient capacity to monitor these onsite systems, the Water Law of 1992 *(110)* required the creation of local public services for onsite sanitation (SPANCs) by 2005. Small municipalities (often with fewer than 500 inhabitants) could team up and create a SPANC with two or three qualified technicians. Around 4000 SPANCs have been created to date. They have two mandatory tasks:

- offering technical advice on sanitation before building a house, taking into account municipal zoning, soil and hydrological conditions and similar, in parallel with building permit procedures;
- examining the sanitation system at the end of the building phase or when an existing house is sold, and assessing the design and maintenance of existing installations within their territory at least every 10 years.

Additional optional tasks include:

- ensuring restoration or maintenance (including emptying septic tanks every 3–5 years and at least when the tank is 50% full of solid matter), often twice a year for the sludge of an aerobic mechanical device;
- ensuring valorization of sewage (for example, by composting or soil injection/spreading) or transfer to an adapted wastewater treatment plant.

The cost of visits to complete the mandatory tasks is covered in a fee paid by the owner of the house (€100 is a mean value, but there are large disparities between different SPANCs).

Cooperation and networking can also trigger awareness of challenges encountered in other settings, thereby generating an “experience pool” of small-scale systems and supporting a preventive approach. Various types of cooperation are possible (see Table 3).

**Table 3. Options for organizational set-up and cooperation**

| Type of cooperation | Characteristics | Examples |
|---|---|---|
| Informal/individual cooperation | Typically includes joint capacity-building, sharing equipment and giving advice | • Water operator partnerships: temporary partnership arrangements between a larger and smaller entity<br>• Informal collaboration between two or more small systems |
| Creating an organizational entity | Management (operation, maintenance, tariff-setting) carried out jointly across several communities or municipalities, using joint professional staff, office and materials | • Water, wastewater or combined associations (see Case studies 23 and 24) |
| Physical interconnection of systems or sharing structural and organizational support | Harmonizing highly fluctuating water quantities through physical connection of systems and sharing of structural support (such as for treatment) | • Connecting smaller systems to centralized ones<br>• Onsite wastewater and central sludge treatment |
| Transfer of physical assets or of responsibility | Handing over treatment, complete operation and/or maintenance to an existing larger entity for a fixed period of time and price | • Public–private partnerships<br>• Large public utility taking management responsibility for small systems in the same area |

In many rural areas the population is not covered by centralized systems and people operate individual wells or springs and/or onsite sanitation systems themselves, often with little or no support. As households have limited knowledge and resources, they benefit from organized support and supervision by local administrations. This may include providing supporting materials in local languages and information and training from regional support centres.

In many settings drinking-water supply systems are more developed and receive more attention than wastewater collection and treatment systems. This situation could be improved through

partnerships for joint management and operation of systems, while ensuring that services remain sufficiently distinct to avoid contamination. The notional starting-point for promoting such a holistic approach is the idea that all water supplied in a community creates wastewater that needs to be treated. Jointly covering drinking-water and wastewater services within one entity generates synergetic effects – for example, through construction cost savings when pipes for both systems are placed at the same time and strong communication channels between staff of drinking-water and wastewater organizations.

Sharing experiences and information on workable solutions among operators of several communities in workshops or seminars provides a good opportunity for peer-to-peer education. Through networking and attending network meetings operators gain access to technical and financial support from national or regional administrations and can thereby make use of expertise they would not otherwise have. In addition, networks can also facilitate distribution of information on the latest regulatory developments or potential sources for funding.

Owing to a lack of time and money for travel, operators of small-scale water supply and sanitation systems do not usually participate in events organized by national and regional professional associations that enable the exchange of experiences and information on scientific and regulatory developments. Networking activities for small-scale systems should therefore be organized at a relevant scale (local or subnational, for example), taking into account the systems' remoteness and the operators' options for travel.

Cooperative arrangements involving several operators and/or municipalities could be initiated at the national or regional levels, perhaps through associations. Supporting activities for networking and cooperation of stakeholders could have different forms, aims and extents.

- Existing national or local associations and professional networks could develop special programmes and/or activities to involve operators of small-scale systems or new support tools aimed at the needs of those systems. As small-scale systems are often located in rural areas, local subgroups could be established and financial support for participation in network meetings provided.
- Existing networks could be better promoted among operators of small-scale systems.
- Cooperative arrangements could be promoted, and information on and experiences with successful arrangements shared.
- New networks focusing on small-scale systems could be established, provided that due consideration has been given to their continuous operation in terms of finances and network management. This could include online platforms, particularly for remote areas (if access to the Internet is possible) or regular information circulars.
- Local health and environment agencies could act as knowledge brokers for operators of local small-scale water supply and sanitation systems.
- National or regional institutions could function as resource centres that provide access to expertise and support, and could provide a platform for networking among operators of small-scale systems from the respective regions.

**Case study 26. A collaborative initiative in Odzaci municipality, Serbia**

In Serbia municipalities are obliged to provide access to and quality control of drinking-water supplies, but these provisions are not fully implemented in practice. In 2012, Odzaci municipality conducted a baseline analysis of eight small-scale water supply systems providing drinking-water for eight villages within the municipality. This brought to light several challenges, including noncompliance in management of the supplies, a lack of legal responsibility within the local community in the case of system failure, little or no

relevant professional education among those managing the systems and compromised drinking-water quality, which had not been identified previously because of inadequate surveillance.

On the initiative of the municipality the local government adopted a new Decision on Public Utilities *(111)* in December 2012. As a result, six local communities handed over the management of their water supplies to a larger water utility – the public water supply system of the town of Odzaci. The new service provider used the money from tariffs to restore wells and install all necessary equipment to ensure that a sufficient quantity of water is supplied.

**Case study 27. National reform of regional associations in Italy**

The water supply organization in Italy has been characterized by extreme fragmentation for many years. In 1999 the country had 12 347 individual water supplies, of which 9834 operated at the municipal level. A reform process started in 1989 and new general provisions on water source management (Galli's Law) were enacted in 1994 *(112)*. The primary objective of the reform was to overcome the fragmentation by introducing an entrepreneurial organizational model for integrated management from water caption to sewerage. In line with the legislator's intentions, the reform enabled a reduction in the high number of water suppliers to a few hundred. As part of the reform, minimum catchment areas called *ambiti territoriali ottimali* (ATOs) were defined, each administered by an ATO authority composed of representatives of local authorities.

Galli's Law divided responsibilities among the following entities:

- regions, which approve implementation rules, determine territorial boundaries and the institutional form of ATOs and adopt a standard convention to regulate the relationships between local authorities (provinces and municipalities) and water companies;
- provinces and municipalities, which organize the integrated water service by instituting ATOs and nominate their representatives to serve on ATO authorities;
- ATO authorities, which carry out checks on existing works, develop plans for adaptation of infrastructure and improvements in the provision of services, assign the integrated water services to operators (public, private or joint stock water companies) by drawing up agreements and control operator activities;
- one or more public, private or joint stock water companies per ATO, each of which operates the integrated water service by collecting or distributing water from several small and/or large supplies and collecting or treating wastewater.

**Case study 28. Swiss networking – water suppliers helping water suppliers**

Of the nearly 3000 municipal water supplies in Switzerland, more than 90% belong to the category of small-scale supplies serving fewer than 5000 inhabitants. To share the knowledge held in the six laboratories of the large water supplies and to support small-scale water supplies – in particular with quality assurance; drinking-water quality; management of nitrate pollution and approaches to micropollutants, treatment and disinfection; protection zones and self-checking – the laboratories formed the Aquaexpert network *(113)*. Aquaexpert's motto summarizes its aims: "water suppliers help water suppliers". The key element of the network is its Internet platform, which is managed by SVGW (see Box 10 and Case study 18), through which any water supplier searching for support can contact either one of the laboratories or the network as a whole. The first expert consultation by a laboratory is free of charge; further consultations, onsite inspections, study of documents and lab analyses are chargeable, the price being set bilaterally between the laboratory involved and the water supplier.

The network and the Internet platform were established in 2007 and are now an important way for small-scale water supplies to obtain support. Nevertheless, potential users need to be reminded regularly of the

network and its advantages to ensure frequent usage.

### *5.1.1. Further reading*

Water system partnerships, interconnections and interlocal agreements [website]. Chapel Hill, NC: Environmental Finance Center at the University of North Carolina; 2014 (http://www.efc.sog.unc.edu/project/water-system-partnerships-interconnections-and-interlocal-agreements, accessed 10 September 2014).

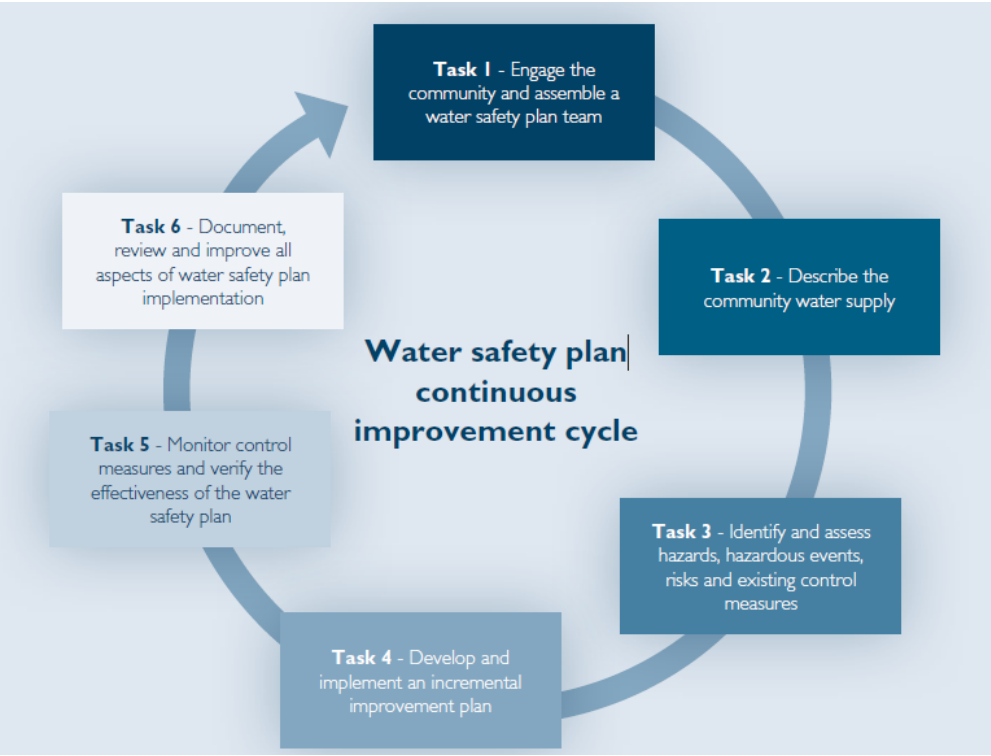
Case studies: gaining operational and managerial efficiencies through water system partnerships. Washington, DC: Environmental Protection Agency; 2009 (http://water.epa.gov/type/drink/pws/smallsystems/financialhelp.cfm, accessed 10 September 2014).

## 5.2. Water, sanitation and hygiene safety planning

- The WSP approach is a well established practice and a good way to improve the drinking-water safety of small-scale systems.
- For a holistic approach it is beneficial to integrate sanitation and hygiene aspects into WSPs for small systems.
- Policy-makers can stimulate WSP implementation through legal instruments; by providing guidance, tools, support centres and financial support, among others; and by training WSP facilitators.
- Successful application of WSPs requires tools that are adapted to the requirements of small-scale systems and that are available in local languages and straightforward wording.

The WSP approach is recommended by the WHO guidelines for drinking-water quality *(49)* as the most effective means of ensuring the safety of water supplies. It is a systematic and proactive process at the level of a water supply system, which focuses on the identification of locally relevant hazards and hazardous events, assessment and continuous management of risks to prevent drinking-water from becoming unsafe (see Fig. 2). Based on the risk assessment, needs for improvement and upgrade are prioritized, which is especially helpful in resource-limited settings. The WSP approach addresses the entire water supply chain from the source water catchment to the point of consumption; it is a continuous process and not a one-off exercise.

**Fig. 2. The six tasks to develop and implement a WSP**




*Source*: WHO *(114)*.

Water safety planning is particularly suitable for small supplies because it empowers operators and communities to improve drinking-water safety through simple measures. WSPs stimulate continuous improvement and are a good basis for decision-making: areas that need the most urgent attention are identified and resources can be targeted to improving them first. WSPs can also be used for attracting financial support for improvements and upgrades, showing due diligence in identifying the requirements *(115)*. The development and continuous implementation of WSPs can result in reduced risks to health, improved supply quality and reliability. For example, a study in Iceland found that the incidence of diarrhoea significantly decreased where WSPs were implemented *(28)*. WSPs improve system understanding and management, particularly through improving operation and maintenance procedures by all involved in these activities. They bring together local stakeholders – both those already involved in the water supply and external stakeholders – and improve their cooperation.

WSPs and drinking-water testing are complementary: while WSPs guide day-to-day system operation and management to reduce risks and continuously provide safe water, surveillance provides occasional “spot checking” – oversight and support to confirm good system management and safety. WSPs can help surveillance authorities set priorities regarding the most relevant parameters and/or systems in rural areas (see Section 4.4 on surveillance).

The principles of WSPs have been adopted widely among large and small water supplies across the world. While WSPs for small systems will typically be less complex than those for larger utilities, the underlying principles are the same. WHO provides detailed guidance on the steps of WSP implementation for different types of supplies, including guidance for applying the WSP approach to community-managed supplies and a field guide offering simple “cookbook” type templates that are an excellent way to get started on practical implementation in small-scale systems *(116)*.

It is essential that people with the necessary skills and experience are involved. The owners and operators of small-scale supplies are not always professionals in the field, so both external support and training materials may be needed to implement WSPs. Trained facilitators at the national or regional levels with good technical skills in the arena of water supply, drinking-water quality, sanitation and hygiene can support the development and countrywide scale-up of WSPs for small-scale systems. When selecting WSP facilitators, gender balance should be considered. This is particularly important because in rural communities water is typically seen as the responsibility of women and because sanitation is a sensitive issue, about which people are likely to feel more comfortable talking to somebody of the same gender. Several small-scale water supplies or communities might join forces in developing their WSPs and, for example, share their experiences of identifying hazardous events. In community-managed supplies the support of NGOs, local stakeholders and the users themselves may be needed, particularly if no entity has yet been assigned to operate the system.

In small communities, water and sanitation are often dealt with by a single entity at the local level, or sanitation solutions are left to the individual responsibility of households. As water, sanitation and hygiene are closely interlinked key elements for ensuring individual and community health, it is very beneficial to address them together.

The assessment of risks related to drinking-water from inadequate sanitation and hygiene, for example, is an integral part of water safety planning. Water, sanitation and hygiene education (see Box 12) generally plays an important role when developing WSPs for small-scale water supply and sanitation systems to foster an understanding of the connection between water, sanitation, hygiene and health in the community *(117)*.

**Box 12. Water, sanitation and hygiene education, household storage and treatment of drinking-water**

Water, sanitation and hygiene education aims to improve the contribution consumers can make to reducing health risks in these areas. It may address issues of personal (including hand-washing), household and food hygiene. As safe water may be re-contaminated during transport and storage at the household level, safe behaviours during these steps are typically also part of water, sanitation and hygiene education.

When drinking-water is of good quality at the point of collection people may still inadvertently introduce faecal contamination during collection, transport and storage *(118)*. This is fully recognized in the case of off-plot water supplies where people must bring water back to the household in containers, but even when households have piped water, if the supply is intermittent they may store water either in large tanks (for example on rooftops) or in household jugs, buckets and other containers.

Wide-mouthed containers can easily allow dirty hands or other objects to come into contact with the water, and containers themselves can be dirty, especially if they are difficult to clean *(119)*. If containers have no tap, people are likely to dip drinking vessels or other utensils – which may be contaminated – into them.

Simply providing safe storage containers can improve the quality of water at the point of consumption *(120)*. If the drinking-water is of poor quality at the point of collection, however, an effective option is for people to treat water themselves before storing it in a safe container. Well established processes for household water treatment include filtration, boiling, chlorination and ultraviolet disinfection *(121)*. More information about household water treatment and safe storage is available from WHO *(122)*.

(And, if you want a photo…)

**Fig. 39.1. The Oxfam bucket: a 14 litre safe storage container, with removable lid and tap**

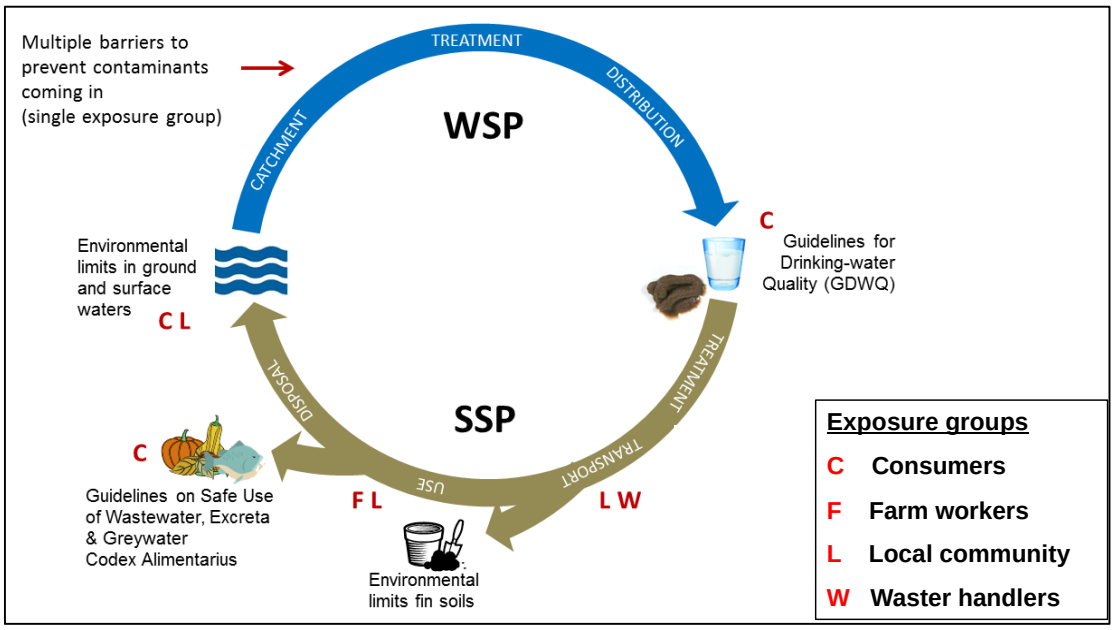
Credit: www.nrs-international.com

Sanitation safety plans (SSPs), in combination with WSPs, could close the loop between risk assessments for sanitation and drinking-water, leading to holistic risk assessment and management. Based on WSP principles, they can also address sanitation-related exposures in the community – for example, the risk from reuse of treated wastewater in agriculture, the potential for sanitation facilities to contaminate sources of drinking-water and risks related to hygiene behaviour at the household level (including food preparation, sanitation and hygiene practices) (see Box 13).

**Box 13. SSPs**

SSPs are intended to be a vehicle to implement the WHO guidelines for the safe use of wastewater, excreta and greywater in agriculture *(48)*. Their aim is to eliminate or reduce adverse health effects from use of such material, particularly in agriculture and aquaculture. As with WSPs, the SSP approach involves a system of risk assessment and risk management. As far as possible, SSPs are intended to complement WSPs, seeking to close a loop from wastewater disposal to source water.

**Fig. 40.1. SSPs and WSPs in the water cycle**




WHO and its partners are currently developing guidance on SSPs. A key difference from WSPs is that SSPs consider multiple pathways for exposure along the sanitation chain: they include workers, farmers communities and consumers. In addition, SSPs tackle complex institutional and stakeholder relationships associated with human waste generation, treatment, use and disposal.

It is envisaged that the concept of the SSP could be extended beyond the scope of wastewater reuse. Possible points of exposure cover several steps in the sanitation chain: wastewater generation, transportation, collection, treatment or non-treatment, valorization through reuse, produce consumption and disposal. The multibarrier approach within SSPs enables selection of a combination of treatment and non-treatment options (for example, crop selections, irrigation methods, restrictions in access and protective equipment) to reduce exposure to wastewater.

The approach has been piloted among others in a municipality of approximately 9500 inhabitants in Portugal, where it was applied to the wastewater drainage and treatment system, with the main objectives of protecting human health, promoting the safety of workers and users and enhancing environmental protection. It brought together various stakeholders with the common goal of reducing health risks. A WSP was implemented in the municipality at the same time.

Although still at the pilot stage, some combined water, sanitation and hygiene safety plans, as well as guidance on their use, have already been developed, particularly in small-scale systems (see Case study 29 for an example of a combined safety plan).

**Case study 29. The water and sanitation safety plan (WSSP) compendium for small-scale systems**

WECF developed a methodology involving schools, based on the WSP approach for very small communities *(104)* (see Case study 20). This was piloted in the eight countries of eastern Europe and the Caucasus for a period of six years. Subsequently, the WECF approach to applying the WSP methodology was further developed to include sanitation. As a result, the WSSP compendium for small communities was published in 2014 *(123)*.

The compendium is an example of a tool tailored to the particularities of small-scale water supply and sanitation systems; it incorporates sanitation issues into the WSP approach and is available in several languages to facilitate its application. The compendium provides a consistent framework document intended to enable communities to develop a WSSP for small-scale water supplies – such as dug wells, boreholes, springs and small piped centralized water supply systems – and to assess the quality of sanitation facilities such as school toilets. It aims to assist its users to develop a step-by-step WSSP for their community through a multistakeholder process in cooperation with authorities, schools, citizens and other relevant groups. The compendium has been published in English and translated into Romanian and Macedonian; translation into additional eastern European languages is planned.

Decision-makers can stimulate WSP implementation for small systems by creating a strong enabling environment (see Section 4). This may include:

- financing and supporting the implementation of pilot projects in order to obtain evidence of success factors and challenges in adapting this approach to small supplies in the national setting (see Case study 30 for an example of pilot projects and resulting tools for WSP implementation);
- encouraging WSP application by:
  - making recommendations based on the lessons learned in the pilot projects;
  - requiring their application in legislation, regulations, sanitary norms or other regulatory instruments (see Case study 31 for an example of legislation requiring risk assessments for small-scale water supplies and accompanying measures to create an enabling environment to support implementation and Section 4.2 on legislation and regulations);
  - allowing an adequate time frame for WSP implementation;
  - empowering institutions;

- sharing information on WSPs, their benefits and success stories – for example, at advocacy and capacity-building workshops and through publications – in order to inspire bottom-up support for WSPs;
- securing financial support not only for developing WSPs but also for implementing improvements identified within the WSP process required for safe water supply;
- building capacity at the national level, including by:
  - training facilitators and auditors of WSPs;
  - improving the capacity of local health agency staff to provide external support and audit WSP implementation in their area of responsibility;
  - developing tools for implementation tailored to small-scale systems;
  - providing support centres;
  - making hands-on guidance available in the national language, adapted to the specific context.

Typical stages of a step-wise approach towards gaining the commitment of decision-makers at the national level to embrace and support the WSP approach are described in the WHO document *Think big, start small, scale up: a road map to support country-level implementation of water safety plans (124)*. This also discusses success factors and challenges to implementation.

**Case study 30. Pilot projects and tools for WSP implementation in small-scale water supplies in Tajikistan**

In Tajikistan, the WSP approach was implemented in pilot projects in two districts (Panjakent – Navobod village and Hamadoni – Qaragoch village). The purpose of the pilots was to gain first-hand experience with WSPs and evaluate their feasibility in the Tajik context.

A number of local community leaders and representatives of district health offices from different Tajik regions were trained as facilitators to assist with implementing community WSPs in local water supplies, conducting sanitary inspections of the water supplies and their vicinity, raising awareness and educating community members on drinking-water quality and general hygiene issues. Short-term improvements included quick one-off infrastructure fixes, improved monitoring, inspection and maintenance procedures and increased community awareness. The population's confidence in the water supply and its management increased and appreciation of the improvements achieved resulted in an increased willingness to pay water fees. The WSP was also used to leverage external financial support by demonstrating a proactive approach.

Based on the pilot project experiences, a field guide on WSPs was developed in the Tajik language for dissemination through local health offices in order to facilitate broader application of the WSP approach throughout the country, particularly for small-scale water supplies *(125)*. The field guide gives background information on water safety planning, presents the outcomes of the pilot studies to demonstrate that the approach "works next door", and provides templates to facilitate practical development and implementation of WSP.

**Case study 31. WSPs in small-scale water supplies in Scotland**

In Scotland 5% of the population receive their drinking-water from about 20 000 private water supplies (small community supplies). These range from individual supplies for domestic properties ("Type B") to those providing water for larger numbers of domestic properties, as well as businesses and public buildings such as hotels and food producers ("Type A").

Updated legislation for private water supplies came into force in Scotland in 2006, introducing a legal

requirement for WSPs for risk assessment of all Type A supplies and an annual review of these risk assessments. These are carried out by environmental health staff based in local authorities across the country, while WSPs are developed by those with responsibility for operating or managing the Type A supplies with the support of environmental health staff. Training and guidance material was provided by the Scottish Government to both environmental health staff and owners; ongoing support is provided by the Scottish Government and the Drinking-water Quality Regulator for Scotland. If owners or users of Type B supplies request a risk assessment, local authorities are also obliged to provide assistance.

These risk assessments, along with the financial assistance provided by local authorities through a non-means-tested grants scheme (see Case study 13), have resulted in a significant improvement in private water supplies in Scotland. Crucially, they have also increased understanding and awareness of these supplies, among both the owners and users of the supplies and the local authorities. The water quality of many supplies – particularly the microbiological quality – is still of concern, however.

Experience in Scotland has shown that while the principles of WSPs are relatively simple, their implementation needs commitment and time from those responsible for the supply. Generally, professional input, support and time from agencies involved with environmental health, public health and drinking-water are required to deliver an effective WSP, review it and keep it up to date. While lack of financial support has not necessarily prevented development of WSPs, in some cases their development has identified clearly where investment is needed, allowing for careful targeting of resources, which can often be very limited for private water supplies.

**Case study 32. WSPs in three small towns in southern Iceland**

This case study provides information on the progress observed as a result of WSP implementation in small-scale water supply systems.

In 2013 over 80% of the population in Iceland received their drinking-water from utilities with a WSP. This relates to 31 towns, of which 22 have fewer than 5000 inhabitants. Once introduced through new legislation in 1995 *(126)* the WSP approach was initiated within large and small utilities alike, and they worked together on WSP guidelines with the association of water utilities, Samorka. The first guidelines were published in 1996 and specific guidelines for small utilities were developed in 2004. A few years into the process the authorities decided to establish formal requirements for WSP implementation. Water supplies serving more than 5000 inhabitants are now required to establish a risk management plan on the basis of “hazard analysis and critical control points” – a WSP-type approach that can be applied in settings where water is considered as food. Supplies serving 500–5000 inhabitants should establish a simplified five-step model, which still includes all the critical elements of a risk management approach. Supplies serving 100–500 inhabitants or serving food processors should have a sanitary checklist.

Early in 1998 three small towns in southern Iceland (with populations of 1600, 2000 and 7000) started work jointly on the implementation of a WSP with a consultant. Experience of WSPs was limited in Iceland and cooperation was seen as a more economical approach. Two of the towns succeeded in implementing WSPs within a year. In the third town the process was delayed by a reorganization of the municipal services including the water utility, but it successfully implemented a WSP later, making use of the WSP guidelines and its own staff.

The whole WSP process was beneficial for the three communities: research on health data showed that incidence of diarrhoea decreased significantly following implementation of the WSP in two of the towns – from 6 to 1 and from 12 to 2.6 incidences per month per 1000 inhabitants. In the third town it was not possible to correlate water service area with public health data as the town’s health care system also serves a large neighbouring rural area. In this town, however, water quality improved significantly: noncompliance with the drinking-water regulation fell from 5% to 0%.

The main benefits of WSPs are safer water, a change of attitude among staff and more systematic

procedures and traceability. It is also seen as an advantage to have “approved water” (once the WSP is implemented and approved by the local compliance authority) when attracting enterprises to the towns. To succeed it is important to have staff involved in the implementation process and intensive training, but for small communities access to training can be a challenge. The lessons for small communities are to participate in national platforms, to work together whenever possible with the active involvement of staff and to continue cooperation following implementation, for example with training and mutual auditing.

### *5.2.1. Further reading*

Think big, start small, scale up: a road map to support country-level implementation of water safety plans *(124)*.

Gunnarsdottir M, Gardarsson S, Elliott M, Sigmundsdottir G, Bartram J. Benefits of water safety plans: microbiology, compliance, and public health *(28)*.

Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities *(114)*.

Rickert B, Schmoll O, Rinehold A, Barrenberg E. Water safety plan: a field guide to improving drinking-water safety in small communities *(116)*.

Developing water safety plans involving schools – a WECF manual *(105)*.

Developing a water and sanitation safety plan in a rural community: compendium *(123)*.

## 5.3. Resource protection

- Resource protection is a proactive and preventive approach: protecting water resources from pollution is often easier and less costly than treating contaminated water. It is therefore particularly well suited to improving the situation of small-scale water supplies, where subsequent treatment steps are often limited both in number and in the level of water quality they can achieve.
- Source water protection safeguards public health by avoiding or reducing contamination of sources used for drinking-water by hazardous agents, thus acting as a first barrier along the supply chain against pathogens and hazardous chemicals – in particular for those agents that cannot be effectively removed by conventional treatment.
- Small-scale water systems should have clear right of access to and use of the water source, particularly where there is strong competition with other users.

The main benefit of having well protected high-quality source water is that it protects public health by effectively applying a preventive approach. Through resource protection measures, contaminants are prevented from entering the water supply chain in the first place, which reduces requirements for later steps and increases long-term safety and sustainability of the water supply system. This is particularly relevant for small-scale systems where treatment is often lacking or limited in scope and availability.

In addition, sustained access to that source water must be maintained. This is particularly important where there may be competing claims from other uses, such as agriculture or commercial activity. Most countries give general priority to use of water resources for drinking-water, but specific water rights may need to be fixed as an important guarantee to ensure sustainable access.

The water-supplying service provider can implement technical resource protection measures at the local level, often only in the immediate vicinity of wellheads or reservoirs (such as fencing the area around the abstraction point to prevent contamination). Implementation of protection measures for

the wider vicinity or even the entire water catchment, however, usually encounters conflicts of interest regarding land use and therefore requires legislative and planning processes at the subnational and national levels. In particular, small-scale systems often have only limited influence on activities in the catchment area beyond the local context.

For existing water supplies – in particular for small-scale supplies, which often do not own the land surrounding their source water abstraction point – it can be more difficult to implement and enforce new restrictions. For such supplies, therefore, support from authorities with the power to influence existing and new activities in the catchment area is important. In addition to authorities involved in health, water management stakeholder mapping should also consider those involved in potentially contaminating activities such as sanitation, agriculture, industry and transportation, as well as planning authorities that may have the means to influence catchment use developments directly. Land use planning and management is an efficient tool to influence activities in the catchment area. National or subnational authorities may encourage catchment management approaches, such as establishing bodies seeking to allocate water of sufficient quality and quantity to different uses. In these cases, the interests and voices of small-scale water systems need to be represented in the management body. Introducing the needs of several small-scale systems in a larger region into such processes may mean that they have more influence than if one system tries to achieve protection on its own.

Successful source water protection is tailored to the unique concerns and circumstances of the local community. Effective involvement of the landowners and stakeholders in the catchment area at an early stage is particularly critical: where protection requires activities to be restricted, their cooperation is essential for implementation of such restrictions. Financial incentives for applying water protecting practices or for limiting land use may significantly increase acceptance and implementation of source protection measures (see Section 4.2 on legislation and regulation).

Protecting the water source is the first step in the multibarrier approach, which aims to have several barriers or controls in place to avoid hazards (such as pathogens) reaching the consumer. Moreover, resource protection can reduce requirements and costs for treatment steps. This is particularly important in rural areas, where potentially contaminating activities (such as agricultural activities and poorly sited or maintained sanitation facilities) are often in very close proximity to the water source.

For small-scale systems, local measures in resource protection may include, for example:

- awareness-raising campaigns, communication and education of communities and catchment stakeholders, addressing how their activity may affect water quality and thus public health (see Section 4.7 on advocacy and awareness-raising);
- agreements and communication – for example, with farmers – to restrict potentially contaminating activities in parts of the catchment area or to undertake them only with specific technical controls in place (see Case study 33 for an example of reducing potentially contaminating activities through raising awareness and incentivizing resource-protecting practices);
- local arrangements for planning and siting of sanitation and wastewater facilities, including provisions for wastewater collection, treatment and proper disposal locations (see Section 5.4 on sanitation planning);
- monitoring of source water quality;
- fencing of water abstraction points to avoid access of animals and unauthorized people;
- regular site inspections of abstraction facilities and their surroundings.

**Case study 33. Cooperative agreements with farmers in Germany**

In Germany the Federal Water Act *(127)* empowers federal states to establish "drinking-water protection areas" to protect catchments of public drinking-water supplies from adverse impacts, issuing a separate legal decree for each area. Development of such decrees is typically the responsibility of the local or regional water authority. Voluntary cooperative agreements between water suppliers and farmers are also an important instrument for protecting drinking-water resources in designated protection areas in some federal states.

In the Federal State of North Rhine-Westphalia the German Association of Energy and Water Industries and the Chamber of Agriculture signed a framework agreement to promote farming practices that protect drinking-water resources. The framework agreement strongly encourages water suppliers and farmers to create voluntary but formalized and binding local cooperation agreements. These typically contain specific goals, the main targets being prevention of pesticide and pathogen introduction and the reduction of nitrate levels in groundwater. About 120 such local cooperation agreements currently exist in North Rhine-Westphalia; they include advice for farmers from specially trained advisors of the Chamber of Agriculture on techniques and farming practices that protect water resources. Specific advice typically includes guidance on fertilization regimes, optimization of manure use, catch cropping practices, erosion control and pesticide control (including advice on storage practices, application techniques and choices of alterative active substances).

In the Federal State of Lower Saxony cooperative agreements have the main goal of reducing nitrate pollution in source water. As part of the cooperation model, guidance is given on farming practices in individual and group consultations, during site visits and in circular letters. The fee for abstraction of water for drinking-water purposes is regulated in the Lower Saxony Water Act *(128)*, and at least 40% of this has to be used to finance water protection measures such as cooperative agreements. The money is spent on advising farmers and implementing the terms of the agreements. In 2011 there were a total of 75 such agreements, covering more than 90% of the agricultural areas located in drinking-water protection areas in Lower Saxony.

Financial aid is granted when implementation of an established protection concept exceeds €50 000, so smaller drinking-water supplies have merged to subregional cooperation to be eligible for financing.

The Oldenburg and East Friesland Water Association (OOWV) is a public water and wastewater association in the Federal State of Lower Saxony, and is responsible for the water supply and wastewater management of German communities, serving 350 000 households in 81 villages and two cities *(129)*. OOWV developed – in cooperation with the district administration, scientists and farmers – a comprehensive programme for groundwater protection to ensure sustainable water management, which included free personal and group consultations for farmers on organic farming. This was supported by promotion of food produced under these conditions to local meat processing companies and supermarkets: 99% of the products were marketed at higher prices to compensate for the decreased yields of organic farmers. Farmers received the higher price per kilogram or unit directly from the buyer (the consumer or food processing company) with the aim of compensating for the average 30% decreased yields of organic farmers. OOWV finances the costs of the farmers' consultancy via revenue from the fees charged for water abstraction. Among other results, the concentration of nitrate in groundwater decreased in the catchment areas where organic farming was introduced – for example, in Holdrof it dropped from 110 mg/litre to below 50 mg/litre in 12 years.

An established approach for resource protection is to designate an area around the source or abstraction point that is subject to protection measures. This is applicable to all water supplies, irrespective of whether they use surface water, groundwater or spring sources. The criteria for determining the dimensions of the area should be defined, as should the types of activity to be restricted or banned; this is generally done at a higher level of government. More detailed identification of such activities and potential needs for their restriction may also take place at the local level within a water safety planning process.

The catchment area may be divided into several zones: the strictness of limitations on activities typically increases the closer the zone is to the abstraction point (see Case studies 33 and 34 for examples of how resource protection zoning, including for small-scale water supplies, can be

integrated into legislation). Decisions about the number and size of such zones should be based on the local situation and on a risk assessment analysis. Small-scale water supplies may find protection measures particularly hard to enforce in the outer zones; however, fencing and influencing activities in the inner area should be possible in most settings, even for individual wells.

**Case study 34. Regulations for protection of drinking-water supplies in Switzerland**

In Switzerland groundwater is the most important source of drinking-water. To prevent it from being polluted by human activities and to keep the requirements for water treatment as low as possible, groundwater protection is included in federal environmental legislation in regulations on water protection (Federal Act on Water Protection *(130)* and Federal Ordinance on Water Protection *(131)*).

In particular, the regulations on spatial planning related to groundwater protection are of the utmost importance for water supplies. Accordingly, three groundwater protection zones (S1–S3) must be designated around all groundwater wells serving the public, in which significant restrictions are imposed on human activities. These restrictions become less stringent from the centre to the periphery. Around the wellhead (zone S1) only construction work and activities connected with drinking-water supply are permitted. The inner zone (S2) is primarily designated to prevent contamination of drinking-water with pathogenic microorganisms and to ensure that groundwater flows are not adversely affected or obstructed as they approach the well. Here, liquid manure may only be applied in exceptional cases and infiltrating wastewater is forbidden. The outer zone (S3) is designed to ensure that – in the event of an accident – sufficient time and space are available to ward off any hazards to drinking-water. Thus, facilities that pose a risk to groundwater (such as petrol stations) are not allowed in this zone. Furthermore, infiltration of wastewater, handling of liquid fuels or lubricants and storage of heating oil above the quantity required to heat the relevant building for two years are prohibited.

In general, restrictions within zone S1 amount to an expropriation; therefore, the drinking-water supplier is advised to purchase and fence in the area. In contrast, restrictions in zones S2 and S3 are normally less severe and the water supplier is not obliged to reimburse the affected landowners.

The process of designating groundwater protection zones is defined in the Federal Act on Water Protection and is applicable to all sizes of water supply except private supplies. Regulations summarize the specific protection measures for the groundwater protections zones. Based on this information the water supplier should draw up a plan for regular controls of these protection measures. SVGW (see Box 10 and Case study 18) has published guidelines for quality assurance in groundwater protection zones to support water suppliers in self-surveillance of the catchment area and implementation of groundwater protection zones and measures.

**Case study 35. Policy instruments for sanitary protection zones in Serbia**

Serbia's 2008 regulation defining and maintaining the sanitary protection zones of water supply sources *(132)* refers to all drinking-water supply systems intended for public supply, which includes all those producing more than 10 $m^3$ per day. Its provisions are obligatory for all systems supplying more than five households or 20 inhabitants and individual water facilities intended for production and trade of food and items of general use, schools, restaurants and other public facilities. The regulation defines protection zones according to the type of drinking-water source and activities in the basin and requires the establishment of three protections zones (immediate, inner and outer), with restrictions on human and animal activities.

The regulation requires very complex documentation to be prepared on sanitary protection zones, maintenance (restricted activities within the zones) and marking of zones for approval by sanitary inspectors within the Ministry of Health. The required documentation is very demanding and costly for small-scale water supply systems and local self-government. As a result, no claim for the approval of sanitary protection zones has yet been submitted to the Ministry of Health for small-scale water supplies in rural areas.

In 2013 the Ministry of Health initiated an amendment to this regulation and drafted a new provision for small-scale water supply systems. Accordingly, such systems are required to establish, maintain, fence and mark only the immediate protection area surrounding a groundwater well to protect the catchment area from pollution, without submission of complex documentation and payment for the study on sanitary

protection zones. This exemption for small-scale systems should facilitate local self-government to take measures, protect drinking-water sources in rural areas and implement the legislation.

Measures may require legislative, planning and financial support from the subnational and national levels (see Sections 4.2–4.5 for details of the policy processes necessary to create an enabling environment), as the available resources and the opportunities for involvement in policy development are typically limited for managers of small-scale system. Measures specified by these policy instruments may include:

- restricting access to catchments;
- restricting potentially polluting activities (such as spreading of manure/slurry/fertilizers or spraying with pesticides, building of new permanent settlements unless adequate sanitation solutions are in place, waste dumping and so on) in the catchment area, permitting such activities only with specific controls in place or moving them away from sensitive locations;
- requiring minimum protection measures as a prerequisite for allowing drinking-water abstraction;
- influencing the siting of potentially contaminating activities;
- establishing abstraction licences for small-scale water systems;
- providing representatives of small-scale water supply and sanitation system with a voice in catchment management bodies so they can defend their rights to water resources and negotiate in case of water scarcity;
- restricting water use for other purposes to preserve sufficient quantities for drinking-water supply;
- enabling water utility ownership and control of catchment land;
- requiring application of good management practices in potentially contaminating activities – for example, implementing codes of good practice (see Section 4.3 on design and management standards);
- offering incentives for limiting polluting activities or using fees for water abstraction to fund protection measures (see details on incentive-based regulation in Section 4.2 and Case study 33).

Poorly managed and/or sited sanitation and the resulting contamination are one of the main risks to safe drinking-water. While connecting to a central wastewater treatment plant often may not be possible or feasible, measures such as positioning decentralized sanitation facilities at safe distances and downstream from the drinking-water abstraction point are effective for protecting sources of small-scale water supplies.

For new water supplies, the first step is to select and prioritize sources for drinking-water supply and to determine where and which protection measures may be implemented. If wells or surface water uptakes can be situated in fairly pristine areas or where land use is not intensive, it may be possible to designate protection zones in which potentially polluting activities are restricted. In contrast, if new wells need to be drilled in areas of intensive land use, acceptance of restrictions to ongoing activities may be difficult to achieve, particularly for systems only serving a small number of people. Implementation challenges can be overcome by conducting a municipal planning process before commissioning the new source, thereby seeking stakeholder involvement at an early stage.

In many countries water suppliers must have approval from various authorities to abstract water and supply people with drinking-water. In such cases, cooperation and communication between the different authorities (such as environmental and health authorities) is very useful to establish an overview of the number and location of water supplies, as well as decentralized sanitation and potentially contaminating activities. In cases where a fee is required for abstracting water, money collected through this system may be used for targeted measures in resource protection.

**Box 14. Regulations for source protection measures in small-scale water supply catchments in the WHO European Region**

Of the questionnaires returned under the survey on small-scale water supplies conducted under the Protocol *(2)*, 37 (83%) from 35 countries stated that regulations for source protection measures in small-scale water supply catchments are in place.

In Denmark a 25-metre protection zone is obligatory around supplies providing water for 10 or more households. In addition to this, paragraph 21b in the Law on Environmental Protection *(133)* creates an instrument for regulating the catchment of water supplies. This applies to both small (supplying fewer than 10 households) and larger water supplies. Delineation of the catchment is calculated and designated by municipalities. Within the catchment area the municipalities are authorized to impose the restrictions deemed necessary to safeguard existing or future water supplies.

According to the Water Act of Estonia *(134)*, each point from which groundwater or surface water is abstracted for drinking-water purposes must have a water protection zone. The scope of the zone is set according to the amount of water used. The owner of the water abstraction point is responsible for enforcement of the requirements of protection zones. Surveillance of implementation of the requirements falls within the remit of the Environmental Inspectorate.

In Lithuania sanitary protection zones are required for all drinking-water sources. Their size and requirements for their establishment are subject to the groundwater extraction rate. Municipalities are responsible for enforcement.

All waterworks in Norway that serve more than 50 people must have at least two hygienic barriers, one of which should (if possible) be a protected/nonpolluted catchment area. This is part of the waterworks approval process.

A regulation for source water protection measures in Serbia *(132)* applies to small-scale water supply catchments. The Sanitary Inspection Department of the Ministry of Health is responsible for its enforcement.

To protect the source water of drinking-water treatment plants supplying more than 10 $m^3$ per day in Sweden, water protection areas can be established. This includes restrictions on wastewater treatment plants, grazing by animals and other activities. Permits from regional authorities are required for wastewater treatment plants and other activities considered potentially harmful to the environment.

### *5.3.1. Further reading*

Protecting groundwater for health: managing the quality of drinking-water sources. Geneva: World Health Organization; 2006 (http://www.who.int/water_sanitation_health/publications/protecting_groundwater/en/, accessed 24 October 2014).

The *Cryptosporidium* (Scottish Water) directions 2003. Edinburgh: Scottish Government; 2003 (http://www.scotland.gov.uk/Publications/2004/01/18727/31490, accessed 25 September 2014).

Grundsätze und Maßnahmen einer gewässerschützenden Landbewirtschaftung [Basic principles and measures of water protecting farming]. Bonn: DVGW; 2004 (W 104; http://www.dvgw.de/fileadmin/dvgw/angebote/publikationen/infoschriften/w104_en.pdf, accessed 25 September 2014).

## 5.4. Sanitation planning

- National policy-makers can support sanitation planning by providing baseline data, priorities and guidance for decision-makers at the local level.
- The application of locally appropriate technologies for small-scale sanitation systems can be facilitated by regulation that allows for flexible solutions.
- If they are common practice, schemes for reuse of treated wastewater, sludge and human excreta should be regulated to ensure safety.

Finding suitable sanitation solutions for small-scale systems and planning for their demand, location and sustainable operation will decrease the population's exposure to faecal pathogens, and health risks from unsafe sanitation practices, as well as preventing the contamination of drinking-water sources. Policy-makers at the national level can foster the implementation of suitable sanitation solutions by contributing to sanitation planning efforts and enabling the choice of appropriate technologies at the local level.

Decision-making on aspects of sanitation, wastewater disposal and treatment in rural and periurban areas can be more difficult than in urban areas. The typical characteristics of low population density, longer distances between houses and remoteness of settlements in rural areas are important considerations in making technology choices and deciding on overall sanitation management approaches. Standard solutions such as conventional wastewater collection and treatment systems might be less efficient and more expensive with respect to per capita costs. As with drinking-water supplies, sanitation solutions have to be economically viable, socially acceptable, physically accessible and technically and institutionally appropriate, as well as protective of the environment and natural resources in order to be sustainable *(9)*. The *Compendium of sanitation systems and technologies (135)* provides information on a wide range of sanitation technologies and is a valuable resource for decision-making in the sanitation planning process.

Planning of wastewater collection and treatment at the national level (through, for example, national strategies, programmes and action plans) should take into account national requirements, as well as the specific geographical, social, economic and technical conditions in individual countries. Furthermore, wastewater fees need to be affordable for the population (see Section 4.5 on costing and financing) and sanitation systems need to be operable using locally available knowledge. To keep systems in operation, the availability of financial and human resources for proper operation and maintenance should be ensured (see Section 4.6 on education, qualifications and training programmes).

Sanitation planning tools are often tailored to urban systems; however, their principles may generally also be applied to the rural context if tailored to the prevailing conditions. Examples include the community-led urban environmental sanitation planning (CLUES) guidelines *(136)* for planning and implementing environmental sanitation infrastructure and services, including for periurban communities, and the planning framework for improving city-wide sanitation services, Sanitation 21 *(137)*, which considers a wider range of aspects of sanitation, including issues of poverty, inequity, land ownership, environmental concerns and the wider political economy.

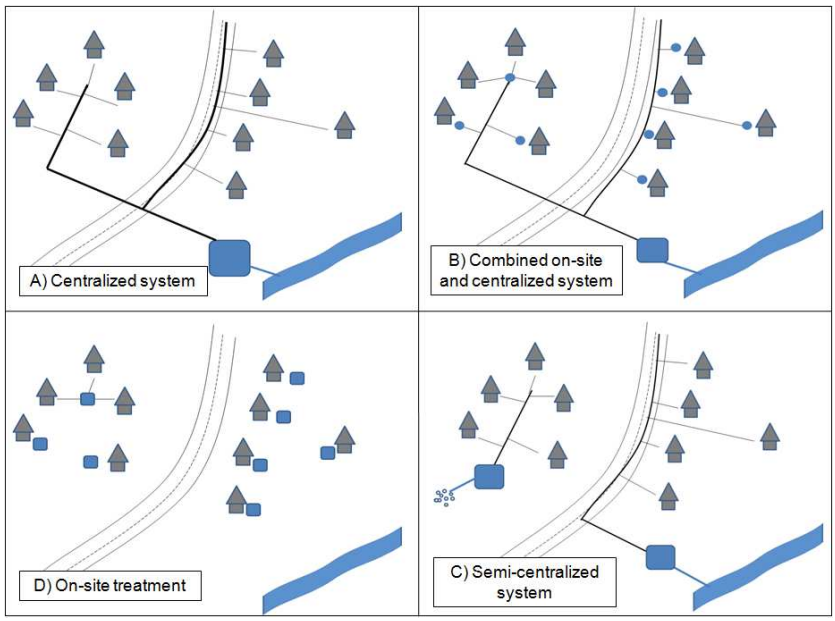
The five stages of the Sanitation 21 approach are as follows:

- stage 1: build institutional commitment and partnership for planning
- stage 2: understand the existing context and define priorities
- stage 3: develop systems for sanitation improvement

- stage 4: develop models for service delivery
- stage 5: prepare for implementation.

Sanitation planning typically includes the development of a sanitation and wastewater disposal scheme on a district, municipal or catchment area level, usually including a combination of collective and onsite systems for disposal of all wastewater generated for rural areas (see Fig. 3 for options of how centralized and onsite systems may be arranged in rural settings). Sanitation planning does not solely concern municipal wastewater collection and treatment: it should take a holistic approach that includes nutrient and water recycling, such as safe reuse of wastewater, which may save water resources and costs of fertilizers.

**Fig. 3. Options for sanitation and wastewater collection and treatment systems**




*Note*: small blue boxes represents onsite treatment, large ones the treatment plant(s).
*Source*: Wendland & Albold *(138).*

National and subnational policy-makers can support districts and municipalities in sanitation planning efforts by developing such concepts for water basins and by providing the data required as a basis for such plans. The municipalities can use this information for sanitation planning and for making strategic local decisions, such as technology selection and whether or not to consider including reuse schemes. Another important aspect is to also consider changes in drinking-water consumption (for example, if water is piped to the home, this affects wastewater generation and respective disposal solutions).

Policy-makers at the national and subnational levels can support awareness-raising efforts and public participation (see Section 4.7 on advocacy and awareness-raising) to help ensure overall acceptance of a sanitation system, responsibility for its proper operation and willingness to pay. They can also encourage sanitation planning efforts that consider a scale beyond the strict boundaries of a community. This helps communities located downstream with their water and sanitation safety planning activities and resource protection. Municipalities will also benefit from national guidance on the concept of local sanitation planning and on what technological options may be applicable, given the prevailing conditions in the country. Local solutions may require flexible approaches that national legislation should cater for.

Where the application of wastewater or sewage sludge in agriculture is common practice (for example, in cases of limited availability or affordability of fresh water or as a soil conditioner and fertilizer) policy-makers may wish to consider aspects of reuse in legislation and related guidance to enable safe reuse for food or biomass production. While the reuse of wastewater in agriculture has several benefits – such as the possibility of partial cost recovery of wastewater treatment through selling or better harvests through higher levels of nutrients – they must be weighed against substantial health risks. These include higher exposure to faecal pathogens of the population (directly while handling wastewater and sewage sludge or via contaminated drinking-water) and a possible reduction in food safety from faecal contamination. WHO has published guidelines for the safe use of wastewater, excreta and greywater in agriculture *(48)* in order to assist countries when choosing appropriate options and adequate precautions. Guidance on SSPs is also in development, which aims to assist in the application of the guidelines, and to reduce the health risks resulting from reuse of wastewater, excreta and greywater (see Section 5.2 on water, sanitation and hygiene safety planning).

**Case study 36. National and local planning of small-scale wastewater treatment in Slovenia**

In Slovenia 98% of settlements have fewer than 2000 inhabitants; these small settlements represent 51% of the total national population. The hilly and mountainous landscape, high settlement dispersion and low population density render the conditions for wastewater collection and treatment unfavourable. Onsite and semi-centralized systems have therefore been selected in many cases as much more appropriate from financial, operational and ecological perspectives.

On the basis of Council Directive 91/271/EEC on urban wastewater treatment *(40)*, Slovenia adopted a national programme on collection and treatment of urban wastewater, which defines guidelines and deadlines for the period 2005–2017. Although the Directive refers to agglomerations with more than 2000 inhabitants, the Slovenian programme also covers smaller settlements.

As a first step, sanitation zoning was carried out and agglomerations were mapped for each municipality. An agglomeration in this context is a settlement or concise part thereof with more than 50 population equivalents and a density of more than 10 population equivalents per hectare; 80% of the Slovenian population lives in such agglomerations, which are equipped with public sewers. Settlements and individual houses that are not included in agglomerations need to be provided with private wastewater collection and treatment within defined deadlines. Deadlines for establishment of wastewater collection and treatment as well as discharge limits are defined according to settlement size, population density, catchment area and specific treatment demands for special areas.

Additional programmes and activities have emerged at the regional and local levels. Municipalities and regional development agencies have been encouraged to apply for different European funds for co-financing of wastewater collection and treatment systems. With lessons learned from central wastewater treatment systems, regional development agencies, municipalities and companies offering wastewater treatment plants have begun to promote onsite and semi-centralized wastewater treatment: special information campaigns and demonstration wastewater treatment plants for up to 50 population equivalents have been implemented.

Despite the engagement of regional development agencies and some local decision-makers, the main problem in reaching the set deadlines for wastewater collection and treatment is the lack of appropriate funding. Treatment plants for individual households and buildings not included in agglomerations are financed by private owners, while those for agglomerations are financed by municipalities. Some municipalities have adopted programmes to co-finance onsite wastewater treatment plants for individual households in remote areas, which encourage the owners to arrange wastewater treatment before the legislation deadline.

Overall, the legislation and operational programme on small-scale wastewater treatment in Slovenia are clearly elaborated, but in light of the course of construction of the systems, the deadlines seem overly

optimistic and unattainable. Since a lack of funding is the main obstacle, applications must be made to different EU funds and the most cost-efficient wastewater treatment systems selected carefully.

**Case study 37. Demonstration Centre for Decentralized Wastewater Treatment, Germany**

Since 2002 the Bildungs- und Demonstrationszentrum für Dezentrale Abwasserbehandlung e.V. (Demonstration Centre for Decentralized Wastewater Treatment - BDZ) has established an expert network with partners from research, industry and administration and created an initiative to support decentralized wastewater management. BDZ offers an independent service at the national and international levels that is composed of three main elements: a demonstration site; education and training; and research and development. The work is financed by membership fees, funding and participation fees from seminars and conferences.

On a converted former wastewater treatment plant, BDZ has installed various decentralized and onsite treatment technologies that can be seen in operation running with municipal wastewater, demonstrating 10 different processes and 38 plants. Representatives of local governments, stakeholders and technicians have an opportunity to find out more about the designs, application range and maintenance of the different systems. Approximately 1500 visitors visit BDZ every year.

The foremost purpose of BDZ is to raise awareness and to inform households about onsite treatment technologies. Citizens living in areas without collective wastewater systems are obliged to invest and operate an own certified onsite treatment system; at BDZ they can get an impression of different technical solutions and select which best fit their requirements. They also get an overview of the different companies providing service for installation and maintenance of the onsite system.

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