

European Strategic Workshop on Water Safety Planning

12 – 13 March 2014
Berlin, Germany

– Key Outcomes –

IN COOPERATION WITH

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Annex: Workshop program

1. Introduction

In 2014, it was ten years since the World Health Organization (WHO) introduced the Water Safety Plan (WSP) approach in the 3rd edition of the WHO *Guidelines for drinking-water quality* and the International Water Association (IWA) Bonn Charter for Safe Drinking Water. The WSP concept is a risk-based approach to drinking-water quality management and is internationally considered as the point of reference for safe management of drinking-water supply from catchment to tap.

While there is ongoing momentum for WSP in Europe, there had been no recent WSP-events with a tight focus on Europe and on approaches that work for implementing and scaling up WSP, bringing together a wide audience of stakeholders. Therefore, the German Federal Environment Agency (UBA), the WHO Regional Office for Europe (WHO/Europe), and the IWA in cooperation with the Berlin Centre of Competence for Water (KWB), the European Federation of National Associations of Water Services (EUREAU) and the DVGW German Technical and Scientific Association for Gas and Water organized the European Strategic Workshop on Water Safety Planning. The workshop took place in Berlin (Germany) on 12 - 13 March 2014 and was co-hosted by the organizers at the headquarters of the Berliner Wasserbetriebe (BWB, Berlin Water Utility), and financially supported by the German Federal Ministry of Health and UBA. The workshop program is provided as an annex to this report.

The workshop aimed at sharing and evaluating the current status of WSP implementation across Europe, focusing on member states and accession states of the European Union (EU). It brought together a wide audience of high level stakeholders from regulation, water suppliers and research (see Figure 1).

Over 20 European countries were represented at the workshop. Additionally, representatives of the WHO, IWA, European Commission (EC) and EUREAU participated at the workshop. While the target audience was broad, the manageable number of 60 participants facilitated active exchange and extensive sharing of practical information, particularly of experience in implementation of the WSP approach, success factors and challenges.

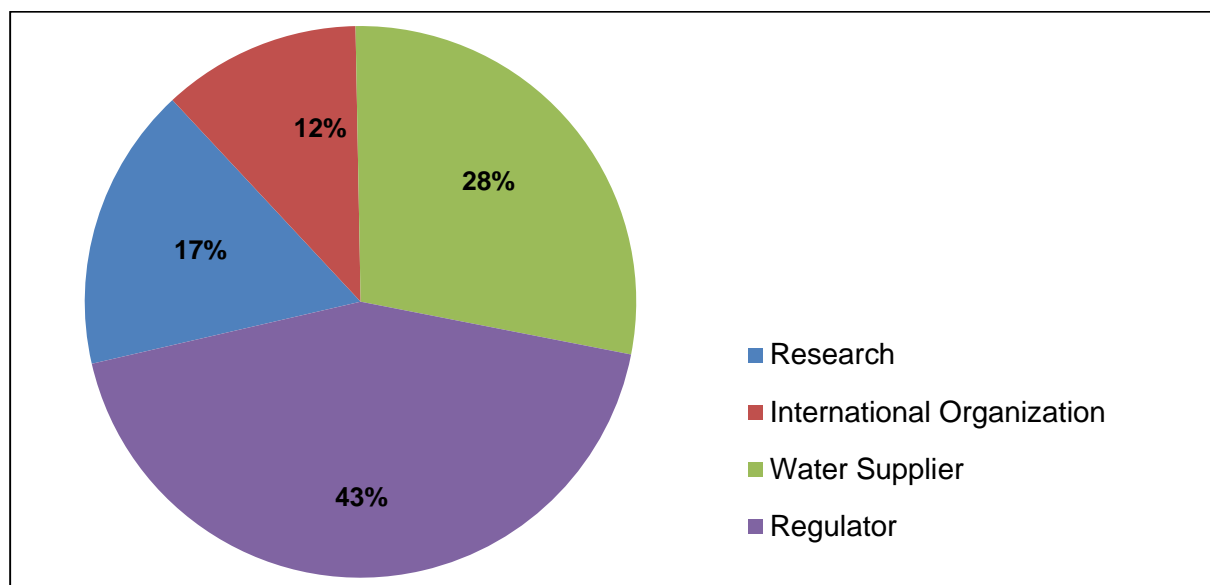


Figure 1: Stakeholders attending at the European WSP workshop

The workshop is complementary to other events in the area of water safety planning such as the biannual WHO / IWA water safety conference or forums on the European Drinking Water Directive (DWD) for regulators from the EU.

The workshop consisted of plenary presentations and statements as well as thematic split-out working group sessions. Themes focused on the:

- Implementation status and regulation of WSP in Europe,
- Enabling environment for WSP implementation,
- Link between WSP and health-based targets,
- Potential interfaces to risk assessment and management in adjacent fields,
- WSP auditing and certification, and
- Particularities of WSP in small-scale water supplies.

In the following we summarize the experiences reported and the discussion outcomes for each of these themes.

2. Implementation status and regulation of WSP in Europe

The benefits of risk management approaches have been widely recognized. In the food industry Hazard Analysis and Critical Control Points (HACCP) is commonly used or even mandatory. The most effective way of adapting a risk management approach to drinking-water supply systems is the implementation of WSP.

Since 2003 the European Commission has been exploring possibilities to adopt a risk based management approach. While the aim of the DWD is to protect human health by ensuring wholesome and clean drinking-water, the Commission's view on drinking-water quality is that the DWD requirements should be duly accounted for in wider environmental policies, both to highlight the importance of using the resource with care, and because clean source water is an important environmental quality indicator. Although overall compliance with the standard values of the DWD is very high for water supplies subject to the reporting requirements of the DWD (i.e. microbiological parameters > 99%), monitoring of small supplies is insufficient. The Commission's emphasis is therefore on improving quality from small supplies as part of the 7th Environmental Action Programme by 2020. Regarding WSP, the Commission recognizes that a more flexible, risk-based approach to water quality monitoring would be valuable, and a first step towards introducing this could be to change annex II of the DWD accordingly, if legally feasible and enforceable. It specifies minimum monitoring requirements and is currently in the process of being reviewed. The intention is to introduce more flexibility by permitting deviation from the current monitoring provisions if a risk assessment has been conducted which shows that different parameters and/or time patterns of monitoring would be more appropriate in the given situation. Moreover, possibly the first successful European Citizens' Initiative – *the right2water* (concerned with access to water, transparency of data and privatization of water supplies), and the subsequent public consultation on the DWD – may lead to an overall revision of the DWD sooner than previously intended and thus also re-open the discussion about introducing a mandatory WSP-requirement.

The degree of implementation of WSPs and of their impact on drinking-water quality varies significantly between European countries. The preliminary results of a WHO/IWA global and regional survey on WSP concerning Europe¹ were presented at the workshop. They showed that about

- Approximately 40% of all countries in the WHO European Region have experiences with WSPs,
- Approximately one third of all countries in the WHO European Region have national scale-up strategies for WSP implementation and
- In approximately 1/10 of all countries in the WHO European Region, WSPs are actively enforced.

In countries where WSPs are not mandatory (and no similar requirements for risk-based quality management exist, such as HACCP) in many cases the water industry has implemented WSPs on a voluntary basis.

The benefits of WSPs are well known from published case studies and country experiences, and preliminary results of a WHO / IWA survey on WSP re-confirm many of these. Benefits are, in particular:

- Better understanding of the supply system and risks,
- Identification of improvement/upgrade needs and prioritisation of investments,
- Improved drinking-water quality (e.g. compliance with regulations),
- Improved water service continuity,
- Improved communication and collaboration with stakeholders,
- Prioritisation of surveillance efforts,
- Improved customer satisfaction,
- Reduction in the number and severity of drinking-water related incidents, including diarrheal disease,
- Financial gains (e.g. because of increased operational efficiency), and
- Better access to financial support from government or donors.

In Iceland, for example, over 80% of the population is now served by water supplies using a WSP-type approach. Data reported at the workshop indicate measurable benefits for human health: supplies without WSP are 3.7 times more likely to have incidents of non-compliance and 2.2 times more likely to have heterotrophic plate count (HPC) levels above 10 colony forming units (cfu) per milliliter. Importantly, the risk of developing clinical diarrhea was 14% lower in water supplies managed under a WSP. Moreover, communities perceive certified drinking-water suppliers as an advantage.

¹ Information from the survey is not on the EU region, but refers to the WHO European Region, which comprises 53 Member States.

The reports and statements at the workshop showed a broad variety of approaches taken. While in Portugal and Germany, for example, pilot projects are being conducted to find viable ways of implementing WSPs, other countries (e.g. the United Kingdom of Great Britain and Northern Ireland (UK), Switzerland, Iceland, Hungary, Slovenia) have made WSP (or HACCP) a regulatory requirement for all public drinking-water supplies. Tools to support WSP implementation are broadly emerging. For example, Ireland and Finland are currently developing online-tools in the national languages that guide users through the WSP process and thereby promote methodological consistency.

The drivers and motivation for introducing WSPs vary between the countries.

- In Iceland, Slovenia and Switzerland drinking-water is regulated as a foodstuff. As such it is subject to food legislation, under which HACCP requirements have to be fulfilled. Risk assessment is therefore mandatory.
- In the UK, 99.96% compliance to standards was reached by the larger supplies subject to reporting, i.e. those serving more than 5,000 inhabitants, before introducing WSPs, but the Drinking Water Inspectorate still considered that there were too many incidents and significant failures which posed a risk to public health. Furthermore, overreliance on end point monitoring was seen to overstate the role of treatment and disinfection. To improve the situation and introduce pro-active management, mandatory raw water monitoring and risk assessment were introduced in the UK.
- In Ireland, because drinking-water will no longer be free of charge for consumers from 2015 onward, there is pressure on the suppliers to reach high compliance with standards and to ensure to supply safe water with good drinking-water quality.
- In Flanders (Belgium), a cluster of incidents and the need for a frame-work to address emerging issues (e.g. emerging pollutants) were key drivers for implementing WSP.

In countries where WSPs are not mandatory some water suppliers have implemented them on a voluntary basis, with main drivers being the intention to improve system understanding, substantiate and prioritize improvement and upgrade needs and increase consumer confidence. However, for small supplies the discussion showed that WSP implementation on a voluntary basis is rare, due to a lack of staff, knowledge and time resources,

The experience reported shows several possibilities for authorities to encourage the implementation of a WSP without legally requiring it. In Scotland, for example, owners of private supplies can request improvement grants of up to 800 GBP. A risk assessment has to be carried out, however, making the existence of a WSP a prerequisite for such grants is currently being discussed. Finland has introduced WSP indirectly: there, it is not mandatory to have a WSP in place, but without the core WSP-element, i.e. risk assessment, the supplier will not be able to fulfill other legal requirements. Health legislation in Finland, as well as the Water Services Act, both require a plan for exceptional situations, i.e. all situations when existing measures fail to control any of the risks identified within the risk assessment.

At large the experience reported shows that WSPs are in place in many countries throughout Europe. The discussion revealed that the most effective way to ensure broad implementation of WSP-type approaches is certainly a “regulatory push”. However, other possibilities to encourage the implementation of a WSP have proven successful, too. This particularly applies to those suppliers which clearly need to improve because of recent failures or which are

committed to introduce quality management approaches. Without a regulatory requirement, particularly the smaller suppliers with limited financial and personnel resources, are not easily energized to introduce WSPs (see also Chapter 7).

3. An enabling environment for WSP implementation

A summary of preconditions given from the viewpoint of EUREAU emphasized the importance of a clear framework within which water suppliers can develop their WSP, including a shared vision of the tolerable residual risk (even if not defined by regulation; (see chapter 4 below) and a common, clearly defined risk assessment methodology and terminology. Water suppliers can implement WSP much better if national authorities clearly define the roles of all stakeholders sharing responsibility in drinking-water supply, including external stakeholders (e.g. from the catchment).

To understand which circumstances promote and facilitate the implementation of WSPs, the workshop highlighted the obstacles that might impede the implementation. Main challenges to WSP implementation identified from the preliminary results of the WHO / IWA global WSP survey include:

- Limited staff (time) to develop and implement WSPs,
- Lack of financial support,
- Limited qualification of staff to develop, implement and / or assess WSPs,
- Attitude of complacency and hesitation to acknowledge risks, with some of the benefits of WSP not being perceived immediately,
- Lack of supporting policy and regulatory environment,
- Lack of guidance materials in local language,
- Lack of (access to) technical support capacities, and
- Lack of access to supporting activities (e.g. WSP training).

Some participants reported that the need for a WSP is not yet acknowledged by all stakeholders. Especially if water quality is already good (i.e. in compliance with the parametric values of the EU DWD) or water quality concerns are not obvious, suppliers are not willing to spend time and money on something they do not necessarily have to do.

For smaller suppliers, in particular, obstacles often are a lack of financial and personnel capacities as well as deficiencies in the knowledge needed to develop and implement a WSP. Availability of manuals and field guides adapted to national context, specifically addressing the conditions of small supplies and available in local language is an important prerequisite to successfully implement WSPs. Once the WSP process gets started, it may still remain difficult to keep it going, in particular if financial resources prove insufficient to implement improvements that have been identified as necessary.

The discussion linked the importance of an enabling environment to the benefit of a regulatory requirement. It was highlighted that a regulatory obligation will trigger broad WSP adop-

tion. Regulatory provisions can focus on requiring core WSP-elements, including risk assessment, while details outlining how to do this may be specified elsewhere. Regulatory provisions will provide a frame and trigger the adoption of a common WSP terminology. If it is mandatory to develop and implement a WSP, it is easier to mobilize the personnel and financial resources needed. If the aim also is to use WSPs for priority-setting at the national level by the regulator, procedures for risk assessment need to be specified in order to achieve comparable outcomes. This may include the challenge of developing a consistent definition of likelihood and severity classes to determine the risk assigned to hazardous events.

The discussion highlighted the importance of allowing for an adequate timeframe for WSP implementation. Successful WSP uptake and enforcement will largely depend on an effective enabling environment. Therefore, the establishment of mandatory WSP requirements needs to allow for sufficient time for mobilizing required resources, including external support capacities (e.g. through allowing sufficient time between publishing a new legal requirement and its coming into force). Phased approaches have been reported to be successful.

With or without a regulatory requirement, experience reported showed that authorities can support the development of an enabling environment with the following measures:

- Communicating WSP benefits (as per section 2 above);
- Initiating pilot and “lighthouse” projects to provide model WSPs as national examples, to develop a core group of experts, to demonstrate the added value, and to identify the personnel and financial inputs required;
- Developing national WSP tools and resources, including guidance documents, templates and training materials in the local language(s), also taking into consideration the particularities of small systems;
- Providing tools and guidance for identifying hazards/hazardous events and assessing risks, including those which are not subject to standard setting (e.g. “emerging contaminants”);
- Offering training, preferably tailored to the needs of different groups (e.g. specifically for operators of small supplies, public authorities, WSP-auditors);
- Providing platforms and opportunities for networking for exchange of experiences between water supplies and responsible authorities; and
- Developing financing mechanisms that incentivize and support WSP uptake (e.g. grant schemes as part of the domestic budget cycle).

Regional workshops have proved useful to help water suppliers to understand the WSP approach and its benefits. By highlighting similarities to other quality management systems that are already established, such as economic risk assessment, inhibitions towards WSPs could be overcome. The discussion proposed that it might help to relieve the pressure on limited staff responsible for WSP training and support if small suppliers were to form local associations to provide a forum for lateral exchange of experiences, tools and training. Another possibility suggested at the workshop is to involve external specialist support, potentially from larger water suppliers with WSP-experience.

Most workshop participants emphasized the importance of getting the WSP process started. First attempts are never perfect, but an imperfect WSP will still deliver better results than a non-existent WSP. Since regular revision is a key element of the WSP concept, a WSP can be improved gradually, and the concept of incremental improvement is essential.

Internationally available documents of WHO and IWA can help to implement a WSP or support the development of national tools. They include the *Water Safety Plan Manual*², *A Road Map to Support Country-Level Implementation of Water Safety Plans*³, *Water safety planning for small community water supplies*⁴ and *Water safety plan: a field guide to improving drinking-water safety in small communities*⁵. Further helpful information can be found at the WSPortal⁶, which has been developed and sustained by WHO and IWA and offers a platform for discussions and the exchange of experiences on a national as well as international level. Selected resources to support WSP implementation are listed in chapter 9.

The discussion highlighted that providing financial resources for WSPs is an important aspect of an enabling environment, which may save costs that could arise due to a lack of action (the need for which would have been recognized during WSP-development) or poor investment priorities in the long run: WSPs are a tool to prioritize investments and consequently help to reduce financial risks.

For the European context, the recent EN 15 975 part 2 provides a standardized methodology for risk management in water supplies, based on the core principles of the WHO WSP approach.

4. The link between WSP and health-based targets

Health-based targets (HBTs) can be defined and specified in different ways: health outcome targets (i.e. like tolerable risk of infection or tolerable additional disease burden) can inform the definition of water quality standards. In turn, these can be translated into performance targets in terms of log-removal, and eventually into specified technology targets, such as specified treatment technologies and safe setback distances for groundwater wells.

When setting HBTs, overall disease burden needs to be weighed against financial costs of reducing it. Therefore, decisions on HBTs need to be made by every country individually, on the basis of different conditions of health, public health priorities and financial backgrounds. At the workshop it was strongly suggested that HBTs should not be set without broad debate of all concerned stakeholders eventually leading to societal or political consensus of acceptable risk. However, although the WHO *Guidelines for drinking-water quality* emphasize

² WHO (2009). *Water safety plan manual: step-by-step risk management for drinking-water suppliers*. World Health Organization, Geneva (available at: http://www.who.int/water_sanitation_health/publication_9789241562638/en).

³ WHO (2010). *Think big, start small, scale up: a road map to support country-level implementation of water safety plans*. World Health Organization, Geneva (available at: http://www.who.int/entity/water_sanitation_health/dwq/thinkbig_small.pdf?ua=1).

⁴ WHO (2012). *Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities*. World Health Organization, Geneva (available at: http://www.who.int/water_sanitation_health/publications/2012/water_supplies/en/).

⁵ WHO Regional Office for Europe (2014). *Water safety plan: a field guide to improving drinking-water safety in small communities*. World Health Organization regional Office for Europe, Copenhagen (available at: <http://www.euro.who.int/en/publications/abstracts/water-safety-plan-a-field-guide-to-improving-drinking-water-safety-in-small-communities>)

⁶ www.WSPortal.org

that HBTs are for the society as a whole to decide upon and to set, to date there seems to be limited experience with conducting such a societal discussion of HBTs.

Health outcome targets, as one type of HBTs, are meant to support regulators to strike the balance between health status of the population and costs for improving and/or maintaining it. For example, the Dutch target for the maximum risk of 10^{-4} infections through drinking-water per person per year can be related to the disease burden through other pathways for infections. For water suppliers, health outcome targets may provide a benchmark for water safety planning. In particular, they are needed as a basis for defining water quality targets for parameters which are not regulated (e.g. a tolerable concentration of viruses). They can also function as a benchmark for continuous improvement.

The scientific data for selected microbiological hazards is now available to define health-outcome targets, and this may also be used to inform risk assessment for drinking-water supplies. The discussion about difficulties in finding information on infectious dose for some pathogens revealed that currently dose-response data for carcinogens are often less certain than for pathogens. Nonetheless, to date few studies have compared risks from chemicals to those from pathogens in relation to health outcome targets.

For risk assessment, qualitative, semi-quantitative or quantitative approaches can be used. Quantitative approaches such as QMRA (quantitative microbial risk assessment) can be implemented using existing monitoring data, data from literature, or a combination of different sources. Assumptions, the use of default values and other uncertainties have to be communicated in a transparent manner. Calculations may be performed by the use of point estimates for different parameters. However, using point estimates suggests a level of certainty and precision which is not given in reality. These constraints can be overcome by using more advanced methods, like Monte Carlo Simulations or Markov Chain Monte Carlo, which account for present variability and uncertainty. The use of these methods, however, may reach a level of complexity requiring qualifications not necessarily readily available - neither for water suppliers nor for surveillance authorities, and external expertise may be lacking or too costly.

The workshop showed a distinct need for discussion of quantitative approaches. Participants from countries that use QMRA generally approved it while the others remained skeptical. In fact, experiences with the explicit use of QMRA reported at the workshop are so far limited to the Netherlands, Sweden and Norway, (whereas successful experience with qualitative and semi-quantitative approaches is widespread). However, implicitly quantitative approaches such as set-back distances and flushing times after repairs have been in use for a long time, and they are based on generalized quantitative data. Such type of evidence can be improved and made available as better foundation for measures and actions.

The key advantage reported from using QMRA is the case-specific definition of the log removal that treatment needs to achieve, depending on maximum concentrations of reference pathogens in the raw water. Making data on log removal by specific natural and technical processes available – preferably in relation to the range of conditions under which these processes can operate – is highly valuable in practice. Internet-based tools are being developed in some countries for such evaluations.

Because of their still quite pronounced uncertainties and lack of acceptance, quantitative approaches should, according to the majority of the workshop participants, not be made a mandatory basis for developing WSPs. While acknowledging the added value quantitative

and probabilistic approaches may have for water safety planning, it is important to communicate that the implementation of a WSP does not necessarily require this kind of approach. Demanding it would risk discouraging suppliers from implementing a WSP altogether. Therefore, currently it is important that QMRA and WSP are not too closely linked.

For future development it is important to continue work on clarification of how best to develop quantitative benchmarks for QMRA as proposed by the WHO *Guidelines for drinking-water quality*; collecting and evaluating experience in this field is perceived as important. Indeed, semi-quantitative and qualitative approaches to risk assessment as part of a WSP, using matrix or scoring systems, checklists or sanitary surveys have proven to be a useful tool in practice to identify knowledge gaps, to allocate resources, and to improve system understanding and risk prioritizing. Examples for web-based risk assessment tools that are currently being developed in Ireland and Finland were presented at the workshop. The workshop participants agreed that risk matrices based on a combination of severity of a hazard and the likelihood of a hazardous event to occur are relatively easy to handle and doubtlessly a valuable tool in risk assessment.

However, it has proven to be difficult to achieve comparable results. Classes for likelihood and severity can rarely be clearly defined, which leads to subjective evaluations. Nevertheless, if the classes are defined consistently within a water supply system, it is possible to prioritize risks for this supply. For regulators using WSPs to prioritize water supplies that need improvement, attention and support, standardized scoring systems have proven helpful.

5. Potential interfaces to risk assessment and management in adjacent fields

WSPs are intended to extend “from source to tap” and thus to include steps in the chain of water provision which are beyond the responsibility of the water supplier. For these, other areas of legislation are relevant, and indeed a significant portion of water quality and non-compliance issues are due to failures in domestic installations or in the catchment. The workshop analyzed risk assessment and management approaches in fields that are closely linked to WSP. The outcome shows that there are analogies, which can be useful in implementing a WSP.

The concept of sanitation safety planning (SSP) derives from the WHO *Guidelines for the safe use of wastewater, excreta and greywater*⁷. The concept follows the same basic structure and major steps as WSPs. However, whereas in WSP the system boundaries and major exposure routes are quite well defined, SSPs need to consider multiple routes of exposure to wastewater and excreta. The control measures are just as diverse and range from discharge control, wastewater treatment and water use restrictions to personal protective equipment and good hygiene practices. In addition to the safe use of wastewater, the concept of SSP may be extended to include wastewater in a broader sense, including discharge and treatment, as well as safety of sanitation facilities. If there is wastewater discharged within the catchment area of a drinking-water supply, it is virtually impossible to implement a WSP without considering sanitation safety issues, and implementation of a SSP can be highly beneficial for WSP implementation.

⁷ WHO (2006). *Guidelines for the safe use of wastewater, excreta and greywater*. World Health Organization, Geneva (available at: http://www.who.int/water_sanitation_health/wastewater/gsuww/en/).

The Water Framework Directive (WFD) also applies risk management approaches. Since raw water quality is of utmost importance for the provision of safe drinking-water, activities to improve the quality of surface and groundwater bodies serving as resources for drinking-water supplies may also have co-benefits for managing drinking-water safety. A “good ecological status” of surface waters and the “good chemical status” of groundwater resources defined in the WFD does not necessarily fully translate to good raw water for drinking (particularly for microbiological quality, which is not addressed by the WFD). However, there are linkages between the two directives, including e.g. through Article 7 of the WFD that establishes the connection to the DWD: it refers directly to the protection of water bodies used for drinking-water abstraction and obligates member states to take all necessary actions to ensure drinking-water quality, taking into consideration prevailing drinking-water treatment. Future legislation would do well to link the WFD and the DWD more intensively in order to support water suppliers in obtaining the input they need about the source water, and in order to link planning cycles. Possible obstacle discussed include differences in scale: While WSP is a managerial instrument chiefly for day-to-day operation of a water supply, the WFD is a policy instrument which specifies longer-term cycles of revision for an entire catchment. Nonetheless, there are gains from using the platform established under the WFD for catchment planning for WSP-development.

The Flemish (Belgium) approach reported shows how aims of the WSP and the WFD can be integrated. Source files, containing all available information on catchment areas, are made by the environment agency in close cooperation with the water suppliers. These files allow the identification of “quick wins” and “no regret measures” and contain a vision on the needed source protection. The source files are used as input for the implementation of art 7 of the WFD. The Coordination Commission on Integral Water Management (CIW) and sub-basin-secretariats provide a platform for consultation between the policy domains and also involves water companies. They develop water management action programs with the help of an advisory board consisting of stakeholders from economy, industry, agriculture and environment. The government or sub-basin board then decides on measures to be implemented for sources that have proved vulnerable.

Another part of drinking-water systems requiring risk assessment and management are installations in buildings, which can substantially introduce hazards into drinking-water. Pilot studies show that WSPs for buildings can be highly effective, and WHO provides guidance on Water Safety in Buildings⁸. Most WSPs that are in place so far only cover the path from the catchment to the exit of the waterworks. The discussion emphasized that a requirement for auditing and certification of installations – at least for large buildings with public and commercial use (hospitals, schools, rental compounds) – would be important.

The objective of the Water Cycle Safety Plan (WCSP), which was developed within the EU research project “PREPARED”, is to integrate the major tasks of urban water management into a comprehensive risk-based water management framework. It includes the components drinking-water, wastewater, urban drainage, and river basin management. As outcome of the project, bringing sectors together and promoting interaction of the different parts of urban water management was perceived as a major benefit, as it substantially improved communication and decision making⁹.

⁸ WHO (2011). *Water safety in buildings*. World Health Organization, Geneva (available at: http://www.who.int/water_sanitation_health/publications/2011/9789241548106/en/).

⁹ Further information is available at: www.prepared-fp7.eu

Overall, the discussion of these interfaces to the adjacent fields of catchment, sanitation and installations in buildings, showed that there is overlap between these fields, particularly to the catchment, and thus linking related processes can be beneficial. For example, a number of potentially contaminating activities (including e.g. wastewater discharge and agriculture) can pose risks both to aquatic environments and to human health. Workshop participants therefore saw value in further developing the interface between catchment managing frameworks such as WFD and WSP and/or SSP. Outcomes of assessing the water-body and its catchment can feed into a WSP, and developing a WSP can include calling for quality targets in the source water (as shown by the Flemish experience). Similarly, SSP are a useful tool to reduce wastewater-derived hazards in the source water.

6. WSP auditing and certification

“Audit” can be defined as a systematic and independent inspection or assessment of something, for example, a WSP. The word “review” can have a similar meaning to “audit” and audits can form an important part of the WSP review process (verification).

While discussions on WSP often show initial concerns regarding external audits, workshop participants reported that in countries where WSPs are already being audited, these audits are actually not being perceived as a problem. For the staff of a water supply, audits should be viewed as a positive element by recognizing and acknowledging good WSP implementation and progress as well as identifying areas for improvement. Participants also reported audits as valuable “coaching sessions” and “eye-openers” on aspects of WSP methodology.

Approaches to WSP auditing reported at the workshop ranged from internal to external, from informal to formal audits required as part of a regulatory approach. Participants agreed that the basic aim and role of audits is to support implementation and strengthening of the WSP throughout the process of its development into maturity and they have an important advisory role for small supplies. However, they also recognized that audits would need to become mandatory if WSPs are a regulatory requirement, in particular if WSP are used to justify deviations from defined monitoring schemes (as currently discussed for the annexes of the DWD; see above). For this they should enable critical assessment of the methodology and technical adequacy of the WSP by checking if it is developed and implemented according to its methodology, is robust and technically plausible and is achieving its aims.

Regarding the timing of audits, experience showed that all types of audit should be carried out regularly although it is not helpful to start auditing too early in the WSP implementation process. The actual timing of the first internal audit will depend on the WSP’s implementation timetable but the date should be fixed early on as a marker for progress and should not be changed without good reason. As WSP implementation continues and matures, internal and external audits should continue on a regular basis. When a WSP is mature, audits should continue as part of verification at least annually (but likely less frequently for small supplies) and more frequently if findings suggest problems.

The task of auditing requires that principles be established, key performance indicators are clear, confidentiality is respected and a detailed report for the water supplier describes the outcomes and suggested improvements. Summary reports of external audits may be made available to the public. Auditors of WSPs should preferably have a general background of technical work experience within a water organization, experience and training on the complete WSP approach and training in auditing techniques. Multi-disciplinary auditing teams are

preferable if the audit is to cover the whole supply chain; alternatively, separate audits are possible for catchment, treatment plant, distribution system and domestic installations.

While participants considered training in WSP auditing to be very important, its availability currently is still limited. Peer-by-peer WSP auditing can be a way forward to fill this gap, i.e. using the auditing process in one water supply to train its staff to be auditors for another supply. Also there is a need for recognized certification schemes for WSP auditors as a way of raising standards and consistency.

Three countries reported on auditing WSPs at the workshop. In England and Wales (UK) there is no requirement to audit WSPs but the regulator carries out formal external audits on water suppliers' risk assessments and their risk management approach (including site visits and improvement programs). These are not officially approved or rejected but water suppliers are given informal feedback. However, the regulator can take formal action if it considers that not all risks have been covered adequately. All the regulator's inspectors have a water industry background and teams of inspectors are put together to provide complementary competencies.

Hungary has recently changed its water supply regulations to define how a WSP should be enforced and applied. Previously the national body only audited the largest water suppliers, now small supplies are included but are audited by local authorities (who also run the supplies). Local authorities have a good understanding of the small supplies but they are over-worked, there are regional differences of auditing approaches and there is a need for more training about WSPs. Training sessions are now starting.

Slovenia has over 1,000 water supply systems. Drinking-water is regulated as food and accordingly HACCP was included in drinking-water legislation in 2004 as a mandatory internal control measure for water suppliers. HACCP principles are mainly incorporated in water supplier's guidelines for good practice. Sanitary inspectors from the Ministry of Health make site visits to water suppliers every one to two years. Their inspections cover the water supply from source to tap, or only part of this and include field observation, interviews and examination of documentation. Audit reports are internal with an annual report to the Ministry.

Amongst the many points discussed and agreed at the workshop the main conclusions were that:

- Audit is an integral part of the WSP approach,
- WSP needs some form of audit,
- Whether audit is a regulatory requirement depends on each country's regulatory culture; however, if audits are mandatory and outcomes can result in sanctions, auditing requires clear regulatory specifications,
- WSP audits span from informal WSP coaching to external verification of a WSP,
- Audits should be used wherever possible as an opportunity for coaching and improvement in the WSP approach,

- There is a need for training schemes and capacity building for WSP auditors, as they need competency in the fields of drinking-water, audit techniques, social and communication skills and an analytical but also open and flexible approach, and
- Particularly in countries where audits are required by legislation, auditors should be certified.

7. Particularities of WSP in small-scale water supplies

The definition for a small water supply commonly used in the EU, based on the reporting provisions of the DWD, is a supply serving up to 5,000 persons or distributing less than 1,000 m³ per day. In the EU, 56 million people are served by such small supplies. According to a EUREAU survey, there are over 86,000 small supplies in Europe (excluding private wells). The quality requirements of the DWD also apply to small supplies but they have no reporting obligations at EU level.

Small supplies have a history of generally lower compliance rates with drinking-water quality standards. Additionally small supplies are typically monitored at lower frequencies than larger supplies, and this may be insufficient to provide evidence of overall quality. Thus, non-compliances can easily be missed. Therefore, WSPs would be particularly beneficial for small supplies.

While in most countries the majority of small supplies currently do not have a WSP in place, in the UK regulations require risk assessment for all private water supplies. The responsibility for carrying out the risk assessment of private water supplies lies with the local authorities instead of the supplier. Also in Switzerland all water supplies have to be risk assessed since water is regarded as food and food legislation is applied. In practice this proves complicated due to the immense number of small water supplies, which sometimes serve as few as five persons. These extremely small supplies are in many cases operated by a single person who does not have the knowledge or financial means to implement a WSP.

In Germany, three small public water supplies were assisted in the implementation of a WSP in a pilot project. A key outcome of the project was a German-language WSP-manual for small public supplies¹⁰, which structures WSP implementation into ten manageable tasks and includes checklists and templates to simplify WSP implementation. Evaluation of the experience gained in this pilot project shows that WSP – although externally supported – is not only valuable, but also feasible; however, external support is critically important, i.e. regarding risk assessment and documentation which is challenging to many technical operators (“time-consuming paper work”).

Workshop discussions of experience with WSP for small supplies concluded that for small supplies there are more obstacles to implementing a WSP than for larger supplies: the lack of finances, staff and knowledge is more distinct. With sometimes just one person (sometimes without sufficient technical knowledge) being responsible for a drinking-water supply, finding time for training and implementing a WSP may be particularly challenging. Therefore, small supplies are particularly in need of an enabling environment, availability of easy-to-use tools and external support is therefore essential in most cases. However, small supplies typi-

¹⁰ UBA (2014). *Das Water-Safety-Plan-Konzept: Ein Handbuch für kleine Wasserversorgungen*. Umweltbundesamt, Dessau-Roßlau (available at: <http://www.umweltbundesamt.de/publikationen/das-water-safety-plan-konzept-fuer-kleine>).

cally have fairly simple structures, making WSP-development more straight-forward, and due to the more frequent deficits, benefits are most pronounced if WSP are implemented for small supplies.

8. Conclusions

It is hoped that the workshop will inspire steps forward in WSP implementation, based upon the experiences collected in the European region. The experience from many countries in the region can certainly be helpful to others, less advanced in the process. A proposal at the workshop in order to keep the communication between stakeholders from different European countries going was to organize repeated European workshops on WSP, and participants were encouraged to organize and facilitate such meetings. A European online-WSP-network to share materials, tools, and case studies would also support this purpose, and perhaps the currently existing WSPortal¹¹ can be expanded for this purpose.

At the end of the event the workshop, all participants discussed a list of conclusions. The plenary then agreed on the conclusions in principle, and the planning committee was mandated to improve the phrasing after the meeting and then presented the result to all participants electronically. Once more everyone had the chance to comment the outcome. This process resulted in the following 10 consensus conclusions (WaterWiki-version, posted on 25.03.2014):

1. Since 2003 the WSP approach, as promoted by the World Health Organization (WHO) Guidelines for Drinking-water Quality, has been scaled-up significantly in Europe. Many initiatives are going on, ranging from first conceptual exploration of the way to go ahead over voluntary scale-up approaches to introducing regulatory requirements for WSP. Major policy drivers varied between countries and include drinking-water being subject to food legislation (and thus to HACCP requirements) and water quality incidents as well as the awareness of the need for complementing product monitoring with a systematic approach to improving the control of processes throughout the supply chain.
2. In the 21st century, risk management approaches such as WSP are good practice. Drinking-water should not lag behind other sectors such as food or industry. In that sense, the introduction and scaling-up of systematic risk assessment and risk management schemes for drinking-water safety in the European Union (EU) would benefit from a “regulatory push“.
3. Even in face of the high levels of compliance with the parametric values of the EU Drinking Water Directive (DWD) in many member states, there is consensus on the multiple added values of WSP, for both water suppliers and regulators, as a management tool for effectively ensuring the continuous delivery of safe drinking-water. The WSP approach particularly fosters due diligence in performance; it leads to more awareness and clarity on supply-related risks and improved operations, provides a rationale for decision making and for setting priorities, and thus continuous systematic improvement planning; WSPs also serve as a platform for integrating other stakeholders, particularly in the drinking-water catchment area. WSPs have been reported to reduce failures to meet standards and water quality incidents and thus increase consumer confidence; and there is evidence of measurable improvement of public health.

¹¹ www.WSPortal.org

4. Currently WSPs are implemented to a lesser degree for small-scale water supplies. However, WSPs are a suitable method to address the challenges and public health risks related to small-scale supplies. The above mentioned advantages of WSP may be particularly beneficial in small supplies where compliance monitoring is typically rare. Implementation needs support from and resources for a strong enabling environment, including access to appropriate guidance and training in local languages, assistance by WSP facilitators and financing for improvement.
5. Auditing is an integral part of WSP. Its application ranges from informal “WSP coaching” to formalized external verification of WSP performance and compliance. The role of auditing may change over time, reflecting the development of WSPs in a given setting. Systematic capacity building of WSP auditors has been identified as a crucial step towards scaling-up of WSPs.
6. At the water supply level, the experience with qualitative and semi-quantitative approaches to risk assessment using matrix- or scoring systems is increasing, and such systems are proving a useful tool in practice.
7. For regulators, standardized scoring systems, which are used in a number of countries, provide valuable information for prioritizing water supplies that need improvement, attention and support.
8. To date, very few workshop participants have experience with quantitative microbial risk assessment (QMRA). It is considered a useful method for supporting WSP development, in particular for translating health-based targets to operational ones. Although the WHO guidelines call for setting health-based targets as a government responsibility, there is yet space for discussion on how best to establish quantitative public health benchmarks for using QMRA-type approaches.
9. There is great potential for linking WSP to sanitation safety planning and to catchment management, particularly for public health objectives. Although the objectives of protecting public health and aquatic ecosystems do not have a common metric, much of the information from catchment management is of value for risk assessment in the WSP context, and in many settings sanitation safety planning has a high potential to reduce source water contamination.
10. As installations in buildings can substantially introduce hazards into drinking-water, developing WSPs for installations is highly beneficial. The vision therefore is to close the water cycle loop by establishing links and utilizing synergies between WSP, sanitation safety planning, catchment management and WSPs for installations.

9. Literature and resources to support WSP implementation

The following list comprises web links referring to resources which have been made available by WHO and IWA to support WSP implementation:

- *Chapter 4 of the WHO Guidelines for Drinking-water Quality* (2011) (available at: http://www.who.int/entity/water_sanitation_health/publications/2011/9789241548151_ch04.pdf?ua=1)
- *Water safety plan manual: step-by-step risk management for drinking-water suppliers* (2009) (available at: http://www.who.int/water_sanitation_health/publication_9789241562638/en)
- *Water safety planning for small community water supplies: step-by-step risk management guidance for drinking-water supplies in small communities* (2012) (available at: http://www.who.int/water_sanitation_health/publications/2012/water_supplies/en)
- *Water safety plan: a field guide to improving drinking-water safety in small communities* (2014) (available at: <http://www.euro.who.int/en/publications/abstracts/water-safety-plan-a-field-guide-to-improving-drinking-water-safety-in-small-communities>)
- *Water safety plan quality assurance tool* (2013) (available at: http://www.who.int/water_sanitation_health/publications/wsp_qa_tool/en/index1.html)
- *Water safety plan - trainings package* (2012) (available at: http://www.who.int/water_sanitation_health/publications/wsp_training_package/en)
- *Think big, start small, scale up: a road map to support country-level implementation of water safety plans* (2010) (available at: http://www.who.int/entity/water_sanitation_health/dwq/thinkbig_small.pdf?ua=1)
- *The WHO/IWA Water Safety Portal* at <http://www.wsportal.org/ibis/water-safety-portal/eng/home>

Additional resources mentioned by speakers at the meeting include:

- Centers for Disease Control and Prevention. *A conceptual framework to evaluate the impacts of water safety plans* (available at: http://www.cdc.gov/nceh/ehs/gwash/Publications/WSP_Evaluation_Framework.pdf)
- University of North Carolina at Chapel Hill. *Water safety plans: an online distance learning program* (available at: <http://waterinstitute.unc.edu/learning/water-safety-plans/>)
- Standard EN 15 975 Security of drinking water supply - Guidelines for risk and crisis management - Part 2: Risk management.

Acknowledgements

Special thanks are due to Friederike Brauer and Sebastian Sturm (DVGW-Technologiezentrum Wasser (TZW), Karlsruhe) for preparing this report, to David Drury for preparing the chapter on auditing, to the Berlin Water Works for hosting the meeting and to the German Federal Ministry of Health, the German Federal Environment Agency and the Berlin Centre of Competence for Water (KWB) for financial support.

Annex: Workshop program

VENUE:

Headquarters Berliner Wasserbetriebe, Neue Jüdenstr. 1, Berlin, Germany

PROGRAM, 12 - 13 March 2014

European Strategic Workshop on Water Safety Planning (WSP)

Wednesday, 12 March 2014

12:00	Welcome (beverages & snacks)
13:00	Greeting addresses: Jens Feddern (Berliner Wasserbetriebe, Germany) ; Birgit Mendel (Federal Ministry of Health, Germany)
13:10	General introduction: Oliver Schmoll (WHO Regional Office for Europe); María Gunnarsdóttir (University of Iceland, Iceland)
13:40	Presentation of outcomes of the WHO/IWA WSP survey: Camilo Munoz Trochez (International Water Association)
13:55-15:30	Topic 1: Regulation Chair: Dominique Gâtel (European Federation of National Associations of Water Services) Rapporteur: Ingrid Chorus (Federal Environment Agency, Germany) Presentations:
13:55	<ul style="list-style-type: none">Tobias Biermann (European Commission): <i>The DWD: Status of implementation and exploring possibilities to introduce a risk based monitoring and analysis approach</i>
14:10	<ul style="list-style-type: none">Claire Pollard (Drinking Water Inspectorate, United Kingdom): <i>Experience with regulation of a WSP approach to managing drinking water supplies in England and Wales</i>
14:25	<ul style="list-style-type: none">Luis Simas (Water and Waste Services Regulation Authority, Portugal) <i>The Portuguese roadmap towards safe water</i>
14:40	Short statements (5 minutes each): Márta Vargha (National Institute of Environmental Health, Hungary), Pierre Studer (Federal Office of Public Health, Switzerland), Jarkko Rapala (Ministry of Social Affairs and Health, Finland), Kris van den Belt (Flemish Environment Agency, Belgium), Ans Versteegh (National Institute for Public Health and the Environment, Netherlands), Philip Anderson (Drinking Water Quality Regulator for Scotland)
15:10	On-line tools: <ul style="list-style-type: none">Derval Devaney (Environmental Protection Agency, Ireland): <i>Adopting the Water Safety Plan Approach for safe and secure drinking water</i>
15:20	<ul style="list-style-type: none">Heli Härkki (Solinatech, Finland): <i>The WSP approach in Finland and the Web-based WSP/SSP tool for water suppliers and wastewater treatment systems</i>
15:30	Coffee break

16:00-18:15

Topic 2: Enabling environment

Chair: Gesche Grützmacher (Berliner Wasserbetriebe, Germany)

Rapporteur: Claudia Castell-Exner (DVGW German Technical and Scientific Association for Gas and Water, Germany)

Presentations:

16:00

- Dominique Gâtel (European Federation of National Associations of Water Services): *Utilities planning for water safety*

16:20

- Angella Rinehold (WHO): *Global WSP resources and lessons on supporting WSPs through an enabling environment*

16:40

Group work on enabling environment

17:40

Reports back to the plenary and discussion

18:30

Guided city walk from the venue to the restaurant

20:00

Get together/joint dinner at Clärchens Ballhaus

Thursday, 13 March 2014

08:30-09:30

Topic 3: Risk assessment and health-based targets

Chair: Oliver Schmoll (WHO Regional Office for Europe)

Rapporteur: Wolfgang Seis (Berlin Center of Competence for Water, Germany)

Presentation:

08:30

- Gertjan Medema (KWR Watercycle Research Institute, Netherlands): *Water safety plans, risk assessment and health based targets.*

09:00

Discussion

09:30-10:30

Topic 4: Potential interfaces to risk assessment and management in adjacent fields

Chair: Oliver Schmoll (WHO Regional Office for Europe)

Rapporteur: Wolfgang Seis (Berlin Center of Competence for Water, Germany)

Presentations:

09:30

- Angella Rinehold (World Health Organization): *Sanitation Safety Planning: a risk-based approach for the safe use and disposal of wastewater*

09:45

- Maria do Céu Almeida (Laboratório Nacional de Engenharia Civil, Portugal): *From the WSP to the WCSP: integrating risk management for the urban water cycle*

10:00

- Kris van den Belt (Flemish Environment Agency, Belgium): *Matching the Water Framework Directive obligations with the risk assessment and management concept*

10:15

Discussion

10:30

Coffee break

11:00-14:15	<p>Topic 5: WSP auditing and certification</p> <p>Chair: Rui Sancho (Águas do Algarve, SA and International Water Association WSP SG)</p> <p>Rapporteur: David Drury (independent consultant on drinking water quality, Japan) and Claire Pollard (Drinking Water Inspectorate, United Kingdom)</p> <p>Presentations:</p> <p>11:00 • Camilo Munoz Trochez (International Water Association): <i>Current European panorama of WSP auditing Implementation</i></p> <p>11:20 • David F Drury (independent consultant on drinking water quality, Japan): <i>Auditing Water Safety Plans</i></p> <p>11:40 Short statements (5 minutes each): Claire Pollard (Drinking Water Inspectorate, United Kingdom), Marta Vargha (National Institute of Environmental Health, Hungary), Aleš Petrovič (National Institute of Public Health, Slovenia), Kenneth Persson (Sydvatten AB, Sweden)</p> <p>12:00 Group work on auditing and certification</p>
13:00	Lunch
13:45	Report back to the plenary on certification and auditing
14:15-15:30	<p>Topic 6: WSP in small supplies</p> <p>Chair: Bettina Rickert (Federal Environment Agency, Germany)</p> <p>Rapporteur: Enkhsetseg Shinee (WHO Regional Office for Europe)</p> <p>Presentations:</p> <p>14:15 • Sebastian Sturm (DVGW Water Technology Center, Germany): <i>The WSP concept as a challenge for small water supplies? Experiences from Germany and practical solutions</i></p> <p>14:35 • Pierre Studer (Federal Office of Public Health, Switzerland), Andreas Peter (Drinking water inspectorate at the cantonal laboratory of Zurich, Switzerland): <i>Why is it so complicated to implement WSP to small Swiss drinking water suppliers?</i></p> <p>14:55 • Charlotte Frambøl (European Federation of National Associations of Water Services): <i>Safe, sensible and simple – the Eureau position on WSP in small supplies</i></p> <p>15:15 Discussion</p>
15:30-16:30	<p>Concluding session</p> <p>Chair: Oliver Schmoll (WHO Regional Office for Europe)</p> <p>Rapporteur: Ingrid Chorus (Federal Environment Agency, Germany)</p> <p>Conclusions from 1.5 days of exchange of experience, agreeing on next steps for a way forward</p>
16:30 - 16:45	Closure of the meeting