

From international developments to local practice: Germany's evaluation and dialogue process towards Water Safety Plan implementation

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ABSTRACT

The third edition of the WHO Guidelines for Drinking-water Quality establishes a 'Framework for Safe Drinking-water' that promotes a risk assessment and risk management approach called Water Safety Plan (WSP). In Germany, the discussion on the WSP approach started with significant scepticism by various stakeholders questioning its added value in light of the high quality and service level of water supply. In response, the Federal Ministry of Health, the Federal Environment Agency and the DVGW Association for Gas and Water jointly took the leadership for initiating a sectoral dialogue process involving water suppliers and local public health offices, including a series of WSP pilot projects to evaluate WSP feasibility, benefits and expected challenges for scaling-up. As the regulatory system in Germany makes explicit reference to 'generally acknowledged codes of good practice' the paper also examines how far the suite of established DVGW technical and managerial standards already supports WSP implementation. The evaluation process confirmed an added value of the WSP approach under Germany's national conditions, clearly providing an impetus for safeguarding a high quality and service level of drinking-water supply. Various activities to support scale-up implementation of a WSP-type approach have been initiated, including the preparation of step-by-step guidance in German (i.e. DVGW Guidelines W 1001), information campaigns to broadly raise awareness amongst all stakeholders in water supply, and capacity building initiatives.

Key words | drinking-water quality, Germany, pilot projects, technical and managerial standards, Water Safety Plan, water supply

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INTRODUCTION

The World Health Organization (WHO) Guidelines for Drinking-water Quality provide the international point of reference for the majority of drinking-water regulations. The third edition of the Guidelines launched in 2004 established a 'Framework for Safe Drinking-water'. It encompassed health-based target setting, a risk assessment and risk management approach called a Water Safety Plan (WSP), and a system of independent surveillance (WHO 2004).

Based on HACCP (hazard analysis and critical control points) which is well known and has been established in the food industry since the 1960s, WSPs take an integrated

systems approach, aiming to minimize risks in the water supply chain from catchment to consumer through the systematic identification of hazards, prioritization of risks as well as implementation and operational monitoring of control measures. The WSP approach provides a means for enhancing the quality of drinking-water by complementing 'traditional' compliance monitoring by a risk-based and process-orientated approach in day-to-day management routines of water suppliers.

To facilitate WSP development, WHO have made available a series of supporting materials and resources, such as the Water Safety Plan Manual (Bartram *et al.* 2009) which

provides practical step-by-step guidance for water suppliers on how to develop and implement a WSP, the web-based Water Safety Portal (www.wspportal.org) providing access to WSP case studies or references to tools, practical guidance and training materials from various countries, or guidance on steps towards introducing and implementing a WSP on a country level (WHO 2010).

REGULATORY DEVELOPMENTS IN EUROPE

So far, there has been significant international momentum and increasing policy recognition of the WSP approach in response to the WHO Guidelines published in 2004. An increasing number of countries have either revised, or plan to revise, their drinking water regulations to require WSP implementation (Summerill *et al.* 2010).

In the European Union (EU), the European Commission (EC) has on several occasions said that the WSP approach shall be an important element to be considered in the forthcoming revision of the Drinking Water Directive (DWD) which provides the framework law for all 27 EU member states for their national drinking-water legislation (Council of the European Union 1998). As early as 2003, the EC conducted a 'drinking water seminar' at which governmental and non-governmental stakeholders had the opportunity to give their views and input to the upcoming DWD revision (EC 2003). The WSP approach was one major focus of discussion, the outcome of which was wide recognition of substantial added value of WSP-type approaches in the EU context and strong endorsement for the inclusion of WSP-related requirements in a future DWD. Moreover, the group encouraged EU member states to initiate national WSP pilot projects to evaluate the WSP approach within national contexts (Gibert *et al.* 2003).

Since the 2003 seminar the EC has adopted a position which supports the WSP approach and announced the inclusion of respective requirements in a revised DWD. To further develop and substantiate this position, in 2006 the EC invited WHO to review current evidence in terms of experiences, added value, costs and potential concerns related to WSP implementation in the EU as well as to advise the EC on how to integrate WSP requirements in a revised DWD. The key conclusion derived from this study

was the recommendation to the EC to proceed in revising the DWD to include a WSP-type approach, as this would broaden the DWD's approach beyond over reliance on compliance monitoring towards risk assessment and risk management principles and thus improved process control (WHO 2007).

While the DWD opinion building and revision process is still ongoing, a number of EU member states have already introduced WSP-based regulations. In the United Kingdom, for example, 2007 regulations require water suppliers in England and Wales to periodically carry out comprehensive risk assessments for each public water supply system, including documentation of measures to mitigate identified risks (UK Statutory Instruments 2007); Hungary introduced new regulations requiring water suppliers to present a WSP to the Office of the Chief Medical Officer for approval with compliance target dates for different supply categories (Hungarian Government 2009). In some non-EU countries, such as Switzerland or Iceland, drinking-water is classified as a foodstuff, and water suppliers are required to comply with food hygiene regulations and to prepare safety plans on the basis of HACCP principles (Swiss Federal Council 2005; Gunnarsdóttir & Gissurarson 2008).

THE POINT OF DEPARTURE IN GERMANY

In Germany, water supply is a core task of public services under the responsibility and competence of the municipalities. Public and private forms of organisation have existed for decades alongside each other, currently at a ratio of 56% public to 44% private. Of the total of around 6,200 utilities in 2007, a small number of water utilities supply a large number of inhabitants: only 1.6% of the utilities provide about half of the total drinking-water supplied in Germany while 35% of the utilities serve less than 1% of the total water. About one fifth of the German population is supplied by around 3,500 small water suppliers serving less than 5,000 inhabitants (Federal Statistical Office 2009).

The WSP approach was first discussed among national stakeholders in Germany in response to the publication of the third edition of the WHO Guidelines and the outcomes of the 2003 EC seminar. A major impetus for the national discussion also came from the first international WSP-

related conference, 'Water Safety – Risk Management Strategies for Drinking Water', held in April 2003, in Berlin, Germany (Schmoll & Chorus 2003).

This early discussion was characterised by significant scepticism both among water suppliers and health authorities for a range of reasons: in particular doubts about the added value of formalizing drinking-water quality management with a system such as WSP, significant concern about more bureaucracy and paperwork as well as doubts about the general feasibility of pre-determining management responses to possible supply risk. Sceptics pointed to three national success stories which they deemed render a quality management system such as a WSP superfluous:

- high service levels achieved by German drinking-water suppliers;
- a uniquely (internationally) elaborated set of technical standards developed largely by the German Technical and Scientific Association for Gas and Water (DVGW) already providing elements of the WSP approach, to a certain extent (see below); and
- constantly high compliance levels of >99% with the quality standards set by the DWD by suppliers serving >5,000 inhabitants (Grummt 2007; EC 2008).

Also, most stakeholders viewed the provisions of the German Drinking Water Ordinance (German Government 2001), which already go beyond the minimum requirements of the EU DWD, as a sufficiently effective and proven regulation to safeguard drinking-water quality.

The Ordinance particularly encompasses explicit reference to the 'generally acknowledged codes of good practice'. The codes comprise a library of more than 200 technical and managerial standards covering aspects of planning, design, construction, maintenance and rehabilitation of water supply infrastructure as well as operation and management of water supply chain processes from catchment to tap. The standards, largely published by the DVGW, are jointly developed by drinking-water quality experts, planners, water supply practitioners, scientists and regulators, following a well-established process of cross-sectoral consensus building and external peer review. The standards provide valuable technical and managerial guidance and define due diligence benchmarks in water supply. Many sceptics of the WSP approach argue that the suite of existing technical

and managerial standards and respective practices in the water industry would already cover WSP requirements. They therefore asked in which way the WSP approach could add value and provide an additional margin of safety in comparison to established management practices (Schmoll & Chorus 2003).

TARGETS OF THE NATIONAL EVALUATION AND OPINION BUILDING PROJECT

In response to the issues raised and in accordance with the recommendations given by the EC drinking water seminar, the Federal Ministry of Health (BMG) as the drinking-water regulator, the Federal Environment Agency (UBA) as the supreme scientific authority responsible for drinking-water and the DVGW jointly took the leadership for initiating a sectoral dialogue process in Germany. The overall goal of this process was to moderate an open opinion formation process on the WSP approach among key national stakeholders, including water suppliers, local public health offices, professional associations as well as relevant Federal and State agencies. Targets of the project were in particular to:

- gain first-hand practical experience with WSP implementation through a series of pilot projects in the light of the above described existing national framework and circumstances;
- evaluate applicability and feasibility of WSP under given local circumstances, the added value of WSP in comparison to current practices, the role of local public health offices responsible for drinking-water quality surveillance as well as legitimate concerns and perceived implementation barriers for scaling-up WSP nationally;
- evaluate how the existing generally acknowledged codes of good practice (technical and managerial standards) relate to the WSP approach;
- provide a regulatory assessment of the WSP approach by exploring needs and options for integrating it into the national regulatory context;
- develop an informed position enabling BMG to actively contribute to the ongoing discussions in the EU DWD revision process on how best to integrate and to shape the WSP approach;

- define possible next steps for facilitating future WSP implementation in Germany.

METHODOLOGY OF THE WSP EVALUATION PROCESS

The core of the process was conducting practical WSP map exercises and test runs in collaboration with five selected water suppliers of varying sizes, source waters, treatment chains, organisational setup and staffing profiles. For the purpose of the project, suppliers formed local project teams in partnership with local public health office staff. Principal project steps included:

- compilation of a WSP training handbook in German by UBA, based on WHO (2004) and Davison *et al.* (2005), covering background information on WSPs, practical guidance for implementation of individual WSP steps, case examples from countries where WSP-type approaches had already been in use and references for further reading;
- in-house training seminars to introduce the WSP approach individually for each local project team;
- a period of WSP realisation (with a duration of approximately one year) in which local project teams 'conceptionally' developed a full WSP or elements thereof;
- accompanying consultations between local project teams, DVGW and UBA to assist further WSP implementation and to collect feedback;
- evaluation of the local team's experiences, judgements and recommendations through formalised questionnaires and targeted interviews;
- an additional seminar with operators of 13 small public water suppliers (i.e. with <5,000 inhabitants served) and local public health office staff responsible for their surveillance which aimed at basic WSP training and respective desk-top exercises as basis for an initial evaluation of the operators' reflections on WSP implementation feasibility in their given working environments.

In a complementary study initiated by DVGW, Bethmann & Baus (2005) evaluated the extent to which the suite

of current DVGW technical and managerial standards already covers guidance and advice on core WSP elements and identified gaps that might be bridged in future updates of the standards. The analysis included 55 standards in the fields of water resource protection, water abstraction, treatment, storage and distribution, as well as those addressing managerial and organisational aspects in drinking-water supply, including the expert guide to the Technical Safety Management (TSM), a DVGW-certified management system for drinking-water suppliers.

PROJECT RESULTS AND RECOMMENDATIONS

On the basis of the project experience, all project partners assessed the WSP approach as having significant added value, clearly providing an impetus to safeguarding a high quality level of drinking-water supply. From the WSP pilots, project partners collectively reported a number of key benefits. These include in particular that developing a WSP:

- supports systematising long-established operation and management practices;
- stimulates a way of thinking or a management culture oriented towards continuous improvement;
- helps to systematically evaluate the supply system's setup and its performance, and thus the identification of 'weak points';
- supports diligent performance of system operations;
- facilitates the use of generally acknowledged codes of good practice or technical standards of DVGW; particularly for small water suppliers, the WSP approach may provide a 'vehicle' for identifying which technical standards are locally relevant and putting them into practice;
- provides rationale for an economically efficient supply system and asset management in the long term, including better transparency of reasons for investment decisions;
- strengthens organisational reliability of the utility;
- supports avoiding complacency, a too narrow focus as well as blindness of system managers and operators to system weaknesses which can arise if there is no stepping back from day-to-day routine to look at the whole supply system;

- improves exchange of experience among staff and knowledge management, including keeping and concentrating internal and external knowledge and competence;
- improves communication, mutual understanding and cooperation with surveillance authorities and catchment stakeholders.

All five pilot water suppliers involved reported that 70–90 per cent of the WSP requirements correspond with current practices. Particularly suppliers that had already established formalised quality management systems – such as the DVGW-certified TSM – confirmed substantial overlap between WSP requirements and existing managerial and operational practices. Interestingly, this applies specifically to establishing control measures and procedures for operational monitoring, including corrective actions in case of deviations from nominal operating conditions. In contrast, explicit system assessment, i.e. systematically analysing potential hazards and hazardous events along with characterising and prioritising respective risks in the entire supply chain from catchment to tap, largely proved ‘new territory’ for the pilot water suppliers, particularly for small suppliers. To date, the rationale for decisions on management strategies, control measures and operations had been technical standards rather than system-specific hazards and the risks these pose. Whereas all project partners clearly confirmed the value of complementing current management practices by regular hazard analysis and risk assessment elements for improved decision-making, at the same time the WSP map exercise pilots revealed rather significant difficulties with utilising semi-quantitative risk matrixes in a methodologically consistent way which reliably informs sound decision-making. In face of the novelty of this approach, this project result is not surprising. Suppliers therefore strongly recommended to UBA and DVGW, in order to facilitate the use of such approaches in the future, that further detailed guidance be provided and related training programmes be developed on risk assessment methods.

In face of the expected inclusion of the WSP approach in the revised EU DWD, project partners intensively discussed important prerequisites to be kept in mind when formulating any potential future regulatory requirement. For acceptance of WSP-type approaches and avoiding widespread misperceptions, such as a WSP being ‘something additional’ or

‘something completely new’, the project partners also emphasised the importance of ensuring clear minimum requirements. Importantly, these should allow enough flexibility of implementation to enable suppliers to easily integrate the development of their WSP into their proven management approaches, reflecting their prevailing conditions and available resources. As expected, larger suppliers with voluntarily established management systems (e.g. DVGW TSM) were less in favour of any explicit regulatory WSP-type requirements but stressed their self-responsibility in implementing such approaches, while in contrast, managers and operators of smaller suppliers emphasised the need for a ‘regulatory push’ as a prerequisite for mobilising necessary resources and external support from local decision-makers.

Further, a key project result was the surprisingly positive perception of the WSP approach by the 13 small-scale operators: while they indeed lack the resources for developing a WSP completely on their own, they are also the least familiar with established technical and managerial standards. Thus, the added value of guidance on priority-setting provided by WSP implementation (with external support) is most pronounced for these suppliers. Also, as the structure of their supply systems tends to be simple, the workshop found provision of such external guidance quite feasible (e.g. through a generic ‘model WSP’ for different supply types or a joint WSP development in local workshops for similar types of a small suppliers). To promote the approach among local decision makers and operators of small scale water suppliers, easy-to-understand, checklist-based tools and guidance materials as well as accessible advice and support mechanisms reflecting the operators’ working realities and qualifications need to be developed.

In principle, external advice and support may be useful in many cases, particularly for small suppliers. The two key caveats recognised by the pilot projects are sufficient qualification and in particular the people management and communication skills of the consultant in guiding the water suppliers’ operators through the process, rather than developing a WSP for them – as that would end up sitting on the shelf rather than being an intensively used ‘living’ concept.

The analysis of the DVGW technical and managerial standards demonstrated that they collectively support the

development and implementation of a supply-specific WSP. The suite of standards particularly include acknowledged information and guidance on key WSP elements, including identifying typical hazards in different supply train steps, defining adequate control measures, operational monitoring procedures and corrective actions. Also, the scope of a TSM-audit covers a systematic enquiry of these aspects of a WSP. Technical standards particularly provide a valuable source of technical and scientific information and thus a point of departure for the validating of existing or new control measures as, in consequence of the broad consensus in the process of standard compilation, these summarise extensive practical experience confirming the control measure's suitability (Bethmann & Baus 2005).

On the other hand, Bethmann & Baus (2005) also identified a number of 'gaps' that DVGW will now incrementally address in future standard and TSM updates for improved support of WSP-type approaches. This particularly applies to system assessment and documentation. Whereas the managerial standard DVGW W 1000 explicitly requires suppliers to carry out hazard analysis and risk assessment (DVGW 2005), at the time of the study, the suite of standards did not cover any substantiating methodological guidance and supporting technical information on how to practically assess and prioritise risks. Also, at present managerial standards primarily emphasise documenting supply organisation whereas a WSP also requires up-to-date documentation of the supply system and its control measures, including related managerial and operational processes.

FURTHER STEPS SUPPORTING LOCAL WSP DEVELOPMENT

Both the UBA- and DVGW-led projects suggested that an important element for facilitating local WSP development and scaling-up of the WSP approach in Germany is methodological guidance in the German language as an integral part of the library of DVGW managerial and technical standards. To this aim, DVGW established a working group in 2006, in collaboration with the BMG and UBA as key responsible government bodies, to develop 'Guideline W 1001: Safe and secure drinking water supply – risk management under normal operating conditions' (DVGW 2008a).

This provides step-by-step guidance covering all core principles of risk-based and process-oriented management following a WSP-type approach, adapted to the regulatory context in Germany, taking into consideration experiences and lessons learned from the UBA-led pilot projects and other WSP pilots in Germany (e.g. as reported by Mälzer *et al.* (2010)). The Guideline is complemented by a sister Guideline W 1002 which provides guidance to water suppliers on basic organisational and managerial prerequisites and requirements for successfully handling of crisis situations (DVGW 2008b). The numbering of the new DVGW guidelines W 1001 and W 1002 reflects their proximity to the DVGW standard W 1000 'Requirements for the qualification and organisation of drinking water suppliers', the framework for the organisation and management of a drinking-water supply (DVGW 2005).

Guideline W 1001 was released with an information and capacity building initiative. The aim of the initiative is to further broaden sector discussions and to increase awareness of W-1001- or WSP-type approaches and their potential benefits among water suppliers and local health offices responsible for drinking-water quality surveillance. Apart from increased communication efforts at relevant national and regional conferences and seminars in the field of drinking-water quality management, this initiative by DVGW offers:

- specifically packaged in-house training seminars for drinking-water suppliers which plan to complement their current management practices by W-1001-based principles;
- further education and training seminars for water professionals, introducing risk-based management approaches generally;
- access to sharing of information through a web-platform (www.dvgw.de/wasser/organisation-management/sicherheit-in-der-wasserversorgung) that provides background and resource materials, relevant publications, case study examples, information on relevant events and a section with frequently asked questions.

In the rolling revision process of technical standards, the DVGW committees will orientate future updates such that standards provide improved information to support the principles of risk-based and process-oriented management,

as described in Guideline W 1001. To better reflect and support implementation of W 1001 or WSP-type requirements, DVGW has already supplemented the existing questionnaire for auditing the TSM by the following questions:

1. How are hazards identified which may compromise supply safety?
2. How is risk assessment applied to identified hazards?
3. How are identified risks tackled?
4. How is the decision-making process in risk assessment and risk management documented?
5. Which procedures are in place ensuring periodic review?

In Germany, at the moment, the implementation of the WSP approach is not mandatory. We expect, however, that Guideline W 1001, ongoing information and capacity building initiatives and, not least of all, ongoing international developments will incrementally smoothe the path for increasing interest and motivation in implementation of risk-based and process-oriented management approaches among the more than 6,000 German water supply utilities – so far on a voluntary basis.

CONCLUSIONS

Some fundamental outcomes of the German WSP trial runs turned out similar to experiences from other countries, including the range and nature of reported benefits that go along with implementing WSP-type approaches as well as the observation that in well-managed water utilities, many of the elements of a WSP are already in place (e.g. Sinclair & Rizak 2004; Mahmud *et al.* 2007; Gunnarsdóttir & Gissurason 2008). Nonetheless, the experience gained from our own national WSP awareness raising and evaluation process proved extremely valuable, in particular because national conditions differ, with Germany's specific regulatory culture extensively relying on technical standards, having developed in a broad consensus of experts. It was essential to sort out how this relates to key WSP requirements in order to understand whether or not the WSP approach actually adds value to water safety and system security in Germany.

The national piloting and evaluation process clearly confirmed the added value of a WSP-type approach. The

WSP elements of hazard analysis and risk assessment indeed turned out to be the key novelty and gain. A key consequence is the recognition of a general need for building and exchanging of experience and concept development for risk assessment. Whereas the WSP-trigger to step back and think about potential hazards and associated risks exercises a fair amount of fascination, it also leads to difficulties in consistently assessing or even just ranking risks in a way that clearly informs management decisions. This includes a temptation to do this with more scientific rigor than possible or adequate. Thus, there is a need for a steep learning curve to find adequate approaches to risk assessment. Implementation on the basis of DVGW W 1001 will bring more consolidated experience over time – for the time being, however, it is important to get started.

The WSP discussion particularly highlighted that the understanding of small suppliers regarding risks to water supply and knowledge about the technical standards is often quite poor, and this is of concern since about a fifth of the German population is served by small suppliers. Guiding them through WSP development could be an effective way to support small suppliers in focusing on risks important to control in their supplies, in better understanding the hazards and control measures – in better knowing what they are doing and why. The recognition that the added value of a WSP is probably highest for small public suppliers is one unexpected project outcome, and it is planned to address how best to do this with a follow-up project for small suppliers.

Regarding drinking-water installations in buildings the WSP approach also offers a high potential for improvements. While technical standards are well developed, legal requirements scarcely exist. The WSP approach, however, is intended for systems from catchment to consumer. An outcome of the trial run was a currently ongoing follow-up project testing the approach for the management of installations in public buildings such as schools and hospitals. A positive assessment is emerging.

If a revised EU DWD will call for legally binding WSP requirements, the German drinking-water sector is now in a good position to respond to that 'regulatory push' in an adequate and informed manner. In particular, the BMG as the regulator, is now not only well-informed, but also has its own national position to actively shaping the inclusion

of the WSP approach in the EU DWD. It now uses outcomes of the projects, in collaboration with other EU member states, to spell out recommendations to the EC on effective regulatory mechanisms for WSP implementation.

Irrespective of whether or not future regulations may require WSP-type approaches, the awareness raising and capacity building initiated with the WSP piloting and evaluation process have proved to be highly valuable. Overall, the German experience has confirmed the importance of and need for a proper dialogue and communication process with key stakeholders such as regulators, water suppliers, surveillance authorities and professional associations. Effective long-term strategies to scale-up WSP-type approaches are composed of a number of building blocks, including availability of clear guidance in operators' mother tongue, ongoing capacity building initiatives and – equally important – focussed attention and targeted initiatives to develop acceptance and motivation among various stakeholders for their long-term support. An organised and moderated piloting and evaluation process at the national level is a crucial integrating effort to raise the awareness of key stakeholders and institutions and to secure their long-term ownership and leadership for WSP uptake.

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